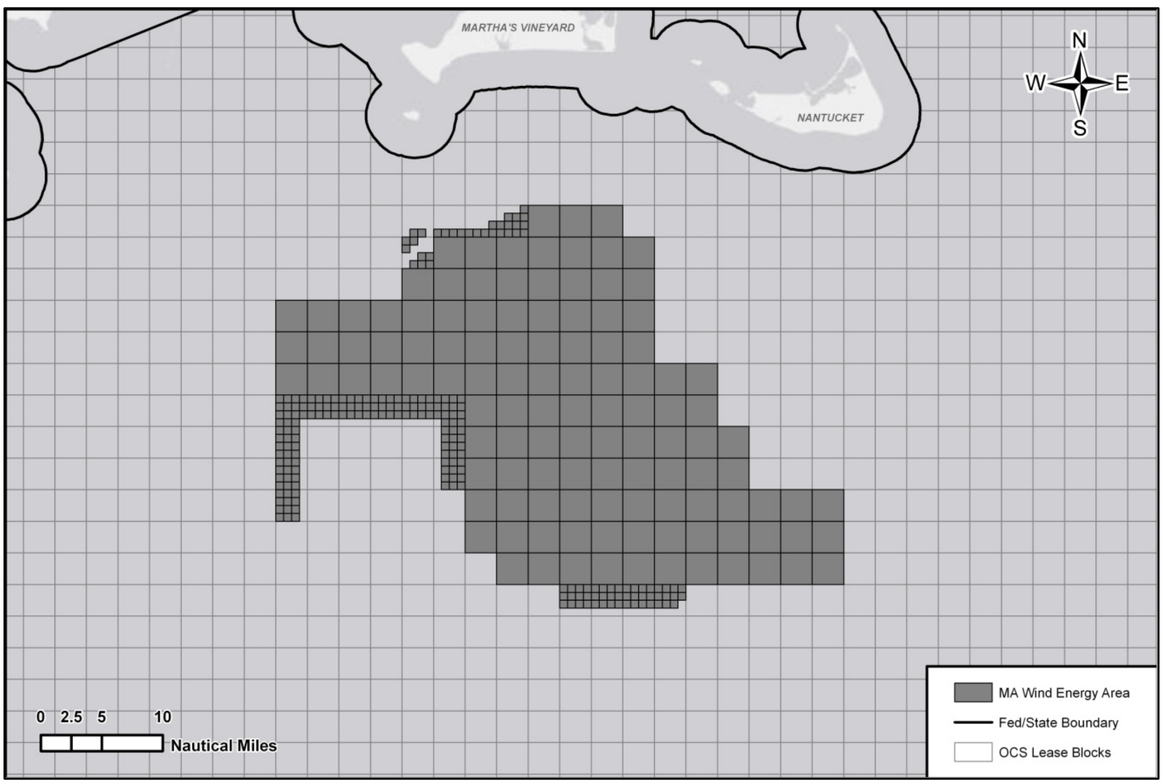
OCS EIS/EA
BOEM 2014-603

Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts

Revised Environmental Assessment



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Bureau of Ocean Energy Management
Office of Renewable Energy Programs

Published by

U.S. Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs

June 2014

FINDING OF NO SIGNIFICANT IMPACT

Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts

INTRODUCTION

The United States Department of the Interior (USDOI), Bureau of Ocean Energy Management (BOEM) prepared an environmental assessment (EA) to determine whether issuance of leases and approval of site assessment plans (SAPs) within an area identified offshore Massachusetts would have a significant effect on the environment and whether an environmental impact statement (EIS) must be prepared. BOEM conducted its analysis to comply with the National Environmental Policy Act (NEPA), 42 United States Code (U.S.C.) §§ 4321-4370f, the Council on Environmental Quality (CEQ) regulations at 40 Code of Federal Regulations (CFR) 1501.3(b) and 1508.9, USDOI regulations implementing NEPA at 43 CFR 46, and USDOI Manual (DM) Chapter 15 (516 DM 15).

BOEM conducted its environmental analysis after BOEM identified an area potentially suitable for commercial wind development, called a Wind Energy Area (WEA). BOEM identified the WEA through input from the BOEM-lead Massachusetts Intergovernmental Task Force (Task Force), comments on the *Notice of Intent to Prepare an Environmental Assessment (77 FR 5830),* comments on the *Commercial Leasing for Wind Power on the OCS Offshore Massachusetts - Call for Information and Nominations (77 FR 5820)*, comments on the Commercial Leasing for Wind Power on the OCS Offshore Massachusetts – Request for Interest (RFI) (75 FR 82055), and input received during public outreach efforts. The environmental analysis was limited to the effects of lease issuance: site characterization activities (i.e., surveys of the lease area and potential cable routes), and site assessment activities (i.e., construction and operation of meteorological towers and/or buoys on the leases to be issued) within the WEA.

On November 2, 2012, BOEM published a *Notice of Availability for the Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts Environmental Assessment* (2012 EA) *(77 FR 66185)* for a 30-day comment period. Public information meetings were held in Massachusetts on November 13, 14, and 15, 2012, to provide stakeholders an additional opportunity to offer comments on the 2012 EA. To address comments received during the public comment period, public information meetings, stakeholder outreach, required consultations, and the Task Force meetings, BOEM has revised the 2012 EA. The revised EA includes a summary of the comments and questions received (see Section 5.1.3). This finding is accompanied by and cites the revised EA.

PURPOSE AND NEED

The purpose of the proposed action is to issue leases and approve SAPs to provide for the responsible development of wind energy resources in the WEA offshore Massachusetts (Figure 1-4 in the attached EA). The need for BOEM issuance of leases and approval of SAPs is to adequately assess wind and environmental resources of the WEA to determine if areas within the WEA are suitable for, and could support, commercial-scale wind energy production.

DESCRIPTION OF THE PROPOSED ACTION

The proposed action that is the subject of the revised EA is the issuance of wind energy leases covering the entirety of the Massachusetts WEA, and the approval of site assessment activities within those leases. During the process of identifying the WEA (Area Identification), BOEM identified Alternative A as the proposed action. Alternative A analyzes issuing leases in the largest geographic area (i.e., the entire WEA). BOEM has identified Alternative A as the preferred alternative. In addition to the proposed action, BOEM considered four other alternatives, including no action (Section 2).

The area offshore Massachusetts considered in this EA is approximately 742,974 acres and contains 117 whole OCS lease blocks and 20 partial OCS lease blocks.

BOEM AUTHORITY AND REGULATORY PROCESS

The Energy Policy Act (EPACT) of 2005, Public Law No. 109-58, added Section 8(p)(1)(C) to the Outer Continental Shelf Lands Act (OCSLA), which grants the Secretary of the Interior the authority to issue leases, easements, or rights-of-way on the Outer Continental Shelf (OCS) for the purpose of renewable energy development (43 U.S.C. § 1337(p)(1)(C)). The Secretary delegated this authority to the former Minerals Management Service (MMS), now BOEM. On April 22, 2009, BOEM promulgated final regulations implementing this authority, which can be found at 30 CFR 585.

The regulations require that a lessee provide the results of surveys with its SAP or Construction and Operation Plan (COP), including a shallow hazards survey (30 CFR 585.626 (a)(1)), geological survey (30 CFR 585.616(a)(2)), geotechnical survey (30 CFR 585.626(a)(4)), and an archaeological resource survey (30 CFR 585.626(a)(5)). BOEM refers to these surveys as "site characterization" activities. Although BOEM does not issue permits or approvals for these site characterization activities, it will not consider approving a lessee's SAP or COP if the required survey information is not included with the plan.

NATURE OF THE ANALYSIS IN THE EA

BOEM prepared the EA to inform decisions to issue leases in the WEA, and to subsequently approve SAPs on those leases. As discussed above, BOEM does not issue permits for shallow hazards, geological, geotechnical, or archaeological resource surveys. However, since BOEM regulations require that a lessee include the results of these surveys in its application for COP approval, the EA treated the environmental consequences of these surveys as reasonably foreseeable consequences of issuing a lease.

Thus, the EA analyzes the reasonably foreseeable consequences associated with two distinct BOEM actions in the WEA:

(1) Lease issuance (including reasonably foreseeable consequences associated with shallow hazards, geological, geotechnical, and archaeological resource surveys); and

(2) SAP approval (including reasonably foreseeable consequences associated with the installation and operation of meteorological towers and meteorological buoys).

BOEM's primary strategy for minimizing impacts to offshore cultural resources and biologically sensitive habitats has been and will continue to be avoidance. Based on the analysis in the EA, BOEM developed several Standard Operating Conditions (SOCs) to reduce or eliminate the potential environmental risks to or conflicts with individual environmental and socioeconomic resources (Section 2.6 and Appendix B). These SOCs were developed through the analyses presented in Section 4.2 and through consultation with other federal and state agencies. This EA considers the SOCs to be part of the proposed action.

Endangered Species Act Consultations – BOEM initiated consultations in July 2012 with the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) concerning the Endangered Species Act (ESA). During these consultations, the NMFS evaluated new modeled sound information that BOEM provided which was based on methodology from BOEM's March 2012 *Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas: Draft Programmatic Environmental Impact Statement* (G&G DPEIS). The calculations from this methodology indicated that sound from equipment such as boomers and other sub-bottom profilers travels a greater distance than indicated in the 2012 EA. Specifically, the modeled area of ensonification for some HRG survey equipment constituting level B harassment of marine mammals under the Marine Mammal Protection Act was beyond what BOEM considered could be effectively visually monitored for the presence of marine mammals. In light of the information from the sound propagation model, BOEM requested formal ESA consultation with the NMFS on October 19, 2012 (Morin, personal communication, 2012). As part of the incidental take statement, the NMFS required reasonable and prudent measures (RPMs) to be implemented to help minimize the potential impacts (ESA Section 7 Consultation Biological Opinion, April 10, 2013). BOEM revised the SOCs in this EA to reflect the RPMs and the new acoustic impact model found in the G&G DPEIS. The NMFS determined that, with the SOCs and the RPMs, the proposed action may adversely affect but is not likely to jeopardize the continued existence of Kemp's ridley, green, or leatherback sea turtles; the Northwest Atlantic distinct population segment (DPS) of loggerhead sea turtles; North Atlantic right, humpback, fin, sei, or sperm whales, or the Gulf of Mexico, New York Bight, Chesapeake Bay, or South Atlantic DPSs of Atlantic sturgeon. Because no critical habitat is designated in the action area, none would be affected by the action.

BOEM and the U.S. Fish and Wildlife Service (USFWS) concluded informal ESA consultation on November 1, 2012. The USFWS concurred with BOEM's Biological Assessment dated October 19, 2012, that determined that the site assessment activities described were "not likely to adversely affect" federally endangered roseate terns, threatened piping plovers, and the candidate red knot (Chapman, personal communication, 2012).

ALTERNATIVES

BOEM considered the proposed action (Alternative A) and four alternatives including a no action alternative. Alternative A is the alternative that contemplates the issuance of wind energy leases within the maximum area of the WEA offshore Massachusetts (Figure 2-1), associated site characterization surveys, and subsequent approval of site assessment activities on those leases (Section 2.1). Alternatives B (Section 2.2), C (Section 2.3), and D (Section 2.4), contemplate issuing leases and approving SAPs in smaller areas offshore Massachusetts. Alternative E contemplated taking no action (Section 2.5). Alternative A is generally anticipated to have the greatest environmental consequences of the action alternatives. As a result, Alternative A is the focus of the environmental analysis in the EA, and is the alternative against which the lesser or equal impacts of the other alternatives are compared (Sections 4.2-4.5).

Environmental and Socioeconomic Consequences of Alternative A (Preferred Alternative): The Proposed Action

Alternative A presumes reasonably foreseeable scenarios for leasing, site characterization, and site assessment (Chapter 3). Alternative A contemplates leasing the maximum area of each WEA, resulting in up to five total leases. It should be noted that BOEM may not offer five leases. If BOEM elects to offer less than five leases the impacts related to the installation of meteorological towers and meteorological buoys would be proportionally less based on the number of leases offered.

Like the other action alternatives, Alternative A assumes that lessees would undertake the maximum amount of site characterization surveys (i.e., shallow hazards, geological, geotechnical, archaeological and biological surveys) in their leased areas, which, under Alternative A, would constitute the full area of the WEA. Under Alternative A, assuming that all lessees choose to install meteorological facilities, BOEM anticipates that up to five meteorological towers or ten meteorological buoys, or some combination or meteorological towers and buoys, would be installed within in the WEA. These site characterization and assessment activities are projected to result in approximately 2,808 to 6,500 round-trips by vessels over a five year period, which would be divided among major and smaller ports in Massachusetts, Rhode Island, Connecticut, and New York. Under Alternative A, as well as the other alternatives, BOEM would require lessees to comply with various requirements while conducting activities on their leases for the purpose of ensuring that potential impacts to the environment are minimized or eliminated. These requirements will be imposed as SOCs in the lease instrument and/or as conditions of approval of a SAP.

The reasonably foreseeable impacts of Alternative A (full leasing of the WEA) on environmental resources and socioeconomic conditions based on the scenario above are described in detail in Section 4.2: air quality (Section 4.2.1.1); geology (Section 4.2.1.2); physical oceanography (Section 4.2.1.3); water quality (Section 4.2.1.4); birds (Section 4.2.2.1); bats (Section 4.2.2.2); benthic resources (Section 4.2.2.3); coastal habitats (Section 4.2.2.4); Finfish, Shellfish, and Essential Fish Habitat (Section 4.2.2.5); marine mammals (Section 4.2.2.6); sea turtles (Section 4.2.2.7); cultural resources (4.2.3.1); demographics and employment (4.2.3.2); environmental justice (4.2.3.3); recreation and visual resources (4.2.3.4); commercial and recreational fishing (4.2.3.5); aviation (4.2.3.6); military use areas (4.2.3.7); and navigation and vessel traffic (4.2.3.8).

The impact levels used throughout the EA, are derived from a four-level classification scheme used to characterize the predicted impacts if the proposal is implemented and activities occur as described. This classification scheme is defined in the *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf* (October 2007). The reasonably foreseeable impacts for the proposed action scenario described in the EA could result in impacts ranging from negligible to minor except in the case of the species identified in the NMFS Biological Opinion of April 10, 2013. These species are likely to be adversely affected by the proposed action; however, it is not likely to jeopardize the continued existence of any of these species. The potential effects on individual Kemp's ridley, green, leatherback sea turtles; the Northwest Atlantic DPS of loggerhead sea turtles; North Atlantic right, humpback, fin, sei, and sperm whales, and the Gulf of Mexico, New York Bight, Chesapeake Bay, and South Atlantic DPSs of Atlantic sturgeon from noise or the risk of vessel collisions are expected to be temporary and localized. Thus, these impacts are not anticipated to be significant, and specifically would not result in any population-level impacts to marine mammals, protected fish species, or sea turtles.

Offshore activities associated with the proposed action and alternatives would result in localized impacts. The impacts of individual meteorological towers and their associated activities would not overlap because of different geographic locations. The incremental contribution of the proposed action to other past, present, and reasonably foreseeable actions that may affect the environment would be negligible to minor (Section 4.7). Moreover, the proposed action would facilitate the collection of meteorological, oceanographic, and biological data of the environment within the WEA.

Public and stakeholder comments, Task Force input, and information received through BOEM's outreach efforts also weighed heavily in this determination. BOEM finds that issuing leases and approving site assessment activities within the WEA would have no significant impact on the environment. As a result, the preparation of an EIS is not necessary for BOEM to proceed with the lease issuance process for a portion or all of the WEA.

SUPPORTING DOCUMENTS

The following environmental documents are available upon request or at www.boem.gov/:

- *Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas, Draft Programmatic Environmental Impact Statement.*(G&G PEIS 2012) (USDOI, BOEM, OCS EIS/EA BOEM 2012-005);
- Bullard, John K., Regional Administrator, NOAA NMFS, Northeast Region, Gloucester, Massachusetts. Transmittal letter re: Formal Endangered Species Act (ESA) Section 7 Consultation for the Rhode Island, Massachusetts, New York, and New Jersey WEAs, April 10, 2013, to M. Morin, BOEM;
- Chapman, T.R., Supervisor, New England Office, USFWS, New England Field Office, Concord, New Hampshire. Concurrence letter responding to October 19, 2012, request to the USFWS to review the October 2012 *Biological Assessment for the Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Rhode Island and Massachusetts,* November 1, 2012, to M. Morin, BOEM;.
- Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts – Revised Environmental Assessment (attached);
- Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts, Rhode Island, New York, and New Jersey, For the National Marine Fisheries Service, Biological Opinion (March 2012)(BiOp NOAA NMFS) (US Department of Commerce, NOAA NMFS NER-2012-9211);
- Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia - Final Environmental Assessment. (USDOI, BOEM, OCS EIS/EA 2012-003);
- Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Rhode Island and Massachusetts, For U.S. Fish and Wildlife Service, Biological Assessment (October 2012). (USDOI, BOEM, OREP);
- Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Rhode Island and Massachusetts - Revised Environmental Assessment;
- Morin, Michelle, BOEM, Chief, Environmental Branch for Renewable Energy. Letter requesting formal consultation with the NMFS under Section 7 of the ESA, October 19, 2012, to John Bullard, NOAA NMFS, Regional Administrator, Northeast Region;
- Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, Final Environmental Impact Statement. (USDOI, MMS, OCS EIS/EA 2007-046).

CONCLUSION

I have thoroughly considered the prominent issues and concerns identified in the EA and by the public and cooperating and consulting agencies in their comments, as well as the evaluation of the potential effects of the proposed action and alternatives in the attached EA. It is my determination that there are no substantial questions regarding the reasonably foreseeable impacts of the proposed action or alternatives, and that no reasonably foreseeable significant impacts are expected to occur as the result of the preferred alternative or any of the alternatives contemplated in the EA. It is therefore my determination that implementing the proposed action or any of the alternatives would not constitute a major federal action significantly affecting the quality of the human environment under Section 102(2)(C) of the National Environmental Policy Act of 1969. As a result, an EIS is not required, and I am issuing this finding of no significant impact.

Michelle Morin
Chief, Environment Branch for Renewable Energy
Office of Renewable Energy Programs

6/3/2014
Date

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ACRONYMS, ABBREVIATIONS, AND SYMBOLS

ACHP	Advisory Council on Historic Preservation
ACPARS	Atlantic Coast Port Access Route Study
ADCP	Acoustic Doppler Current Profilers
AIS	Automatic Identification Systems
BLS	Bureau of Labor Statistics
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BP	before present day
CD	Consistency Determination
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	methane
CHIRP	Compressed High Intensity Radar Pulse
cm	centimeters
cm/s	centimeters per second
CMP	coastal zone management plan
CMSP	Coastal and Marine Spatial Planning
CO	carbon monoxide
CODAR	Coastal Ocean Dynamic Applications Radar
COLOS	Coastal Buoy and the Coastal Oceanographic Line-of-Sight
COP	construction and operation plan
CPT	Cone Penetrometer Test
CZMA	Coastal Zone Management Act
dB	decibels
DMA	dynamic management area
DMF	Division of Marine Fisheries
DO	dissolved oxygen
DOD	U.S. Department of Defense
DPS	distinct population segments
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
EOEEA	Massachusetts Executive Office of Energy and Environmental Affairs
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration

ft	feet
GGARCH	Geological and Geophysical, Hazards, and Archaeological Information
GHG	greenhouse gas
GIS	Geographical Information System
GSOE	Garden State Offshore Energy
HAPC	Habitat Areas of Particular Concern
HRG	High-Resolution Geophysical
Hz	hertz
IFR	Instrument Flight Rules
ISRP	Independent Scientific Review Panel
IUCN	International Union for Conservation of Nature
kg	kilograms
kHz	kilohertz
km	kilometers
L	liter
LiDAR	Light Detection and Ranging
m	meters
MA CZM	Massachusetts Office of Coastal Zone Management
MADFW	Massachusetts Division of Fisheries and Wildlife
MARAD	Maritime Administration
MassCEC	Massachusetts Clean Energy Center
MBTA	Migratory Bird Treaty Act
µg	microgram
mg	milligrams
MHC	Massachusetts Historical Commission
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
µPa	micro Pascals
µs	microseconds
ms	milliseconds
MSD	marine sanitation device
MSR	Mandatory Ship Reporting system
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NARWSS	North Atlantic Right Whale Sightings Survey
NABCI	North American Bird Conservation Initiative
NCCOS	National Center for Coastal Ocean Science
n.d.	no date

NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NGO	Non-governmental organization
NHPA	National Historic Preservation Act
NJDEP	New Jersey Department of Environmental Protection
nm	nautical miles
NMFS	National Marine Fisheries Service
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPS	National Park Service
NREL	National Renewable Energy Laboratory
NSF	National Science Foundation
NTL	Notice To Lessees and Operators
NTU	Nephelometric Turbidity Unit
O3	ozone
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OPAREA	operating area
OSAMP	Ocean Special Area Management Plan
OST	Office of Science and Technology
Pb	lead
PEIS	Programmatic Environmental Impact Statement
PM	particulate matter
ppm	parts per million
PTS	Permanent Threshold Shift
RFI	Request for Interest
RICRMC	Rhode Island Coastal Resources Management Council
RMS	root mean square
ROV	remotely operated underwater vehicle
SAP	site assessment plan
SEFSC	Southeast Fisheries Science Center
SEL	sound exposure level
SHPO	State Historic Preservation Office
SMA	seasonal management area

SNE	Southern New England
SO_2	sulfur dioxide
SOC	Standard Operating Condition
SODAR	Sonic Detection and Ranging
SPL	sound pressure level
SPUE	Sightings per Unit Effort
Task Force	Massachusetts Renewable Energy Task Force
TEWG	Turtle Expert Working Group
TSS	traffic separation schemes
TTS	Temporary Threshold Shift
UNEP	United Nations Environment Programme
USACE	U.S. Army Corps of Engineers
U.S.C.	U.S. Code
USCG	U.S. Coast Guard
USDOI	U.S. Department of the Interior
USDOT	U.S. Department of Transportation
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VFR	Visual Flight Rules
VMS	Vessel Monitoring Systems
VOC	volatile organic compound
WEA	Wind Energy Area
WESA	Wind Energy Study Area

1 INTRODUCTION

The U.S. Department of the Interior (USDOI), Bureau of Ocean Energy Management (BOEM) has prepared this environmental assessment (EA) to determine whether issuance of leases and approval of site assessment plans (SAPs) within the Wind Energy Area (WEA) offshore Massachusetts would lead to reasonably foreseeable significant impacts on the environment and, thus, whether an environmental impact statement (EIS) should be prepared before leases are issued. BOEM identified the WEA then conducted an environmental analysis. This analysis is limited to the effects of lease issuance, site characterization activities (i.e., surveys of the lease area), and site assessment activities within the WEA (i.e., construction and operation of meteorological towers, buoys, or a combination of towers and buoys on the leases to be granted). This analysis complies with the National Environmental Policy Act (NEPA), Title 42 of U.S. Code (U.S.C.) §§ 4321–4370f and the Council on Environmental Quality (CEQ) regulations at Title 40 of the Code of Federal Regulations (CFR) 1501.3.

1.1 PURPOSE AND NEED

The purpose of the proposed action is to issue leases and approve SAPs to provide for the responsible development of wind energy resources in the WEA offshore Massachusetts. The need for BOEM issuance of leases and approval of SAPs is to adequately assess wind and environmental resources of the WEA to determine if areas within the WEA are suitable for, and could support, commercial-scale wind energy production.

1.2 DESCRIPTION OF THE PROPOSED ACTION

The proposed action is the issuance of commercial and research wind energy leases within the WEA offshore Massachusetts and approval of site assessment activities on those leases. Of the alternatives considered in this EA, Alternative A would result in lease issuance over the largest geographic area. Three other action alternatives and a no action alternative are also considered in this EA and discussed in Section 2.

1.3 BACKGROUND

1.3.1 Bureau of Ocean Energy Management Authority and Regulatory Process

The Energy Policy Act of 2005, Pub. L. No. 109-58, added Section 8(p)(1)(C) to the Outer Continental Shelf Lands Act (OCSLA), which authorized that the Secretary of the Interior to issue leases, easements, or rights-of-way on the Outer Continental Shelf (OCS) for the purpose of wind energy development. See 43 U.S.C. § 1337(p)(1)(C). The Secretary delegated this authority to the former Minerals Management Service (MMS), now BOEM. Final regulations implementing this authority at 30 CFR Part 585 were promulgated on April 22, 2009.

Under the renewable energy regulations, the issuance of leases and subsequent approval of wind energy development on the OCS is a staged decision making process. BOEM's wind energy program occurs in four distinct phases as described below.

1. Planning and Analysis. The first phase is to identify suitable areas to be considered for wind energy project leases through collaborative, consultative, and analytical processes using the Massachusetts Renewable Energy Task Force (Task Force), public information meetings, and input from the States, Federally Recognized Tribes, and other stakeholders.

2. Lease Issuance. The second phase, issuance of a commercial wind energy lease, gives the lessee the exclusive right to subsequently seek BOEM approval for the development of the leasehold. The lease does not grant the lessee the right to construct any facilities; rather, the lease grants the right to use the lease area to develop its plans, which must be approved by BOEM before the lessee can move on to the next stage of the process. See 30 CFR 585.600 and 585.601.

3. Approval of a SAP. The third stage of the process is the submission of a SAP, which contains the lessee's detailed proposal for the construction of a meteorological tower, installation of meteorological buoys, or a combination of the two on the leasehold. The SAP allows the lessee to install and operate site assessment facilities for a specified term. See 30 CFR 585.605–585.618. The lessee's SAP must be approved by BOEM before it conducts these "site assessment" activities on the leasehold. BOEM may approve, approve with modification, or disapprove a lessee's SAP. See 30 CFR 585.613.

4. Approval of a Construction and Operation Plan (COP). The fourth stage of the process is the submission of a COP, a detailed plan for the construction and operation of a wind energy project on the lease. A COP allows the lessee to construct and operate wind turbine generators and associated facilities for a specified term. See 30 CFR 585.620–585.638. BOEM approval of a COP is a precondition to the construction of any wind energy facility on the OCS. See 30 CFR 585.628. As with a SAP, BOEM may approve, approve with modification, or disapprove a lessee's COP. See 30 CFR 585.628.

The regulations also require that a lessee provide the results of surveys with its SAP and COP, including shallow hazards surveys (30 CFR 585.610(b)(2) and 30 CFR 585.626(a)(1)), geological surveys (30 CFR 585.610(b)(4) and 30 CFR 585.616(a)(2)), geotechnical surveys (30 CFR 585.610(b)(1) and 30 CFR 585.626(a)(4)), biological surveys (30 CFR 585.610(b)(5) and 30 CFR 585.626(a)(3)), and archaeological resource surveys (30 CFR 585.610(b)(3) and 30 CFR 585.626(a)(5)). BOEM refers to these surveys as "site characterization" activities. Although BOEM does not issue permits or approvals for these site characterization activities, it will not consider approving a lessee's COP if the required survey information is not included. See also BOEM's *Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information Pursuant to 30 CFR Part 585* (GGARCH) (BOEM OREP, 2012), *Guidelines for Providing Avian Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585, Guidelines for Providing Information on Marine Mammals and Sea Turtles for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585 Subpart F, Guidelines for Providing Information on Fish for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585, and Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585* (http://www.boem.gov/Regulatory-Development-Policy-and-Guidelines/).

In addition to commercial leases, BOEM has the authority to issue leases to other Federal agencies and to States for the purpose of conducting renewable energy research activities that support the future production, transportation, or transmission of renewable energy. See 30 CFR 585.238. The terms of these types of research leases would be negotiated by the Director of BOEM and the head of the Federal agency or the Governor of the relevant State, or their authorized representatives, on a case-by-case basis, subject to the provisions of 30 CFR Part 585, including those pertaining to public involvement.

1.3.2 "Smart from the Start" Atlantic Wind Energy Initiative

On November 23, 2010, Secretary of the Interior Ken Salazar announced the "Smart from the Start" Atlantic wind energy initiative to accelerate the responsible development of wind energy on the Atlantic OCS. The initiative calls for the identification of areas on the Atlantic OCS that appear most suitable for commercial wind energy activities, and the opening of these areas for leasing and detailed site assessment activities.

On February 6, 2012, BOEM launched this initiative offshore Massachusetts through the publication of a Notice of Intent (NOI) to prepare an EA (77 FR 5830) and a Call for Information and Nominations (Call) (77 FR 5820) in the *Federal Register*. The NOI and Call identified an area of the OCS offshore Massachusetts that appeared to provide the most suitable opportunity for wind energy development while presenting the fewest apparent user conflicts. The prospective area for wind energy leasing published in the NOI was developed through extensive consultation with other Federal agencies and BOEM's Task Force, public input, and the Area Identification process. See Section 1.5 and Appendix A for further discussion of the development of wind energy on the OCS offshore Massachusetts.

1.4 OBJECTIVE OF THE ENVIRONMENTAL ASSESSMENT

Pursuant to NEPA, 42 U.S.C. §§ 4321–4370f, and the CEQ regulations at 40 CFR 1501.3, this

EA was prepared to assist the agency in determining which OCS areas offshore Massachusetts should be the focus of BOEM's wind energy leasing efforts. This EA considers a number of reasonable geographic and non-geographic alternatives, and evaluates the environmental and socioeconomic consequences, including potential user conflicts, associated with issuing leases and approving SAPs under each alternative.

1.4.1 Information Considered

Information considered in preparing the NEPA document includes:

- Public response to the February 6, 2012, NOI to prepare this EA;
- Research and review of current relevant scientific and socioeconomic literature;
- Comments received in response to the Request for Interest (RFI) and Call associated with wind energy planning offshore Massachusetts;
- Ongoing consultation and coordination with the members of BOEM's Task Force;
- Government-to-Government consultation with federally recognized Tribes: Mashpee Wampanoag Tribe, Narragansett Indian Tribe, and the Wampanoag Tribe of Gay Head (Aquinnah);
- Consultations with other Federal agencies, including the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the U.S. Department of Defense (DOD), and the U.S. Coast Guard (USCG);
- Public response to the November 2, 2012, Notice of Availability of an Environmental Assessment (77 FR 66185);
- Literature Synthesis for the North and Central Atlantic Ocean, OCS Study BOEMRE 2011-012 (BOEMRE, 2011a);
- Relevant material from the Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia Final Environmental Assessment (Mid-Atlantic EA) (BOEM, 2012);
- Relevant material from the Project Plan for the Installation, Operation, and Maintenance of Buoy Based Environmental Monitoring Systems OCS Block 6931, New Jersey (Fishermen's Energy of New Jersey, LLC, 2011);
- Relevant material from the Issuance of Leases for Wind Resource Data Collection on the Outer Continental Shelf Offshore Delaware and New Jersey (MMS, 2009a);
- Revised Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Rhode Island and Massachusetts (BOEM, 2013a);
- Rhode Island Ocean Special Area Management Plan (OSAMP) (RICRMC, 2010);
- Massachusetts Ocean Management Plan (MA EOEEA, 2009);

- Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas: Final Programmatic Environmental Impact Statement, February 2014 (BOEM, 2014);
- Relevant material from the Programmatic Environmental Impact Statement (PEIS) for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, Final Environmental Impact Statement (MMS, 2007a); and
- Relevant material from the Endangered Species Act Section 7 Consultation Biological Opinion for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf in Massachusetts, Rhode Island, New York and New Jersey Wind Energy Areas (NER-2012-9211) (NMFS, 2013a).

1.4.2 Scope of Analysis

BOEM intends to use this EA to inform decisions to issue leases in the MA WEA, and to subsequently approve SAPs on those leases. Although BOEM does not issue permits for shallow hazards, geological, geotechnical, or archaeological resource surveys, BOEM regulations require that a lessee include the results of these surveys in its application for SAP and COP approval.

Thus, this EA will analyze two distinct BOEM actions in the WEA—lease issuance and SAP approval—and the reasonably foreseeable consequences associated with these actions, including:

1. Shallow hazards, geological, geotechnical, biological, and archaeological resource surveys (associated with lease issuance); and

2. Installation and operation of a meteorological tower, two meteorological buoys, or a combination of one tower and one buoy (associated with SAP approval).

Additional analysis under NEPA will be required before any future decision is made regarding construction or operation of any wind energy facility on leases that may be issued within the WEA or construction of marine cables and onshore grid transmission connections that are constructed in support of wind energy facilities in the WEA.

The purpose of conducting surveys and installing meteorological measurement devices is to assess the wind resources in the lease area, characterize the biological resources in the lease area, and to characterize the conditions of the water column and seabed so that a lessee can determine whether the site is suitable for commercial development and, if so, submit a COP.

The issuance of a lease does not mean, should a lessee submit a COP in the future, that the COP would be approved, or that the lease will ultimately be developed at all. Rather, the lease only grants the lessee the exclusive right to subsequently seek BOEM approval for the development of the leasehold. The lease does not grant the lessee the right to construct any facilities; rather, the lease grants the lessee the right to use the lease area to develop its plans, which must be approved by BOEM before the lessee can move on to the next stage of the process. See 30 CFR 585.600 and 585.601. Should a lessee submit a COP, BOEM would consider its merits, perform the necessary consultations with the appropriate State, Federal, local, and tribal entities, solicit input from the public and the appropriate Intergovernmental Task Force(s), and perform an independent site- and project-specific NEPA analysis before determining whether to approve, approve with modifications, or disapprove a lessee's COP under 30 CFR 585.628.

This EA considers whether issuing leases and approving site assessment activities in certain areas of the OCS offshore Massachusetts would lead to reasonably foreseeable significant impacts on the environment, and thus, whether an EIS should be prepared before leases are issued (see 40 CFR 1508.9). Should a particular area be leased, and should the lessee subsequently submit a SAP, BOEM would then determine whether this EA adequately considers the environmental consequences of the activities proposed in the lessee's SAP. If BOEM determines that the analysis in this EA adequately considers these consequences, then no further NEPA analysis would be required before the SAP is approved. If, on the other hand, BOEM determines that the analysis in the EA is inadequate for that purpose, BOEM would prepare an additional NEPA analysis before approving the SAP.

If and when a lessee is prepared to propose wind energy generation on its lease, it will submit a COP. If a COP is submitted, BOEM would prepare a separate site- and project-specific NEPA analysis from the analysis in this EA. This would likely take the form of an EIS and would provide additional opportunities for public involvement pursuant to NEPA and the CEQ regulations at 40 CFR Parts 1500–1508. BOEM will use the EIS document to evaluate the reasonably foreseeable environmental consequences associated with the proposed COP activities. BOEM will use the EIS to decide whether to approve, approve with modification, or disapprove a lessee's COP pursuant to 30 CFR 585.628.

1.5 DEVELOPMENT OF WIND ENERGY AREA

1.5.1 Planning Process

The RFI and Call processes are planning notices designed to assist BOEM in acquiring environmental and socioeconomic information and determining whether interest exists in acquiring a wind energy lease on the OCS. See 43 U.S.C. § 1337(p)(3). Anyone interested in acquiring a lease in the area identified in the RFI or Call must submit a valid expression or nomination of interest, which includes the identification of the specific block or blocks the applicant is interested in acquiring, and a general description of the applicant's objectives and the facilities that it contemplates using to achieve them. See 30 CFR 585.213. These submissions have assisted BOEM in developing some of the reasonably foreseeable scenarios on which the alternatives in this EA are based:

1. The reasonably foreseeable leasing scenario, which was used to determine how many leases the WEA could reasonably support; and

2. The reasonably foreseeable site assessment scenario that was used to determine how many meteorological towers or buoys would likely be installed in the WEA.

1.5.2 Stakeholder and Public Consultation

BOEM developed the WEA through extensive collaboration and consultation with the Task Force, Federal agencies, Federally Recognized Tribes, the general public, and other stakeholders between November 2009 and May 2012. Figure 1-1 illustrates the extent of consultation with stakeholders and the public over time.

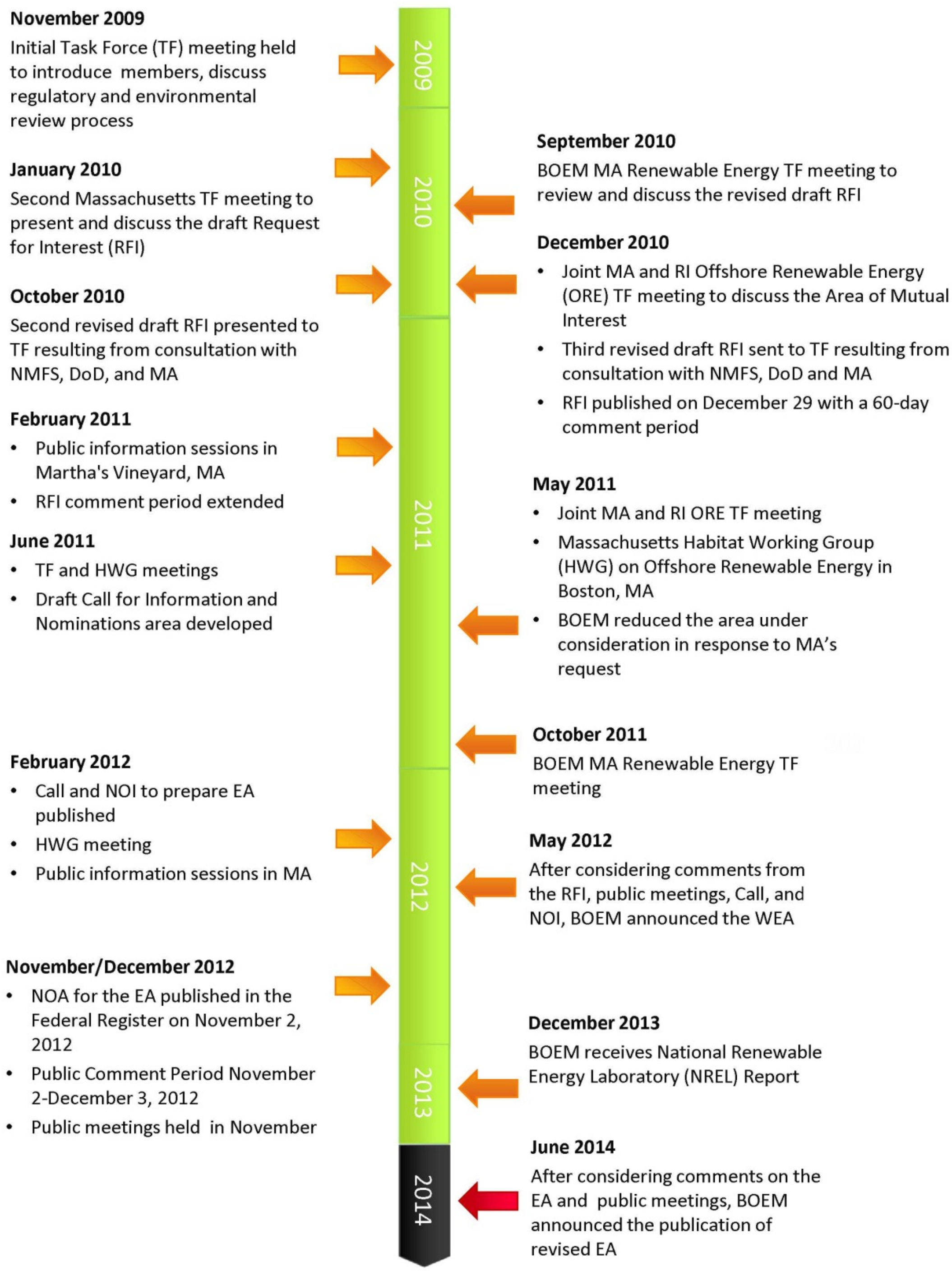

Figure 1-1. Planning Process Overview

Following several task force meetings and consultations with NMFS, DOD, and Massachusetts, the RFI was published in the *Federal Register* on December 29, 2010 (75 FR 82055). BOEM reopened the RFI comment period for an additional 30 days starting on March 17, 2011, with a notice in the *Federal Register* (76 FR 14681). BOEM received approximately 260 public comments and 11 individual expressions of interest in response to the RFI. Figure 1-2 illustrates the RFI area.

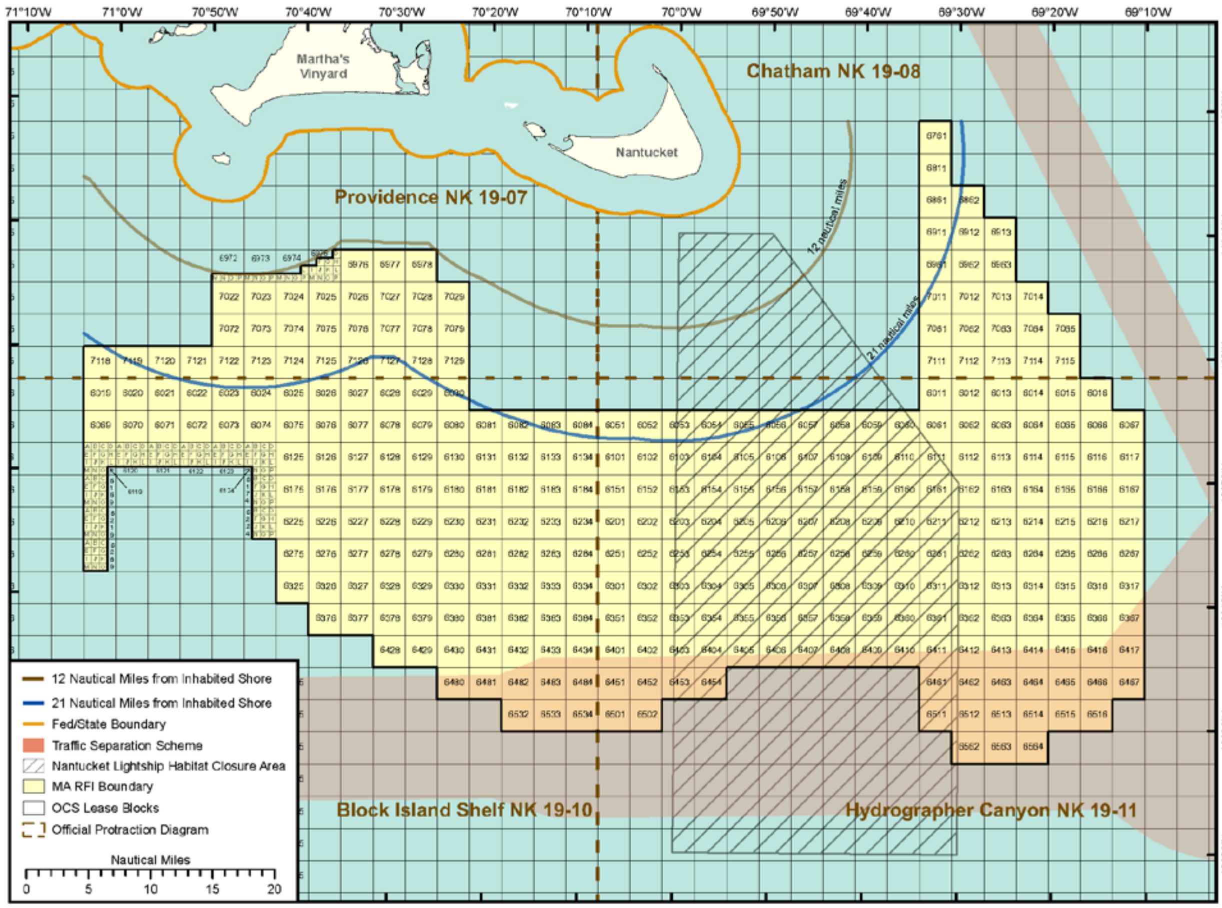

Figure 1-2. Offshore Massachusetts RFI Area

Following the release of the RFI (77 FR 5820), BOEM hosted several public meetings throughout 2011 about the leasing process for the potential wind energy development area offshore Massachusetts. Public information sessions hosted by the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) were held on February 16 and 17, 2011. In response to public input at the February information sessions, the Commonwealth of Massachusetts EOEEA established two working groups to facilitate non-governmental consultation: the Fisheries Working Group on Offshore Renewable Energy and the Massachusetts Habitat Working Group on Offshore Renewable Energy. Meetings of these two groups were held on May 2, 2011, and May 4, 2011, respectively.

After considering public input on the RFI and based on further consultation with the Task Force, the potential WEA was refined to avoid the following areas:

1. Shipping lanes, traffic separation schemes (TSS), recommended routes;

2. Nantucket Lightship Habitat Closure Area; and

3. Commercial fishing areas of interest (this resulted in removal of the eastern half of the RFI area from further consideration).

In total, 189 whole OCS blocks (an OCS block is 3 statute miles by 3 statute miles) and 144 partial OCS blocks were removed.

Additionally, public informational meetings hosted by the Commonwealth of Massachusetts EOEEA were held in New Bedford, MA, on June 7, 2011; with the Massachusetts Habitat Working Group on Offshore Renewable Energy and the public in Boston, MA, on June 8, 2011; and in Martha's Vineyard, MA, on June 9, 2011.

As a result of these meetings and consultations, the area considered for lease issuance was reduced to approximately half the size of the RFI area. On February 6, 2012, BOEM published the Call for Commercial Leasing for Wind Power on the OCS Offshore Massachusetts in the *Federal Register* (77 FR 5820). BOEM received 32 public comments and 10 expressions of interest in response to the Call. On February 6, 2012, BOEM also published an NOI that solicited public input regarding the environmental and socioeconomic issues associated with wind energy leasing in the proposed development area (77 FR 5830). Figure 1-3 below illustrates the Call Area.

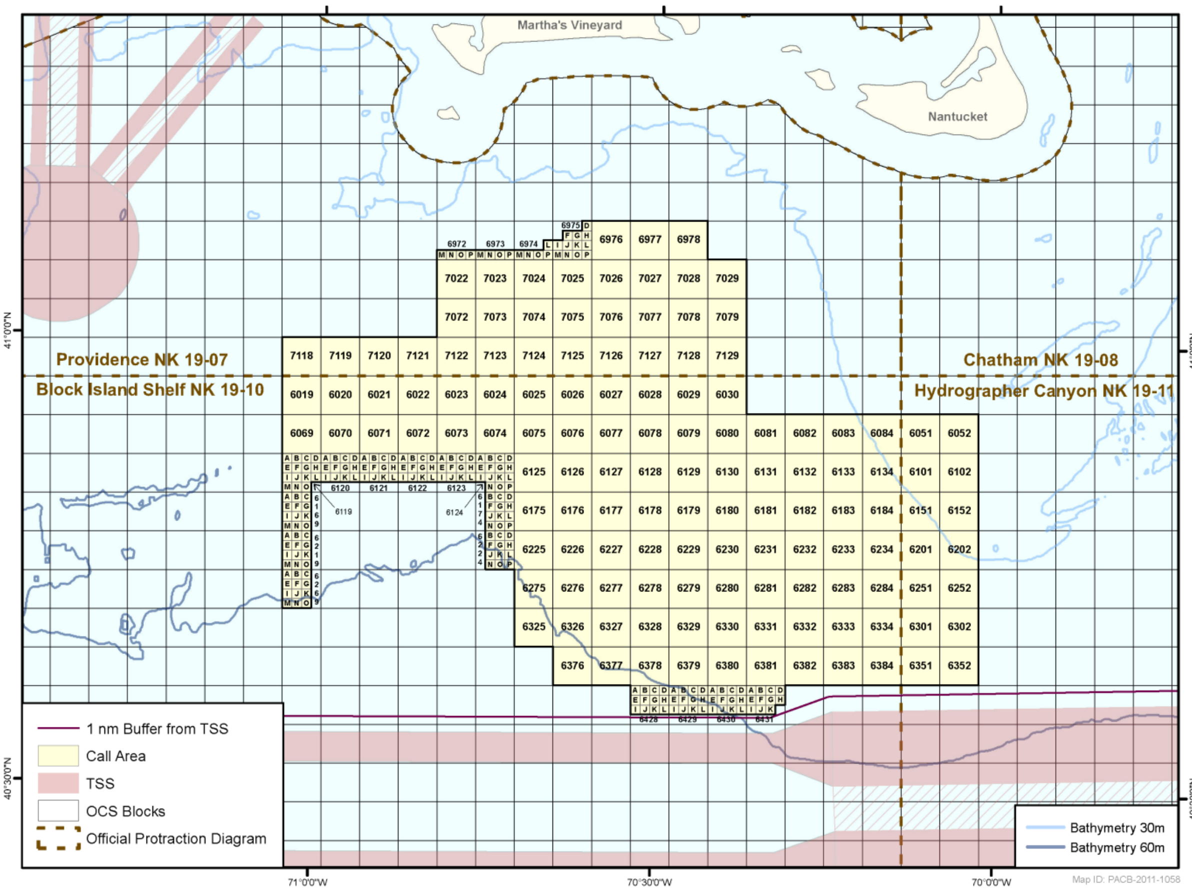

Figure 1-3. Offshore Massachusetts Call Area

Following the publication of the Call Area, BOEM convened public information sessions to explain the commercial leasing process and provide additional opportunities for public input on the scope of the EA in Massachusetts on February 13 and 14, 2012. BOEM also met with the Massachusetts Fisheries Working Group on February 13, 2012, and the Massachusetts Habitat Working Group on February 14, 2012.

During the Area Identification process (March through May 2012), BOEM excluded some of the OCS blocks that overlapped with high value sea duck habitat and areas that, if ultimately developed with commercial wind energy facilities, would likely cause substantial conflict with commercial and recreational fishing activities. The remainder of the Call Area, consisting of 117 whole and 20 partial OCS lease blocks, was announced as the final WEA on May 30, 2012, by BOEM. This final WEA is the area that will be considered for leasing and approval of SAPs in this EA. Figure 1-4 illustrates the Massachusetts WEA.

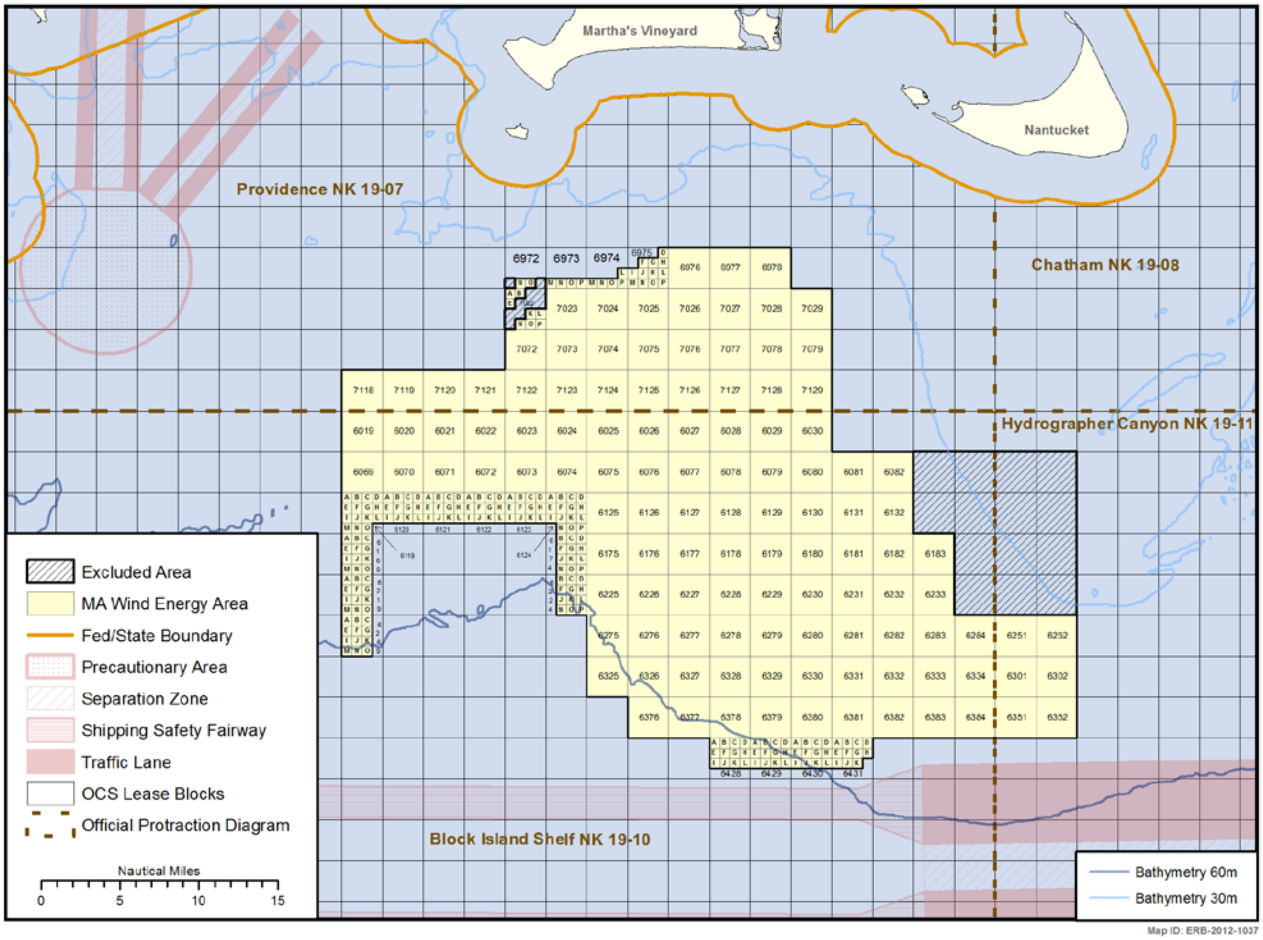

Figure 1-4. Offshore Massachusetts WEA

1.5.3 Coastal and Marine Spatial Planning

On July 19, 2010, the President signed Executive Order (EO) 13547: *Stewardship of the Ocean, Our Coasts, and the Great Lakes* establishing a National Ocean Policy and the National Ocean Council (75 FR 43023). The Order establishes a comprehensive, integrated national policy for the stewardship of the ocean, our coasts, and the Great Lakes. Where BOEM actions affect the ocean, the Order requires BOEM to take such action as necessary to implement this policy, the stewardship principles, and national priority objectives adopted by the Order and guidance from the National Ocean Council. Following the principles of Coastal and Marine Spatial Planning (CMSP) along with other tools, BOEM developed the WEA through coordination with the Task Force as described in Section 1.5.1.

1.5.4 Massachusetts Ocean Management Plan

The Commonwealth of Massachusetts established a comprehensive ocean management plan that provides a framework for managing, reviewing, and permitting proposed uses of State waters.

The plan provides a roadmap for both environmental protection and sustainable use of ocean resources. Although the plan is limited to State waters, the EOEEA identified potentially suitable locations adjacent to these areas in Federal waters for commercial-scale wind energy development because it recognized "that the three-nautical mile (5.6 km) limit of State jurisdiction (and the limit of jurisdiction of the ocean management plan) is an artificial constraint to considerations of technology, economics, and environmental and social benefits and impacts" (MA EOEEA, 2009). Massachusetts requested that BOEM form an intergovernmental task force in 2009 to assist BOEM in the planning and regulatory review associated with leasing areas of Federal waters for large-scale wind energy development.

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2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

This section describes a number of geographic alternatives for lease issuance and the approval of site assessment activities within the WEA offshore Massachusetts. See Table 2-1.

Table 2-1

Alternatives Considered

Alternative	Description
Alternative A (Preferred Alternative) – Full Leasing of WEA	Under Alternative A, lease issuance and approval of site assessment activities could occur in all areas of the WEA offshore Massachusetts (Figure 2-1). High-value fishing grounds and important sea duck habitat areas were excluded from the WEA (depicted as “Excluded Area” on Figure 2-1).
Alternative B – Removal of Areas for North Atlantic Right Whales	Activities could occur in all areas of the WEA offshore of Massachusetts, except where right whales occur and/or—based upon historical and current records, whale watch boat records, and NMFS aerial and shipboard protected species abundance surveys—are predicted to occur (Figure 2-2).
Alternative C – Removal of Areas within 15 nm[1] of Inhabited Coastline	Under Alternative C, lease issuance and approval of site assessment activities could occur in all areas of the WEA offshore Massachusetts except areas within 15 nm of the inhabited Massachusetts coastline because of possible impacts on cultural resources (Figure 2-3).
Alternative D – Removal of Areas within 21 nm of Inhabited Coastline	Under Alternative D, lease issuance and approval of site assessment activities could occur in all areas of the WEA offshore Massachusetts except areas within 21 nm of the inhabited Massachusetts coastline because of possible impacts on cultural resources (Figure 2-4)

[1] nm = nautical miles

These alternatives are the result of extensive meetings with the Task Force, relevant consultations with Federal, State, and local agencies, and potentially affected Federally Recognized Tribes, and extensive input from the public and potentially affected stakeholders. BOEM also received useful environmental, economic, use conflict, and safety-related information in response to the Call and NOI. The alternatives were identified and defined by excluding certain areas of the WEA because of the potential for affecting the following resources and uses:

- Sea duck habitat;
- Fishing and fishery resources;
- North Atlantic right whales *(Eubalaena glacialis)* (hereafter referred to as “right whale”); and
- Visual /cultural resources.

This EA uses a “reasonably foreseeable scenario,” evaluating the maximum amount of site characterization surveys (i.e., shallow hazards, geological, geotechnical, archaeological, and biological surveys) and site assessment activities (i.e., installation of data collection devices under approved SAPs) that could be conducted as a result of the proposed action. BOEM assumes that for each lease, zero to one meteorological tower, one to two buoy(s), or a combination, would be constructed or deployed.

2.1 ALTERNATIVE A (PROPOSED ACTION) – LEASING OF THE WHOLE WIND ENERGY AREA

As a result of comments received on the RFI and NOI, BOEM has identified the WEA offshore Massachusetts as the area considered for wind energy development under the proposed action (see Section 1.5 and Figure 1-1). The northern boundary of the WEA offshore Massachusetts begins approximately 12 nautical miles (nm) (22 kilometers [km]) south of Martha's Vineyard and 13 nm (24 km) southwest of Nantucket. From its northern boundary, the WEA extends roughly 33 nm (61 km) south. The WEA has an east/west extent of approximately 47 nm (87 km). The northern boundary of the WEA is at an approximately 98-foot (ft) (30-meter [m]) ocean depth and extends to approximately the 197 ft (60 m) bathymetric contour along the southern boundary. The entire area is 877 square nm (3008 square km) and contains 117 whole OCS blocks and 20 partial OCS blocks. Figure 2-1 illustrates the lease area (the whole WEA) under Alternative A.

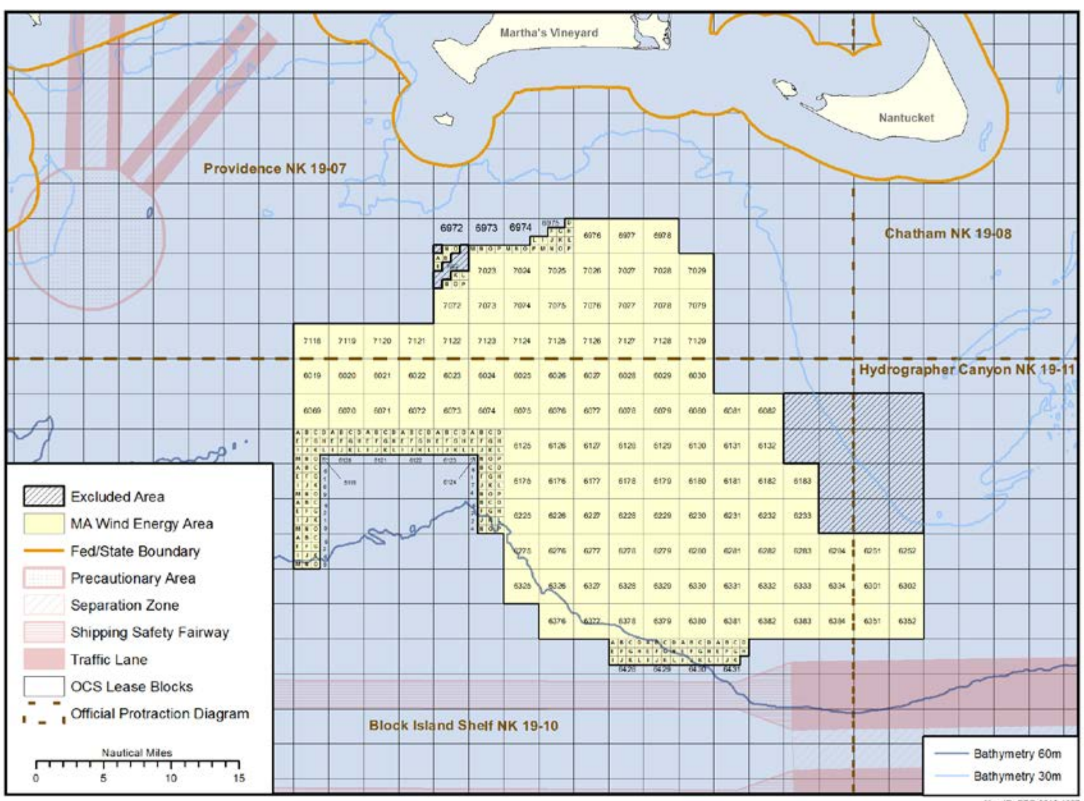


Figure 2-1. Alternative A lease area (whole WEA)

Alternative A (the preferred alternative) is the issuance of commercial and research wind energy leases within the whole WEA offshore Massachusetts, and approval of site assessment activities on those leaseholds. Based on the expressions of commercial wind energy interest received by BOEM, this alternative assumes that the entire WEA area would be leased, resulting in five total leaseholds. See Section 3, Reasonably Foreseeable Scenarios, for further discussion. Therefore, up to five meteorological towers (should all lessees choose to propose meteorological towers on their leases), 10 meteorological buoys (should all lessees choose to propose meteorological buoys on their leases), or a combination of towers and buoys are projected for the WEA under Alternative A.

The site characterization and assessment activities combined are projected to result in between 2,808 and 6,500 vessel round trips as a maximum scenario over a 5-year period (see Section 3.1.3.4). Vessel traffic would be divided between 10 major and 21 smaller ports in Massachusetts, Rhode Island, Connecticut, and New York (see Section 3.1.2). These leasing, site characterization, and site assessment scenarios are described in detail in Section 3 of this EA. The impacts of Alternative A (the preferred alternative) on environmental resources and socioeconomic conditions are described in detail in Section 4.2 of this EA.

2.2 ALTERNATIVE B – NORTH ATLANTIC RIGHT WHALE AREA EXCLUSION

To reduce the likelihood of impacts on North Atlantic right whales, Alternative B would exclude areas of the WEA (Alternative A) from leasing and site assessment activities where right whales are most likely to occur. Vessel traffic (particularly traffic associated with biological surveys) may still traverse the excluded areas.

The right whale, which is protected under the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA), has been observed exhibiting feeding behavior in the Call Area. According to the NMFS, right whales are found seasonally in the waters off Massachusetts and have been documented in the waters of the Call Area (see Section 4.2.2.6.1). The most current minimum population estimate for the right whale is 455 individuals (NMFS, 2014). Two primary human-induced threats have been identified—collisions with vessels (ship strikes) and entanglement with fishing gear. Collisions between ships and whales are the leading cause of right whale deaths (Kraus et al., 2005). Sound produced by vessels, seismic surveys, and pile driving during construction of meteorological towers is another potential source of adverse effects on right whales during site characterization and site assessment activities (Southall et al., 2007). Recent sightings data confirm that the endangered right whale is present in the Call Area during the species' regular migration. Although the number of right whales appears to be variable between years, in the last few years approximately one-quarter of the population has been observed in the Call Area (Khan et al., 2011).

Comments received during the Call and NOI comment periods expressed concerns about impacts on right whales during site assessment activities. Because the NOI focused on input relating to lease issuance and site characterization and site assessment activities, most of the issues expressed focused on the impacts that vessel traffic associated with site assessment activities would have on right whales. The concern most often identified was that the Call Area is an important migratory corridor and potential feeding habitat for the right whale.

The lease area under Alternative B is 644 square nm (2209 square km) and contains 83 whole OCS blocks and 18 partial OCS blocks. Up to three meteorological towers and six meteorological buoys are assumed for the lease area under this alternative. The impacts of Alternative B on environmental and socioeconomic resources are described in detail in Section 4.3 of this EA. Figure 2-2 below illustrates the lease area under Alternative B. The shaded area illustrates the blocks excluded because of their potential importance to right whales. This area was delineated based upon modeled occurrence using effort-corrected sightings data through 2008. Some areas were already removed through the Area Identification process.

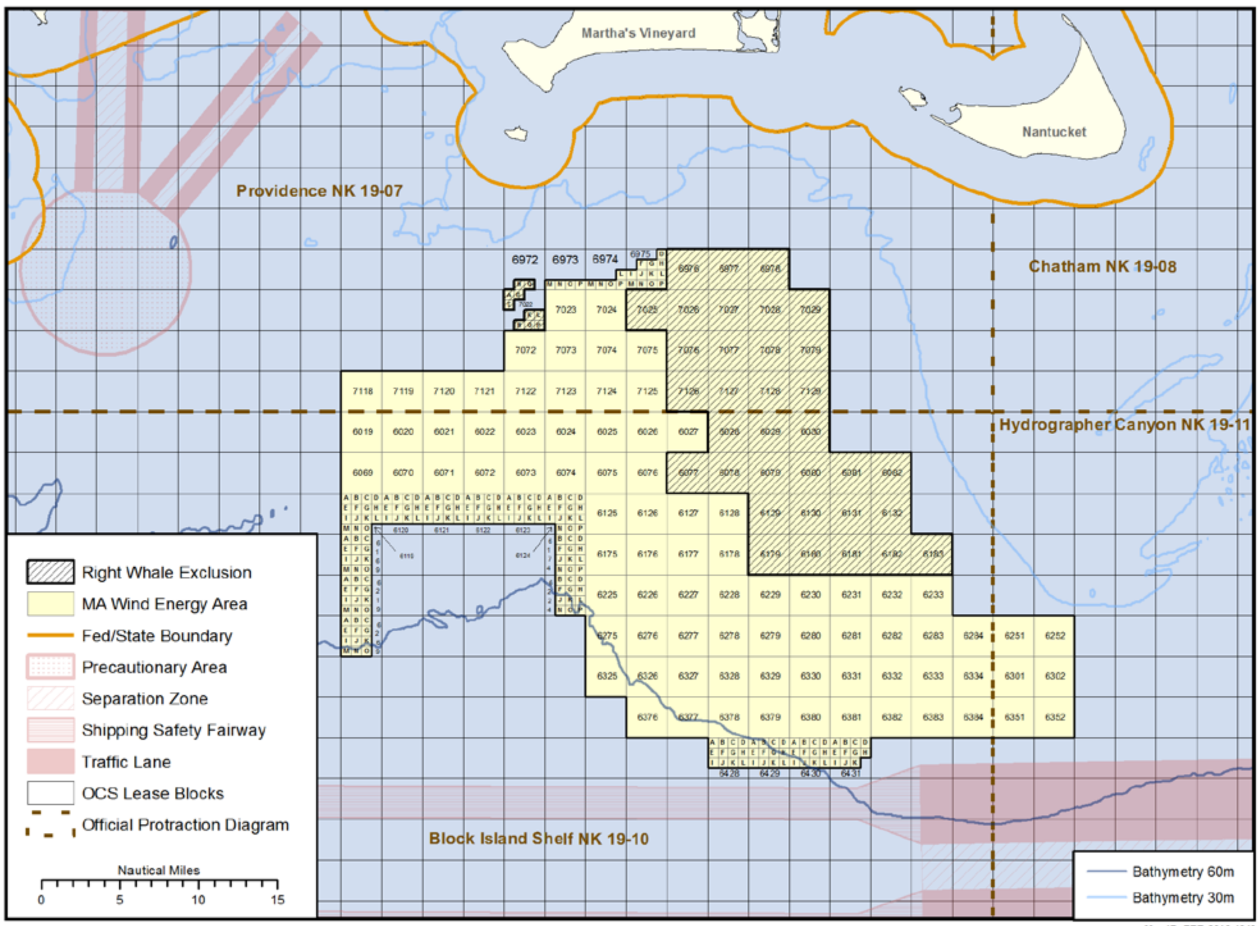


Figure 2-2. Alternative B lease area

2.3 ALTERNATIVE C – AREAS WITHIN 15 NAUTICAL MILES OF THE INHABITED COAST EXCLUDED

Under Alternative C, any OCS blocks within 15 nm (27.8 km) of the inhabited coastline are excluded from leasing to reduce possible visual impacts on cultural resources. Historic properties of religious and cultural significance to Native Americans are found in the vicinity of the coast, likely because of the important role maritime resources played in the lives of native peoples. European colonists were also attracted to and found plentiful natural resources in coastal areas. The ocean coastline in this area has gone through several periods of change, yet it retains a variety of significant cultural resources from different periods in history, including districts, sites, buildings, and traditional cultural properties. For most of these historical properties along the shore, the coastal waters are a fundamental aspect of their historical significance and an integral feature in their historical setting. In the offshore waters, increasing levels of ship traffic over the past three centuries combined with strong currents, storms, and frequent periods of heavy fog created an environment in which shipwrecks on shore and collisions at sea were relatively common (RICRMC, 2010).

During the development of the Call Area, several members of the Task Force requested that Federal waters within 15 nm (27.8 km) of the coast not be considered for leasing because visible structures in offshore areas could adversely impact the viewshed from onshore historical and cultural resources. In consideration of this request, Alternative C would exclude all areas within 15 nm (27.8 km) of the inhabited Massachusetts coastline from leasing consideration. The lease area under Alternative C is 865 square nm (2967 square km) and contains 108 whole OCS blocks and 20 partial OCS blocks. The primary visual impact concern of the the Wampanoag Tribe of Gay Head (Aquinnah) is potential commercial development (impacts from a fully developed offshore wind energy facility). While commercial development is out of the scope of this document and not analyzed, the proposed action involves the installation of meteorological towers and/or meteorological buoys which could introduce a manmade element to a natural landscape.

Up to five meteorological towers and 10 meteorological buoys are projected for the lease area under this alternative. The impacts of Alternative C on environmental and socioeconomic resources are described in detail in Section 4.4 of this EA. Figure 2-3 below illustrates the lease area under Alternative C.

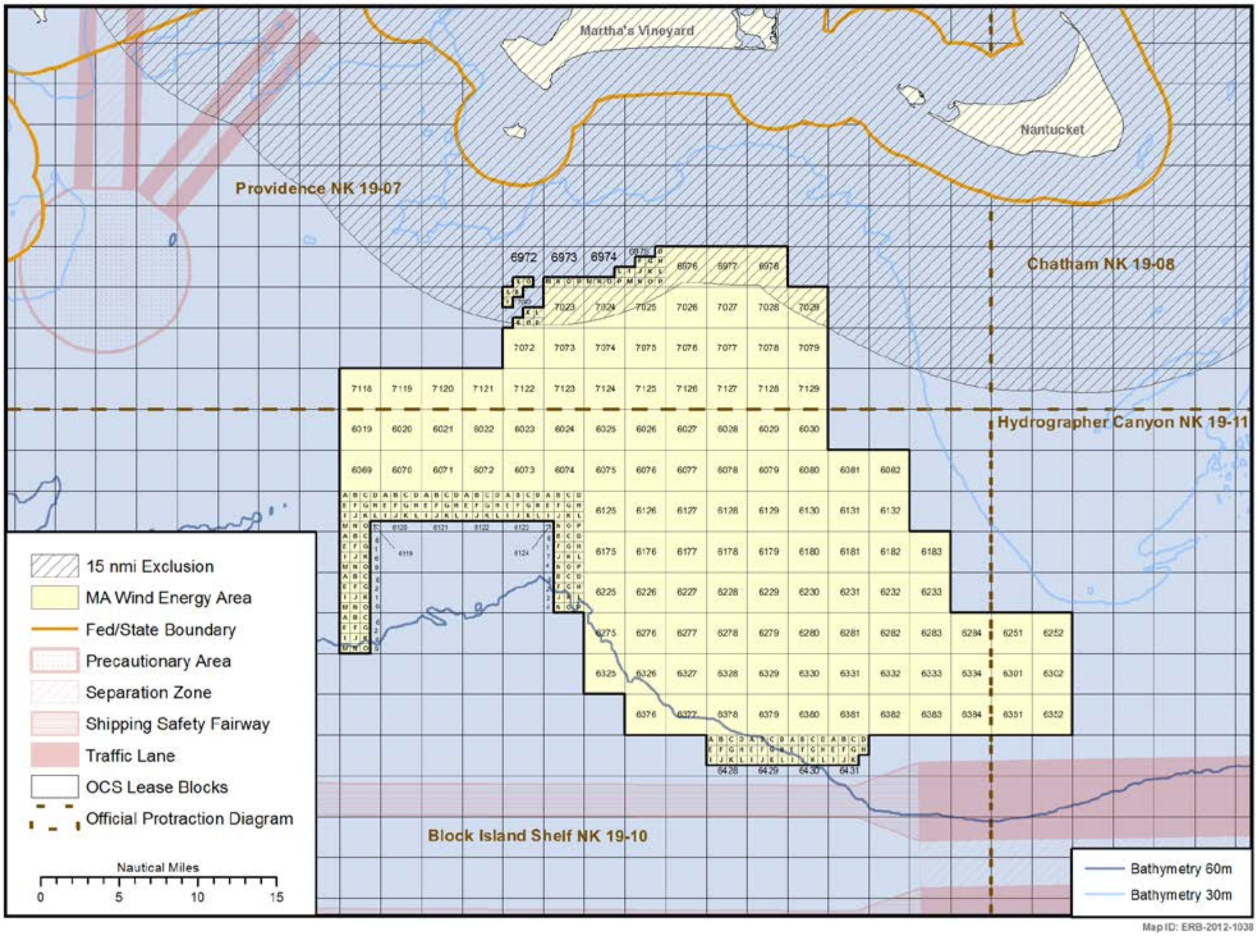


Figure 2-3. Alternative C lease area

2.4 ALTERNATIVE D – AREAS WITHIN 21 NAUTICAL MILES OF THE INHABITED COAST EXCLUDED

Under Alternative D, any OCS blocks within 21 nm (39 km) of the inhabited coastline are excluded from leasing to reduce possible visual impacts to cultural resources. The Tribal Historic Preservation Officer of the Wampanoag Tribe of Gay Head (Aquinnah) requested a minimum distance of 21 nm (39 km) from the Massachusetts coastline. The Wampanoag Tribe of Gay Head (Aquinnah) has tribal lands on the west side of Martha's Vineyard that include Gay Head Cliffs, which are designated as a National Natural Landmark by the National Park Service (NPS). An unencumbered view from the cliffs is considered by the Aquinnah to be essential to the sacred nature of the site. The lease area under Alternative D is 709 square nm (2432 square km) and contains 81 whole OCS blocks and 28 partial OCS blocks. The primary visual impact concern of the the Wampanoag Tribe of Gay Head (Aquinnah) is potential commercial development (impacts from a fully developed offshore wind energy facility). While commercial development is out of the scope of this document and not analyzed, the proposed action involves the installation of meteorological towers and/or meteorological buoys which could introduce a manmade element to a natural landscape. Up to four meteorological towers and eight meteorological buoys are projected for the lease area under this alternative. The impacts of Alternative D on environmental and socioeconomic resources are described in detail in Section 4.5 of this EA. Figure 2-4 below illustrates the lease area under Alternative D.

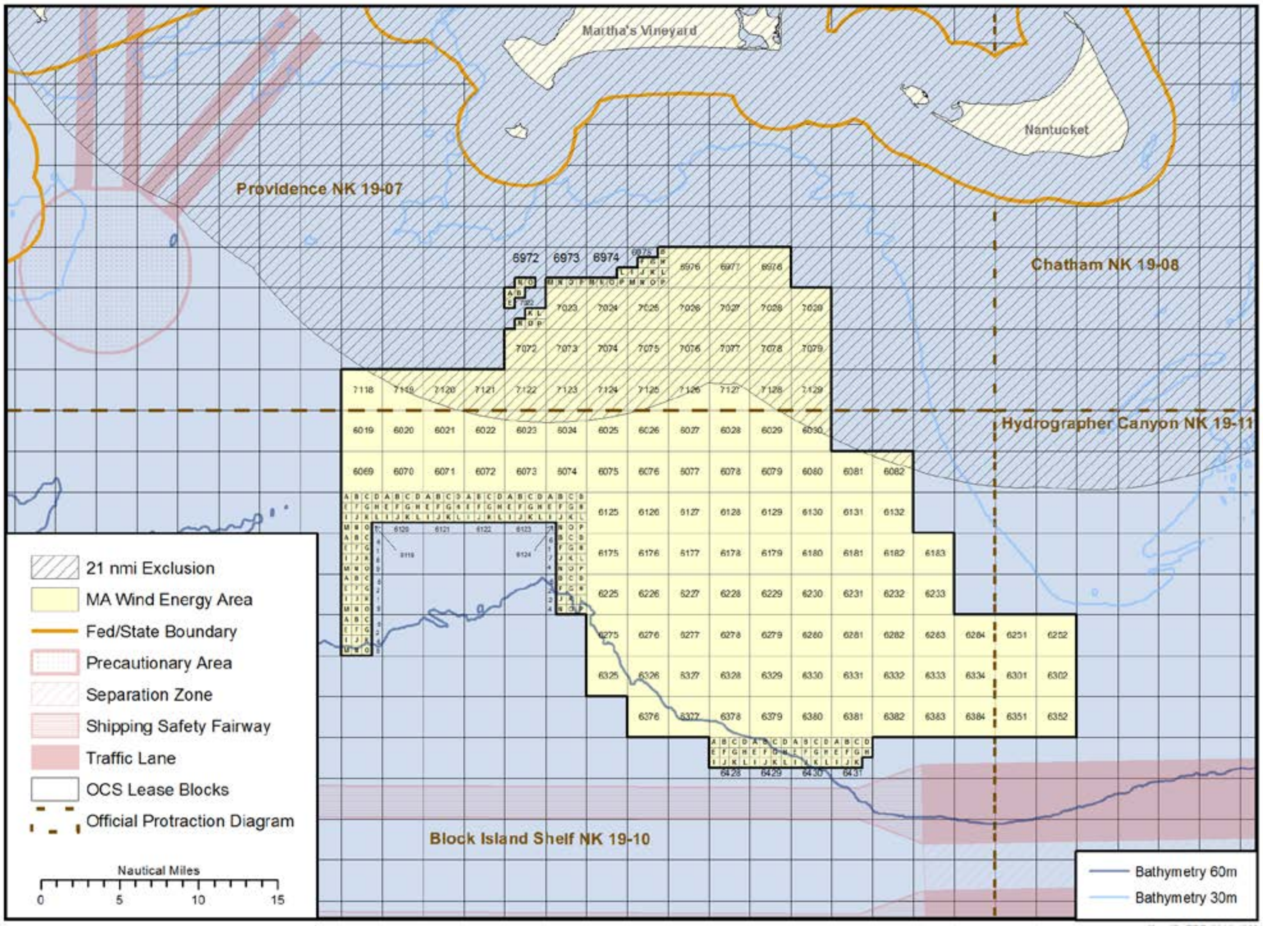


Figure 2-4. Alternative D lease area

2.5 ALTERNATIVE E – NO ACTION

NEPA requires the analysis of a No Action Alternative. Under the No Action Alternative, no wind energy leases would be issued and no site assessment activities would be approved within the WEA offshore Massachusetts. Site characterization surveys could be conducted, although they are not likely to occur without the possibility of a commercial energy lease. The impacts of Alterative E (No Action) on environmental and socioeconomic resources are described in detail in Section 4.6 of this EA.

2.6 STANDARD OPERATING CONDITIONS

Under the renewable energy regulations, after the lease is issued, the lessee may not begin construction of meteorological or other site assessment facilities until a SAP and the site characterization survey reports are submitted to and reviewed by BOEM (see 30 CFR 585.605–585.618). The lessee's SAP must contain a description of environmental protection features or measures that the lessee would implement. For offshore cultural resources and biologically sensitive habitats, BOEM's primary mitigation strategy is and will continue to be avoidance. For example, the exact location of meteorological towers and buoys would be adjusted to avoid adverse effects to offshore cultural resources or biologically sensitive habitats, if present.

BOEM has developed several measures called Standard Operating Conditions (SOCs) as part of the proposed action to minimize or eliminate impacts on protected species, including ESA-listed species of whales, sea turtles, fish, and birds (Appendix B). These SOCs were developed through the analyses presented in Section 4.2 and through consultation with other Federal and State agencies.

Additionally, BOEM will continue to analyze and develop SOCs in subsequent NEPA documentation based upon staff recommendations and consultations with the NMFS and the USFWS pursuant to obligations under the ESA, the Magnuson-Stevens Fishery Conservation and Management Act, and public comments. At this time, no fishery or fishery-related SOCs are proposed for the lease issuance and site characterization activity. Development of any additional measures addressing these resources and impacts related to construction and operation of a wind energy facility will be considered at a future time as part of the COP and not as part of this EA. Additional SOCs will be developed and analyzed after the collection and submittal of site characterization and assessment information. BOEM may add SOCs designed to mitigate the impacts of lease-specific site characterization activities and site assessment activities in the form of lease stipulations and/or conditions of approval of a SAP.

3 SCENARIO OF REASONABLY FORESEEABLE ACTIVITY AND IMPACT-PRODUCING FACTORS

To describe the level of activity that could reasonably result from the proposed action and alternatives, BOEM developed the following scenarios for routine activities (Section 3.1 below) and non-routine events (Section 3.2). These scenarios provide the framework for the analyses of potential environmental and socioeconomic impacts of the proposed action (Section 4.2) and alternatives (Sections 4.3–4.6).

3.1 ROUTINE ACTIVITIES

This section discusses the reasonably foreseeable leasing scenario, including infrastructure that could be built and the activities that could occur on those leases over the site assessment period. This would include site characterization surveys as well as the construction, operation, and decommissioning of meteorological and oceanographic data collection facilities for site assessment. The routine scenario is intended to be broad enough to cover the range of reasonably foreseeable activities that would take place on a commercial or research wind lease, and structure types and activities that would be authorized under a SAP.

BOEM developed the following scenario based on previous lease applications submitted to BOEM and public comments and expressions of interest received in response to the RFI, Call, and NOI associated with the wind energy development area offshore Massachusetts (Section 1.4.3). Unless otherwise noted, assumptions in this section are based on those previous proposals and expressions of interest.

3.1.1 Leasing Scenario

A leasing scenario is necessary to develop a scenario for site characterization and assessment activities. Because there is no historical record to use to develop a leasing scenario for OCS wind energy, BOEM based its leasing scenario assumptions on the offshore wind industry's unsolicited applications for commercial leases, and responses to BOEM's renewable energy planning notices (e.g., RFIs, Call).

In response to BOEM's renewable energy planning notice (the Call) issued for the wind energy development area offshore Massachusetts, the offshore wind industry submitted 10 expressions of commercial wind energy interest. The requested leaseholds ranged from 10 OCS blocks to the entire WEA; therefore, this EA assumes that the whole WEA would be leased. After reviewing the configuration of the OCS blocks within the WEA along with the size and areas that were identified in the expressions of interest, BOEM determined that the average size leasehold would encompass 27 OCS blocks. Therefore, to develop a conservative leasing scenario for the purposes of this EA, the average size of a proposed wind energy lease within the WEA is anticipated to be 27 OCS blocks. Using a lease size equivalent to 27 OCS blocks and a total lease area of 137 OCS blocks (117 whole plus 20 partial blocks), BOEM determined that a maximum of five leases are anticipated under Alternative A.

The timing of lease issuance, weather, and sea conditions would be the primary factors influencing timing of site characterization and site assessment activities. Under the reasonably foreseeable scenario, BOEM would issue all leases in February 2015. The most suitable sea states and weather conditions in the WEA occur from April to August; therefore, meteorological towers and buoys would likely be installed and decommissioned during these months.

The lessee must submit a SAP within 1 year of lease issuance (30 CFR 585.235 (a)(1)). Therefore, site characterization activities in support of the SAP are anticipated to take place in the first year after lease issuance (30 CFR 585.610), between February and October 2015. Remaining site characterization is projected to occur over the 5-year site-assessment term. Because site assessment activities would need to be approved in the SAP, but completed with enough time to prepare the COP, the majority of site assessment is assumed to take place in years 1 through 3 (2015 through 2018). The COP must be submitted 6 months prior to the expiration of the 5-year site assessment term.

3.1.2 Port Facilities

Specific ports that would be used by lessees would be determined in the future and primarily by proximity to the lease blocks, capacity to handle the proposed activities, and/or established business relationships between port facilities and lessees. Existing ports or industrial areas that are likely to be used by lessees in support of the proposed action occur in Massachusetts, Rhode Island, Connecticut, and New York. Because these port facilities are adequate to support proposed action activities, expansion of port facilities to meet lessee needs is not anticipated, and, therefore, only existing facilities that can currently accommodate proposed site characterization and site assessment activities are considered. For this EA, “major” ports include existing sites that have deepwater access (greater than a 15 ft [4.6 m] channel depth) and fabrication yards for the staging, assembly (or partial assembly), and decommissioning of meteorological towers and buoys. Deepwater access at ports is required to accommodate vessels carrying meteorological tower components from port to the WEA. Because vessels used for site characterization work are generally smaller in scale than what is needed for site assessment, and infrastructure requirements for surveying/research equipment are also likely to be smaller than what is needed for site assessment, a list of “minor” ports was also developed for this EA. “Minor” ports are characterized as those that would serve as staging areas and crew/cargo launch sites for the survey vessels, which are anticipated to be approximately 65 to 100 ft (20 to 30 m) in length.

Ten major ports and 21 minor ports are identified (Tables 3-1 and 3-2); however, there is overlap of four ports (Providence, Quonset Point, New London, and Groton) between the lists because these ports could be used by the larger vessels for site assessment and by the smaller research/survey vessels for site characterization. Some of the major ports are not typically used by smaller research-sized vessels and therefore are not included in the minor ports list. There are several marinas and facilities that could be used at most of the minor port locations.

Table 3-1

Major Port Facilities

Location	Nearest Lease Block	Approximate Distance[1] to Nearest Lease Block under Alternative A (nautical miles)	Approximate Distance[1] to Mid-Point[2] of Wind Energy Area (OCS Block 6179) (nautical miles)
Boston, MA	6352	215	238
Chelsea, MA	6352	215	238
Gloucester, MA	6352	215	238
New Bedford, MA	6972M (partial)	40	68
Providence, RI	7118	55	85
Quonset Point, RI (Port of Davisville)	7118	45	75
New London, CT	7118	60	90
Groton, CT	7118	60	90
Brooklyn, NY	6269M (partial)	170	195
Staten Island, NY	6269M (partial)	165	190

[1]Distance was calculated using Traffic Separation Scheme routes and not as the shortest distance between the port facility and the nearest lease block. OCS = Outer Continental Shelf.

[2]To come up with a reasonably foreseeable leasing scenario, it can be assumed that some of the site assessment and characterization would take place in the portion of the WEA closer to shore than the mid-point, and an equally similar amount the activities would take place in the portion of the WEA from the mid-point to the farthest point from shore. Therefore, the mid-point distance was chosen to represent an average of how far vessels would travel to conduct surveys and site assessments within the WEA.

Table 3-2

Minor Port Facilities

State	Port Location
Massachusetts	Fall River
	Falmouth
	Fairhaven & New Bedford
Rhode Island	Galilee
	North Kingstown
	Newport
	Quonset Point (Port of Davisville)
	Providence
Connecticut	New Haven
	Groton
	New London
	Westbrook
	Clinton
	Stonington
	Avery Point
New York	Montauk
	Hampton Bays
	Greenport
	Islip
	Sag Harbor
	Orient Point

3.1.3 Site Characterization Surveys

BOEM regulations require that the lessee provide the results of a number of surveys with its SAP or COP, including:

- Shallow hazards (30 CFR 585.610(b)(2) and 30 CFR 585.626(a)(1));
- Geological (30 CFR 585.610(b)(4) and 30 CFR 585.616(a)(2));
- Geotechnical (30 CFR 585.610(b)(1) and 30 CFR 585.626(a)(4));
- Archaeological resource (30 CFR 585.610(b)(3) and 30 CFR 585.626(a)(5)); and
- Biological surveys (30 CFR 585.610(b)(5) and 30 CFR 585.626(a)(3)).

BOEM refers to these surveys as "site characterization" activities. It is assumed that the site of a meteorological tower or buoy would be surveyed first to meet the similar data requirements for a lessee's SAP (30 CFR 585.610 and 585.611), and the site of a meteorological tower or buoy would not be resurveyed when the remainder of the leasehold is surveyed to meet the data requirements for a lessee's COP (30 CFR 585.626(a)). Although BOEM does not issue permits or approvals for these site characterization activities, the agency will not consider approving a lessee's SAP and COP if the required survey information is not included. Because an applicant would not likely invest in undertaking these potentially expensive site characterizations prior to acquiring a lease (which would convey the exclusive right to apply for a SAP and a COP), and because the survey information must be submitted to BOEM before any SAP or COP could be approved, this EA treats site characterization activities as actions connected to the issuance of a lease.

As described in the PEIS (MMS, 2007a), high-resolution geophysical (HRG) surveys and geotechnical exploration would likely be necessary to characterize a site. The HRG surveys would be used to locate shallow hazards, cultural resources, and hard-bottom areas; evaluate installation feasibility; assist in the selection of appropriate foundation system designs; and determine the variability of subsurface sediments. The survey information is used in the design, construction, and operations of structures to mitigate the potential impacts to installations, operations, and production activities, and for structure integrity. The scope of HRG surveys would be sufficient to reliably cover any portion of a site that may be affected by the construction, operation, and decommissioning of structures. These areas include, but are not limited to, the footprint of all seafloor/bottom-disturbing activities (including the areas in which installation vessels, barge anchorages, and/or appurtenances may be placed) associated with construction, installation, inspection, operation, maintenance, and removal of structures.

BOEM's GGARCH details the information that would be required to satisfy 30 CFR 585.626(a) (BOEM OREP, 2012). In this guidance, the agency provides descriptions of survey methods that, should lessees follow them, would yield information sufficient to to support the submission of a lessee's plans. For the purposes of this scenario, BOEM assumes that all lessees would employ these methods, or methods substantially similar.

Lessees would only be required to submit survey information for those areas that would be disturbed or otherwise affected by future actions it proposes in a lease area. As explained further in this section, different types of site characterization surveys would be necessary to acquire the various types of information required by the regulations.

This EA assumes that the maximum number of surveys would be conducted over the entire WEA and analyzes the reasonably foreseeable environmental effects associated with maximum surveying. The extent to which lessees survey less than 100 percent of their leasehold area would be the same extent to which the potential environmental effects associated with site characterization activities would be less than the effects analyzed in this EA. Because of the mobilization costs of site characterization surveys, this EA assumes that the site of a meteorological tower or buoy would be surveyed (30 CFR 585.610–585.611) at the same time the lease area is surveyed to meet the similar data requirements for a COP (30 CFR 585.626(a)).

3.1.3.1 High-resolution Geophysical Surveys

The lessee must submit the results of site characterization surveys with their SAP (30 CFR 585.610 and 585.611) and COP (30 CFR 585.626(a) and 585.627). Assuming lessees would follow the GGARCH guidelines to meet the geophysical data requirements (30 CFR 585.626(a); BOEM OREP, 2012), BOEM anticipates that the surveys would entail the following:

- For collecting geophysical data for shallow hazards assessments, magnetometers and side-scan sonar/sub-bottom profilers would be deployed at 98 ft (30 m) line spacing over the lease area;
- For collecting geophysical data for archaeological resources assessments, magnetometers side-scan sonar, and sub-bottom profiler systems would be deployed at 98 ft (30 m) line spacing; and
- For collecting bathymetric charting information, lessees would use a multi-beam echo-sounder.

In addition, the geophysical survey grid(s) for proposed transmission cable route(s) to shore would likely include a minimum 984 ft-wide (300 m-wide) corridor centered on the transmission cable location(s) to allow for all anticipated physical disturbances and movement of the proposed location, if necessary. See GGARCH guidelines (BOEM OREP, 2012). Because predicting precisely where a power substation would ultimately be installed on any given lease or the route that any potential future transmission line would take across the seafloor to shore is not yet possible, this EA uses direct lines between the edge of the potential lease areas and the potential interconnection points on shore to approximate the reasonably foreseeable level of surveys that may be conducted to characterize undersea transmission cable routes. BOEM is using five potential grid transmission connection points along the Connecticut, Rhode Island, and Massachusetts shorelines identified by lessees in response to the Call as the reasonably foreseeable locations where undersea cables would connect to the onshore electrical grid. The total length of all five cable routes (from the onshore grid connection point to the edge of the WEA) combined is approximately 150 nm (278 km).

The vessel traffic associated with surveying transmission cable routes outside of the WEA has been accounted for in the vessel traffic scenarios associated with the proposed action and alternatives in this EA. Surveying of cable routes within the WEA would be captured during other surveying efforts. Line spacing for surveys associated with transmission cable route surveys would follow the scenario described in the GGARCH (BOEM OREP, 2012).

The possible types of equipment to be used during a HRG survey are summarized below.

Bathymetry/Depth Sounder: A depth sounder is a microprocessor-controlled, high-resolution survey-grade system that measures precise water depths in both digital and graphic formats. The system would be used in such a manner as to record with a sweep appropriate to the range of depths expected in the survey area. This EA assumes the use of multi-beam and/or single-beam bathymetry systems. The use of a multi-beam bathymetry system may be more appropriate for characterizing those lease areas containing complex bathymetric features or sensitive benthic habitats such as hard-bottom areas.

Magnetometer: Magnetometer surveys would be used to detect and aid in the identification of ferrous, ferric, or other objects having a distinct magnetic signature. The magnetometer sensor is typically towed as near as possible to the seafloor, which is anticipated to be no more than approximately 20 ft (6 m) above the seafloor.

Seafloor Imagery/Side-Scan Sonar: This survey technique is used to evaluate surface sediments, seafloor morphology, and potential surface obstructions (MMS, 2007a). A typical side-scan sonar system consists of a top-side processor, tow cable, and towfish with transducers (or "pingers") located on the sides, which generate and record the returning sound that travels through the water column at a known speed. To meet regulatory requirements as explained in the GGARCH guidelines (BOEM OREP, 2012), BOEM assumes that lessees would use a digital dual-frequency side-scan sonar system with frequencies of 445 and 900 kiloHertz (kHz) and no less than 100 and 500 kHz to record continuous planimetric images of the seafloor. The data would be processed in a mosaic form to allow for a true plan view and 100 percent coverage of the project area. The side-scan sonar sensor would be towed above the seafloor at a distance that is 10 to 20 percent of the range of the instrument.

Shallow and Medium (Seismic) Penetration Sub-bottom Profilers: Typically, a high-resolution Compressed High Intensity Radar Pulse (CHIRP) System sub-bottom profiler is used to generate a profile view below the bottom of the seabed, which is interpreted to develop a geologic cross-section of subsurface sediment conditions under the track line surveyed. Another type of sub-bottom profiler is a boomer or impulse-type system. Sub-bottom profilers are capable of penetrating sediment depth ranges of 10 ft (3 m) to greater than 328 ft (100 m) depending on frequency and bottom composition.

Table 3-3 gives a list of typical equipment used in high-resolution site surveys and their acoustic intensity. This table is representative of the types of equipment that BOEM has received in draft project plans submitted under Interim Policy leases in Delaware and New Jersey, and with the assumptions used in the *Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas Final Programmatic Environmental Impact Statement Volumes I and II* (BOEM, 2014). Actual equipment used could have frequencies and/or sound pressure levels (SPL) somewhat below or above those indicated in Table 3-3. This scenario does not assume the use of any air guns that are used for deeply penetrating two-dimensional and three-dimensional exploratory seismic surveys to determine the location, extent, and properties of oil and gas resources.

Table 3-3

Typical High-Resolution Geophysical Survey Equipment

Source	Pulse Length	Broadband Source Level (dB re 1 µPa at 1 m)	Operating Frequencies
Boomer	180 µs	212	200 Hz–16 kHz
Side-scan sonar	20 ms	226	100 kHz
			900 kHz
CHIRP sub-bottom profiler	64 ms	222	3.5 kHz
			12 kHz
			200 kHz
Multi-beam depth sounder	225 µs	213	240 kHz

Source: BOEM, 2014

CHIRP = Compressed High Intensity Radar Pulse, µs = microsecond, ms = millisecond, Hz = hertz, kHz = kilohertz, dB re 1 µPa at 1 m = source level, received level measured or estimated 3 ft (1 m) from the source

Proposed Action Scenario for HRG Surveys

This EA assumes that the WEA would be surveyed in its entirety, and geophysical surveys for shallow hazards (492 ft [150 m] line spacing) and archaeological resources (98 ft [30 m] line spacing) would be conducted at the same time on the same vessels conducting sweeps at the narrower line spacing. This results in about 500 nm (926 km) of HRG surveys per OCS block, not including turns. Therefore, approximately 63,500 nm (117,602 km) of HRG surveys would be conducted over the WEA (an average of 250 nm [463 km] of surveys was used for each of the 20 partial blocks). Assuming a vessel speed of 4.5 knots (Continental Shelf Associates, Inc., 2004), completing 63,500 nm (117,602 km) of surveying would take approximately 14,100 hours of vessel time. Assuming a 10-hour work day (not including transit time to/from the WEA), surveying one OCS block would take about 11 days and surveying an average-size lease of 27 OCS blocks would take about 297 days. Assuming one round trip per day, approximately 1,485 round trips (five leases multiplied by 297 days per average-size lease) would be conducted for HRG surveying of the entire WEA.

Because one cable route could be constructed for each individual lease, up to five cable routes are anticipated. Surveying a 984 ft-wide (300 m-wide) corridor along each potential cable route located outside the WEA would result in about 5 nm (9.3 km) or 1 hour of surveys per mile of cable. Based on the estimated length of all five cable routes at approximately 150 nm (278 km), 750 nm (1389 km) of HRG surveys taking approximately 150 hours would occur to survey the cable routes. Assuming a 10-hour work day and assuming one round trip per day for surveying of the cable routes, 150 hours of surveying would take approximately 15 days (and thus 15 round trips).

To survey the entire WEA and five potential cable routes, HRG surveys would have to be conducted by multiple vessels and/or over multiple years. Using the assumptions described in this section and including surveying of OCS blocks and cable routes, the proposed action would result in a total of approximately 64,250 nm (118,991 km) (63,500 nm [117,602 km] for within the WEA plus 750 nm (1389 km) outside of the WEA for cable routes) equaling approximately 14,250 hours (594 days) of HRG surveys and 1,500 round trips for survey vessels.

3.1.3.2 Geotechnical Exploration

A series of site-specific geotechnical exploration methods would be used by lessees to characterize the sub-bottom environment of the WEA. Geotechnical exploration would be used to assess the suitability of shallow sediments to support a structure foundation or transmission cable under any operational and environmental conditions that could potentially be encountered (including extreme events), as well as to document the sediment characteristics necessary for design and installation of all structures and cables. Physical and chemical data on surface sediments are obtained through geotechnical exploration and, therefore, BOEM is provided with a detailed geotechnical evaluation of the location of potential structure foundation(s) based on the analysis of site-specific samples. The results of the evaluation allow for a thorough investigation of the stratigraphic and geotechnical properties of the sediments that may affect the foundations or anchoring systems of an offshore wind energy project (MMS, 2007a).

The surveying approach most often taken is to simultaneously conduct a series of bottom sampling methods and shallow-bottom coring from a small marine drilling vessel. For sampling sub-bottom sediment, BOEM assumes that one sample would be taken at each meteorological buoy and tower location, each turbine location, and at every nautical mile along cable routes. The following sediment sampling methods may be used to obtain physical and chemical properties of surface sediments.

Bottom-sampling devices: Bottom-sampling devices have the ability to penetrate depths ranging from a few centimeters to several meters below the seafloor. A piston core or gravity core is often used to obtain samples of soft surficial sediments. Unlike a gravity core, which is essentially a weighted core barrel that is allowed to free-fall into the water, piston corers have a “piston” mechanism that triggers when the corer hits the seafloor. The main advantage of a piston core over a gravity core is that the piston helps to avoid disturbance of the sediment sample and allows for the best possible sediment sample (MMS, 2007a). Shallow-bottom coring is a method that employs a rotary drill that penetrates through several feet of consolidated rock. None of the above sampling methods uses high-energy sound sources (Continental Shelf

Associates, 2004; MMS, 2007a).

Vibracores: Vibracores are often used for obtaining samples of unconsolidated sediment or when there are known or suspected archeological and/or cultural resources present that may have been identified through the HRG survey (BOEM, 2012). Vibracores are commonly used because they can retrieve deep samples in most types of undisturbed sediment and can be used to assess bulk physical and chemical properties at and above proposed construction depths. Vibracore samplers typically consist of a core barrel and an oscillating driving mechanism that propels the core into the sub-bottom. Once the core barrel is driven to its full length, the core barrel is retracted from the sediment and returned to the deck of the vessel. Typically, cores up to 15 ft (4.6 m), with 4-inch (10.2 centimeter [cm]) diameters are obtained, although some devices have been modified to allow for samples up to 40 ft (12 m) long (MMS, 2007a; USACE, 1987).

Deep borings: Deep borings may be used to sample and characterize the geological properties of the sediments at the maximum expected depths of the structure foundations (MMS, 2007a). Deep borings take place on a drill rig on a jack-up barge that is supported by four "spuds" that are lowered to the sea-floor. Geologic borings can generally reach depths of 100 to 200 ft (30 to 61 m) within a few days (based on weather conditions). The acoustic levels from deep borings can be expected to be in the range of 118 to 145 decibels (dB) at a frequency of 120 hertz (Hz).

Cone Penetration Test (CPT): CPTs could supplement or be used in place of deep borings (BOEM, 2012). A CPT rig would be mounted on a jack-up barge similar to that used for the deep borings. The top of a CPT drill probe is typically up to 3 inches (8 cm) in diameter, with connecting rods less than 6 inches (15 cm) in diameter.

CPTs and boreholes are often used together because they provide different data on sediment characteristics. A CPT provides a fairly precise stratigraphy of the sampled interval, plus other geotechnical data, but does not allow for capture of an undisturbed soil sample. Bore holes can provide undisturbed samples, but are most effectively used in conjunction with CPT-based stratigraphy so that sample depths can be pre-determined. A CPT is suitable for use in clay, silt, sand, and granule-sized sediments as well as some consolidated sediment and colluvium. Bore hole methods can be used in any sediment type and in bedrock. Vibracores are suitable for extracting continuous sediment samples from unconsolidated sand, silt, and clay-sized sediment up to 33 ft (10 m) below the surface. The WEA is characterized by unconsolidated silt, clay, and sand deposits, so all three sampling methods may be used over the entire area. The bedrock surface in the WEA is hundreds of meters below the seabed (Oldale, 1992).

Proposed Action Scenario for Geotechnical Surveying/Geotechnical Exploration

The renewable energy regulations at 30 CFR 585.610(b) (for SAP) and 30 CFR 585.626(a) (for COP) require sediment testing at the proposed site of any proposed bottom-founded structure.

The scenario in this EA assumes that one geotechnical exploration sample may be taken at the proposed location for a meteorological tower or anchoring location for an instrumented buoy. See Section 3.1.4 below for a description of the reasonably foreseeable scenario for the installation of meteorological towers/buoys associated with the proposed action. With regard to potential future COPs, the number of geotechnical exploration samples would depend on the number of turbines a lessee ultimately proposes (see 30 CFR 585.626(a)(4)). As discussed in the PEIS (MMS, 2007a), spacing between turbines is typically determined on a case-by-case basis to minimize wake effect and is based on the rotor diameter associated with turbine size. In Denmark's offshore applications, for example, a spacing of seven rotor diameters between units has been used (MMS, 2007a). Spacing of six by nine rotor diameters, or six rotor diameters between turbines in a row and nine rotor diameters between rows was approved for the Cape Wind project (MMS, 2009a). Based on this range in spacing for a 3.6 megawatt (MW) (360 ft [110 m] rotor diameter) turbine and a 5 MW (426 ft [130 m] rotor diameter) turbine, placing anywhere from 4 to 20 turbines in one OCS block (3 statute miles by 3 statute miles) would be possible.

The following assumptions result in a total of between 668 and 2,700 geotechnical (seafloor-penetrating) samples taken as a result of the proposed action.

- BOEM assumes a "maximum" scenario of wind development on every OCS block (which is extremely unlikely, but the smaller number of samples associated with less development would result in lower environmental impacts), resulting in a potential of between 508 to 2,540 wind turbines (117 whole OCS blocks in the WEA multiplied by a potential maximum of 20 wind turbines per OCS block plus 20 partial OCS blocks multiplied by an estimated maximum of 10 wind turbines per partial OCS block). Because BOEM assumes that one geotechnical exploration sample (Vibracore, CPT, and/or deep boring) would be collected at every potential wind turbine location throughout the WEA, a total of up to 2,540 geotechnical exploration samples may be taken for the wind turbine locations.
- BOEM assumes that a geotechnical exploration sample would be collected every nautical mile along each of the five projected transmission corridors to shore (see GGARCH guidelines [BOEM OREP, 2012]). BOEM estimates approximately 150 total nm (278 km) of potential cable route would be surveyed, resulting in 150 geotechnical exploration samples for the cable routes.
- BOEM assumes that a geotechnical exploration sample would be collected at the foundation of each meteorological tower and/or buoy, resulting in a maximum of 10 geotechnical exploration samples over the entire WEA (assuming two buoys per leasehold as the maximum scenario).

The amount of effort and vessel trips required to collect the geotechnical samples vary greatly by the type of technology used to retrieve the sample. Vibracore samples would likely be advanced from a single small vessel (approximately 45 ft [14 m]). CPT sampling would depend on the size of the CPT; it could be advanced from medium vessel (approximately 65 ft [20 m]), a jack-up barge, a barge with a four-point anchoring system, or a vessel with a dynamic positioning system. Each barge scenario would include a support vessel. Geologic boring would be advanced from a jack-up barge, a barge with a four-point anchoring system, or a vessel with a dynamic positioning system. Each barge scenario would include a support vessel. For all types of sampling, BOEM assumes one sample could be taken per day and that each work day would be associated within one round trip.

3.1.3.3 Biological Surveys

Under BOEM's regulations, plans (SAP, COP, and General Activities Plans) must describe biological survey information that could be affected by the activities proposed in the plan, or that could affect the activities proposed in the plan. See 30 CFR 585.611(a)(3); 30 CFR 585.626(a)(3); and 30 CFR 585.645(a)(5). Three primary categories of biological resources would need to be characterized using vessel and/or aerial surveys of the lease area: (1) benthic habitats; (2) avian resources; and (3) marine fauna. This EA assumes all vessels and aircraft associated with the proposed action would be required to abide by the standard operating conditions detailed in Appendix B. NMFS may require additional measures from the lessee to comply with the MMPA.

BOEM has published survey guidelines for birds, marine mammals and sea turtles, fish, and benthic habitats titled *Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585* (Benthic Habitat Survey Guidelines) on their website at http://www.boem.gov/Regulatory-Development-Policy-and-Guidelines/ (BOEM, 2013b) .

Benthic Habitats

The HRG and geotechnical surveys would help identify sensitive benthic habitat on the leasehold. These surveys would follow BOEM's Benthic Habitat Survey Guidelines (BOEM, 2013b) and would acquire information suggesting the presence or absence of exposed hard bottoms of high, moderate, or low relief; hard bottoms covered by thin, ephemeral sand layers; and algal beds, all of which are key characteristics of sensitive benthic habitat (see Sections 4.2.2.3 and 4.2.2.4). BOEM does not anticipate that lessees would need to conduct separate HRG surveys to delineate benthic habitats that could be affected by potential future leasehold activities. If the HRG survey, or other information, identifies the presence of sensitive benthic habitats on the leasehold, then further investigations referenced within the BOEM Benthic Habitat Survey Guidelines (BOEM, 2013b) would likely be necessary.

Avian Resources

A variety of surveys have provided information on the avian resources in the WEA (Allison et al., 2006; Allison et al., 2009; Menza, et al., 2012; Normandeau Associates Inc., 2011, 2013a; USFWS, 2012a; Zipkin et al., 2010). To supplement data collected from these studies, the Massachusetts Clean Energy Center (MassCEC) has recently conducted an extensive aerial survey effort to provide comprehensive coverage of the entire Massachusetts area under consideration for this EA for all avian resources (Veit et al., 2013). The information resulting from the MassCEC survey is similar to information provided by the New Jersey Department of Environmental Protection's (NJDEP's) *Field Surveys and Marine Resource Characterization for Offshore Wind Energy Planning* study of the area for the New Jersey offshore WEA (NJDEP, 2010a). The NJDEP report produced data on avian distribution and abundance, flight height, and flight direction. The MassCEC study is designed to show hotspots of bird activity both spatially and temporally (Veit et al., 2013). BOEM may choose not to require additional surveys given the combination of information from the Menza et al. (2012) and the Veit et al. (2013) studies.

If additional surveys are required, BOEM anticipates that 2 to 3 years of surveys would be necessary to document the distribution and abundance of bird species within the area. This survey timeframe is based on the renewable energy regulations at 30 CFR 585.626, which indicate that lessees must document the spatial distribution of avian resources in the areas proposed for development, incorporating both seasonal and interannual variation. Historically, avian data has been collected using a combination of boat and aerial surveys. Boat surveys could be completed in a single day for approximately 10 OCS blocks when subsampling 10 percent of the leasehold, which is standard practice (Thaxter and Burton, 2009). Therefore, the average size leasehold of 27 OCS blocks that BOEM anticipates for this WEA would result in 3 days of boat surveying per lease. A monthly sampling interval for boat-based surveys represents an upper limit of survey frequency; therefore, 2 to 3 years of surveying at monthly intervals would result in a maximum of 72 to 108 days of surveys for a single leasehold of 27 OCS blocks.

The Massachusetts WEA was originally defined as comprising all or most of approximately 330 OCS lease blocks and has been subsequently reduced. Because of the speed with which aerial surveys can cover large areas, the entire WEA could potentially be covered in 2 days of aerial surveys (assuming 10 percent subsampling). If aerial surveys occurred on a monthly basis for 2 to 3 years, 48 to 72 aerial survey days would occur. MassCEC is currently using this single effort approach to conduct avian surveys of the entire WEA. If leaseholds are surveyed separately, assuming that five leaseholds represents an upper limit for what could potentially be proposed within the WEA, as many as 120 to 180 days of aerial survey and 360 to 540 days of boat survey could be conducted in the WEA, assuming monthly surveys of each leasehold for 2 to 3 years. The number of boat survey days is not likely to be strongly affected by whether surveys are conducted separately for individual leaseholds or jointly under a single, WEA-wide effort, as boats would generally not be capable of covering much more than 10 to 15 OCS blocks in a single day due to speed constraints. Although both boat-based and aerial surveys using visual observers have been used in the past, including for offshore wind baseline studies in the United States (NJDEP, 2010a; Paton et al., 2010), these methodologies have been largely replaced by aerial digital imaging surveys in Europe because of reduced observer effects, higher statistical and scientific validity of the data, and the ability to conduct surveys at altitudes above the rotor swept zone of commercial marine wind turbine rotors (Rexstad and Buckland, 2009; Thaxter and Burton, 2009; Normandeau Associates Inc., 2013a). These types of surveys may be appropriate for the Massachusetts WEA. Avian surveys would follow BOEM's *Guidelines for Providing Avian Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585*, available online at http://www.boem.gov/uploadedFiles/BOEM/Renewable_Energy_Program/Regulatory_Information/Avian%20Survey%20Guidelines.pdf (BOEM, 2013c).

Bat Resources

Bats have been emerging as a potential impact issue for offshore wind energy projects. Migratory behavior on the OCS is not well understood. Very few surveys have been conducted to investigate bat activity over the ocean, and little information is available on the presence of bats off the coast of Massachusetts. Bats are difficult to survey because of their elusive nocturnal nature. Fortunately, bats use echolocation when orienting through space, and ultrasonic detectors are a cost-effective method for monitoring multiple bat species on a large spatial scale because bat species emit echolocation calls with species-specific characteristics. Ultrasonic detectors are portable and can be easily installed on survey vessels being used for other biological surveys. BOEM assumes that bat acoustic surveys would be conducted at least monthly throughout the warm season (approximately March through November) to capture temporal variation in bat activity within the project area. Additionally, to ensure adequate coverage of the project area ship transects, evenly distributed monitoring points should be designated to allow for an examination of spatial variation in bat activity within the WEA.

Marine Fauna

Lessees are required to characterize the marine fauna (i.e., marine mammals, sea turtles, and fish species) occurring within their lease area and include this information in their plan submissions (see 30 CFR Part 585 Subpart F). Lessees may use existing information, if the information meets plan requirements. If biological information is not available, or does not meet plan requirements for specific lease areas, data gaps may need to be filled by survey work. The NMFS North Atlantic Right Whale Sightings Survey Reports provide an important source of information for right whales within the WEA. These annual reports have been produced since 2002 and summarize right whale aerial sightings surveys (NMFS NEFSC, 2012a). Another source of information is the Technical Report Number 10 of the Rhode Island OSAMP titled “Marine Mammals and Sea Turtles in Narragansett Bay, Block Island Sound, Rhode Island Sound, and Nearby Waters: An Analysis of Existing Data for the Rhode Island Ocean Special Area Management Plan” (RICRMC, 2010). The OSAMP report, while mostly targeting Rhode Island waters, also includes information for the “Rhode Island Study Area,” which includes the coastal and continental shelf and slope waters from Long Island to Nantucket and outer Cape Cod.

BOEM, the U.S. Department of Energy, and State governments are in the process of collecting biological information in several of the Atlantic WEAs. One source of information on the presence and distribution of many marine mammal and sea turtle species that occur in the Massachusetts WEA is the study by MassCEC. The MassCEC effort, which has been supported by BOEM, provides data for right whales and other large whale species. The goal of the MassCEC whale surveys is to better understand the spatial and temporal distributions of right whales (and other large whale species, to the extent possible) as well as migratory patterns in the MassCEC study area, which includes the entire WEA. Survey efforts included a combination of passive acoustic monitoring and aerial surveys. Data for sea turtles were also gathered through this study. Kraus et al. (2013) reported results for surveys conducted during 2011 and 2012, covering right whales, other large whales, and sea turtles for the MassCEC study; the data and summary report for 2013 surveys are expected to be publically available later in 2014. Regional-scale efforts, including the National Oceanic and Atmospheric Administration (NOAA)/BOEM Atlantic Marine Assessment Program for Protected Species, will also aid in site characterization.

With the results of these studies, BOEM anticipates that lessees may not be required to complete additional pre-construction surveys to document marine mammal or sea turtle resources in the WEA prior to submitting a plan. However, BOEM will evaluate the sufficiency of biological surveys submitted in support of a lessee’s plans and determine if completed surveys are adequate given the scope and scale of the lessee’s COP. Independent marine fauna surveys could be undertaken in special circumstances or to address important data gaps. For instance, because fish data in the WEA are generally lacking, additional surveys, such as trawl and hydroacoustic surveys, may be required to adequately characterize the demersal and pelagic fish assemblages. Conducting demersal fish community sampling efforts may also be necessary to further study the relationship between benthic habitat complexity and demersal fish community diversity. Nonetheless, BOEM anticipates that very little, if any, additional vessel or aerial traffic would be associated with marine fauna surveys within the WEA.

3.1.3.4 Vessel Traffic Associated with Site Characterization

This EA assumes that vessels associated with site assessment would strongly trend to larger ports, while vessels associated with site characterization activities would use whatever port is convenient. As a result, this EA assumes generally that the total vessel traffic associated with the proposed action would be more or less evenly distributed among several ports in Massachusetts, Rhode Island, Connecticut, and New York. Section 3.1.2 of this EA identifies 21 existing ports that could be used to support site characterization activities. Vessel trips associated with site characterization surveys would add traffic to already heavily used waterways (Section 4.2.3.8 of this EA). Additionally, because vessels would be limited to working only during specific times of the year because of weather conditions, the traffic associated with the proposed action would be concentrated during months with favorable sea state conditions.

Based on the assumptions for all site characterization surveying under the proposed action, BOEM anticipates between 2,588 to 4,800 vessel trips (round trips) to occur over 5 years from 2014 through 2019 (Table 3-4). Appendix C contains vessel trip assumptions and calculations associated with site characterization.

Table 3-4

Total Number of Maximum Vessel Trips for Site Characterization Activities

Survey Task	Total Round Trips[1]
HRG surveys of all OCS blocks within WEA under Alternative A	1,485
HRG surveys of five cable routes	15
Geotechnical exploration	668–2,700
Avian surveys	360–540
Fish surveys	60
Total	2,588–4,800

[1]Ranges are provided when data or information was available to determine an upper and lower number of round trips. Otherwise, only a maximum value was determined.

3.1.3.5 Operational Waste

The U.S. Environmental Protection Agency (EPA) regulates discharges incidental to the normal operation of all non-recreational, non-military vessels greater than 79 ft (24 m) in length into U.S. waters under Section 402 of the Clean Water Act. EPA requires that eligible vessels obtain coverage under the National Pollutant Discharge Elimination System Vessel General Permit. With the exception of ballast water discharges, non-recreational vessels less than 79 ft (24 m) in length and all commercial fishing vessels, regardless of length, are not subject to this permit. Additionally, the Commonwealth of Massachusetts added a provision to the EPA Vessel General Permit that prohibits the discharge of tetrachloroethylene from all maritime operations.

Operational waste generated from all vessels associated with the proposed action includes bilge and ballast waters, trash and debris, and sanitary and domestic wastes. Bilge water is water that collects in the lower part of a ship. The bilge water is often contaminated by oil that leaks from the machinery within the vessel. The discharge of any oil or oily mixtures greater than 15 parts per million (ppm) without dilution into the territorial sea is prohibited under 33 CFR 151.10. Ballast water is used to maintain the stability of the vessel and may be pumped from coastal or marine waters. Generally, the ballast water is pumped into and out of separate compartments and is not usually contaminated with oil. However, the same discharge criteria apply to ballast water as to bilge water (33 CFR 151.10). Ballast water may be subject to the USCG Ballast Water Management Program to prevent the spread of aquatic nuisance species (33 CFR 151 Subpart D).

The discharge of trash and debris is prohibited (33 CFR 151.51–77) unless it is passed through a comminutor (a machine that breaks up solids) and can pass through a 25 millimeter mesh screen. All other trash and debris must be returned to shore for proper disposal with municipal and solid waste. BOEM assumes vessel operators would discharge trash and debris only after it has passed through a comminutor and that all other trash and debris would be returned to shore. Vessel operators are expected to abide by the USCG Ballast Water Management Program.

All vessels with toilet facilities must have a Type II or Type III marine sanitation device (MSD) that complies with 40 CFR 140 and 33 CFR 159. A Type II MSD macerates waste solids so that the discharge contains no suspended particles and has a bacteria count below 200 per 100 milliliters. Type III MSDs are holding tanks and are the most common type of MSD found on boats. These systems are designed to retain or treat the waste until it can be disposed of at the proper shoreside facilities. State and local governments regulate domestic or graywater discharges. However, a State may prohibit the discharge of all sewage within any or all of its waters. Massachusetts has several no discharge areas where the discharge of all boat sewage, whether treated or not, is prohibited. See Figure 3-1. Domestic waste consists of all types of wastes generated in the living spaces on board a ship, including graywater that is generated from dishwasher, shower, laundry, bath, and washbasin drains. Graywater from vessels is not regulated outside the State’s territory and may be disposed of outside State waters. Graywater should not be processed through the MSD, which is specifically designed to handle sewage. Graywater discharges are not allowed in some State waters; in these restricted areas, graywater would be stored onboard a ship until vessel operators are able to dispose of it at a shoreside facility.

Source: EPA, 2014

Figure 3-1. Massachusetts No Discharge Areas

3.1.4 Site Assessment Activities and Data Collection Structures

A SAP describes the activities (e.g., installation of meteorological towers and buoys) a lessee plans to perform for the assessment of the wind resources and ocean conditions of its commercial lease (30 CFR 585.605). No site assessment activities could take place on a lease until BOEM has approved a lessee's SAP (30 CFR 585.600(a)). Once approved, site assessment activities would take place during the site assessment term of a commercial lease period, which is up to 5 years from the date of lease issuance (30 CFR 585.235(a)(2)). This EA assumes that each lessee would install some type of data collection device (i.e., meteorological tower, buoy, or both) on its lease area to assess the wind resources and ocean conditions of the lease area. This information will allow the lessee to determine whether the lease area is suitable for wind energy development, where on the lease area it will propose development, and what form of development to propose in a COP.

The following scenario is broad enough to address the range of data collection devices that may be installed under approved SAPs. The actual tower and foundation type and/or buoy type and anchoring system would be included in a detailed SAP submitted to BOEM, along with the results of site characterization surveys, prior to installation of any device(s).

3.1.4.1 Meteorological Towers and Foundations

One of the traditional instruments used for characterizing wind conditions is the meteorological tower. A typical meteorological tower consists of a mast mounted on a foundation anchored to the seafloor. The mast may be either a monopole (see Figure 3-2) or a lattice type (similar to a radio tower—see Figure 3-3). Mast and data collection devices can be mounted on a fixed or pile-supported platform (monopile, jackets, or gravity bases) or on a floating platform (spar, semi-submersible or tension-leg). Based on the activities described in the Interim Policy EA Offshore Delaware and New Jersey (MMS, 2009b), and other applications received by BOEM for potential offshore leases, the following meteorological tower scenario is anticipated.

As of this date, no proposals have been submitted for data collection devices or meteorological towers mounted on a floating platform (spar, semisubmersible, or tension-leg). Because no proposals for these types of floating platforms have been submitted, this EA assumes the use of data collection devices mounted on a fixed or pile-supported platform (monopile, jackets, or gravity bases). BOEM anticipates that fixed or pile-supported platforms compared to semi-submersible or tension-leg floating platforms would result in fewer impacts from bottom disturbance and noise because of a smaller footprint. Should BOEM receive an application for a semi-submersible or tension-leg platform, the agency would consider whether such a platform would lead to environmental consequences not considered in this EA.

In the case of fixed platforms, a deck would be supported by a tripod (see Figure 3-2), a single 10 ft (3 m)-diameter monopile (see Figure 3-3), or a steel jacket with three to four 36-inch-diameter (91 cm-diameter) piles (see Figure 3-4). The monopile or piles would be driven anywhere from 25 to 100 ft (8 to 30 m) into the seafloor.

Source: Cape Wind Associates, LLC, 2012a

Figure 3-2. Example of monopole mast meteorological tower

Source: GL Garrad Hassan, 2012

Figure 3-3. Example of a lattice mast meteorological tower with a monopile foundation

The foundation structure, and a scour control system, if required based on potential seabed scour anticipated at the site, would occupy less than 2 acres (0.8 hectare). Once installed, the top of a meteorological tower would be 295 to 377 ft (90 to 115 m) above mean sea level. The area of ocean bottom affected by a meteorological tower would range from about 0.0046 acre (0.002 hectare), if supported by a monopile, to 0.046 acres (0.02 hectares) if supported by a jacket foundation. The final foundation selection would be included in a detailed SAP submitted to BOEM along with the results of SAP-related site characterization surveys prior to BOEM consideration for approval.

The only meteorological tower currently installed on the OCS is located on Horseshoe Shoal, in Nantucket Sound (shown in Figure 3-2). In 2002, the U.S. Army Corps of Engineers (USACE) prepared an EA for this monopole mast meteorological tower (USACE, 2002). The tower was installed in 2003 and consists of three pilings supporting a single steel pile that supports the deck. The overall height of the structure is 197 ft (60 m) above the mean lower low water datum.

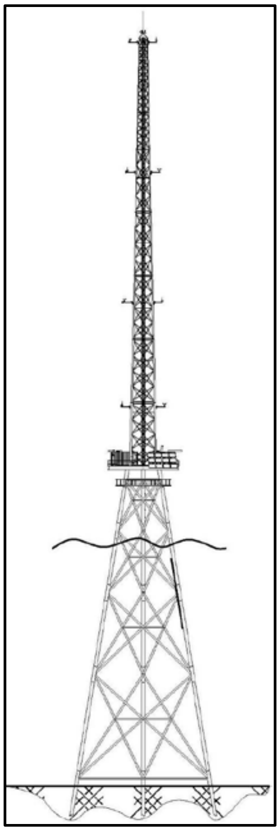


Figure 3-4(a). Lattice-type mast mounted on a steel jacket foundation

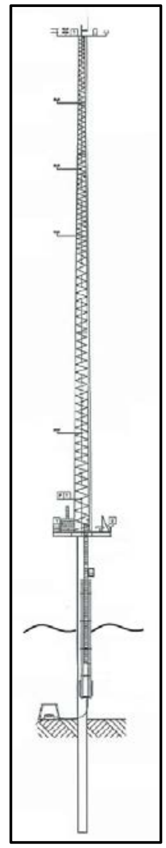


Figure 3-4(b). Lattice-type mast mounted on a monopile foundation

Source: Deepwater Wind, LLC as cited in BOEM, 2012

Figure 3-4. Example of a lattice-type mast mounted on a steel jacket foundation

Installation

Review of the SAP

After a lease is issued and initial survey activities are conducted, the lessee may not install a meteorological tower until a SAP is submitted for review and approved by BOEM (30 CFR 585.614(a)). BOEM regulations (30 CFR 585.600–585.618) require that the SAP include the following information:

- A description of the proposed activities, including the technology intended to be used in conducting activities authorized by the lease and all additional surveys the lessee intends to conduct;
- The surface location and water depth for all proposed facilities to be constructed in the lease area;
- General structural and project installation information with proposed schedules;

- A description of the safety, prevention, and environmental protection features or measures that the lessee would use;
- A brief description of how the meteorological tower and other components on the lease area would be removed and the lease area would be restored to original condition;
- Any other information reasonably requested by BOEM to ensure the lessee's activities on the OCS are conducted in a safe and environmentally sound manner; and
- Results of the geophysical and geological surveys, hazards surveys, archaeological surveys, and baseline collection studies (e.g., biological and benthic habitat) with supporting data.

The siting of meteorological towers would also be authorized by the USACE, likely under a Nationwide Permit 5 for scientific measurement devices. The USACE is a cooperating agency on this EA (see Section 5.2).

Total installation time for one meteorological tower would take 8 days to 10 weeks depending on the type of structure installed and the weather and sea state conditions (MMS, 2009b). Because of delays caused by weather and sea conditions, acquiring permits, and availability of vessels, workers, and tower components, it is possible that installation may not occur during the first year of a lease, and may be spread over more than one construction season. If installation occurs over two construction seasons, then the foundation would likely be installed first with limited meteorological equipment mounted on the platform deck, and the mast and remaining equipment would be installed the following year (MMS, 2009b).

Onshore Activity

A meteorological tower platform would be constructed or fabricated onshore at an existing fabrication yard. Production operations at fabrication yards would include the cutting, welding, and assembling of steel components. These yards occupy large areas with equipment including lifts and cranes, welding equipment, rolling mills, and sandblasting machinery. The location of these fabrication yards is directly tied to the availability of a large enough channel that would allow the towing of these structures. The average bulkhead depth needed for water access to fabrications yards is 15 to 20 ft (5 to 6 m). Thus, platform fabrication yards must be located at deep-draft seaports or along the wider and deeper of the inland channels. Section 3.1.2 identifies 10 major ports in New York, Connecticut, Rhode Island, and Massachusetts that could support the fabrication of meteorological towers.

The meteorological tower could also be fabricated at various facilities or at inland facilities in sections, and then shipped by truck or rail to the port staging area. The meteorological tower would then be partially assembled and loaded onto a barge for transport to the offshore site. Final assembly of the tower itself would be completed offshore (MMS, 2009b).

Offshore Activity

During installation, a radius of approximately 1,500 ft (457 m) (equaling 162 acres [65 hectares]) around the site would be needed for the movement and anchoring of support vessels. The following sections describe the installation of a foundation structure and tower. Several vessels would be involved with construction of a meteorological tower (see Table 3-5).

Table 3-5

Projected Vessel Usage and Specifications for the Construction of a Meteorological Tower

	Round Trips	Hours on Site	Length in feet (meters)	Displacement (tons)	Engines (horsepower)	Fuel Capacity (gallons)
Crane barge	2	232	150–250 (46–76)	1,150	0	500
Deck cargo	2	232	150–270 (46–82)	750	0	0
Small cargo barge	2	232	90 (27)	154	0	0
Crew boat	21	54	51–57 (16–17)	100	1,000	1,800
Small tug boat	4	54	65 (20)	300	2,000	14,000
Large tug boat	8	108	95 (29)	1,300	4,200	20,000

Source: MMS, 2009b

Installation of the Foundation Structure and Mast

A jacket or monopile foundation and deck would be fabricated onshore, then transferred to barge(s) and carried or towed to the offshore site. This equipment would typically be deployed from two barges, one containing the pile-driving equipment and a second containing a small crane, support equipment, and the balance of materials needed to erect the platform deck. These barges would be tended by appropriate tugs and workboats as needed.

The foundation pile(s) for a fixed platform could range from either a single 10 ft (3 m)-diameter monopile to four 3 ft (1 m)-diameter piles (jacket). These piles would be driven anywhere from 25 to 100 ft (8 to 30 m) below the seafloor with a pile-driving hammer typically used in marine construction operations. When the pile driving is complete after approximately 3 days, the pile-driver barge would be removed. In its place, a jack-up barge equipped with a crane would be used to assist in the mounting of the platform decking, tower, and instrumentation onto the foundation. Depending on the type of structure installed and the weather and sea conditions, the in-water construction of the foundation pilings and platform would take approximately a few days (monopole in good weather) to 6 weeks (jacket foundation in bad weather) (MMS, 2009b).

The mast sections would be raised using a separate barge-mounted crane; installation would likely be complete within a few weeks.

Scour Control System

Wave action, tidal circulation, and storm waves interact with sediments on the surface of the OCS, inducing sediment reworking and/or transport. Episodic sediment movement caused by ocean currents and waves can cause erosion or scour around the base of the towers. Erosion caused by scour may undermine meteorological tower structural foundations leading to potential failure, and erosion would also increase turbidity, potentially affecting marine biota. BOEM assumes that scour control systems would be installed, if required based on potential seabed scour anticipated at the site. There are several methods for minimizing scour around piles, such as the placement of rock armoring and mattresses of artificial (polypropylene) seagrass.

A rock armor scour protection system may be used to stabilize a structure's foundation area. Rock armor and filter layer material would be placed on the seabed using a clamshell bucket or a chute. The filter layer helps prevent the loss of underlying sediments and sinking of the rock armor (ESS Group, Inc., 2006a). In water depths greater than 15 ft (4.6 m), the median stone size would be about 50 pounds with a stone layer thickness of about 3 ft (1 m). The rock armor for a monopole foundation for a wind turbine would occupy an estimated 0.37 acre (0.15 hectare) of the seabed (ESS Group, Inc., 2006a). While the piles of a meteorological tower would be much smaller than those of a wind turbine, a meteorological tower may be supported by up to four piles. Therefore, the maximum area of the seabed impacted by rock armor for a single meteorological tower is also estimated to be 0.37 acre (0.15 hectare).

Artificial seagrass mats are made of synthetic fronds that mimic seafloor vegetation to trap sediment. The mats become buried over time and have been effective for controlling scour in both shallow and deep water (ESS Group, Inc., 2004). Divers installed artificial seagrass mats around the Cape Wind meteorological tower piles; monitoring of scouring over a 3-year period found that there was a net increase of 12 inches (30 cm) of sand at one pile and a net scour of 7 inches (17.8 cm) at another pile (Ocean and Coastal Consultants Inc., 2006). If used, these mats would be installed by a diver or remotely operated underwater vehicle (ROV). Each mat would be anchored at 8 to 16 locations, about 1 ft (0.3 m) into the sand. For a pile-supported platform, an estimated four mats each about 16.4 by 8.2 ft (5.0 by 2.5 m) would be placed around each pile. Including the extending sediment bank, a total area of disturbance of about 0.12 to 0.14 acres (0.049 to 0.057 hectare) (for a three-pile structure) and 0.13 to 0.18 acres (0.053 to 0.073 hectare) for a four-pile structure is estimated. For a monopile, an estimated eight mats about 16.4 by 16.4 ft (5.0 m by 5.0 m) would be used, with a total area of disturbance of about 0.08 to 0.09 acres (0.032 to 0.036 hectare).

Operation and Maintenance

Under the proposed action and alternatives, BOEM is considering the operation of a meteorological tower to assess wind resource potential during the site assessment term of a lease.

A lessee must submit a COP at least 6 months before the end of the site assessment term of the lease if the lessee intends to continue its commercial lease (30 CFR 585.618(c)). If the COP describes continued use of existing facilities, such as a meteorological tower or buoy approved in the SAP, the lessee may keep such facilities in place on its lease during the time that BOEM reviews the COP for approval (30 CFR 585.618(a)), which may take up to 2 years. If, following the technical and environmental review of the submitted COP, BOEM determines that such facilities may not remain in place throughout the lease, the lessee must initiate the decommissioning process (30 CFR 585.618(c)). Depending on how long it takes to install a meteorological tower, and depending on whether the lessee submits a COP (or the lease expires) and/or how long subsequent COP approval would take, BOEM anticipates that a meteorological tower would be present for approximately 5 years before BOEM decides whether to allow the tower to remain in place for the commercial term of a lease or require that it be decommissioned immediately.

While the meteorological tower is in place, data would be collected and processed remotely; as a result, data cables to shore would not be necessary. The structure and instrumentation would be accessible by boat for routine maintenance. As indicated in previous site assessment proposals submitted to BOEM, lessees with towers powered by solar panels or small wind turbines would conduct monthly or quarterly vessel trips for operation and maintenance activity over the 5-year life of a meteorological tower (MMS, 2009b). However, if a diesel generator is used to power the meteorological tower's lighting and equipment, a maintenance vessel would make a trip at least once every other week, if not weekly, to provide fuel, change oil, and perform maintenance on the generator. Depending on the frequency of the trips, support for all of the meteorological towers in the WEA would result in a maximum of 1,300 round trips (52 weeks per year times 5 towers times 5 years). No additional or expansion of onshore facilities would be required to conduct these tasks. BOEM projects that crew boats 51 to 57 ft (16 to 17 m) in length with 400- to 1,000-horsepower engines and 1,800-gallon fuel capacity would be used for routine maintenance and generator refueling, if diesel generators are used. The distance from shore would make vessels more economical than helicopters, so the use of helicopters to transport personnel or supplies during operation and maintenance is not anticipated.

If a diesel generator is proposed, a lessee would be required to submit an Oil Spill Response Plan with their SAP and COP that describes their emergency response action plan, worst-case discharge scenario, and training and drills for responders under 30 CFR 254.

Lighting and Marking

All meteorological towers and buoys, regardless of height, would have lighting and marking for navigational purposes. Meteorological towers and buoys would be considered Private Aids to Navigation, which are regulated by the USCG under 33 CFR 66.01. A Private Aid to Navigation is a buoy, light, or day beacon owned and maintained by any individual or organization other than the USCG. These aids are designed to allow individuals or organizations to mark privately owned marine obstructions or other similar hazards to navigation.

If meteorological towers are taller than 199 ft (61 m) and within 12 nm (22 km) from shore, the lessee would be required to file a "Notice of Proposed Construction or Alteration" with the Federal Aviation Administration (FAA) per Federal aviation regulations (14 CFR 77.13). The FAA would then conduct an obstruction evaluation analysis to determine whether a meteorological tower would pose a hazard to air traffic, and would issue a Determination of Hazard/No Hazard. Currently, there are no specific FAA regulations or guidance on lighting and marking of ocean-based towers less than 200 ft (61 m) tall (Edgett-Baron, personal communication, 2012).

Other Uses

The meteorological tower and platform could also be used to gather other information in addition to meteorological information, such as data regarding birds, bats, and marine mammals in the lease area. Information on other equipment that could be installed on meteorological towers is included in Section 3.1.4.3 of this EA.

Decommissioning

At the latest, within 2 years after the cancellation, expiration, relinquishment, or other termination of the lease, the lessee would be required to remove all devices, works, and structures from the site and restore the lease area to its original condition before issuance of the lease (30 CFR Part 585, Subpart I). Lessees are required to submit a decommissioning application to BOEM for approval prior to starting decommissioning activities (30 CFR 585.902(b)).

BOEM estimates that the entire removal process of a meteorological tower would take 1 week or less. Decommissioning activities would begin with the removal of all meteorological instrumentation from the tower, typically a single vessel. A derrick barge would be transported to the offshore site and anchored adjacent to the structure. The mast would be removed from the deck and loaded onto the transport barge. The deck would be cut from the foundation structure and loaded on the transport barge. The same number of vessels necessary for installation would likely be required for decommissioning. The sea bottom area beneath installed structures would be cleared of all materials that have been introduced to the area in support of the lessee's project.

Cutting and Removing

As required by BOEM, the lessee would sever bottom-founded structures and their related components at least 16 ft (5 m) below the mudline to ensure that nothing would be exposed that could interfere with future lessees and other activities in the area (30 CFR 585.910(a)). Which severing tool the operators use depends on the target size and type, water depth, economics, environmental concerns, tool availability, and weather conditions (MMS, 2005). Because of the type and size, piles of meteorological towers in the WEA would be removed using non-explosive severing methods.

Common non-explosive severing tools that may be used consist of abrasive cutters (e.g., sand cutters, abrasive water jets), mechanical (carbide) cutters, diver cutting (e.g., underwater arc cutters, oxyacetylene/oxyhydrogen torches), and diamond wire cutters. Of these, the most likely tools to be employed would be an internal cutting tool, such as a high pressure water jet-cutting tool that would not require the use of divers to set up the system or jetting operations to access the required mudline (Kaiser et al., 2005). To cut a pile internally, the sand that had been forced into the hollow pile during installation would be removed by hydraulic dredging/pumping and stored on a barge. Once cut, the steel pile would then be lifted on to a barge and transported to shore. Following the removal of the cut pile and the adjacent scour control system, the sediments would be returned to the excavated pile site using a vacuum pump and diver-assisted hoses. As a result, no excavation around the outside of the monopole or piles prior to the cutting is anticipated. Cutting and removing piles would take anywhere from several hours to 1 day per pile. After the foundation is severed, it would be lifted on the transport barge and towed to a decommissioning site onshore (MMS, 2009b).

Removal of the Scour Control System

Any scour control system would also be removed during the decommissioning process. Scour mats would be removed by divers or ROV and a support vessel in a similar manner to installation. Removal is expected to result in the suspension of sediments that were trapped in the mats. If rock armoring is used, armor stones would be removed using a clamshell dredge or similar equipment and placed on a barge. BOEM estimates that the removal of the scour control system would take a half day per pile. Therefore, depending on the foundation structure, removal of the scour system would take a total of 0.5 to 2 days to complete (MMS, 2009b).

Disposal

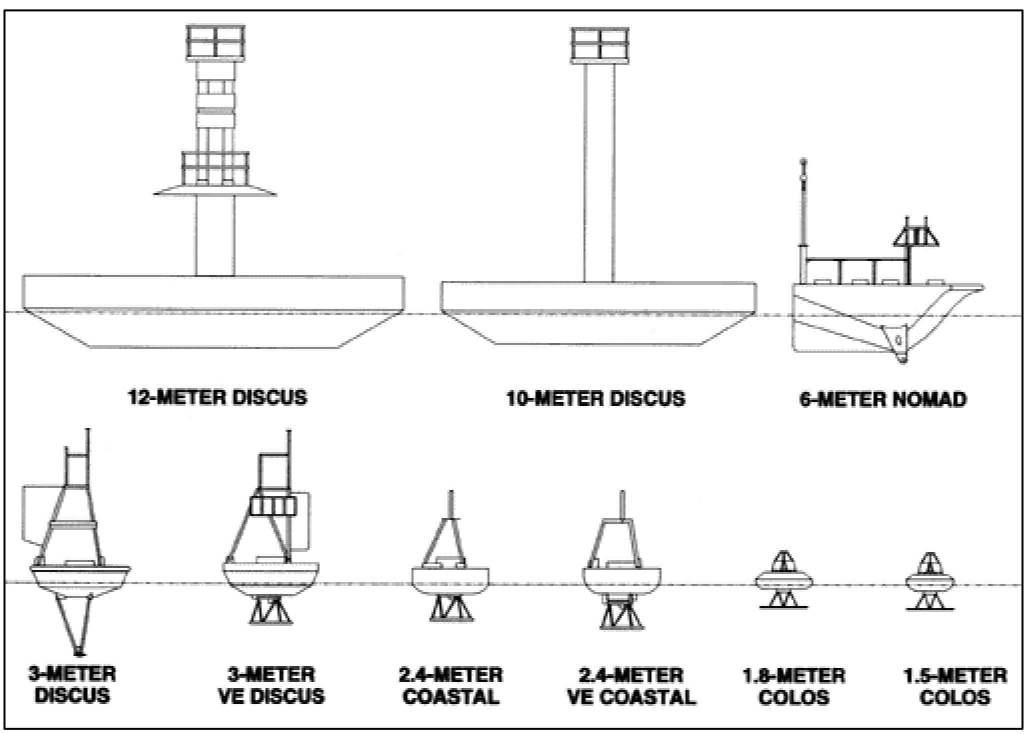
Unless portions of the meteorological tower would be approved for use as artificial reefs, all materials would be removed by barge and transported to shore. The steel would be recycled and remaining materials would be disposed of in existing landfills in accordance with applicable law. Additionally, obsolete materials have been used as artificial reefs along the coastline of the United States to provide valuable habitat for numerous species of fish in areas devoid of natural hard bottom. The meteorological tower structures may also have the potential to serve as artificial reefs. However, the structure must not pose an unreasonable impediment to future development. If the lessee ultimately proposes to use the structure as an artificial reef, its plan must comply with the artificial reef permitting requirements of the USACE and the criteria in the

National Artificial Reef Plan of 1985 (33 CFR 35.2103). The Massachusetts Division of Marine Fisheries (DMF) manages Massachusetts' artificial reef program and must accept liability for the structure before BOEM would release the Federal lessee from the obligation to decommission and remove all structures from the lease area.

3.1.4.2 Meteorological Buoy and Anchor System

Although a meteorological tower has been the traditional device for characterizing wind conditions, lessees could install one to two meteorological buoys per lease instead. Meteorological buoys can be used as an alternative to a meteorological tower in the offshore environment for meteorological resource data collection (i.e., wind, wave, and current). This EA assumes that, should a lessee choose to employ buoys instead of meteorological towers, it would install a maximum of two buoys per lease. These meteorological buoys would be anchored at fixed locations and regularly collect observations from many different atmospheric and oceanographic sensors.

A meteorological buoy can vary in height, hull type, and anchoring method. NOAA has successfully used discus-shaped hull buoys (known as Naval Oceanographic and Meteorological Automated Devices, or "NOMADS") and the newest, the Coastal Buoy and the Coastal Oceanographic Line-of-Sight (COLOS) buoys for weather data collection for many years (Figure 3-5).



Source: National Data Buoy Center, 2008

Figure 3-5. Buoy schematic

The choice of hull type used usually depends on its intended deployment location and measurement requirements. To assure optimum performance, a specific mooring design is produced based on hull type, location, and water depth. For example, a smaller buoy in shallow coastal waters may be moored using an all-chain mooring. On the other hand, a large discus buoy deployed in the deep ocean may require a combination of chain, nylon, and buoyant polypropylene materials designed for many years of service (National Data Buoy Center, 2008).

Discus-shaped, boat-shaped and spar buoys (Figure 3-6) are the buoy types that would most likely be adapted for offshore wind data collection. A large discus-shaped hull buoy has a circular hull range between 33 and 40 ft (10 and 12 m) in diameter, and is designed for many years of service (National Data Buoy Center, 2012). The boat-shaped hull buoy is an aluminum-hulled, boat-shaped buoy that provides long-term survivability in severe seas (National Data Buoy Center, 2012).

Source: National Data Buoy Center, 2012

Figure 3-6(a). 10-meter discus-shaped hull buoy

Source: National Data Buoy Center, 2012

Figure 3-6(b). 6-meter boat-shaped hull buoy

Source: Australian Maritime Systems, 2012

Figure 3-6(c). Spar buoy

Figure 3-6. Example of buoy types

A buoy's specific mooring design is based on hull type, location, and water depth (National Data Buoy Center, 2012). Buoys can use a wide range of moorings to attach to the seabed. On the OCS, a larger discus-type or boat-shaped hull buoy may require a combination of a chain, nylon, and buoyant polypropylene materials designed for many years of ocean service. Some deep ocean moorings have operated without failure for over 10 years (National Data Buoy Center, 2012). The spar-type buoy can be stabilized through an on-board ballasting mechanism approximately 60 ft (18 m) below the sea surface. Approximately 30 to 40 ft (9 to 12 m) of the spar-type buoy would be above the ocean surface where meteorological and other equipment would be located. Tension legs attached to a mooring by cables has been proposed for one spar-type buoy (Tetra Tech EC, Inc., 2010).

In addition to the meteorological buoys described above, a small tethered buoy (typically 10 ft [3 m] in diameter or less) and/or other instrumentation could also be installed on or tethered to a meteorological tower to monitor oceanographic parameters and to collect baseline information on the presence of certain marine life.

Installation

Boat-shaped and discus-shaped buoys are typically towed or carried aboard a vessel to the installation location. Once at the location site, the buoy would be either lowered to the surface from the deck of the transport vessel or placed over the final location, and then the mooring anchor dropped. A boat-shaped buoy in shallower waters of the WEA may be moored using an all-chain mooring, while a larger discus-type buoy would use a combination of chain, nylon, and buoyant polypropylene materials (National Data Buoy Center, 2012). Based on previous proposals, anchors for boat-shaped and discus-shaped buoys would weigh about 6,000 to 8,000 pounds with a footprint of about 6 square ft (0.5 square m) and an anchor sweep of about 8.5 acres (3.4 hectares). After installation, the transport vessel would remain in the area for several hours while technicians configure proper operation of all systems. Buoys would typically take 1 day to install. Transport and installation vessel anchoring for 1 day is anticipated for these types of buoys (Fishermen's Energy of New Jersey, LLC, 2011).

Based on the Garden State Offshore Energy (GSOE) proposal offshore New Jersey, a spar-type buoy would be towed to the installation location by a transport vessel after assembly at a land-based facility. Deployment would occur in two phases: deployment of a clump anchor to the seabed as a pre-set anchor (Phase 1) and deployment of the spar buoy and connection to the clump anchor (Phase 2). Phase 1 would take approximately 1 day and would include placement of the clump anchor on a barge and transporting it to the installation site. In this example, a rectangular clump weight anchor is 22 ft x 22 ft x 3 ft (6.7 m x 6.7 m x 1 m) in size and weighs approximately 100 tons, with a bottom footprint area of 484 square ft (45 square m). Phase 2 would include towing the spar buoy to the site, deployment, and connection to the clump anchor (Tetra Tech EC, Inc., 2010). Once at the final location site, the buoy would be positioned vertically in the water column with a height from mean sea level to main deck of 36 ft (11 m) and a highest mast point of approximately 52 ft (16 m). The buoy would be anchored to the seafloor using a clump weight anchor and mooring chain. Installation would take approximately 2 days. The bottom disturbance associated with buoy and vessel anchors would measure 28 ft x 28 ft (8.5 m x 8.5 m), with a total area of 784 square ft (73 square m). The maximum area of disturbance to benthic sediments occurs during anchor deployment and removal (e.g., sediment resettlement, sediment extrusion) for this type of buoy.

Onshore Activity

Onshore activity (fabrication, staging, and launching of crew/cargo vessels) related to the installation of buoys is expected to use existing ports that are capable of supporting this activity. Refer to Section 3.1.2 of this document for information pertaining to existing ports or industrial areas that would be used for meteorological buoys. No expansion of existing facilities would be necessary for the same reasons provided in the onshore activity section for meteorological towers, above.

Operation and Maintenance

Monitoring information that would be transmitted to shore would include systems performance information, such as battery levels and charging systems output, the operational status of navigation lighting, and buoy positions. Also, all data gathered via sensors would be fed to an on-board radio system that transmits the data string to a receiver on shore (Tetra Tech EC, Inc., 2010). Onsite inspections and preventative maintenance (i.e., marine fouling, wear, and lens cleaning) are expected to occur on a monthly or quarterly basis. Periodic inspections for specialized components (i.e., buoy, hull, anchor chain, and anchor scour) would occur at different intervals, but would likely coincide with the monthly or quarterly inspection to minimize the need for additional boat trips to the site.

Because limited space would restrict the equipment that could be placed on a buoy, BOEM anticipates that this equipment would be powered by small solar panels or wind turbines instead of diesel generators. Weekly or bi-weekly vessel trips, which would be necessary for refueling generators on meteorological towers, are not projected for any of the anticipated buoys.

Decommissioning

Decommissioning is basically the reverse of the installation process. Equipment recovery would be performed with support of a vessel(s) equivalent in size and capability to those used for installation (see section on installation above). For small buoys, a crane lifting hook would be secured to the buoy. A water/air pump system would de-ballast the buoy into the horizontal position. The mooring chain and anchor would be recovered to the deck using a winching system. The buoy would then be transported to shore by the barge.

Buoy decommissioning is expected to be completed within 1 day. Buoys would be returned to shore and disassembled or reused in other applications. BOEM anticipates that the mooring devices and hardware would be re-used or disposed of as scrap iron for recycling (Fishermen's Energy of New Jersey, LLC, 2011).

3.1.4.3 Meteorological Tower and Buoy Equipment

Meteorological Data Collection

To obtain meteorological data, scientific measurement devices, consisting of anemometers, vanes, barometers, and temperature transmitters, would be mounted either directly on the tower or buoy or on instrument support arms. In addition to conventional anemometers, Light Detection and Ranging (LiDAR), Sonic Detection and Ranging (SODAR), and Coastal Ocean Dynamic Applications Radar (CODAR) devices may be used to obtain meteorological data. LiDAR is a ground-based remote sensing technology that operates via the transmission and detection of light. SODAR is also a ground-based remote sensing technology; however, it operates via the transmission and detection of sound. CODAR devices use high frequency surface wave propagation to remotely measure ocean surface waves and currents.

Ocean Monitoring Equipment

To measure the speed and direction of ocean currents, Acoustic Doppler Current Profilers (ADCPs) would likely be installed on each meteorological tower or buoy. An ADCP is a remote sensing technology that transmits sound waves at a constant frequency and measures the ricochet of the sound wave off fine particles or zooplankton suspended in the water column. The ADCPs may be mounted independently on the seafloor or to the legs of the platform, or attached to a buoy. A seafloor-mounted ADCP would likely be located near the meteorological tower (within approximately 500 ft [152 m]) and would be connected by a wire that is hand-buried into the ocean bottom. A typical ADCP has three to four acoustic transducers that emit and receive acoustical pulses from different directions, with frequencies ranging from 300 to 600 kHz with a sampling rate of 1 to 60 minutes. A typical ADCP is about 1 to 2 ft tall (0.3 to 0.6 m) and 1 to 2 ft (0.3 to 0.6 m) wide. Its mooring, base, or cage (surrounding frame) would be several feet wider.

Other Equipment

A meteorological tower or buoy could also accommodate environmental monitoring equipment, such as bird and bat monitoring equipment (e.g., radar units, thermal imaging cameras), acoustic monitoring for marine mammals, data logging computers, power supplies, visibility sensors, water measurements (e.g., temperature, salinity), communications equipment, material hoist, and storage containers.

3.1.4.4 Vessel Traffic Associated with Site Assessment

Vessel trips would be associated with all phases of site assessment (installation, decommissioning, and routine maintenance). As explained in Section 3.1.2, there are 10 major ports in the region that are likely to be used to support site assessment activities for the proposed action. The site assessment trips would add vessel traffic in already heavily used waterways (see Section 4.2.3.8).

Based on previous site assessment proposals submitted to BOEM, up to about 40 round trips by various vessels are expected during construction of each meteorological tower (see Table 3-5).

Should each potential lessee decide to install a meteorological tower on its leasehold, a total of 200 round trips are estimated for construction (40 trips per tower multiplied by 5 towers [see Table 3-6]). These vessel trips may be spread over multiple construction seasons as a result of the various times at which lessees acquire their leases, weather and sea state conditions, the time to assess suitable site(s), the time to acquire the necessary permits, and the availability of vessels, workers, and tower components. Because the decommissioning process would basically be the reverse of construction, vessel usage during decommissioning would be similar to vessel usage during construction, so another 200 round trips are estimated for decommissioning of towers. Meteorological buoys would typically take 1 to 2 days to install by one vessel, and 1 to 2 days to decommission for one vessel.

Table 3-6

Projected Maximum Vessel Trips for Site Assessment Activities

Site Assessment Activity	Round Trips	Formula
Meteorological Buoys		
Meteorological Buoy Installation	10–20	1–2 round trip x 10 buoys
Meteorological Buoy Quarterly–Monthly Maintenance Trips	200–600	4 quarters x 10 buoys x 5 years – 12 months x 10 buoys x 5 years
Meteorological Buoy Decommission	10–20	1–2 round trip x 10 buoys
Total Buoy Trips Over 5-Year Period	*220–640*	
Meteorological Towers		
Meteorological Tower Construction	200	40 round trips x 5 towers
Meteorological Tower Quarterly–Weekly Maintenance Trips[1]	100–1,300	4 quarters x 5 towers x 5 years – 52 weeks x 5 towers x 5 years
Meteorological Tower Decommission	200	40 round trips x 5 towers
Total Tower Trips Over 5-Year Period	*500–1,700*	

[1]Although construction and decommissioning would occur during some of the weeks and, therefore, not all weeks would require maintenance trips for the towers, all weeks were included for maintenance to be conservative in the trip calculations.

Maintenance trips to each meteorological tower may occur weekly to quarterly, and monthly to quarterly for each buoy. However, to provide for a conservative scenario, total maintenance vessel trip calculations are based on weekly trips for towers and monthly trips for buoys over the entire 5-year period (see Table 3-6).

The total vessel traffic estimated as a result of the installation, decommissioning, and routine maintenance of the meteorological towers/buoys that could be anticipated in connection with the proposed action is anticipated to be between 220 and 1,700 round trips over a 5-year period (Table 3-6).

3.2 NON-ROUTINE EVENTS

Section 5.2.24 of the PEIS discusses in detail potential non-routine events and hazards that could occur during data collection activities. The primary events and hazards are: (1) severe storms such as hurricanes and extratropical cyclones; (2) collisions between the structure or associated vessels with other marine vessels or marine life; and (3) spills from collisions or during generator refueling. These events and hazards are summarized below.

3.2.1 Storms

Severe weather events have the potential to cause structural damage and injury to personnel. Major storms, winter nor'easters, and hurricanes pass through the area regularly resulting in elevated water levels (storm surge) and high waves and winds. Storm surge and wave heights from passing storms are worse in shallow water and along the coast, but can pose hazards in offshore areas.

Data collected between 1982 and 2008 from a National Data Buoy Center buoy located southeast of Nantucket, MA, (Buoy 44008) show average wind speeds are typically lowest in June and July at approximately 8 to 9 knots, and highest in December and January at approximately 15 to 16 knots (National Data Buoy Center, 2010a). Peak winds over the period of record (1988–2008) were recorded in the month of December at 82 knots at Buoy 44008 (National Data Buoy Center, 2010b). The highest winds are associated with tropical cyclones (i.e., hurricanes), but more often, high-wind events are associated with extratropical cyclones (i.e., nor'easters) in the winter season.

The Atlantic Ocean hurricane season is June 1 to November 30 with a peak in September when hurricanes would be most likely to impact the WEA at some time during the proposed action. The Atlantic basin averages about 11 storms of tropical storm strength or greater per year; about half reach hurricane level and two and a half become major hurricanes (Category 3 or higher) (NOAA, 2012a). Historically, hurricane threats exist in the region of the WEA. From 1851 to 2010, a reported 11 hurricanes struck the Massachusetts coast and 9 hurricanes struck the Rhode Island coastline, 3 and 4 of which, respectively, were major (Blake et al., 2011). Blake et al. (2011) estimated the return period, in years, of all hurricanes (winds greater than or equal to 64 knots) passing within 50 nm (92.6 km) of various locations along the U.S. coast. In the region of the WEA, the return period for such an event is listed as 13 years, while the return period for a major (Category 3 or greater) hurricane, in the same location, is 62 years.

3.2.2 Allisions and Collisions

A meteorological tower or buoy located in the WEA could pose a risk to both vessel and aviation navigation. An allision between a ship or an airplane and a meteorological structure could result in the loss of the entire facility and/or the vessel/airplane, as well as loss of life and spillage of diesel fuel. When a vessel hits a buoy system, it could damage the buoy hull so the buoy loses its buoyancy and sinks or could damage the equipment or its supporting structure. Because a buoy would protrude from the ocean surface only 30 to 40 ft (9 to 12 m), an airplane striking a buoy is unlikely. Vessels associated with site characterization and assessment activities could collide with other vessels and experience accidental capsizing or result in a diesel spill.

Vessel collisions and allisions are less likely to happen because vessel traffic is controlled by multiple routing measures, such as safety fairways, TSSs, and anchorages. These higher traffic areas were excluded from the WEA. Airplane collisions and allisions are also considered unlikely. 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 and flying at low elevations would pose a safety risk during storms and low visibility. Risk of allisions with meteorological towers and buoys for both vessels and aviation would be further reduced by USCG-required marking and lighting.

Historical data support that the number of potential allisions and collisions resulting in a serious marine incident (damage to property and equipment in excess of $100,000) (46 CFR Part 4.03-2) would be small. Allision and collision incident data were reviewed for the years 1996 through 2010 (BOEMRE, 2011b) for the Gulf of Mexico and Pacific regions, which contain many fixed structures on the OCS like the meteorological facilities that would be installed in the WEA. Operations and maintenance activities on the meteorological facilities in the WEA would be similar to what is needed for fixed structures in the Gulf of Mexico and Pacific regions. Over a 15-year period with over 4,000 structures installed at any one time, 197 allisions and collision were reported in the Gulf of Mexico or Pacific regions; this number includes reports of all serious marine incidents and some, but not all incidents that resulted in damages totaling less than $25,000. The most commonly reported causes of the allisions and collisions include human error, weather-related causes, equipment failure on the vessels, and navigational aids not working on the structures.

3.2.3 Spills

A diesel spill could occur as a result of collisions, accidents, or natural events. If a vessel collision occurs and if the collision leads to major hull damage, a diesel spill could occur. The amount of diesel fuel that could be released by a marine vessel involved in a collision would depend on the type of vessel and severity of the collision. From 2000 to 2011, the average oil spill[1] size for vessels other than tank ships and tank barges in all U.S. waters[2] was 123 gallons

[1] In USCG (2012), oil includes the following categories: crude oils, heavy fuel oils, intermediate fuel oils, gasoline products, other petroleum products, and non-petroleum oils.

(USCG, 2012), and, should the proposed action result in a spill in any given area, BOEM anticipates that the average volume would be similar.

Vessels are expected to comply with USCG requirements relating to prevention and control of oil spills. Most equipment on the meteorological towers and buoys would be powered by batteries charged by small wind turbines and solar panels. However, diesel generators may be used on some of the anticipated meteorological towers. Minor diesel fuel spills may also occur during refueling of generators.

Impacts would depend greatly on the material spilled (diesel fuel in the related vessel and infrastructure types), the size and location of a spill, the meteorological conditions at the time of the spill, and the speed with which cleanup plans and equipment could be employed. Diesel fuel is a refined petroleum product that is lighter than water. It may float on the water's surface or be dispersed into the water column by waves. Diesel is a distillate of crude oil and does not contain the heavier components that contribute to crude oil's longer persistence in the environment. If a diesel spill were to occur, it would be expected to dissipate very rapidly and would then evaporate and biodegrade within a few days (MMS, 2007b). A lessee would be required to submit an Oil Spill Response Plan with their SAP and COP that describes their emergency response action plan, worst-case discharge scenario, and training and drills for responders under 30 CFR 254.

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[2] [2] In USCG (2012, U.S. waters include the following categories: internal/headlands, coastal (0-3 mi), contiguous zone (3-12 mi), ocean (12-200 mi), ocean general and other.

4 ENVIRONMENTAL AND SOCIOECONOMIC CONSEQUENCES

4.1 DEFINITIONS OF IMPACT LEVELS

The conclusions for most analyses in this EA use a four-level classification scheme (negligible, minor, moderate, and major) to characterize the environmental impacts predicted if the proposed action or an alternative is implemented. Definitions of impacts are presented in two separate groups: one for biological and physical resources and one for socioeconomic resources. The CEQ interprets the human environment "to include the natural and physical environment and the relationship of people with that environment" (40 CFR 1508.14).

4.1.1 Impact Levels for Biological and Physical Resources

The following impact levels definitions are used for biological and physical resources. For biota, these levels are based on population-level impacts rather than impacts on individuals.

- Negligible:
  - No measurable impacts.
- Minor:
  - Most impacts on the affected resource could be avoided with proper mitigation.
  - If impacts occur, the affected resource would recover completely without any mitigation once the impacting agent is eliminated.
- Moderate
  - Impacts on the affected resource are unavoidable.
  - The viability of the affected resource is not threatened although some impacts may be irreversible, <u>or</u> the affected resource would recover completely if proper mitigation is applied during the life of the project or proper remedial action is taken once the impacting agent is eliminated.
- Major
  - Impacts on the affected resource are unavoidable.
  - The viability of the affected resource may be threatened, <u>and</u> the affected resource would not fully recover even if proper mitigation is applied during the life of the project or remedial action is taken once the impacting agent is eliminated.

4.1.2 Impact Levels for Socioeconomic Issues

The following impact levels are used for the analysis of socioeconomic resources.

- Negligible:
  - No measurable impacts.
- Minor:
  - Adverse impacts on the affected activity or community could be avoided with proper mitigation.
  - Impacts would not disrupt the normal or routine functions of the affected activity or community.
  - Once the impacting agent is eliminated, the affected activity or community would return to a condition with no measurable effects without any mitigation.
- Moderate
  - Impacts on the affected activity or community are unavoidable.
  - Proper mitigation would reduce impacts substantially during the life of the project.
  - The affected activity or community would have to adjust somewhat to account for disruptions due to impacts of the project, <u>or</u> once the impacting agent is eliminated, the affected activity or community would return to a condition with no measurable effects if proper remedial action is taken.
- Major
  - Impacts on the affected activity or community are unavoidable.
  - Proper mitigation would reduce impacts somewhat during the life of the project.
  - The affected activity or community would experience unavoidable disruptions to a degree beyond what is normally acceptable, <u>and</u> once the impacting agent is eliminated, the affected activity or community may retain measurable effects indefinitely, even if remedial action is taken.

4.2 ALTERNATIVE A – THE PROPOSED ACTION

4.2.1 Physical Resources

4.2.1.1 Air Quality

4.2.1.1.1 Description of the Affected Environment

Since potential impacts on air quality associated with the proposed action could come from vessel traffic from the ports discussed in Section 3.1.2, the affected environment includes coastal areas in Massachusetts, Rhode Island, Connecticut, and New York; State and Federal waters between the coastal areas and the MA WEA; and the MA WEA itself (Figure 4-1).

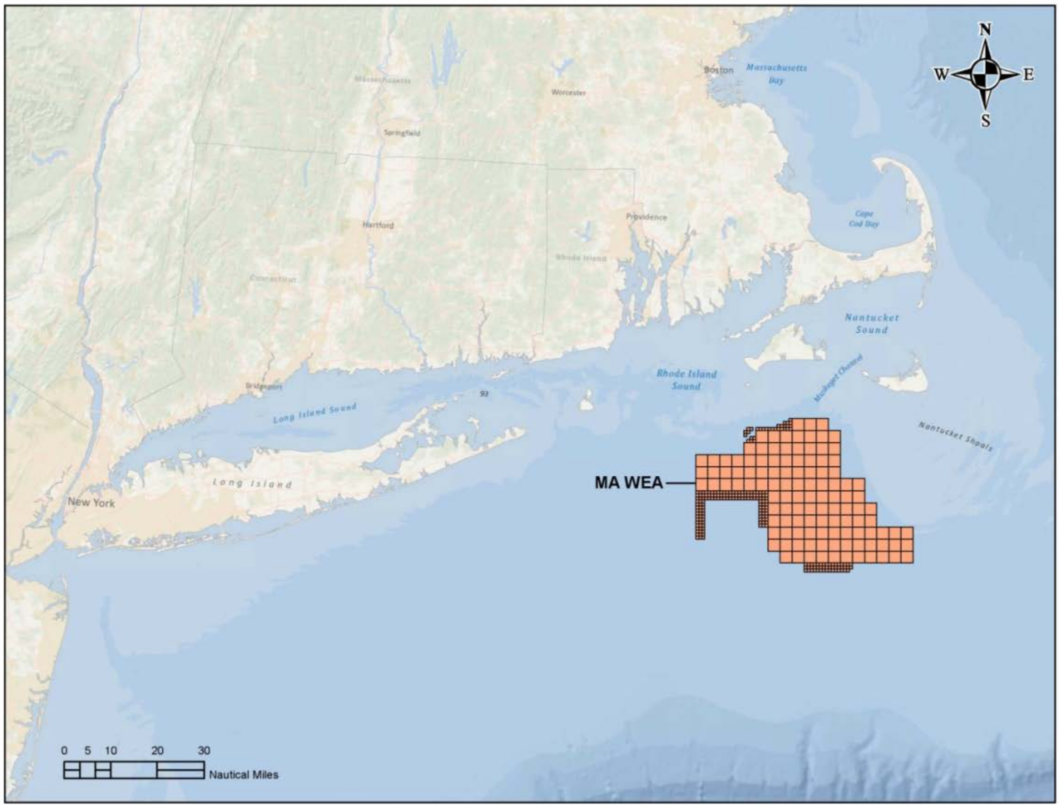

Figure 4-1. Location of Massachusetts WEA in relation to coastal areas

There were approximately 21,100 vessel trips into and out of six[3] of the 10 major ports identified in Section 3.1.2 during 2011 (no data are available for 4 of the 10 ports) (USACE, 2011a). The ports with the most vessel trips were Boston, MA and New London, CT, with 6,494 and 9,498 trips, respectively. The ports of Chelsea, New Bedford, and Providence each had between 1,200 and 2,400 annual trips, and the remaining port, Gloucester, had 110 trips in 2011. Most of the ports and harbors in these coastal counties are heavily developed metropolitan and industrial areas and have historically been host to large volumes of rail, vessel, and air traffic, all of which emit air pollutants.

Alternative A is projected to result in approximately 1,300 annual round trips under the proposed action leasing scenario. This includes a maximum of 4,800 trips for site characterization plus a maximum of 1,700 trips for site assessments over the 5 lease years. The 1,300 trips could be divided among the 10 major and 21 minor ports listed in Section 3.1.2., but based on the USACE

[3] The six ports with USACE (2011a) vessel trip data include Boston, Chelsea, Gloucester, New Bedford, Providence, and New London. No data were available for the following four ports: Brooklyn, Quonset Point (Ports of Davisville), Groton, and Staten Island.

(2011a) data and distances to the WEA, would likely be concentrated at New London and Providence.

The Clean Air Act (CAA) of 1970 and its amendments, requires EPA to establish National Ambient Air Quality Standards (NAAQS) for ambient air pollutants considered harmful to public health and the environment (i.e., criteria pollutants). The CAA established two types of NAAQS: primary and secondary standards to protect public health and public welfare, respectively (40 CFR Part 50). NAAQS have been established for the following criteria pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead (Pb), and two types of particulate matter (PM_{10} is coarse particulate matter [10 micrometers or less in diameter] and $PM_{2.5}$ is fine particulate matter [2.5 micrometers or less in diameter]). Ground level O_3 results from a chemical reaction of sunlight, volatile organic compounds (VOCs), and nitrogen oxide (NO_x), which are ozone precursors, while SO_2 is a precursor for $PM_{2.5}$. The standards are expressed as a concentration in air and duration (often both short- and long-term) of exposure. As with all aspects of environmental regulations, States have the authority to adopt stricter standards.

The EPA air quality standards for ozone are 0.12 ppm (1-hour average) and 0.075 ppm (8-hour average in effect since March 2008), for $PM_{2.5}$ they are 15 micrograms per cubic meter ($\mu g/m^3$) (annual average) and 35 $\mu g/m^3$ (24-hour average), and for PM_{10} the EPA standard is 150 $\mu g/m^3$ (24-hours average). All of the counties that may be affected by emissions associated with Alternative A meet the NAAQS for NO_2, SO_2, CO, and Pb (EPA, 2013). However, based on ambient air monitoring data, other NAAQS are not met for the counties containing Atlantic port cities (Table 4-1) due to indigenous source pollution and intra-State transport of pollutants.

Table 4-1

Total Number of Atlantic Coastal Counties in Nonattainment of Each Criteria Pollutant per State

Criteria Pollutant	Massachusetts	Rhode Island	Connecticut	New York
8-hour O_3	1	-	8	9
PM_{10}	-	-	-	1
$PM_{2.5}$[1]	-	-	2	10

[1]$PM_{2.5}$ (2006 standard)

Source: EPA, 2013

One coastal county in Massachusetts (Dukes) is classified as moderate nonattainment for 8-hour ozone. All eight coastal counties in Connecticut (New London, Middlesex, New Haven, Hartford, Litchfield, Tolland, Windham, and Fairfield) are moderate nonattainment for 8-hour ozone. The nine Atlantic coastal counties in New York (Westchester, Bronx, Suffolk, Nassau, Queens, Kings, Richmond, Rockland, and New York) are also moderate nonattainment for 8-

hour ozone. While all of the coastal counties in Massachusetts are in attainment for $PM_{2.5}$, two coastal counties in Connecticut (New Haven and Fairfield) and 10 Atlantic coastal counties in New York (Westchester, Bronx, Suffolk, Nassau, Queens, Kings, Richmond, Rockland, New York, and Orange) were nonattainment for $PM_{2.5}$. New York County was the only coastal county of the four States in question that was moderate nonattainment for PM_{10}. All coastal counties in Rhode Island are in attainment for 8-hour ozone, PM_{10}, and $PM_{2.5}$.

The General Conformity Rule (40 CFR Parts 51 and 93) requires that Federal actions planned in a nonattainment or maintenance area be reviewed prior to their implementation to ensure that the actions will not interfere with that State's plans to meet the NAAQS, as outlined in the federally approved State Implementation Plan. The Federal agency is required to demonstrate that their action conforms to the approved State Implementation Plan for their geographic area by performing a conformity applicability analysis. The emissions considered must be the total direct and indirect emissions, such as from the transportation of materials, equipment, and personnel, onshore and offshore (within 25 nm [46.3 km] of the State's seaward boundary), during the construction, decommissioning, and operational phases of the action. If, after evaluation and documentation, the total air emissions associated with the action are considered neither exempt nor below the *de minimis* levels (i.e., minimum thresholds for which a conformity determination must be performed for criteria pollutants in non-attainment areas) as specified in 40 CFR 93.153, then a conformity determination is required (see Table 4-2).

Table 4-2

Applicable General Conformity *de Minimis* Levels

Pollutants of Concern (tons per year)				
NO_x [1]	VOC[1]	PM_{10} [2]	$PM_{2.5}$	SO_2
100	50	100	100	100

Source: 40 CFR 93.153(b)(1)

[1]Other ozone NAAQS inside an ozone transport region
[2]Moderate non-attainment area

In addition, EPA has designated the region extending from Northern Virginia to New England as an ozone transport region, meaning that EPA has established more restrictive *de minimis* emissions levels for areas in that region. Since vessels supporting site characterization and assessment activities travel through State waters, a conformity determination would be required if total actual emissions for the Federal action exceed 100 tons of NO_x or 50 tons of VOCs.

For the purposes of NEPA evaluation, the Federal action being evaluated is the issuance of leases in the WEA as well as the associated reasonably foreseeable activities, as described in Section 3. For the purposes of complying with the General Conformity Rule under the CAA, however, project-specific emissions information is required. This information would not be available until an individual lessee submits a SAP. Therefore, General Conformity Rule evaluations would occur at the SAP stage.

Regional Haze and Visibility

Regional haze (reduced visibility) occurs when fine particles scatter and absorb light in the atmosphere, which limits how far people can see and obscures color and clarity of their view. The Mid-Atlantic/Northeast Visibility Union is one of five regional planning organizations made up of numerous States (including Massachusetts), Federal agencies, and several Tribes, to coordinate reducing visibility impairment in major national parks and wilderness areas in the Northeast and Mid-Atlantic regions. Section 169A of the CAA requires that air quality-related values, including visibility, be protected in Class I Areas, which are federally owned lands where very little air quality degradation is allowed. There are no Class I areas that could be affected within 62 miles (100 km) of the WEA.

Regulatory Controls on OCS Activities That Affect Air Quality

Section 328 of the CAA amendments of 1990 directs EPA to promulgate regulations for OCS sources that may affect the air quality of any State (42 U.S.C. 7627). The regulations are found in 40 CFR Part 55, which gives EPA the authority to regulate the air emissions associated with "OCS sources." OCS sources would include meteorological towers; any vessels for the purposes of constructing, servicing, or decommissioning them; and seafloor boring. Under the EPA rules, for all OCS sources located within 25 nm (46.3 km) of States' seaward boundaries, the requirements are the same as would be otherwise applicable if the source were located in the corresponding onshore area (40 CFR 55.3). In the States potentially affected by Alternative A, the State seaward boundaries extend 3 nm from the coastline.

Section 328 also establishes a unique treatment for vessels associated with OCS facilities. With respect to calculations of a facility's Potential to Emit, EPA considers emissions from vessels that are servicing or associated with the operations of OCS facilities as direct emissions from the OCS source when those vessels are at the source or en route to or from the source, as long as they are within 25 nm (46.3 km) of the source (40 CFR 55.2).

4.2.1.1.2 Impact Analysis of Alternative A

Routine Activities

Potential emission sources associated with routine activities under Alternative A would be from a variety of different types and sizes of vessels, equipment used in the assembly of the meteorological towers (both onshore and offshore), and diesel generators to power equipment on the towers. The vessel traffic-associated site characterization surveys and site assessment activities under Alternative A would occur simultaneously with other navigation/vessel traffic that frequents the same waters and airways.

Emissions of Criteria Pollutants

Emissions of criteria air pollutants from the site characterization surveys and site assessment activities were calculated to estimate the reasonably foreseeable scenario for emissions in any given year of the 5-year lease period. These assumptions were conservative and included construction of all five meteorological towers in the same year, the use of boats instead of aircraft for the avian surveys, and roundtrip mileage of vessels from a representative port to the mid-point of the WEA. Emissions were estimated for site characterization surveys and site assessment activities using approved emission factors and conservative assumptions. All calculations, along with the assumptions used to complete the calculations, are provided in Appendix D.

Site Characterization Surveys

Criteria pollutant emissions would be produced by survey vessels traveling to and from the WEA and conducting surveys in the WEA. The average distance that the survey vessels would travel from a port to the WEA was calculated using the maximum value from the range of distances of the five major ports that would most likely be used for surveying, which is estimated to be 75 to 90 nm (139 to 167 km). Therefore, a round trip from a port to the middle of the WEA would be 150 to 180 nm (278 to 333 km). For the calculations, it was assumed that vessels travelled an average speed of 12 knots/hour. Because NAAQS are evaluated on an annual basis, total roundtrip travel was divided equally over the 5-year lease period (Table 4-3).

Table 4-3

Emissions Associated with Site Characterization for Pollutants of Concern (Tons per Year) in a Single Year

Activity	NO_x	VOCs	PM_{10}	$PM_{2.5}$	SO_2
Site Characterization Survey	116	4	6	6	11

Construction and Decommissioning of Meteorological Towers

Because BOEM anticipates that lessees would either construct one tower or two buoys on their leasehold, and there would be fewer vessel trips associated with deployment, operation, and decommissioning of buoys than for construction, maintenance, and decommissioning of the meteorological towers (see Section 3.1.4.4), emissions calculations were based solely on construction, maintenance, and decommissioning of the meteorological towers.

BOEM anticipates that meteorological tower platforms would be partially fabricated onshore at an existing fabrication yard and construction would be completed in the WEA. Typical production operations at fabrication yards include cutting, welding, and assembling steel components. These yards occupy extensive areas with equipment that includes lifts and cranes, rolling mills, welding equipment, and sandblasting machinery. The impacts of onshore activities would be negligible because unlike the existing industrial activities/production operations already occurring at the fabrication yards, they would be temporary.

Vessels would then be used to transport the meteorological towers to their locations within the WEA. Vessel emission calculations were based on an estimate of 39 roundtrips and the vessel specifications (e.g., engine horsepower) shown in Table 3-5 in Section 3.1.4.1.

Operation of Meteorological Towers

BOEM assumes that the meteorological towers in the WEA would be operating concurrently over a 5-year period. The majority of equipment on the meteorological data collection facilities would be powered by batteries charged by small wind turbines or solar panels. However, a diesel generator may be used on some meteorological towers. While turbines and solar panels would not produce any emissions, a diesel generator would emit criteria pollutants. Generator emissions were estimated at approximately 14 tons of NO_x per tower (Appendix D). Assuming three meteorological towers would use generators, total operational emissions would be approximately 42 tons of NO_x. Support vessels traveling to and from shore for operation and maintenance of the meteorological towers are anticipated to make weekly maintenance trips to each tower, resulting in approximately 260 round trips in a year (52 weeks multiplied by 5 towers visited each week). Table 4-4 shows estimated emissions from site assessments in a single year during the 5-year lease period.

Table 4-4

Emissions Associated with Site Assessment for Pollutants of Concern (Tons per Year) in a Single Year

Activity	**NO_x**	**VOCs**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**
Site Assessment Activities	72	6	5	5	6

Non-Routine Events

The most likely impact on air quality in the WEA from non-routine events would be caused by vapors from fuel spills resulting from either vessel collisions or allisions or from servicing or refueling generators on the meteorological towers. As discussed in more detail in Section 3.2.3, if a vessel spill occurred, the estimated spill size would be approximately 123 gallons (USCG, 2012). If such a spill were to occur, it would dissipate rapidly and then evaporate and biodegrade within a few days (MMS, 2007b). Air emissions from a diesel spill would be minor and temporary. A diesel spill in the WEA would not likely have impacts on onshore air quality because of the estimated size of the spill, prevailing atmospheric conditions over the WEA, and distance from shore.

Although unlikely, a spill could occur in the event of vessel collision or allision while en route to or from the WEA or while a lessee surveys potential cable routes. Spills occurring in these areas, including harbor and coastal areas, are not anticipated to have significant impacts on onshore air quality because of the small estimated size and short duration of the spill.

4.2.1.1.3 Conclusion

Vessel traffic associated with the site characterization surveys and site assessment activities would have the largest potential to impact local air quality compared to other sources of emissions from the proposed action (i.e., construction, operations, maintenance, and decommissioning of the meteorological towers). During periods of high surveying activity, these emissions could result in moderate impacts on ambient air quality. Surveying activities would not occur year-round because of weather and sea-state limitations, so impacts from site characterization would be temporary throughout the duration of the lease. Compared to the volume of existing vessel traffic using the major ports listed in Section 3.1.2 (approximately 21,100 annual vessel trips in/out of 6 of the 10 major ports) combined with vessels using nearby TSSs and commercial and recreational fishing trips[4], emissions associated with the 1,300 annual vessel trips under Alternative A are anticipated to be minor,

The prevailing winds in the project area would likely transport offshore emissions away from the shore most of the time; however, wind directions may shift and transport emissions toward the shore. When this wind shift occurs, the distance between the WEA and the shore (12 nm [22 km] at the closest point and 33 nm [61.1 km] at the farthest point) and from the 3 nm (5.6 km) State waters boundary (9 nm [16.7 km] at the closest point and 30 nm [55.6 km] at the farthest point) would minimize impacts to onshore air quality and to ambient air quality over State jurisdictional waters. Also, because of the large size of the WEA, emissions from vessels associated with the proposed action operating in the WEA would be dispersed over a large area. Therefore, impacts on air quality both onshore and in State waters are expected to be minor.

A non-routine event, such as a diesel spill, during site characterization or site assessment may have short-term impacts on ambient air quality in a localized area, but these effects would dissipate very quickly.

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[4] As noted in Table 4-27 of this EA (Section 4.2.3.5.1), over 2.8 million recreational trips occurred in the waters offshore Massachusetts in a single year (2012). Numbers of commercial fishing vessels using the lease area are not available.

4.2.1.2 Geology

4.2.1.2.1 Description of the Affected Environment

Introduction

This section focuses on surface and subsurface geologic features, geologic processes, and geohazards on the continental shelf south of Martha's Vineyard, MA, within the WEA. Although effects from the proposed action on geology may not be substantial, discussing site characteristics adds context by defining the surrounding physical environment.

The WEA covers an area of the shelf that slopes gently seaward (0.03° slope) between depths of 98 and 197 ft (30 and 60 m). The seafloor in this area is primarily sand, with large fractions of silt and clay in the southern portions. The presence of sand waves and other sedimentary features have been documented on the eastern margins of the WEA. Significant physiographic features on the shelf in this region are the result of the advance and retreat of the Laurentide Ice Sheet during the Pleistocene era between 25,000 and 12,000 years before the present. As the ice retreated, sea levels began to rise, and the shelf was again inundated.

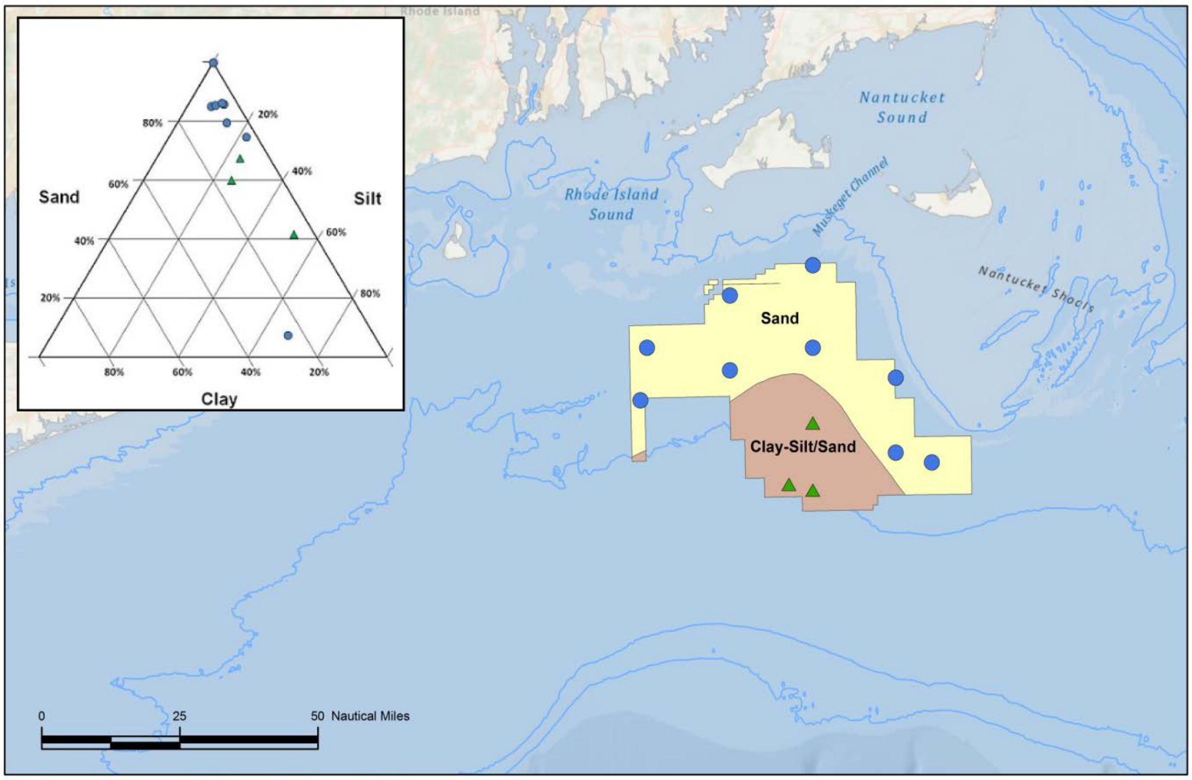
Seabed Characteristics

The WEA includes parts of three distinct bottom types that reflect differences in the underlying geology and sediment transport processes during maximum ice advance and since the ice sheet retreated and the shelf was again submerged. A small portion of the eastern end of the WEA encompasses the sand wave fields of Nantucket Shoals to the east. A small portion on the south end of the WEA includes part of a fine-grained sediment area termed the *mud patch*. The majority of the WEA is characterized by sand deposits found over much of the continental shelf in this region.

The sand waves that make up Nantucket Shoals and extend into the eastern margins of the WEA are bedforms oriented perpendicular to tidal currents, have wavelengths of tens to hundreds of meters, and heights typically 3 to 32 ft (1 to 10 m) (Twichell et al., 1987). Their occurrence is controlled by the availability of sand and tidal currents of sufficient velocity (1.3 feet per second [ft/s] or >40 centimeters per second [cm/s]) to move sand-sized particles. They are actively moving bedforms with highly variable rates of movement.

The mud patch is an area comprising predominantly (up to 95 percent) silt- and clay-sized sediment that began accumulating 8,000 to 9,000 years ago (Bothner et al., 1981) and is still an area of active deposition. The mud patch is unique to the outer eastern continental shelf because it is the only place where surface sediment contains more than 30 percent silt and clay. Deposits in the mud patch are up to 143 ft (13 m) thick (Emery and Garrison, 1967; Twichell et al., 1981). The remainder and majority of the WEA is characterized predominantly by sandy sediment that was deposited and shaped by coastal processes of the transgressing sea after glacial retreat and by currents and waves during storms on this part of the submerged shelf.

Figure 4-2 is a map of the grain size distribution of surface sediment in the WEA. The data are from the U.S. Geological Survey (USGS) Seafloor Geology and Sediment Type layers obtained from the Multipurpose Marine Cadastre maintained by BOEM and NOAA (BOEM and NOAA, 2012). The grain size data show high sand content (80 to 100 percent) in the northern two-thirds of the area, and predominantly silt and clay content in the southern section.



Source: BOEM and NOAA, 2012

Figure 4-2. Map of sediment grain size in the WEA

Bedrock underlying the WEA consists of metamorphic and igneous rocks of varying age and origin. The surface of the bedrock generally slopes toward the southeast from roughly sea level on the shore of Buzzards Bay to 1,804 ft (550 m) below sea level approximately 6.2 miles (10 km) south of Nantucket (Oldale, 1992). The bedrock surface is irregular, with valleys and basins filled with varying thicknesses of sediment.

Sediment Transport Processes

Sediment transport processes currently active on the continental shelf in the area of the WEA are driven by a combination of regional-scale residual currents, locally variable tidal currents, wind-driven currents, and wave-generated currents. These processes, particularly during storms, drive sediment transport that creates the sediment bedforms seen on the existing shelf (Butman, 1987).

The mean east-to-west flow through the area is not strong enough to initiate sediment transport on the seabed, but it is sufficient to transport sediment that is kept in suspension by stronger tidal currents and by storm waves (Twichell et al., 1987). An estimated steady current of 0.8 to 1.1 ft/s (25 to 35 cm/s) at a height of 3 ft (1 m) above the seabed is required to move sediment on the bottom. Waves with a 10-second period, common during winter storms on the shelf, can affect the seabed at depths up to 262 ft (80 m) (Twichell et al., 1987).

The sandy sediment on the seabed in this part of the shelf occurs in wave-like features of different scales. The characteristics of these bedform features demonstrate how sediment is transported through the WEA. The features include:

- *Sand Ridges* – Present in Nantucket Shoals, these large sand features are oriented roughly southwest-northeast and in line with tidal current flow;
- *Sand Waves* – Oriented perpendicular to tidal currents, these bedforms have wavelengths of tens to hundreds of meters with heights typically 3 to 33 ft (1 to 10 m) (Twichell et al., 1987). They are found in the very eastern edge of the WEA; and
- *Mega Ripples* – Smaller bedforms oriented perpendicular to tidal flow, but with wavelengths of 3 to 49 ft (1 to 15 m) and heights less than 3 ft (1 m).

Nantucket Shoals and a small portion of the eastern margin of the WEA are characterized by sand ridges and sand waves. Their occurrence is controlled by the availability of sand and sufficient tidal current velocity (> 1.3 ft/s [40 cm/s]). As noted above, these bedforms are not present in most of the WEA. The silt and clay deposits of the mud patch are thought to come from Georges Bank and Nantucket Shoals to the east, carried westward by the mean flow (Twichell et al., 1987). Tidal currents in these source areas are sufficient to erode the fine-grained sediment and keep it in suspension. Once it reaches the lower currents of the mud patch area, this sediment is able to deposit (Butman, 1987; Twichell, et al., 1987).

Geo-Hazards

Geologic hazards include scouring from currents during storm events, slope failure, faulting, earthquakes, and tsunamis. Currents and waves generated during storm events may be sufficient to cause erosion of unconsolidated sediment on the continental shelf. Estimated residual surface currents in the WEA are on the order of 0.2 ft/s (5 cm/s) (Cowles et al., 2008). Currents were measured in 151 ft (46 m) water depths from March 1979 to July 1979 and from September 1979 to April 1980; the instrument was 46 ft (14 m) above the bottom in the eastern edge of the WEA (Butman, 1987). The mean flow was toward the west at 1 ft/s (29 cm/s). Maximum current velocities measured during these two time periods were 3 ft/s (94 cm/s).

4.2.1.2.2 Impact Analysis of Alternative A

Routine Activities

This section addresses reasonably foreseeable impacts on geologic resources in the WEA from geotechnical exploration and from construction, deployment, and operation of meteorological towers and buoys. Impacts from direct seabed disturbance and from elevated suspended sediment concentration caused by routine activities are considered. Reasonably foreseeable effects on geologic resources in the WEA come from sediment sampling, construction, deployment, and operation of towers and buoys.

Sampling Activities

Geotechnical exploration would result in small areas of the seafloor being disturbed. This may occur at the borehole, coring area, vessel anchor locations, or where equipment contacts the seabed. For example, direct disturbance of the seabed from deployment of a tripod-mounted coring device would occur within a 54 to 108 square ft (5 to 10 square m) area. Direct disturbance from vessel anchors varies widely depending on the size and type of the anchor, the length of the anchor chain or cable, and the water depth. The area of direct impact from the anchor itself is expected to be on the order of 22 to 108 square ft (2 to 10 square m) depending on the anchor type. The direct impact from the anchor cable or chain depends on the length of cable or chain resting on the seabed and the amount of vessel movement that causes the cable to sweep the bottom and suspend sediment. It is expected that these effects would result in a localized disturbance similar to that caused by commercial fishing activities such as bottom trawls. Numerous studies have been performed to determine the effects of fishing activities on seabed geology. A recent publication by the New England Fishery Management Council (NEFMC, 2011) summarizes many such studies.

Sampling activities disturb seabed sediment and suspend it in the water column, where it can be transported away from the sample site and deposited in a new location. The concentration of suspended sediment generated from the sampling methods employed would be similar to the concentrations of sediment suspended during storm conditions on this part of the shelf.

The amount and duration of increased suspended sediment concentration from anchor deployment would depend on the activity, the grain size of seabed sediment, and the current velocity. The direct effect on the seabed occurs from the anchor itself and from the cable sweeping across the bottom. Vessels without dynamic positioning systems would deploy anchors or other methods to maintain position while sampling. Short-term increases in suspended sediment are expected to be confined to the immediate area of the sampling activity.

Deployment/Construction of Towers and Buoys

Driving support piles for meteorological towers would result in small areas of the seafloor being directly disturbed where piles are placed and in areas where equipment contacts the seabed. Placing anchors for buoys would also result in direct impacts on a small area of the seabed. Depending on the type of anchor being used, the direct disturbance area can be a few square meters or up to 107 square ft (10 square m).

Some method of scour protection, including rock armoring and protection mattresses, may be used at the base of piles supporting meteorological towers. Rock armor would be placed on the seabed using a clamshell bucket or a chute. The rock armor for a monopole foundation for a wind turbine would occupy an estimated 0.37 acre (0.15 hectare) of the seabed (ESS Group, Inc., 2006a). While the piles of the meteorological tower would be much smaller than those of a wind turbine, a meteorological tower may be supported by up to four piles. Therefore, the maximum area of the seabed impacted by rock armor for a single meteorological tower is also estimated to be 0.37 acre (0.15 hectare).

If used, the protection mats would be installed by a diver or ROV. For a pile-supported platform, an estimated four mats, each about 16 by 8 ft (4.8 by 2.4 m), would be placed around each pile. Including the extending sediment bank, a total area of disturbance of about 0.12 to 0.14 acre (0.048 to 0.055 hectare) for a three-pile structure and 0.14 to 0.18 acre (0.055 to 0.072 hectare) for a four-pile structure is estimated. For a monopile, an estimated eight mats about 16.4 by 16.4 ft (5.0 m by 5.0 m) would be used, with a total area of disturbance of about 0.08 to 0.09 acre (0.034 to 0.037 hectare).

Meteorological buoys are typically towed or carried aboard a vessel to the installation location. Once at the site, the mooring anchor is dropped and the instruments are configured. A boat-shaped buoy in shallower waters of the WEA may be moored using an all-chain mooring, while a larger discus-type buoy would use a combination of chain, nylon, and buoyant polypropylene materials (National Data Buoy Center, 2012). Based on previous proposals, anchors for boat-shaped and discus-shaped buoys would weigh about 6,000 to 10,000 pounds (2,722 to 4,536 kilograms) and have a footprint of about 6 square ft (0.56 square m) and an anchor sweep of about 8.5 acres (3.4 hectares). Buoys typically take 1 day to install, so vessel anchoring for 1 day is anticipated for these types of buoys (Fishermen's Energy of New Jersey, LLC, 2011).

Based on the GSOE proposal for offshore New Jersey, a spar-type buoy would be deployed in two phases: deployment of a clump anchor on the seabed as a pre-set anchor (Phase 1) and deployment of the spar buoy and connection to the clump anchor (Phase 2). Phase 1 would take approximately 1 day and would include placement of the clump anchor on a barge and transporting it to the installation site. In this example, a rectangular clump anchor is 22 ft x 22 ft x 3 ft (6.7 m x 6.7 m x 1 m) in size, weighs approximately 100 tons, and has a bottom footprint of 484 square ft (45 square m). Phase 2 would involve towing the spar buoy to the site, deployment, and connection to the clump anchor (Tetra Tech EC, Inc., 2010). The buoy would be anchored to the seafloor using a clump weight anchor and mooring chain. Installation would take approximately 2 days. The bottom disturbance associated with buoy and vessel anchors would measure 28 ft x 28 ft (8.5 m x 8.5 m), with a total area of 784 square ft (73 square m).

Deployment and construction of meteorological towers disturbs seabed sediment and suspends sediment in the water column, where it can be transported away from the sample site and deposited in a new location. The concentration of suspended sediment generated would be similar to suspended sediment concentrations occurring during storm conditions on this part of the shelf.

Studies performed by Churchill in the 1980s (Churchill et al., 1988; Churchill, 1989) yielded data from measurements of suspended sediment near the seabed along a line that crossed through the mud patch, the area of fine-grained sediment at the southwest corner of the WEA. Churchill observed elevated suspended sediment concentrations that correlated with the presence of bottom trawls and developed a model to predict the concentrations that would occur during trawling. He used the model to predict suspended sediment concentration in the water column by trawls operating in the mud patch of up to 0.004 pound per gallon (lb/gal) (470 milligrams per liter [mg/L]) at 328 ft (100 m) behind the operating trawl. Elevated suspended sediment concentrations were present for up to 1 day after the trawling activity.

Operation of Towers and Buoys

The effects on the geologic resources in the WEA occurring during operation of meteorological towers and buoys includes scour of sediment adjacent to tower support piles embedded in the seabed. Scour occurs at the base of piles and other structures embedded in the seafloor because of a disturbance of current flow around the pile that causes an increase in bottom shear stress and localized erosion.

Non-Routine Events

Non-routine events include collisions between the structure or associated vessels with other marine vessels or marine life and spills from collisions or during generator refueling. None of these events would adversely affect the geology of the WEA.

4.2.1.2.3 Conclusion

Impacts on geological resources as a result of sediment sampling and the construction, deployment, and operation of meteorological towers and buoys associated with Alternative A are expected to be minor. The disturbance of small areas of the seafloor due to geotechnical exploration and the construction and deployment of meteorological towers and buoys is expected to result in a localized disturbance similar to that caused by commercial fishing, such as bottom trawls. Elevated suspended sediment concentrations generated during pre-assessment sampling and meteorological tower and buoy deployment would be confined to the immediate area of the activity.

4.2.1.3 Physical Oceanography

4.2.1.3.1 Description of the Affected Environment

This section describes the physical oceanography in the WEA and the areas that may be traversed by ships during construction and maintenance activities for the meteorological towers and buoys. Although effects from the proposed action on physical oceanography may not be substantial, discussing these site characteristics adds context by defining the surrounding physical environment.

Currents

Movement of water expressed as currents are categorized by their scales of forcing, i.e., mean, weather band, and tide currents.

The **mean currents** in the WEA originate as the Labrador Current off the Canadian coast and continue down the shelf to the Cape Hatteras area, where they ultimately join the Gulf Stream. Lentz (2008) analyzed current meter records longer than 200 days from deployed instruments and reported that currents on the New England Shelf are aligned with the isobaths (heading in a west-northwesterly direction). The depth of averaged mean currents increased with increasing water depth.

Recent data have been collected in the vicinity of the western boundary of the WEA as part of the Rhode Island OSAMP (RICRMC, 2010) to evaluate offshore areas suitable for renewable energy development, among other goals. Ullman and Codiga (2010) documented a field program that deployed five instrumented moorings from October 2009 to July 2010. The easternmost mooring, in waters 112 ft (34 m) deep at location 41.12°W and 71.03°N, is near the northwestern corner of the WEA. They found monthly mean currents in the range of a few cm/s to 0.3 to 0.5 ft/s (10 to 15 cm/s).

Weather band currents result from meteorological forcing and are the most prominent features in current meter records on the shelf (BOEMRE, 2011a) with timescales from about 1 to 10 days. Strong sustained along-shelf (westerly) winds can drive near surface currents offshore at 20 to 30 cm/s with a corresponding deep shoreward flow on the New England Shelf. Typical onshore-offshore currents are 0.2 to 0.3 ft/s (5 to 10 cm/s).

The recent data (Ullman and Codiga, 2010) taken adjacent to the western boundary of the WEA indicate current magnitudes ranging from 0.2 to 0.7 ft/s (5 to 20 cm/s), with predominant directions of motion toward either the west-northwest or east-southeast.

Tide currents are characteristic of the New England Shelf, located between the Gulf of Maine to the northeast with its large tides, and the much less energetic Mid-Atlantic Bight shelf to the southwest (He and Wilkin, 2006). The most important tidal constituents in the area are semidiurnal (twice daily), with the principal lunar constituent M_2, having a period of 12.42 hours, dominating with an amplitude of 13.8 to 15.7 inches (35 to 40 cm). The range of M_2 currents averaged over the water column from bottom to surface varies from 0.2 ft/s (5 cm/s) in the southwest portion of the WEA to 2.6 ft/s (80 cm/s) in the northeast portion, with a general increase to the north and east (He and Wilkin, 2006). Total tidal currents observed at a site 230 ft (70 m) deep directly south of the eastern end of Martha's Vineyard were found to be 0.43 ft/s (13 cm/s) at the surface, 0.36 ft/s (11 cm/s) at 98 ft (30 m) deep, and 0.33 ft/s (10 cm/s) at 197 ft (60 m) deep, with a vertical average of 0.36 ft/s [11 cm/s] (Cowles et al., 2008).

Waves

Two dominant factors affect the wave climate in the WEA: local meteorological processes generating wind waves (with periods less than approximately 8 seconds) and distant weather systems generating swell (with periods greater than 8 seconds) (BOEMRE, 2011a). The most important characteristics of waves are the significant wave height (average of the highest one-third of waves) and the wave direction. Wave data for the WEA were taken from the USACE Wave Information Study (USACE, 2012), which consisted of a 20-year (1980 to 1999) hindcast of wave conditions based on wind forcing. The deep stations to the south of the WEA were in water depths of approximately 328 ft (100 m), while the shallow stations at the northern boundary of the WEA were located in water depths of approximately 98 ft (30 m) or less.

Wave data were also acquired during field programs as part of the Rhode Island OSAMP development (Ullman and Codiga, 2010). Five stations at locations throughout the Rhode Island area provided continuous wave data from October 2009 to July 2010. Two of the stations, one in waters 112 ft (34 m) deep near the northwestern corner of the WEA, and the other in waters 158 ft (48 m) deep further south, are most representative of wave conditions in the WEA, although all five stations showed similar ranges and temporal variations. Typical significant wave height varied from 1 to 8 ft (0.5 to 2.5 m), with peak periods from 5 to 10 seconds and peak direction from the south or southeast.

4.2.1.3.2 Impact Analysis of Alternative A

Routine Activities

Site characterization surveys are performed during cruises where specialized instrumentation is typically attached to the survey vessel, either through the hull or in packages towed behind the vessel. Other instrumentation, such as dredges and grab samplers, Vibracores, and deep coring devices, are placed on the bottom to acquire data or samples. This instrumentation is relatively compact and too small (on the order of 30 to 40 square ft [3 to 4 square m] in the vicinity of the equipment), to affect the physical oceanography in the WEA, including currents (mean, weather band, or tides) or waves.

The construction, operations, and decommissioning of the meteorological towers could disturb the seabed via anchoring, pile driving, and placement of scour protection devices. However, because the equipment is compact, only minor and localized changes in physical oceanography (currents and waves) around the structures would occur. Similarly, buoy anchor installation, operation, and decommissioning could disturb the seabed, but it is anticipated that this disturbance will be minor, localized, and temporary.

Non-Routine Events

Collisions between structures and vessels or with other marine vessels or marine life and spills from collisions or during generator refueling would not have an impact on physical oceanography.

4.2.1.3.3 Conclusion

Impacts on physical oceanography as a result of Alternative A are expected to be minor. The instrumentation used for site characterization would be compact and small, and impacts as a result of the construction and deployment of buoys and towers would also be minor.

4.2.1.4 Water Quality

4.2.1.4.1 Description of the Affected Environment

Water quality generally refers to the physical, chemical, and biological attributes of water. For the purposes of this section, water quality refers to the ability of the waters of the New England Shelf to maintain the ecosystem within it. Factors such as pollutant loading from both natural and anthropogenic sources via the atmosphere, freshwater drainage, transport of offsite marine waters, and influx from sediments can contribute to changes, usually detrimental, in water quality. Anthropogenic sources include those from direct discharges, runoff, dumping, and spills.

Water quality can be measured by many parameters, some of which are more important to certain water bodies than to others. For the WEA and adjacent nearshore areas, these parameters include water temperature, salinity, dissolved oxygen (DO), nutrients, chlorophyll, acidity as measured by pH, oxidation-reduction potential, suspended sediment/turbidity, and trace constituents, usually metals and organic compounds.

Hydrography

The main water mass affecting the New England Shelf is formed by mixing in the Gulf of Maine of cold, fresh Scotian Shelf water, and warm, saltier slope water that enters the Gulf via the Northeast Channel (BOEMRE, 2011a). This water is modified by estuarine outflows and air-sea interaction as it travels out of the Gulf and moves west across the New England Shelf. The temperature and salinity fields, which define the density field and density stratification, change primarily on a seasonal basis, warming in the spring, peaking in August, and cooling in the fall. Although seasonal changes in salinity have been observed, they are much less predictable than temperature and are smaller than the interannual variability in salinity (BOEMRE, 2011a).

Recent data have been collected in the vicinity of the western boundary of the WEA as part of Rhode Island's OSAMP (RICRMC, 2010). Ullman and Codiga (2010) documented a significant field program that included deployment of an instrumented mooring in waters 112 ft (34 m) deep at location 41.12°W and 71.03°N near the northwestern corner of the WEA from October 2009 to July 2010. They found temperature variations between 35 and 75 degrees Fahrenheit [°F] (2 and 24 degrees Celsius [°C]) and salinity variations between 31.0 and 33.6 practical salinity units at the site.

The density gradient on the New England Shelf is consistent with the larger Mid-Atlantic Shelf pattern of less dense inshore waters and denser offshore water, and is governed more by salinity changes than temperature changes (BOEMRE, 2011a). Density stratification is typically strongest inshore as a result of freshwater outflows from land, although temperature contributes more strongly to the seasonal cycle. In areas shallower than 16 to 66 ft (5 to 20 m) deep, the turbulence of the tidal currents can supply sufficient mixing to limit stratification depending on the strength of the tidal currents.

Ullman and Codiga (2010) reported density variations from 23.5 to 26 kilograms per cubic meter (kg/m^3) and stratification from 0 to -0.13 kg/m^3 from data taken adjacent to the western boundary of the WEA.

Nutrients

Nutrients in the oceanic context consist of nitrogen, phosphorus, and silica (BOEMRE, 2011a). Nitrogen in marine environments is mostly derived from dissolved nitrogen gas, with the rest formed by the dissolved inorganic nitrogen forms of nitrate, nitrite, and ammonium ion, as well as dissolved and particulate organic nitrogen. Inorganic phosphate is the primary form of phosphorus, known as orthophosphate, with lower levels of organic phosphate in surface waters. Silicate makes up most the silica in marine environments.

Little information is available relative to nutrient concentrations in the WEA. Using Georges Bank as a proxy for the New England Shelf, The Research Institute of the Gulf of Maine (TRIGOM, 1974) reported phosphate concentrations of 0.03 microgram of phosphate per liter (μg P/L) at the surface and 1.2 at 394 ft (120 m). Nitrate concentrations ranged between 0.7 and

9.7 µg N/L, nitrite concentrations were close to zero, and ammonia concentrations were about 1 µg N/L.

Sources of nutrients that enter continental shelf areas such as the New England Shelf (and the WEA) include:

- Recycling or resuspension from sediments
- River discharges
- Transport onto the shelf from offshore waters
- Atmospheric deposition
- Upwelling from deeper waters

Chlorophyll

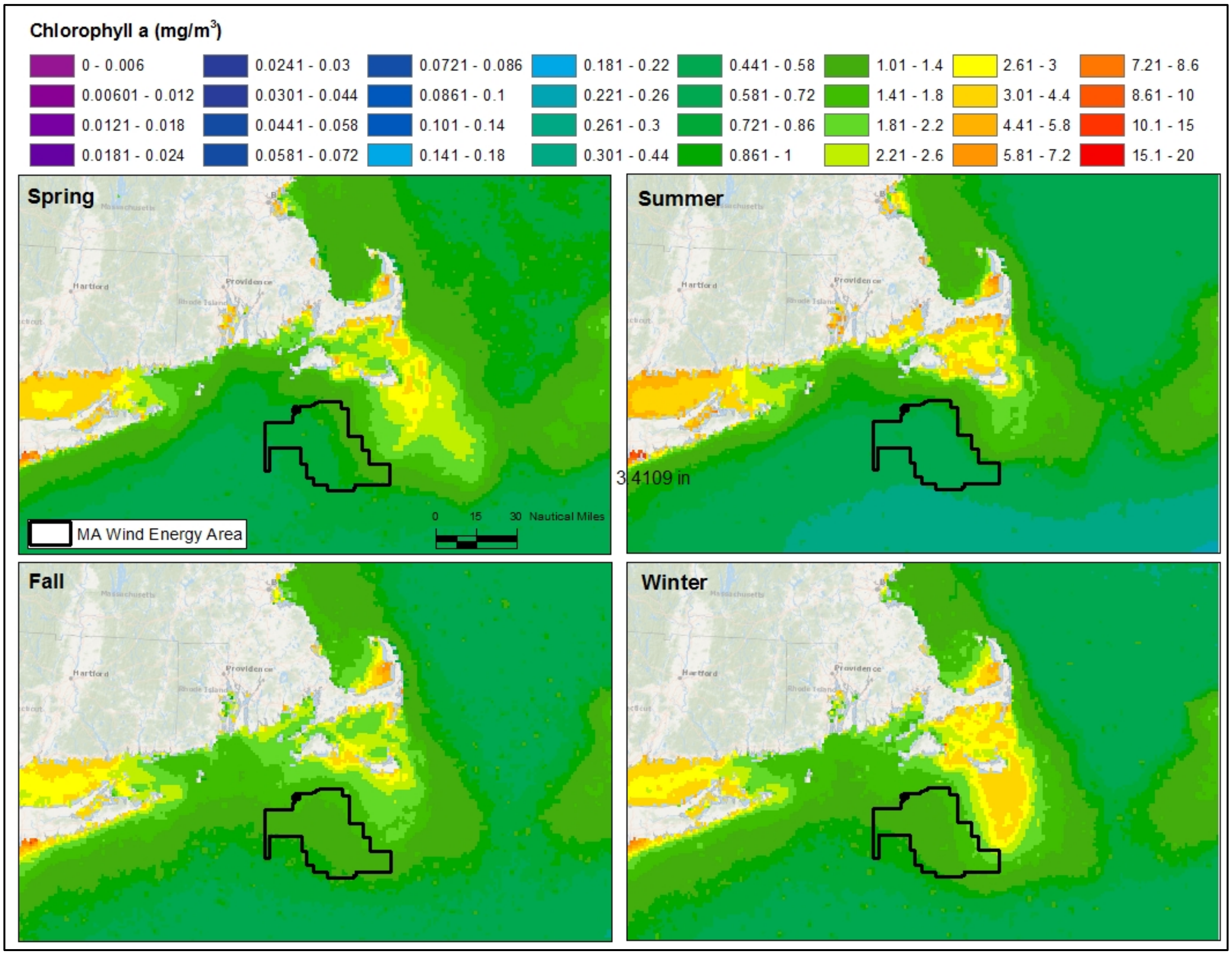
Chlorophyll *a* is a green pigment found in marine plants, and is critical in photosynthesis, the process whereby plants absorb energy from light. It is a measure of biomass, particularly phytoplankton, and may be indicative of eutrophication and linked to nutrient levels, which are more difficult to determine than chlorophyll *a*.

Ullman and Codiga (2010) documented a field program that used a gridded survey plan extending close to the west boundary of the WEA. Stations were located on a line from 41.05°W and 70.88°N in approximately 125 ft (38 m) of water north-northwest to another station in 98 ft (30 m) of water. These stations showed relatively low values of chlorophyll *a*: between 0.5 and 1.5 µg/L at the surface and between 1.5 and 2.5 µg/L at the bottom, with the exception of a pool measured at the shallower station with a level of more than 10 µg/L during the September cruise.

The Northeast Ocean Data portal (http://www.northeastoceandata.org/maps/other-marine-life/) was queried to display seasonal surface chlorophyll *a* distributions for an area encompassing the MA WEA. As stated on the Web site, the maps display

> …seasonal chlorophyll *a* data from The Nature Conservancy's Northwest Atlantic Marine Ecoregional Assessment (NAMERA), which used satellite images from the Sea Viewing Wide Field-of-View Sensor (SeaWiFS) obtained from NASA. Tim Moore (Ocean Process Analysis Laboratory, University of New Hampshire) processed the data to improve the estimation of chlorophyll in the coastal zone. Seasonally averaged chlorophyll images were created for the time period from January 1998 through December 2006. Nature Conservancy obtained this dataset from NEFSC and prepared it for Northeast Ocean Data.

Figure 4-3 shows the seasonal variations in four panels: (upper left) spring, (upper right) summer), (lower left) fall, and (lower right) winter. Although some areas near the coast and to the south-southeast of Nantucket Island show dramatic differences among the seasons, the MA WEA area shows relatively small differences, typically about a factor of two. For spring the range is from 0.7 to 1.6 µg/L, increasing from southwest to northeast; for summer the range is from 0.4 to 1.0 µg/L, for fall the range is from 0.9 to 1.9 µg/L, and for winter the range is from 0.9 to 2.4 µg/L. These values are consistent with those reported by Ullman and Codiga (2010).



Source: Northeast Data Portal, 2014

Figure 4-3. Maps of seasonal chlorophyll concentration (mg/m^3) in the WEA and surrounding area

Dissolved Oxygen

DO mainly enters the ocean via exchange with the atmosphere. Concentrations are also controlled by physical factors (water temperature) and biological factors (respiration, photosynthesis, and bacterial decomposition), which may result in concentration changes through the water column.

Ullman and Codiga (2010) documented a field program that included two stations close to the west boundary of the WEA. These stations showed a seasonal variation of surface DO from 7.5 to 10.5 mg/L and bottom DO from 6.5 to 10.5 mg/L, with the highest values recorded in March and the lowest values recorded in September.

Turbidity

Turbidity is a measure of the scattering of light by suspended particulate matter in contrast to total suspended sediment, which is a measure of the concentration of sediment particles in the water column. There is no accurate way to convert from one to the other except by taking simultaneous measurements of both and performing a regression analysis. Historically, turbidity has been measured directly in Nephelometric Turbidity Units (NTUs), while suspended sediment concentrations were determined in the laboratory in units of mg/L (though newer instruments can now measure total suspended sediment directly).

Measurements reported by Ullman and Codiga (2010) showed that there was little difference in turbidity levels between the surface and the bottom. The levels ranged from 0.25 to 0.5 NTU for the September, March, and June cruises, but rose to between 0.75 and 1.25 NTU in December.

Trace Metals

An arbitrary concentration of 1 mg/kg (1 ppm) is considered the concentration that separates trace metals from other metals in seawater (BOEMRE, 2011a). Trace metals enter the marine environment from runoff, direct discharge/deposition, atmospheric deposition, sediment resuspension, paints from hulls, accidental spills, and even cosmic impacts. The highest concentrations are found closest to sources, which on the New England Shelf would be dumpsites receiving sewage sludge, chemical wastes, and dredged sediments. There do not appear to be any dumpsites in the WEA or directly upstream (east); therefore, trace metal concentrations are expected to be low.

4.2.1.4.2 Impact Analysis of Alternative A

Routine Activities

The routine activities associated with Alternative A that would impact coastal and marine water quality include vessel discharges (including bilge and ballast water and sanitary waste) and structure installation and removal. A general description of these impacts on coastal and marine water quality is presented in Section 5.2.4 of the PEIS (MMS, 2007a).

Site Characterization

Site characterization surveys are described in Section 3.1.3 and include HRG surveys, geotechnical surveys, and biological surveys. These surveys are performed during cruises where specialized instrumentation is typically attached to the survey vessel, either through the hull or in packages towed behind the vessel. Other instrumentation, such as dredges and grab samplers, Vibracores, and deep coring devices, are placed on the bottom to acquire data or samples. All of this instrumentation is self-contained with no discharges to affect the water quality in the WEA, including hydrography, nutrients, chlorophyll, DO, or trace metals.

Survey vessels performing these characterization surveys may affect water quality both during the surveys in the WEA, as well as traveling to and from shore facilities. Vessels generate operational discharges that can include bilge and ballast water, trash and debris, and sanitary waste. Details of these waste discharges and the governing regulations are discussed in Section 3.1.3.5. In the event of failure of the onboard equipment for treating such waste, water quality could be compromised, particularly in nearshore areas. However, in the WEA, coastal and oceanic circulation and the large volume of water would disperse, dilute, and biodegrade vessel discharges relatively quickly, and the water quality impact would be minor.

Construction, Decommissioning, and Operations

Meteorological and oceanographic data collection towers and buoys are described in Section 3.1.4. The construction and deployment of such equipment would disturb the seabed via anchoring, pile driving, and placement of scour protection devices. However, because the equipment is compact, only small, local changes in water quality (turbidity) in the vicinity of the structures would occur. The small changes would likely affect only approximately to 30 to 40 square ft (3 to 4 square m) in the vicinity of the equipment, assuming the area of influence is approximately 3 ft (1 m) above the equipment with a radius of one to two length scales around the equipment. These small changes would cease to occur during operation of towers and buoys.

Non-Routine Events

The water quality effects of non-routine events such as allisions/collisions and spills are described in Sections 3.2.2 and 3.2.3, respectively.

4.2.1.4.3 Conclusion

Impacts on water quality as a result of Alternative A would be minor. The instrumentation used for site characterization is self-contained, so there would be no discharges to affect the water quality in the WEA. Although there would be operational discharges from vessels during site characterization surveys, the coastal and oceanic circulation and large water volume would disperse, dilute, and biodegrade vessel discharges, so impacts on water quality would be minor. The disturbance to the seabed during construction and deployment of towers and buoys would cause small, localized impacts on the water quality in the vicinity of the structures. However, these small, localized impacts would cease during operation of the towers and buoys.

4.2.2 Biological Resources

4.2.2.1 Birds

4.2.2.1.1 Description of the Affected Environment

A wide variety of bird species occur in the WEA and onshore areas associated with the proposed action. Blodget (2007) compiled a list of over 450 species that could possibly use the onshore and offshore areas of Massachusetts. This list includes many accidental and rare species that are not likely to use the offshore pelagic areas. The most likely taxa to occur in the offshore areas include approximately 19 species of waterfowl, 4 species of loons and grebes, 10 species of shearwaters and petrels, 3 species of gannets and cormorants, 2 shorebirds, 3 jaegers, 6 alcids, 3 sulids, and 20 species of gulls and terns (eBird, 2014; Table 4-5). Long-tailed Duck (*Clangula hyemalis*) and other sea ducks winter in the WEA and surrounding areas and especially large populations of Long-tailed Duck occur in the area during November through March (Table 4-5; Allison et al., 2006; Allison et al., 2009). Predicted annual distribution and relative abundance of Long-tailed Ducks are shown in Figure 4-4. Other taxa and species may occur in the area in lower numbers, either throughout the year or at specific times of the year.

Table 4-5

Expected Seasonal Occurrence of Bird Species Likely to Use the Areas Offshore Massachusetts as reported in the Dukes and Nantucket County Lists of eBird.

Bird Type	Genus	Species	Common Name	Expected Occurrence[1] P=present, A=absent			
				winter	spring	summer	fall
Waterfowl (mostly during migration)							
	Chen	*caerulescens*	Snow Goose	P	P	A	P
	Branta	*bernicla*	Brant	P	P	A	P
	Branta	*canadensis*	Canada Goose	P	P	P	P
	Aythya	*valisineria*	Canvasback	P	P	A	P
	Aythya	*americana*	Redhead	P	P	A	P
	Aythya	*marila*	Greater Scaup	P	P	A	P
	Aythya	*affinis*	Lesser Scaup	P	P	A	P
	Somateria	*spectabilis*	King Eider	P	A	A	A
	Somateria	*mollissima*	Common Eider[3]	P	P	P	P
	Histrionicus	*histrionicus*	Harlequin Duck	P	P	A	P
	Melanitta	*perspicillata*	Surf Scoter[3]	P	P	P	P
	Melanitta	*fusca*	White-winged Scoter[3]	P	P	P	P
	Melanitta	*nigra*	Black Scoter[3]	P	P	P	P
	Clangula	*hyemalis*	Long-tailed Duck[3]	P	P	A	P
	Bucephala	*albeola*	Bufflehead	P	P	A	P
	Bucephala	*clangula*	Common Goldeneye	P	P	A	P
	Bucephala	*islandica*	Barrow's Goldeneye	P	P	A	P
	Mergus	*serrator*	Red-breasted Merganser	P	P	P	P

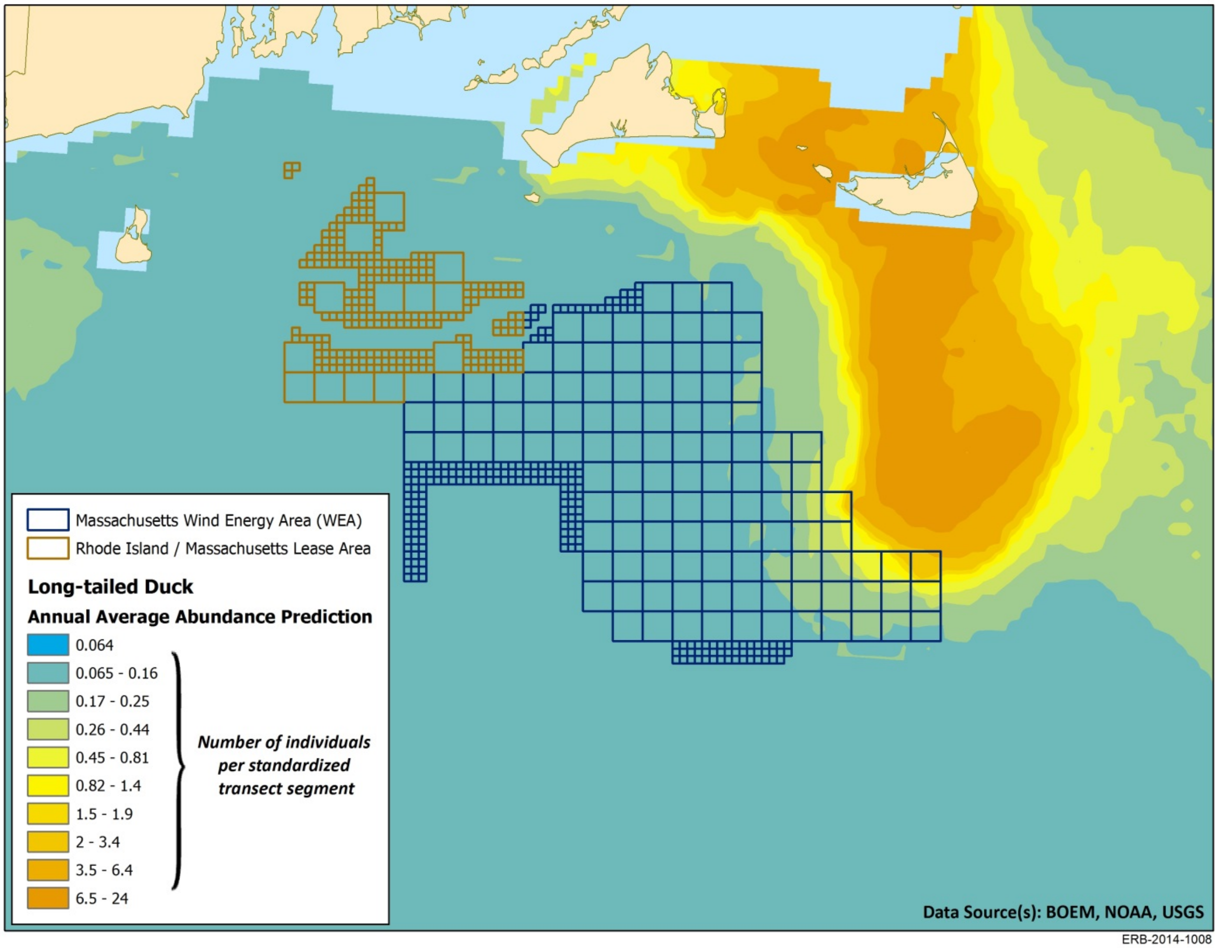
Bird Type	Genus	Species	Common Name	Expected Occurrence[1] P=present, A=absent			
Loons and Grebes							
	Gavia	*immer*	Common Loon[2]	P	P	P	P
	Gavia	*stellata*	Red-throated Loon	P	P	P	P
	Podiceps	*auritus*	Horned Grebe	P	P	A	P
	Podiceps	*grisegena*	Red-necked Grebe	P	P	A	P
Shearwaters and Petrels							
	Fulmarus	*glacialis*	Northern Fulmar[2]	P	P	P	P
	Calonectris	*diomedea*	Cory's Shearwater[2]	A	A	P	P
	Puffinus	*gravis*	Great Shearwater[2, 3]	A	A	P	P
	Puffinus	*griseus*	Sooty Shearwater[2]	A	P	P	P
	Puffinus	*puffinus*	Manx Shearwater	A	P	P	P
	Puffinus	*lherminieri*	Audubon's Shearwater	A	A	P	P
	Oceanites	*oceanicus*	Wilson's Storm-Petrel[2, 3]	A	A	P	P
	Pelagodrama	*marina*	White-faced Storm-Petrel	A	A	P	A
	Oceanodroma	*leucorhoa*	Leach's Storm-Petrel	A	A	P	P
	Oceanodroma	*castro*	Band-rumped Storm-Petrel	A	A	P	A
Sulids							
	Morus	*bassanus*	Northern Gannet[2, 3]	P	P	P	P
	Phalacrocorax	*auritus*	Double-crested Cormorant	P	P	P	P
	Phalacrocorax	*carbo*	Great Cormorant	P	P	P	P
Shorebirds							
	Phalaropus	*lobatus*	Red-necked Phalarope	A	A	A	P
	Phalaropus	*fulicarius*	Red Phalarope	P	P	P	P
Jaegers							
	Stercorarius	*pomarinus*	Pomarine Jaeger[2]	A	P	P	P
	Stercorarius	*parasiticus*	Parasitic Jaeger	A	P	P	P
	Stercorarius	*longicaudus*	Long-tailed Jaeger	A	A	P	P
Alcids							
	Alle	*alle*	Dovekie[2]	P	P	P	P
	Uria	*aalge*	Common Murre	P	P	A	P
	Uria	*lornvia*	Thick-billed Murre	P	A	A	P
	Alca	*torda*	Razorbill	P	P	A	P
	Cepphus	*grylle*	Black Guillemont	P	A	A	A
	Fratercula	*artica*	Atlantic Puffin	P	P	P	P

Bird Type	Genus	Species	Common Name	Expected Occurrence[1] P=present, A=absent			
Gulls and Terns							
	Rissa	*tridactyla*	Black-legged Kittiwake[2,3]	P	P	P	P
	Larus	*philadelphia*	Bonaparte's Gull	P	P	P	P
	Chroicocephalus	*ridibundus*	Black-headed Gull	P	P	A	P
	Hydrocoloeus	*minutus*	Little Gull	P	A	P	A
	Larus	*atricilla*	Laughing Gull[2]	A	P	P	P
	Larus	*delawarensis*	Ring-billed Gull	P	P	P	P
	Larus	*argentatus*	Herring Gull[2]	P	P	P	P
	Larus	*glaucoides*	Iceland Gull	P	P	A	P
	Larus	*fuscus*	Lesser Black-backed Gull	P	P	P	P
	Larus	*hyperboreaus*	Glaucous Gull	P	P	A	A
	Larus	*marinus*	Great Black-backed Gull[2]	P	P	P	P
	Onychoprion	*anaethetus*	Bridled Tern	A	A	P	A
	Sternula	*antillarum*	Least Tern	A	P	P	A
	Sterna	*caspia*	Caspian Tern	A	P	P	P
	Chlidonias	*niger*	Black Tern	A	P	P	P
	Sterna	*dougalli*	Roseate Tern[3]	A	P	P	P
	Sterna	*hirundo*	Common Tern[2,3]	A	P	P	P
	Sterna	*paradisae*	Arctic Tern	A	P	P	A
	Sterna	*forsteri*	Forster's Tern	P	P	P	P
	Sterna	*maxima*	Royal Tern	A	A	P	A

[1]Occurrence indices are derived from the Dukes and Nantucket County eBird Lists, 2014

[2]Species was mapped as part of the Menza et al. (2012) study.

[3]Species was mapped as part of the Veit et al. (2013) study.



Source: Kinlan et al., 2014

Figure 4-4. Predicted annual distribution and relative abundance of Long-tailed Ducks per 15-minute ship survey equivalent transect segment at 10 knots

Birds within this area have historically been, and will continue to be, subject to a variety of anthropogenic stressors, including commercial and recreational boating activity, pollution, disturbance of marine and coastal environments, hunting, loss of breeding and wintering grounds, and climate change (NABCI, 2011). The following sections discuss several categories of birds that are particularly sensitive with respect to the proposed action.

Migratory Birds

Although most North American bird species are exclusively or primarily restricted to terrestrial habitats, a large number of species can occur in the WEA, particularly during spring and fall migratory periods. Most of these species receive Federal protection under the Migratory Bird Treaty Act of 1918 (MBTA) (16 U.S.C. 703–712), which states, "Unless and except as permitted by regulations … it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import … transport or cause to be transported … any migratory bird, any part, nest, or eggs of any such bird, or any product … composed in whole or in part, of any such bird or any part, nest, or egg thereof ….” Generally speaking, the MBTA protects the majority of birds that nest in North America (50 CFR 10.13). As of 2010, 1,007 species were on the List of Migratory Birds protected by the MBTA (50 CFR 10.21), including all bird species native to the United States except upland game birds.

Bald and Golden Eagles

The Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. 668–668d) prohibits the take and trade of Bald Eagles (*Haliaeetus leucocephalus*) and Golden Eagles (*Aquila chrysaetos*). “Take” is defined by the Act as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb.” Bald Eagles can be found year-round in Massachusetts, where they most commonly occur in a variety of terrestrial environments, primarily near water (Buehler, 2000). Although they may inhabit marine environments close to the coast, they do not normally occur in pelagic environments as far from shore as the WEA (Buehler, 2000). Golden Eagles are primarily a species of western North America, though their breeding range does extend eastward as far as Quebec, and small numbers do migrate through the eastern United States (Kochert et al., 2002). During migration, both Bald and Golden Eagles typically migrate over land, where they tend to follow mountain ridgelines (Buehler, 2000; Kochert et al., 2002); hence, neither is expected to migrate through the WEA or onshore areas associated with the proposed action.

ESA-Listed or Candidate Bird Species

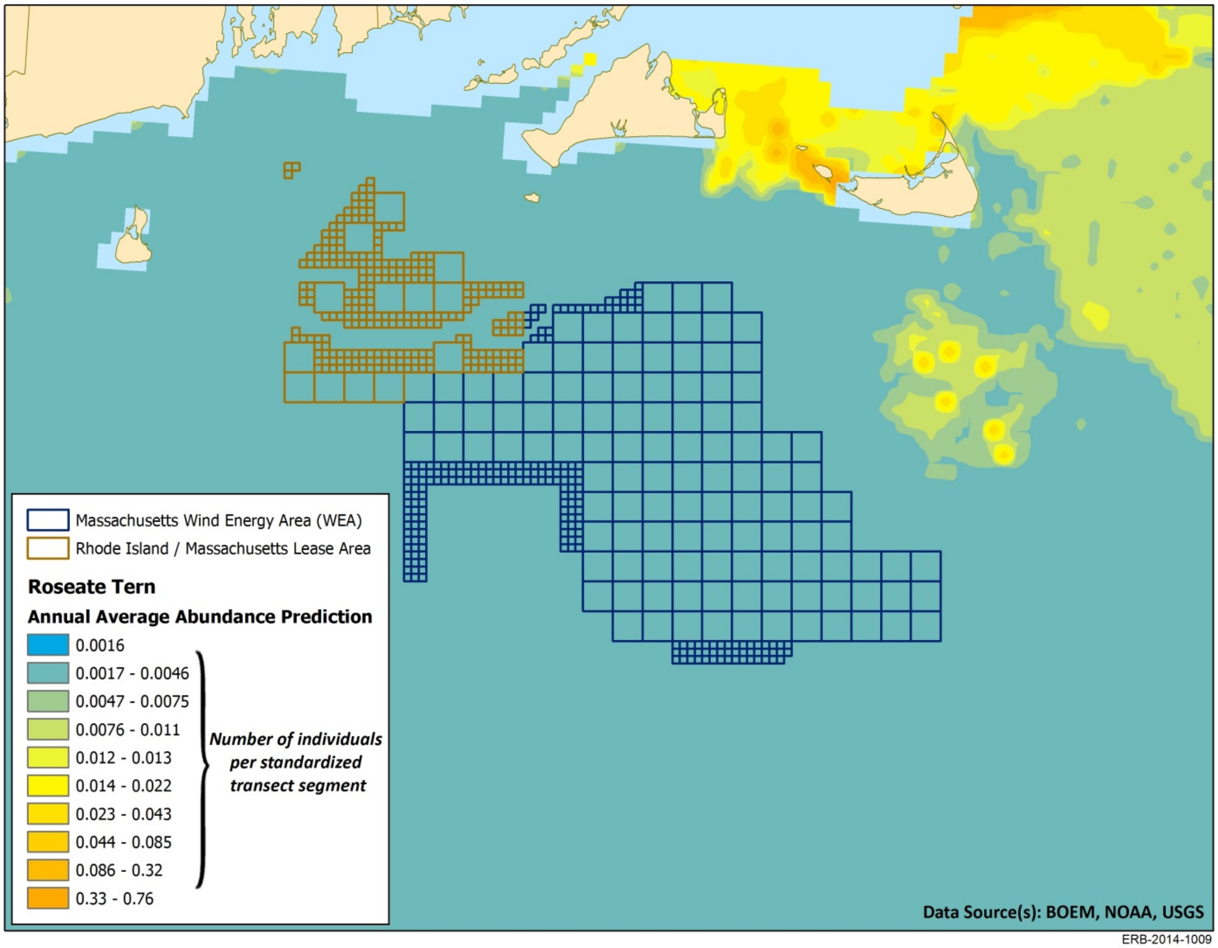
Two species of birds that may occur in the WEA are listed under the ESA as endangered or threatened. The northwestern Atlantic Ocean population of Roseate Tern (*Sterna dougallii*) is listed as endangered, and the Atlantic Coast population of the Piping Plover (*Charadrius melodus*) is listed as threatened. A third bird species that may occur in the WEA, the Red Knot (*Calidris canutus rufa*), is currently regarded by the USFWS as a candidate for ESA listing status (Niles et al., 2007) but has been proposed to be listed as threatened (78 FR 60023); a final ruling is expected by June 2014.

Roseate Tern: The Roseate Tern is a small tern that breeds in colonies on islands. One population in the western Atlantic Ocean breeds along the coast of the northeastern United States and maritime provinces of Canada, winters along the northeastern coast of South America, and is listed under the ESA as endangered (northwestern Atlantic population), while another population, listed as threatened, breeds in the Caribbean (USFWS, 2010). Only the northwestern Atlantic population is likely to occur in the WEA. The diet of Roseate Terns is almost exclusively restricted to small fish, including sand lances, for which it forages by flying slowly, gracefully, and buoyantly, typically 10 to 39 ft (3 to 12 m) above the water, and then plunge-diving to catch fish at depths no greater than a few inches (Gochfeld et al., 1998). Recent population declines in this species have been attributed largely to nesting colony failures caused by various predators, including gulls and rodents (USFWS, 2010).

The northwestern Atlantic breeding population of Roseate Terns currently breeds on a handful of colonies located primarily on islands from the maritime provinces of Canada to Long Island, NY, though historically it bred as far south as North Carolina (Gochfeld et al., 1998; USFWS, 2010). In recent years, this population has become extremely concentrated and restricted, with as many as 87 percent of individuals breeding within just three colonies on islands off of Massachusetts and New York (Bird and Ram Islands in Buzzards Bay, MA and Great Gull Island, NY) (USFWS, 2010).

During both nesting and post-breeding staging periods, very little Roseate Tern activity is expected to occur in the WEA. Roseate Terns arrive on their northwestern Atlantic breeding colonies in late April to early May, at which time they initiate courtship activities and then nesting (Gochfeld et al., 1998). During the nesting period from mid-May through the end of July, adult birds typically remain within 4.3 miles (7 km) of their nesting colonies while foraging for fish to provision their young, occasionally traveling as far as 18.6 miles (30 km) from their colony during this period (Burger et al., 2011; Normandeau Associates Inc., 2011). Beginning as early as late July, and by mid-August, Roseate Terns have completed nesting activity, at which time adults and young move to post-breeding staging areas where they remain until mid-September before migrating southward (Burger et al., 2011; Normandeau Associates Inc., 2011). The coastal region of southeastern Cape Cod, MA, near Chatham and Monomoy Island, is the most important post-breeding staging area for this species, hosting up to 7,000 individuals representing nearly the entire northwestern Atlantic population (Burger et al., 2011; Normandeau Associates Inc., 2011). During this time, most foraging activity is concentrated in shallow water close to shore, but some individuals may occur up to 10 miles (16 km) from the coast (Burger et al., 2011; Normandeau Associates Inc., 2011). Roseate Terns are predicted to be in the northern parts of the WEA near Martha’s Vineyard and Nantucket (Figure 4-5) (Kinlan et al., 2014), and very little (if any) Roseate Tern activity is expected to occur in the WEA during either nesting or post-breeding staging periods. The modeled results from Kinlan et al. (2014) are based on the relationship between Roseate Terns and turbidity, distance from shore, sea surface temperature, and chlorophyll *a* among others. Roseate Tern observations from 124 sightings (582 individuals) from summer to fall (June 1 to November 30) were used to build the model. Although the modeled predictions are similar to those made by Menza et al. (2012), the predictions made by Kinlan et al. (2014) are specific for Roseate Terns. In addition, recent surveys for Roseate Terns in the region support modeled predictions. For example, the recent aerial surveys of the area between the Muskeget Channel and the MA WEA show activity almost exclusively near the

Muskeget Channel from August to September (Veit and Perkins, 2014). Other aerial surveys in the region found Roseate Terns and Common Terns (*Sterna hirundo)* to be the most aggregated near the Muskeget Channel and relatively sparse in the MA WEA (Veit et al., 2013).



Source: Kinlan et al., 2014

Figure 4-5. Predicted annual distribution and relative abundance of Roseate Terns per 15-minute ship survey equivalent transect segment at 10 knots

The aerial surveys of Veit et al. (2013) showed Roseate Terns and Common Terns to be the most aggregated over the Muskeget Channel (see in Veit et al., 2013), and this behavior has been recorded for decades (Veit et al., 2013). Distribution farther offshore from the WEA was not recorded during the surveys. However, since Veit et al. (2013) combined Common Tern and Roseate Tern observations onto one map, this finding cannot conclusively be used or interpreted as a distribution of only the endangered Roseate Tern.

The migration routes of Roseate Terns are not well known, but are believed to be largely or exclusively pelagic (far from shore) in both spring and fall (Gochfeld et al., 1998; Nisbet, 1984; USFWS, 2010); hence, Roseate Terns may traverse the WEA during this period (Burger et al., 2011; Normandeau Associates Inc., 2011). Only a small number of offshore Roseate Tern observations have been recorded, including five recoveries of banded individuals at sea on ships (Nisbet, 1984), as well as a few additional boat-based observations (Normandeau Associates Inc., 2011).

Piping Plover: The Piping Plover is a small migratory shorebird that breeds in sandy dune-beach-riparian habitat along the Atlantic Coast, the Great Lakes, and the Great Plains regions of the United States. It winters in coastal habitats of the southeastern United States, coastal Gulf of Mexico, and the Caribbean (Elliot-Smith et al., 2004, 2009; USFWS, 2009). The Atlantic Coast and Great Plains breeding populations are listed as threatened, while the Great Lakes breeding population is listed as endangered (USFWS, 2009). Only the Atlantic Coast population is likely to occur in the WEA. Throughout its range, the primary threat to Piping Plovers, and most likely cause of its population declines, is coastal development, as well as disturbance by humans, dogs, and vehicles on sandy beach and dune habitat, to which it is highly specialized and ecologically restricted (Elliott-Smith et al., 2004; USFWS, 2009). Piping Plovers spend most of their time on the ground foraging for small animals amidst the debris of coastal wrack lines and beaches, and use extremely cryptic coloration and behavior as protective camouflage (Elliott-Smith et al., 2004).

Nesting locations for the Atlantic Coast breeding population of Piping Plover extend from the maritime provinces of Canada through North Carolina, within relatively undisturbed areas of sand dune-beach habitats along the Atlantic Ocean (Elliott-Smith et al., 2004, 2009; USFWS, 2009). Piping Plovers may occur in Massachusetts from late March through mid-October, which encompasses their breeding season as well as their spring and fall migratory seasons (Normandeau Associates Inc., 2011, 2013b). During the breeding season, particularly from mid-May through mid-August, this species is unlikely to occur in the offshore study area, as Piping Plovers are strictly confined to sandy coastal habitats (Burger et al., 2011; Normandeau Associates Inc., 2011). Migratory pathways of this species are not well known (Normandeau Associates Inc., 2011; USFWS, 2009). During their migratory periods, primarily April and May in springtime and August and September in fall, at least some individuals of this species likely traverse the WEA, as migration does not appear to be concentrated along the coast. Both breeding and wintering sites include islands more than 3 miles (4.8 km) from the coast, and significant premigratory concentrations of this species have been observed in southeastern Cape Cod and Monomoy Island in late summer (Normandeau Associates Inc., 2011). Although there are no definitive observations of this species in offshore environments farther than 3 miles (4.8 km) from the Atlantic Coast, this species may be very difficult to detect in offshore environments during migration because of nocturnal and/or high elevation migratory flights (Normandeau Associates Inc., 2011).

Red Knot: The Red Knot is a medium-sized shorebird in the sandpiper family. The North American breeding population of Red Knots is proposed for listing by the USFWS as threatened

(78 FR 60023), largely based on severe population declines in recent years (Niles et al., 2007). A final action for listing the Red Knot as threatened will be decided by June 2014 (78 FR 60023).

In North America, this species breeds in the high Arctic and winters well to the south of Massachusetts (Harrington, 2001); hence, its potential occurrence in the WEA is restricted to migration. Wintering areas are from the U.S. mid-Atlantic coast through southern South America (Harrington, 2001). The Red Knot forages for a variety of small animal prey while on the ground, or while wading in shallow water within coastal environments (Harrington, 2001). During the Red Knot's spring migratory stopover in the U.S. mid-Atlantic region, horseshoe crab eggs constitute an important food source, and one likely cause of recent Red Knot population declines has been excessive human harvesting of horseshoe crab eggs (Niles et al., 2007).

Migratory routes of this species are not very well characterized, but recent studies using birds tracked with light-sensitive geolocators, as well as analysis of large geospatial datasets of coastal observations, have begun to reveal some migratory patterns of Red Knots in the Atlantic OCS region (Burger et al., 2012a, 2012b; Niles et al., 2010; Normandeau Associates Inc., 2011). These studies have revealed that migratory pathways of Red Knots through this region are fairly widespread and diverse, with some individuals traversing northern sections of the Atlantic OCS as they travel directly between northeastern United States migratory stopover sites and wintering areas or stopover sites in South America and the Caribbean, and others following the U.S. Atlantic coast or traversing the Atlantic OCS farther to the south, as they move between U.S. Atlantic coastal stopover sites and wintering areas in the southern United States, Caribbean, or northern South America (Burger et al., 2012b; Niles et al., 2010; Normandeau Associates Inc., 2011). Amid this migratory route variation, there appears to be more of a mid-Atlantic and southerly concentration of Red Knot coastal arrivals in spring, compared with a more northerly concentration, particularly in Massachusetts, of fall migrant activity and departure (Burger et al., 2012b; Niles et al., 2010; Normandeau Associates Inc., 2011); hence, more Red Knot migratory passage likely takes place through the WEA during fall migration than during spring migration.

4.2.2.1.2 Impact Analysis of Alternative A

The PEIS (Section 5.2.9.2) discusses possible impacts from site characterization activities on marine and coastal birds. This analysis is incorporated here by reference. Several features associated with Alternative A, including vessel traffic, meteorological towers, and meteorological buoys, could affect migratory birds, including some threatened and endangered bird species. Potential impacts from these three sources vary in how they would affect birds in the area, but the impacts are expected to be negligible.

Routine Activities

Increased Vessel Traffic

Although vessel traffic would increase in the WEA with this project, proper vessel operating procedures and regulations would minimize the effects of this activity on birds. The potential release of wastes, debris, hazardous materials, or fuels would occur infrequently and at discrete points widely separated in both space and time. Such releases, to the extent that they occur, would cease following the completion of the activity, and would disperse rapidly in the open ocean resulting in a negligible effect. Noise from vessels could cause disturbance to birds using the WEA, but it is likely that birds would either acclimate or move away from the noise.

Meteorological Towers

Hundreds of millions of birds are killed each year in collisions with communication towers and their associated guy wires, windows, electric transmission lines, and other structures (Dunn, 1993; Klem, 1989; and 1990; Shire et al., 2000). Some birds (i.e., gulls, terns, shorebirds, petrels, shearwaters, sea ducks, and alcids) may collide with the meteorological towers out in the open ocean and be injured or killed.

BOEM anticipates that the meteorological towers contemplated in this EA would be self-supported structures and not require guy wires for support and stability (see Appendix B). Because of the small number of meteorological towers proposed and their distance from each other, relatively short height, and distance from shore, impacts on bird populations from collisions, should any occur, would be negligible. Under good weather conditions, most migratory bird species in the vicinity of the proposed lease areas (at least 12 nm from shore) would be flying at an altitude higher than the anticipated meteorological towers. However, individuals of some species (e.g., sea ducks, cormorants, loons, shearwaters, petrels, alcids, gannets) may fly lower.

Given the small number of anticipated structures scattered over a large area (five towers over 877 square nm) at distances greater than 12 nm (22 km) from the coast, the proposed action is not expected to significantly affect birds in the WEA. Terns may perch on tower equipment, including handrails and equipment sheds. Lattice-type masts (Section 3.1.4, Figure 3-4) with numerous diagonal and horizontal bars are more likely to provide perching opportunities than monopole masts (Section 3.1.4, Figure 3-2). Perching does not pose a threat to the birds and may even be beneficial by providing roosting, loafing, and feeding locations for certain species.

Under poor visibility conditions, migratory species in the vicinity have the potential to collide with a meteorological tower. Also, lighting on tall structures during periods of fog and rain can disorient birds flying at night (Huppop et al., 2006). For instance, certain types of nighttime lighting, like steady burning lights, can confuse or attract birds when it is raining or foggy. Given the small number of structures contemplated and their distance from shore, migratory birds (including pelagic birds) colliding with meteorological towers is possible, but collisions would be rare and thus the impacts would be minor.

Meteorological Buoys

Meteorological buoys are much closer to the water surface than meteorological towers (buoys are generally less than around 39 ft [12 m] above sea level, while tower tops range from around 295 to 377 ft [90 to 115 m] above sea level). Most bird species would be flying above the buoy, so birds would not likely collide with a buoy. However, some individuals and species (e.g., shearwaters) may fly lower. Buoys also hold less equipment than meteorological towers, so there would be fewer perching opportunities, although these opportunities would pose no threat to the birds. Even though there could be more buoys than towers (10 buoys over 877 square nm), the space between the buoys and the space between the buoys and shore would be great. As a result, the impacts of buoys on birds would be negligible.

Migratory Birds

Most migratory passerines would be flying well above the buoys and towers during the spring and fall migration. Other migratory birds would rarely encounter these structures because of the small footprint of the structures themselves, their distance from shore, and great distances between buoys and towers. Low visibility and cloud ceiling could cause birds to fly lower and be more exposed to the towers and buoys, but the small number of structures in the ocean still makes exposure and risk unlikely. Therefore, the towers and buoys, as well as vessel activities in the proposed lease areas, would not likely affect migratory birds.

Bald and Golden Eagles

Bald and Golden Eagles migrate and forage over land, inland water bodies, and bays, and not the open ocean. The meteorological towers and buoys would be at least 12 nm (22 km) offshore; thus, the meteorological towers and buoys, including activities in the proposed lease areas, would not affect these eagles. Because the proposed action would not require expansion of existing onshore facilities and the vessel trips in coastal waters pose no threat to these animals, impacts on Bald or Golden Eagles or their habitat would not be expected or would be negligible.

Endangered and Threatened Birds

The Roseate Tern is listed as endangered under the ESA and may fly through the WEA during spring and fall migration, as well as during the summer breeding season. During migration, Roseate Terns travel across the open ocean and may travel across the WEA when arriving during the spring or departing during the fall. Spring migration staging areas include Martha’s Vineyard and Nantucket Island, where birds congregate after arriving from spring migration but before dispersing to the breeding ground (Gochfeld et al., 1998; USFWS, 2008). Fall post-breeding and staging areas include eastern Cape Cod near the City of Chatham and Monomoy Island where birds congregate before departing for wintering grounds in South America (USFWS, 2008). Terns may pass through the WEA when migrating from wintering grounds or departing from breeding grounds/staging areas to their wintering grounds. The Roseate Tern nesting colony closest to the WEA is on Penikese Island in south Buzzards Bay. This colony is approximately 15.5 miles (25 km) to the northwest of the WEA. Although Roseate Terns have been documented traveling up to 15.5 miles (25 km) away from nesting colonies, most of the time they remain close to shore to feed in shallow water (Burger et al., 2011). Possible Roseate Tern use of the WEA during migration could expose them to meteorological towers and buoys in the WEA. Thus, the time of highest risk would be during migration when Roseate Terns could be migrating at night and meteorological towers would be less visible; foggy conditions may also increase collision risk. Despite slightly elevated levels of risk during low-visibility periods, Roseate Tern exposure to towers and buoys is likely to be minimal because of: 1) the long distance the of the WEA from any breeding colonies, 2) the minimal time spent traveling in the WEA during migration and breeding, and 3) its keen eyesight and diurnal activity (Gochfeld et al., 1998), which will make the towers easy to see and avoid. Given these factors, the effects of the towers and buoys on Roseate Terns are likely to be negligible.

Piping Plovers nest and forage in coastal habitats, but may pass through marine areas during migration or when flying between land masses. This species would rarely encounter the small number of buoys and towers given the small footprint of these structures and the great distances between buoys and towers. In addition, the Piping Plover's preference for coastal habitat (USFWS, 2008) makes it unlikely that birds would travel over the open ocean on a regular basis. Therefore, the towers and buoys, including activities in the proposed lease areas, would have a negligible effect on Piping Plover.

The Red Knot is a shorebird and a candidate species that has been proposed to be listed as threatened under the ESA (78 FR 60023). The Red Knot does not breed or winter in this area, but may fly through the WEA during its spring and fall migration and would likely be flying above meteorological towers or buoys during migration. In addition, the towers and buoys would be place far apart throughout the area, which lowers the exposure even more. This small exposure suggests that impacts on Red Knots from meteorological tower and buoys would be negligible.

Non-Routine Events

Birds could be exposed to operational discharges or accidental fuel releases from vessels involved with site characterization activities, surveys, and site assessment. Many species of birds (e.g., gulls) often follow ships and forage in their wake on fish and other prey that may be injured or disoriented by the passing vessel. By foraging behind boats, these birds may be affected by discharges of waste fluids (such as bilge water) generated by the vessels. As described in Section 4.2.1.4 on water quality, spill prevention and contingency plans would minimize the likelihood of waste discharges. Thus, impacts on marine and coastal birds from waste discharges from survey or construction vessels are expected to be negligible.

Marine and coastal birds may become entangled in or ingest floating, submerged, and beached debris (Heneman and the Center for Environmental Education, 1988; Ryan, 1987, 1990). Entanglement may result in strangulation, injury or loss of limbs, entrapment, or the prevention or hindrance of the ability to fly or swim, and any of these effects could be lethal or injurious. Ingestion of debris may irritate, block, or perforate the digestive tract, suppress appetite, impair digestion of food, reduce growth, or release toxic chemicals (Derraik, 2002; Dickerman and Goelet, 1987). However, the discharge or disposal of solid debris into offshore waters from OCS structures and vessels is prohibited by the USCG (33 CFR 151, Annex V, Public Law 100–220 [101 Stat. 1458]). Thus, entanglement in or ingestion of project-related trash and debris by marine and coastal birds is not expected, and impacts on marine and coastal birds associated with project debris, if any, would be negligible.

4.2.2.1.3 Conclusion

Although birds could be affected by vessel discharges, the presence of meteorological towers and buoys, and accidental fuel releases, these factors pose no threat of significant impacts on these animals. The risk of collision with towers would be minor because of the small number of meteorological towers proposed, their size, and their distance from shore and each other. The impact of meteorological buoys on ESA-listed and non-ESA-listed migratory birds (including pelagic species) is expected to be negligible because buoys are much smaller and closer to the water surface than towers, and would be similarly dispersed over a wide area.

4.2.2.2 Bats

4.2.2.2.1 Description of the Affected Environment

Nine bat species have been documented to occur in Massachusetts, with eight of these species' ranges extending into the eastern portion of the State (Table 4-6). There are no federally listed endangered species in eastern Massachusetts. However, hibernating bat species throughout the northeastern United States have experienced high mortality rates associated with White Nose Syndrome (USFWS, 2012b). This has led to a decline in hibernating bat populations, including the little brown bat (*Myotis lucifugus),* northern long-eared bat (*Myotis septentrionalis),* and eastern small-footed bat (*Myotis lebeii).* As a result, the northern long-eared bat was proposed for listing as endangered under the ESA in October 2013 (78 FR 61046). The status of the eastern small-footed bat was reviewed by the USFWS, but it was found that listing is not currently warranted (78 FR 61046). Additionally, the scientific community has petitioned the USFWS to review the status of the little brown bat (Kunz and Reichard, 2010).

Table 4-6

Bats of Massachusetts and Their State and Federal Status

Common Name	Scientific Name	State Status	Federal Status	Cave-Hibernating Bats	Migratory Tree Bats
Eastern small-footed bat	*Myotis lebeii*	E		X	
Little brown bat	*Myotis lucifugus*	E		X	
Northern long-eared bat	*Myotis septentrionalis*	E		X	
Indiana bat[1]	*Myotis sodalis*	E	E	X	
Tri-colored bat	*Perimyotis subflavus*	E		X	
Big brown bat	*Eptesicus fuscus*			X	
Eastern red bat	*Lasiurus borealis*				X
Hoary bat	*Lasiurus cinereus*				X
Silver-haired bat	*Lasionycteris noctivagans*				X

[1]Does not occur in the eastern portion of Massachusetts

Like birds, migrating bats have been reported to use landmark aids during migration, following coastlines (Barclay, 1984; Tenaza, 1966), peninsulas (Jarzembowski, 2003), river valleys (Furmankiewicz and Kucharska, 2009), and mountain ranges (Baerwald and Barclay, 2009). For example, migratory tree bats have been documented on a barrier island (Assateague Island National Seashore) off the coast of Maryland during migratory periods (Johnson and Gates, 2008), likely using the linear coastline as a landmark aid in migration.

There is a history of sightings of bats in the Atlantic offshore environment (see Pelletier et al., 2013). These sightings include migratory tree bats (hoary bats, eastern red bats, and silver-haired bats), with the eastern red bat making up a majority of the offshore sightings (Hatch et al., 2013). These sightings were most often documented during the fall migratory period (Pelletier et al., 2013). For example, acoustic surveys for bats on islands in Maine revealed that bat activity peaked between early August and mid-October (Peterson et al., 2014). In another study, bat species belonging to the *Myotis* genus were detected as far as 11.9 miles (19.2 km) from shore, with an average distance of 6.6 miles (10.6 km) off the coast of New Jersey (NJDEP, 2010b). Indeed, migratory bats have been documented to occur on the island of Bermuda, roughly 670 miles (1,078 km) southeast of the North Carolina coast, during the fall migratory period (Pelletier et al., 2013). During daytime aerial and boat-based surveys for seabirds, marine mammals, and sea turtles, red bats were photographed flying 10.5 to 26 miles (16.9 to 41.9 km) off the coast of Delaware and Virginia in September 2012 (Hatch et al., 2013).

4.2.2.2.2 Impact Analysis of Alternative A

The bat species most commonly observed offshore are the migratory tree bats (hoary bat, eastern red bat, and silver-haired bat); although, non-migratory species may also occur in the WEA (see Section 4.2.2.2.1). Impacts on these species from Alternative A include avoidance of or attraction to the installed structures (meteorological towers and buoys) as a result of perceived potential feeding and roosting opportunities (Cryan and Barclay, 2009).

Routine Activities

Site Characterization Activities

If bats occur in the WEA, impacts from site characterization activities would be limited to avoidance or attraction responses to the vessels conducting surveys. Attraction or avoidance would be limited to nocturnal periods when bats are active and may be in the WEA. These potential avoidance and attraction responses are not anticipated to have any adverse effect on bats in the WEA.

Site Assessment Activities

Bats in the WEA may be affected primarily by noise from meteorological tower and meteorological buoy construction that occurs at night, when bats are active. Bats rely heavily on auditory processes for orientation, communication with members of their same species, and prey capture; therefore, noise from the construction of meteorological towers and meteorological buoys may affect bats' communication and foraging behavior (Schaub et al., 2008). Nonetheless, given the distance of the WEA from shore, the small number of bats expected in the WEA, and the small number of structures proposed over a large area far from shore (up to five meteorological towers or 10 meteorological buoys throughout the 877 square nm [3008 square km] area), any impacts on bats are expected to be negligible. During the spring and fall, when migratory tree bats may be moving through the WEA, these bats may avoid or be attracted to the meteorological towers and/or meteorological buoys. However, any potential avoidance or attraction responses are expected to have negligible impacts on bats in the WEA.

Non-Routine Events

Migratory tree bats may be present in the WEA during the migratory period when these bats may be migrating over the ocean. While bats do not typically collide with stationary structures, bats have been found at the base of communication towers and large buildings during migratory periods (Crawford and Baker, 1981). Bat collision with meteorological towers in the WEA would be most likely during the fall migratory period. Nonetheless, the likelihood of a collision would be low because of the sporadic occurrence of bats anticipated in the WEA.

4.2.2.2.3 Conclusion

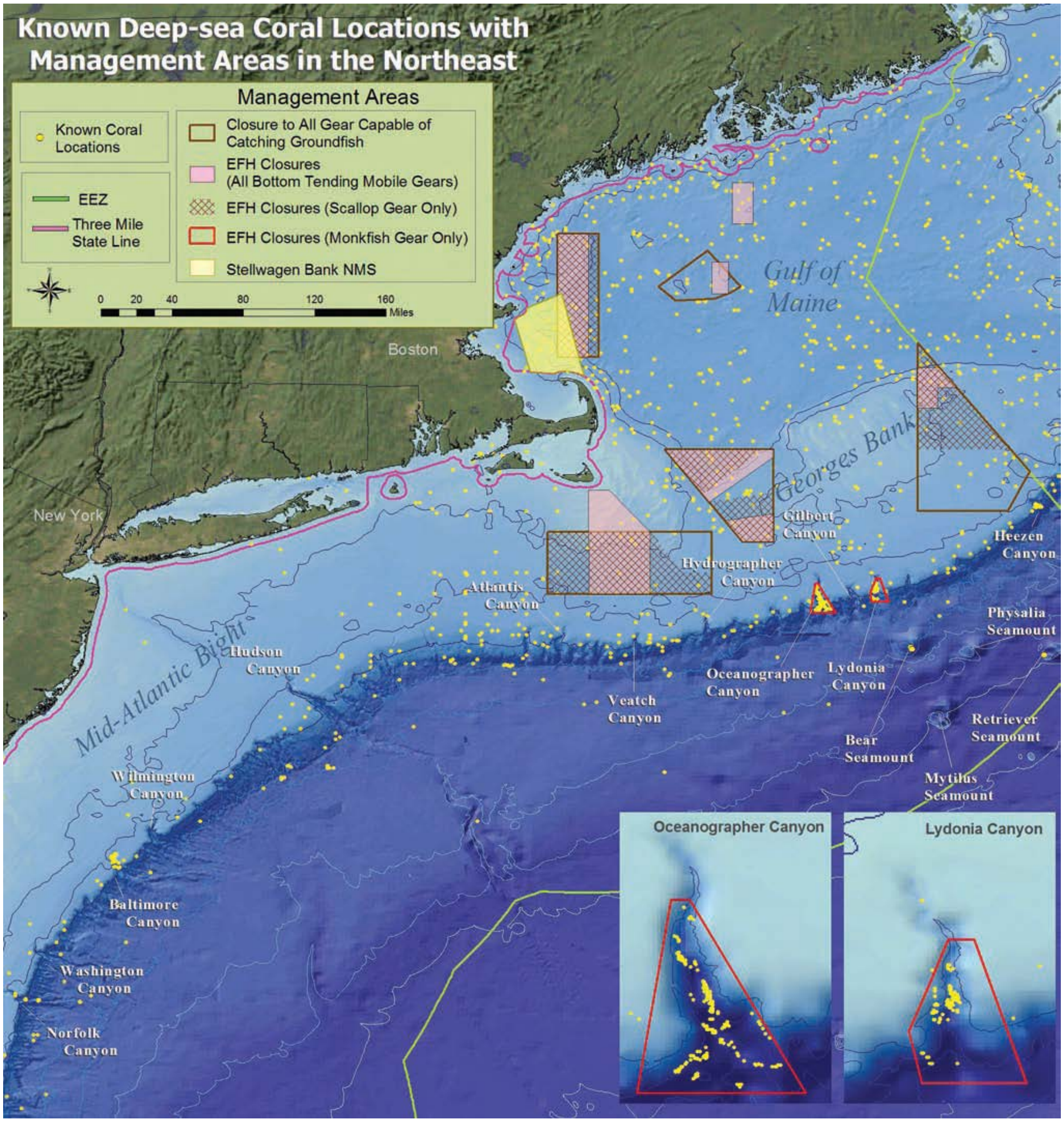
While bats foraging in the WEA is unlikely, it is possible that bats may migrate through the WEA. Bat species with the highest potential for occurrence in the WEA include the three migratory tree bats (hoary bats, eastern red bats, and silver-haired bats). These bats may be driven into the WEA during inclement weather and may have an increased potential for meteorological tower collision, although even under these circumstances, the potential for collision would be very low. Bats in the WEA may display avoidance or attraction responses to the meteorological towers and meteorological buoys or research vessels conducting site characterization activities. These avoidance or attraction effects are expected to be insignificant to bats that may occur in the WEA. The overall impact on bats by Alternative A would be negligible.

4.2.2.3 Benthic Resources

4.2.2.3.1 Description of the Affected Environment

Reef Habitats

Natural and artificial reefs form an important feature of the greater Georges Bank benthic habitat that extends to the WEA. Deep corals have been noted since the surveys of Verrill in the 19th century (Packer et al., 2007). Some of the specific locations with known occurrences include parts of the Gulf of Maine, Georges Bank, and a number of canyons that bisect the continental shelf and slope. Packer et al. (2007) also noted that the northeast region most likely does not have an abundance of large, structure-forming deep corals and deep coral habitats that are present in other regions. They collated data that indicated that in the Gulf of Maine and Georges Bank to the Cape Hatteras region, there are 16 species of stony corals, most of them solitary, with 17 species in 7 families of gorgonians and 9 species in 3 families of true soft corals (Alcyonacea). Known coral locations in the WEA are shown in Figure 4-6 (Packer et al., 2007). The existence of more deep-sea coral habitats than previously discovered is possible. At the time of writing this EA, NOAA is completing a revised database of known deep-sea corals, with considerably more records (Dorfman, pers. comm.).



Source: Packer et al., 2007

Figure 4-6. Known deep-sea coral locations with management areas in the northeast

Artificial reefs include shipwrecks or other materials lost at sea, as well as materials (e.g., tires, subway cars, concrete or steel debris, rock) intentionally placed to support and enhance habitat or recreational fishing. Other, more limited uses for artificial reefs include commercial fisheries enhancement, subsistence fishing, recreational diving, habitat restoration or expansion, coastline protection, marine sanctuaries, mitigation for habitat loss, and as fisheries management tools (Rousseau, 2008). Off the coast of Massachusetts, four intentionally constructed artificial reef sites are located in Nantucket Sound (Yarmouth), Buzzards Bay (Dartmouth), Boston Harbor's Sculpin Ledge, and Brewster Island Reefs. No State-managed artificial reefs exist in the WEA, but shipwrecks and other obstructions provide artificial reef habitat.

Stevenson et al. (2004) reported that the greater Georges Bank area was divided into seven sedimentary provinces, which fit into the benthic assemblages developed by Theroux and Grosslein (1987). These assemblages were established to create a comprehensive relationship of bathymetric/morphologic subdivisions and faunal assemblages. Defining discrete boundaries between faunal assemblages is impossible, as there is substantial overlap of species between adjacent assemblages; however, the assemblages are distinguishable as described in Table 4-7.

Table 4-7

Georges Bank Benthic Habitat Types

Habitat Type	Depth Range in feet (meters)	Description	Characteristic Benthic Macrofauna (benthic assemblage)
Northern Edge/Northeast Peak	131–656 (40–200)	Dominated by gravel with portions of sand, common boulder areas, and tightly packed pebbles; strong tidal and storm currents.	Bryozoa, hydrozoa, anemones, and calcareous worm tubes are abundant in areas of boulders.
Northern Slope and Northeast Channel	656–787 (200–240)	Variable sediment type (gravel, gravel-sand, and sand) and scattered bedforms; strong tidal and storm currents.	Transition zone between the northern edge and southern slope, characterized by benthic macrofauna common to both habitat types.
North/Central Shelf	197–394 (60–120)	Highly variable sediment types (ranging from gravel to sand) with rippled sand, large bedforms, and patchy gravel lag deposits.	Minimal epifauna on gravel because of sand movement; epifauna in sand areas includes amphipods, sand dollars, and burrowing anemones.
Central and Southwestern Shelf–shoal Ridges	33–262 (10–80)	Dominated by sand (fine- and medium-grained) with large sand ridges, dunes, waves, and ripples; small bedforms in southern part.	Minimal epifauna on gravel because of sand movement; epifauna in sand areas includes amphipods, sand dollars, and burrowing anemones.
Central and Southwestern Shelf–shoal Troughs	131–197 (40–60)	Gravel (including gravel lag) and gravel-sand between large sandy ridges; patchy large bedforms, strong currents.	Minimal epifauna on gravel because of sand movement; epifauna in sand areas includes amphipods, sand dollars, and burrowing anemones.
Southeastern Shelf	262–656 (80–200)	Rippled gravel-sand (medium- and fine-grained sand) with patchy large bedforms with gravel lag; weaker currents; ripples are formed by intermittent storm currents.	Epifauna includes sponges attached to shell fragments and amphipods.
Southeastern Slope	1,312–6,562 (400–2,000)	Dominated by silt and clay with portions of sand (medium and fine), with rippled sand on shallow slopes and smooth silt sand deeper.	While Stevenson et al. (2004) did not describe an assemblage for this depth range, Steimle (1990) found brittlestars (*Amphioplus abdita*) as being dominant, with bivalves (*Lucinoma* sp.) as occasionally being important.

Source: Adapted from Stevenson et al. (2004)

Although all the provinces in Table 4-7 are not in the immediate vicinity of the WEA, which occurs at depths between 98 and 197 ft (30 and 60 m), the closest province is described as the "Central and Southwestern Shelf–shoal Ridges" (Stevenson et al., 2004). The characteristic benthic macrofauna for this zone is primarily amphipods, sand dollars, and burrowing anemones (Theroux and Grosslein, 1987). Benthic macroinvertebrates found in the silty sand off southern New England in water depths of 131 to 190 ft (40 to 58 m) include polychaetes, bivalves such as ocean quahog (*Arctica islandica*), amphipod crustaceans, anemones, and sea cucumbers (Provincetown Center for Coastal Studies, 2005). These benthic organisms are an important food source for northern groundfish (e.g., cod, haddock, yellowtail flounder, lobsters, crabs) in the area. Examples of other important sand fauna from Nantucket Shoals and Georges Bank include surf clams (*Spisula solidissima),* razor clams *(Ensis directus),* gastropods, shrimp, crabs, sand dollars, brittle stars, and sea squirt or tunicate (Provincetown Center for Coastal Studies, 2005).

4.2.2.3.2 Impact Analysis of Alternative A

Routine Activities

The main impacts on benthic resources would be crushing or smothering by anchors, the scour control system, driven piles, scour, or redeposition of suspended sediment during tower or buoy construction and deployment. Because most site characterization activities involve remote sensing of the seafloor, they would not directly affect benthic resources other than fish. Impacts on fish are addressed in Section 4.2.2.5.2. Site characterization activities that may disturb benthic resources include grab samples, borings, Vibracores, and CPTs. Impacts from site characterization activities are expected to be limited to the immediate area of the sample and any anchoring vessels. Additionally, the data collected during HRG surveys would indicate any potential sensitive benthic resources, such as those communities living on rocky reefs and deep-sea corals, so the lessee can develop and implement avoidance measures before each geotechnical exploration activity, avoiding the cost of unnecessary or additional sampling. BOEM anticipates that that the bottom disturbance associated with site assessment activities would disturb the seafloor for a maximum radius of 1,500 ft (457 m) (equaling 162 acres [65 hectares]) around each bottom-founded structure, including all anchorages and appurtenances of the support vessels. This would result in a total of approximately 810 acres (328 hectares) of seafloor affected in the WEA, or approximately 0.1 percent of the area of the entire WEA under Alternative A, if all five anticipated meteorological towers (one per leasehold) were installed and they each disturbed the maximum estimated area of seafloor. Should all lessees decide to install two meteorological buoys on their leases instead, the maximum area of disturbance would likely be approximately twice that of the towers, or 1,620 acres (656 hectares) of disturbed seafloor, which is approximately 0.2 percent of the total WEA under Alternative A.

As described in Section 3.1.4.1, the area of ocean bottom affected by a meteorological tower would range from 200 square ft (19 square m) if supported by a monopole to 2,000 square ft

(186 square m) if supported by a jacket foundation, while the bottom disturbance associated with buoy (if used) and vessel anchors would measure 784 square ft (73 square m). A scour control system, if used, would comprise installed rock armor or artificial seaweed mattresses attached to the seafloor by anchoring pins, and would cover an approximately 30 ft (9 m) radius surrounding the piling. If rock armor scour protection were used, the maximum seabed disturbed for a single meteorological tower would cover approximately 0.37 acre (0.15 hectare) (ESS Group, Inc., 2006a). An artificial seagrass mat would disturb a maximum of 0.18 acre (0.073 hectare) of seabed, as further discussed in Section 3.1.4.1. If the proposed maximum of five meteorological towers were built, then the total area expected to be impacted by scour control systems or actual scour would be approximately 0.23 acre (0.093 hectare) (2,000 square ft x five meteorological towers). In some areas that are not expected to be subject to scour, or where expected scouring would not compromise the integrity of the structure, scour protection may not be required. However, if scouring does occur at a given location, the area affected would be similar to or slightly larger than the projected area covered by a scour control system. The introduction of meteorological structures in the benthic environment would increase the hard surface available to support benthic marine organisms, thus increasing their habitats. This relationship is similar to the artificial reefs described in Section 4.2.2.3.1. Scour mats, in addition to providing scour protection, can potentially provide habitat to marine organisms that settle into the stabilized sediment trapped therein.

Upon decommissioning and removal, the equivalent area would be disturbed by severing the pile foundation at least 16 ft (5 m) below the mudline (30 CFR 285.910). Removing the scour control system would displace the same area disturbed when they were installed and would introduce a nearby turbid cloud over the seafloor at each leg. Resuspended sediment would temporarily interfere with filter feeding organisms until the sediment had resettled. The time of sediment suspension would depend on ocean currents and sediment grain size, but is anticipated to be short lived. According to BOEM (2012), depending on the actual species density and diversity in the immediate area at the time of disturbance, soft-bottom communities may take between 1 and 3 years to recover, in terms of number of individuals, to pre-disturbance levels. Brooks et al. (2006) suggest that the recovery of benthic assemblages occurs within 3 months to 2.5 years, with the caveat that these estimates are based on limited studies. These estimates are supported by Michel et al. (2007), who summarize the results of 7 years of monitoring at the Horns Rev Wind Park in Denmark. In this study, no statistically significant changes occurred in the abundance or biomass of the majority of the designated benthic indicator organisms between 2 years of pre-construction data and 3 years of post-construction data. However, Michel et al. (2007) also noted an increase in fouling organisms, or benthic communities that are very different from the native soft sediment benthos. This increase in overall biomass of the benthic community was also reported by Carney (2005); however, little is known about ecological impacts on the native communities. Other research also suggests that recovery of community composition or trophic structure that exploits all ecologic niches available may take longer than 1 to 3 years (Continental Shelf Associates, Inc., 2004).

The duration of activity directly affecting benthic communities from site characterization surveys, meteorological platform installation, and tower removal would likely be short term (8 days to 10 weeks for construction and ≤ 1 week for removal), and, given the limited area of disturbance in the WEA, the impact to benthic habitats would be minor.

Non-Routine Events

Collisions between vessels and allisions between vessels and meteorological towers and buoys is considered unlikely (see Section 3.1.4 of this EA). However in the unlikely event that a vessel allision or collision causes a spill, the most likely pollutant to be discharged would be diesel fuel. If a diesel fuel spill were to occur, it would be expected to dissipate rapidly in the water column, then evaporate and biodegrade within a few days (MMS, 2007b), resulting in negligible impacts to the area of the spill.

4.2.2.3.3 Conclusion

Impacts of site characterization surveys, and construction, operation, and removal of meteorological towers and buoys on benthic communities would be short term (likely less than a year [Continental Shelf Associates, Inc., 2004]), and minor. The primary reasonably foreseeable impacts resulting from routine activities on benthic communities would be direct contact by anchors, driven piles, and scour protection that could cause crushing and smothering. These impacts would be localized, given the areal extent of the benthic habitat types on the continental shelf, and would occur in approximately 0.1 to 0.2 percent of the WEA. If a specific area is adversely affected, the ability of soft-bottom communities to recover, in number and diversity of individuals, to pre-disturbance levels may take 1 to 3 years. Recovery of community composition or trophic structure that exploits all ecologic niches available in that particular area may take longer (Continental Shelf Associates, Inc., 2004). The data collected during HRG surveys would indicate the presence of any potential benthic resources so that the lessee could avoid sensitive habitat types, such as hard-bottom and live-bottom habitats, during geotechnical exploration and when the meteorological facility siting decisions are made. The proposed action would not result in significant impacts on benthic communities. The duration of activity affecting benthic communities would likely be short term, and given the limited area of disturbance within the WEA, impacts on benthic habitats from the proposed action are expected to be minor.

4.2.2.4 Coastal Habitats

4.2.2.4.1 Description of the Affected Environment

Massachusetts has approximately 92 miles (148 km) of oceanfront coastline along the Atlantic

Ocean and over 1,519 miles (2,445 km) of shoreline. Massachusetts is home to three of the minor ports identified in Section 3.1.2 of this EA (Fall River, Falmouth, and Fairhaven/New Bedford) and 16 associated scientific support port/harbor facilities. The coastal resources of Massachusetts include seagrass beds, kelp beds, shellfish beds, sandy sediments (sand dunes), rocky shore, mudflats, saltmarshes, estuarine wetlands, and open water. A general description of these habitat types is provided in the following sections.

Seagrasses provide shelter for small fish, crustaceans, epiphytic algae, and other animals, and are important nursery areas for commercially valuable species such as bay scallops (*Argopecten irradians*), blue mussels (*Mytilus edulis*), and winter flounder (*Pseudopleuronectes americanus*) (Donovan and Tyrell, 2004). The only seagrass beds near the WEA are on the northern shores of Martha's Vineyard and Nantucket; thus, they will not be considered further for this analysis.

Kelp inhabits the rocky subtidal kelp beds. The most common species in Massachusetts are sugar kelp (*Laminaria saccharina*), oarweed (*L. digitalis*), and shotgun kelp (*Agarum clathratum*). They are generally found attached to rock substrates in clear, cold waters, and are likely mostly limited to areas north of Cape Cod. Because of this distribution, they will not be considered further in this analysis.

Bivalve mollusks such as oysters, scallops, quahogs (*Mercenaria mercenaria*), and soft-shelled clams form dense groupings that form the shellfish bed habitat. This habitat supports polychaete worms, juvenile crabs, snails, and seastars in spaces between shells, while other organisms, including slipper shells, sponges, hydroids, algae, and bryozoans, attach to the shells' hard surface (Donovan and Tyrell, 2004). In the northernmost portion of the WEA are areas the Massachusetts DMF defines as Shellfish Suitability Areas that are believed to be suitable for sea scallops, ocean quahogs, and Atlantic surf clams (*Spisula solidissima*).

Sandy sediments include sand dunes above the high tide line, the intertidal beach, and the sandy reaches below the surf. Sand is moved by the tides, winds, and storm surges, forces that are responsible for forming this habitat. The upper section of sandy beaches and sand dunes provide nesting areas for bird species such as the endangered Roseate Tern, the threatened Northern Harrier Hawk (*Circus cyaneus*) and Piping Plover, and the Common Tern and Least Tern (*S. antillarum*). On the subtidal seafloor, some burying organisms proliferate, including moon snails, whelks, sand dollars, and American sand lances (*Ammodytes americanus*). Other species include flounders, gobies, skates, shrimp, surf clams, coquina clams (*Donax variabilis*), hermit crabs, and other shellfish and crustaceans (Donovan and Tyrell, 2004). According to the Massachusetts Environmental Sensitivity Index data compiled in 2000 (NOAA, 2000), the majority of the southern coastline of Martha's Vineyard and Nantucket Island is composed of sandy and gravel beaches.

High wave action removes fine-grained sediment from rocky habitats, leaving a range of larger material from solid rock ledges and boulders to cobble and gravel. Dark lichen thrives in the splash zone, with barnacles in the high intertidal zone and mussels in the mid-intertidal zone, which is exposed as the tide retreats. Along the Massachusetts coast, the low intertidal zone is normally dominated by a dense mat of algae called Irish moss (*Chondrus cripsus*) and false Irish moss (*Mastocarpus stellatus*). Mobile inhabitants of the subtidal zone include lobsters, crabs, sea urchins, and a variety of fish species (Donovan and Tyrell, 2004).

Salt marshes are low-lying vegetated wetlands described as being either "low marsh area" (flooded twice daily) or "high marsh area" (flooded only during storms or spring tides). Low marshes in Massachusetts are dominated by the tall form of salt marsh cordgrass (*Spartina alterniflora*), while high marshes are composed of salt-tolerant flora including the short form of cord grass, salt meadow hay (*Spartina patens*), black grass (*Juncus geradii*), and spikegrass (*Distichlis spicata*). Common inhabitants of saltmarshes include mummichogs (*Fundulus heteroclitus*), striped bass (*Morone saxatilis*), quahogs, mussels, oysters, snails, green crabs, and fiddler crabs. Menhaden (*Brevoortia tyrannus*), winter flounder, and striped bass use salt marshes as breeding or nursery habitats (Donovan and Tyrell, 2004). Salt marshes also provide important forage habitat for a number of bird species, some of which breed and forage only in salt and brackish marshes (obligate species) and others that breed and forage in other habitats as well (facultative species).

Estuarine Wetland Ecosystems

Estuarine wetlands consist of deepwater and wetland habitats subject to tidal flow. These areas are regularly inundated by the tides but are also diluted by freshwater runoff from the land (Stedman and Dahl, 2008). A broad description of wetland habitats in the Atlantic region is provided in the PEIS (MMS, 2007a), and that description is incorporated here by reference. Thus, this section of the EA focuses on those wetlands found near major and minor ports that may be subject to increased ship traffic or other land-based activities required to support the proposed action. Twenty-seven ports have been identified in the region as likely to be used to support site assessment activities for the proposed action (see Section 3.1.2, Port Facilities). Major ports extend from Boston, MA, to Staten Island, NY, and minor ports from Falmouth, MA, to Islip, NY. Wetlands classified by Cowardin et al. (1979) as salt marshes, scrub-shrub wetlands, and forested wetlands are specifically addressed.

Salt marshes are one of the world's most productive ecosystems, and are the dominant wetland habitat from Massachusetts to New York (Mitsch and Gosselink, 2000). Scrub-shrub wetlands are often associated with the upper portions of a salt marsh. This wetland type is absent in the northern portion of the WEA and found more frequently in the south from Rhode Island to New York. No forested estuarine wetlands are located in the vicinity of port facilities.

Many of the ports do not have wetland habitat because they are either sufficiently armored, exposed to the energy of the open coast, or have coastlines that are too rocky to support vegetated wetlands. Nearby port facilities with no wetlands (i.e., salt marshes, scrub-shrub wetlands, or forested wetlands) include six ports in Massachusetts (Gloucester, Boston, Chelsea, Falmouth, Fairhaven, and New Bedford), five in Connecticut (Stonington, Groton, Avery Point, New London, and New Haven), three in Rhode Island (Newport, Quonset Point, and Kingston), and all of the New York ports except Montauk. Several ports that may be used to support the proposed action do have wetlands nearby. The presence of wetlands in certain ports reflects the availability of habitat in coves, inlets, or back barrier areas that are conducive to the development of tidal marshes. Salt marshes occur along the shorelines of Fall River (MA), Westbrook and Clinton Harbors (CT), Providence, Davisville, and Galilee (RI), and Montauk (NY). Galilee and Montauk also have small pockets of scrub-shrub wetlands.

4.2.2.4.2 Impact Analysis of Alternative A

The proposed leased sites would be located approximately 12 nm (22 km) from the nearest shoreline along Martha's Vineyard. Therefore, site characterization surveys, construction, operation, and decommissioning activities of meteorological towers/buoys in the proposed lease areas would have no direct impacts on wetlands or other coastal habitats. Only coastal vessel traffic and use of coastal facilities have the potential to affect coastal habitats. However, as discussed below, coastal vessel traffic associated with Alternative A and the use of existing coastal and port facilities could contribute to impacts on coastal habitats.

Routine Activities

Existing fabrication sites, staging areas, and ports in Massachusetts, Rhode Island, and Connecticut would support survey, construction, operation, and decommissioning activities as discussed in Section 3.1.4.4. No expansion of these existing areas is anticipated in support of the proposed action. Existing channels could accommodate the vessels anticipated to be used, and no additional dredging would be required as a result of the proposed action.

Indirect impacts from routine activities may occur from wake erosion caused by vessel traffic in support of the proposed action. A maximum of approximately 6,500 vessel trips from site characterization and assessment activities associated with Alternative A are projected to occur over a 5-year period if the entire WEA were leased and the maximum number of site characterization surveys were conducted in the lease areas of the WEA. These trips would be divided among New Bedford, Providence, Quonset Point, New London, and Groton, slightly increasing traffic in already heavily used waterways. If all ports are used equally, this would average 268 round trips per year to each of the ports in Massachusetts, Rhode Island, and Connecticut.

Wake erosion and sedimentation effects would be limited to approach channels and the coastal areas near ports and bays used to conduct activities. Given the existing amount and nature of vessel traffic (including tanker ships, container ships, and other very large ships) into and out of the ports (see Section 4.2.3.8), there would be a negligible, if any, increase to wake-induced erosion of associated channels based on the relatively small size and number of vessels associated with Alternative A. Moreover, all approach channels to these ports are armored, and speed limits would be enforced, which also helps to prevent most erosion.

Non-Routine Events

Spills can occur in a channel or bay from several activities, such as transit of WEA-related vessels to or from the ports, survey activities in the WEA, or installation, maintenance, and decommissioning of meteorological towers and buoys. Should a spill occur in a channel or bay and contact shore, the impacts on coastal habitats would depend on the type of material spilled, the size and location of the spill, the meteorological conditions at the time, and the speed with which cleanup plans and equipment could be employed. These impacts are expected to be minimal because vessels are expected to comply with USCG regulations at 33 CFR 151 relating to the prevention and control of oil spills. Based on the distance from shore where these activities would occur and the rapid evaporation and dissipation of diesel fuel, a spill occurring in the WEA would likely not contact shore. Collisions between vessels and allisions between vessels and meteorological towers and buoys are unlikely. However, if a vessel collision or allision were to occur, and in the unlikely event that a spill would result, the most likely pollutant to be discharged into the environment would be diesel fuel. Diesel dissipates very rapidly in the water column, then evaporates and biodegrades within a few days (MMS, 2007b), resulting in negligible, if detectable, impacts to the area of the spill.

4.2.2.4.3 Conclusion

No direct impacts on wetlands or other coastal habitats would occur from routine activities in the WEA based on the distance of the WEA from shore. Existing ports or industrial areas in Massachusetts, Rhode Island, and Connecticut are expected to be used in support of the proposed project. In addition, no expansion of existing facilities is expected to occur as a result of Alternative A. Indirect impacts from routine activities may occur from wake erosion and associated added sediment caused by increased traffic in support of the proposed action. Given the volume and nature of existing vessel traffic in the area, a negligible increase of wake-induced erosion may occur. Should an incidental diesel fuel spill occur as a result of the proposed action, the impacts on coastal habitats are expected to be negligible.

4.2.2.5 Finfish, Shellfish, and Essential Fish Habitat

4.2.2.5.1 Description of the Affected Environment

Finfish

The Northeast U.S. Shelf Ecosystem includes a broad range of habitats with varying physical and biological properties. These habitats range from the cold waters of the Gulf of Maine south to the more tempered climate of the Mid-Atlantic Bight; thus, oceanographic and biological processes interact to form a network of expansively to narrowly distributed habitat types (Stevenson et al., 2004). The Northeast Shelf Ecosystem ranges from the Gulf of Maine south to Cape Hatteras, extending from the coast seaward to the edge of the continental shelf, including the slope off shore to the Gulf Stream. Stevenson et al. (2004) further subdivides the area into four distinct sub-regions: the Gulf of Maine, Georges Bank, Mid-Atlantic Bight, and the continental slope. Occasionally, another sub-region, Southern New England, is described (Stevenson et al., 2004).

Table 4-8 lists the major demersal finfish assemblages of the Northeast Continental Shelf that occur in the vicinity of the WEA. The WEA supports both the intermediate and shallow finfish assemblages defined by Overholtz and Tyler (1985). Many of the fish species in these assemblages are important because of their value in the commercial and/or recreational fisheries. However, some of these species are of special concern as a result of their depleted population status (BOEM, 2012). All the species play some role in the ecosystem of the Northeast Shelf as a predator, prey, or in some other defined niche in the ecosystem. In addition to these demersal finfish, there are also important pelagic finfish in the area of the WEA. Federally managed demersal fishes in the area include winter flounder (*Pseudopleuronectes americanus*), yellowtail flounder (*Limanda ferruginea*), and monkfish (*Lophius americanus*). Examples of federally managed pelagic species in the WEA include Atlantic herring (*Clupea harengus*), Atlantic bluefin tuna (*Thunnus thynnus*), yellowfin tuna (*Thunnus albacares*), king mackerel (*Scomberomorus maculates*), and whiting (*Merluccius bilinearis*). A complete list of the species with Essential Fish Habitat (EFH) designations in the WEA, as defined by the Magnuson-Stevens Fishery Conservation and Management Act, is included later in this section of the EA.

Table 4-8

Demersal Fish Assemblages in the Vicinity of the WEA

Assemblage	**Species**
Intermediate	silver hake, red hake, goosefish (monkfish), Atlantic cod (*Gadus morhua)*, haddock (*Melanogrammus aeglefinus*), ocean pout (*Macrozoarces americanus*), yellowtail flounder (*Scophthalmus aquosus*), winter skate (*Leucoraja ocellata*), little skate (*Raja erinacea*), sea raven (*Hemitripterus americanus)*, longhorn sculpin (*Myoxocephalus octodecemspinosus*)

Assemblage	Species
Shallow	Atlantic cod, haddock, pollock, silver hake, white hake, red hake, goosefish (monkfish), ocean pout, yellowtail flounder, windowpane flounder, winter flounder, winter skate, little skate, longhorn sculpin, summer flounder (*Paralichthys dentatus*), sea raven, sand lance (*Ammodytes americanus*)

Source: Overholtz and Tyler, 1985

The NMFS Northeast Fisheries Science Center (NEFSC) has been conducting their fishery-independent Autumn Bottom Trawl Survey annually since 1963. Two metrics derived from this survey, total biomass and vertebrate richness, can be used to show the relative distribution of fish in the area of the WEA relative to surrounding locations (Figures 4-7 and 4-8). For total biomass, the expanded catch weights for all species were summed by station. Vertebrate richness was derived by counting the number of vertebrate species present at each station. More details on the data and interpolation methods used to create these maps can be found in NMFS NEFSC (2013). While total biomass and vertebrate richness appear relatively high in the vicinity of the WEA, it is important to refer to the full extent of the NEFSC Autumn Bottom Trawl Survey data available at NMFS NEFSC (2013) and Northeast Ocean Data (2014) for a more complete comparison.

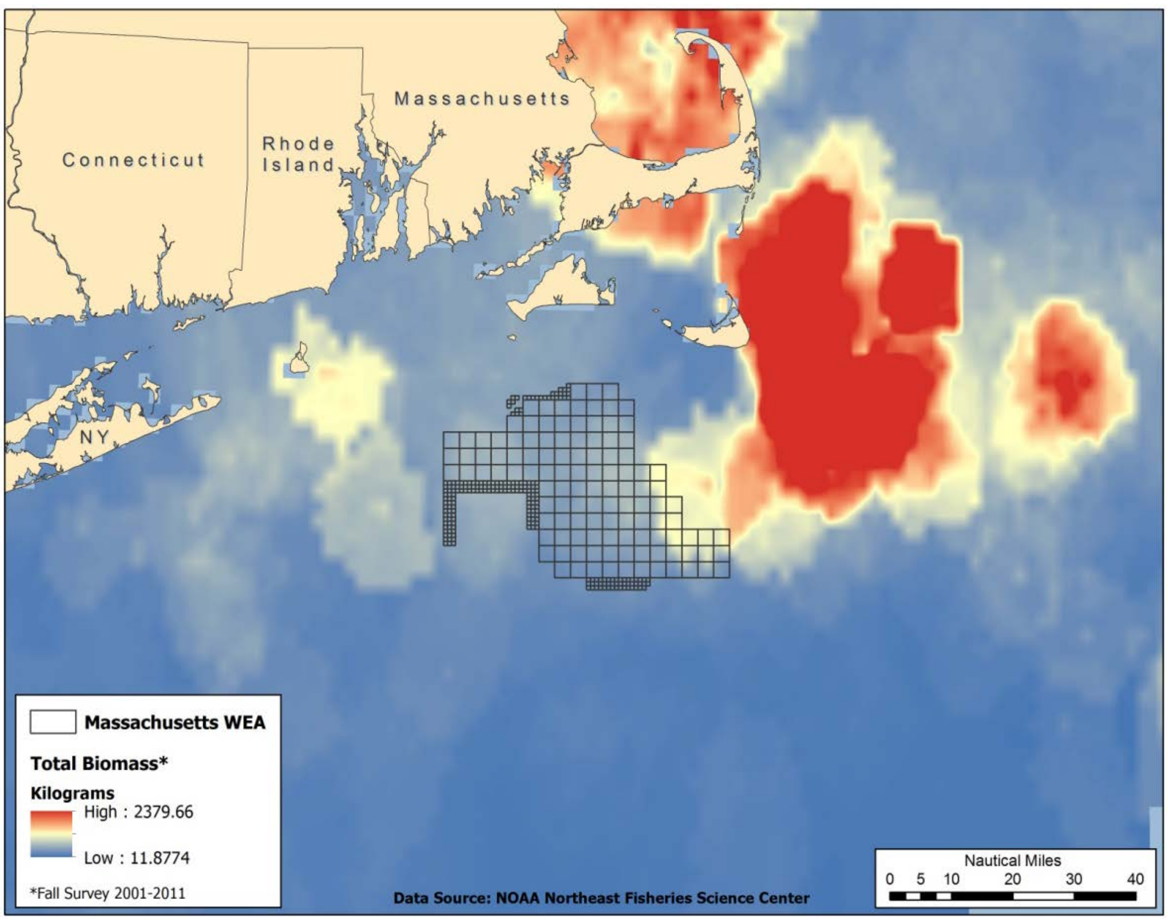
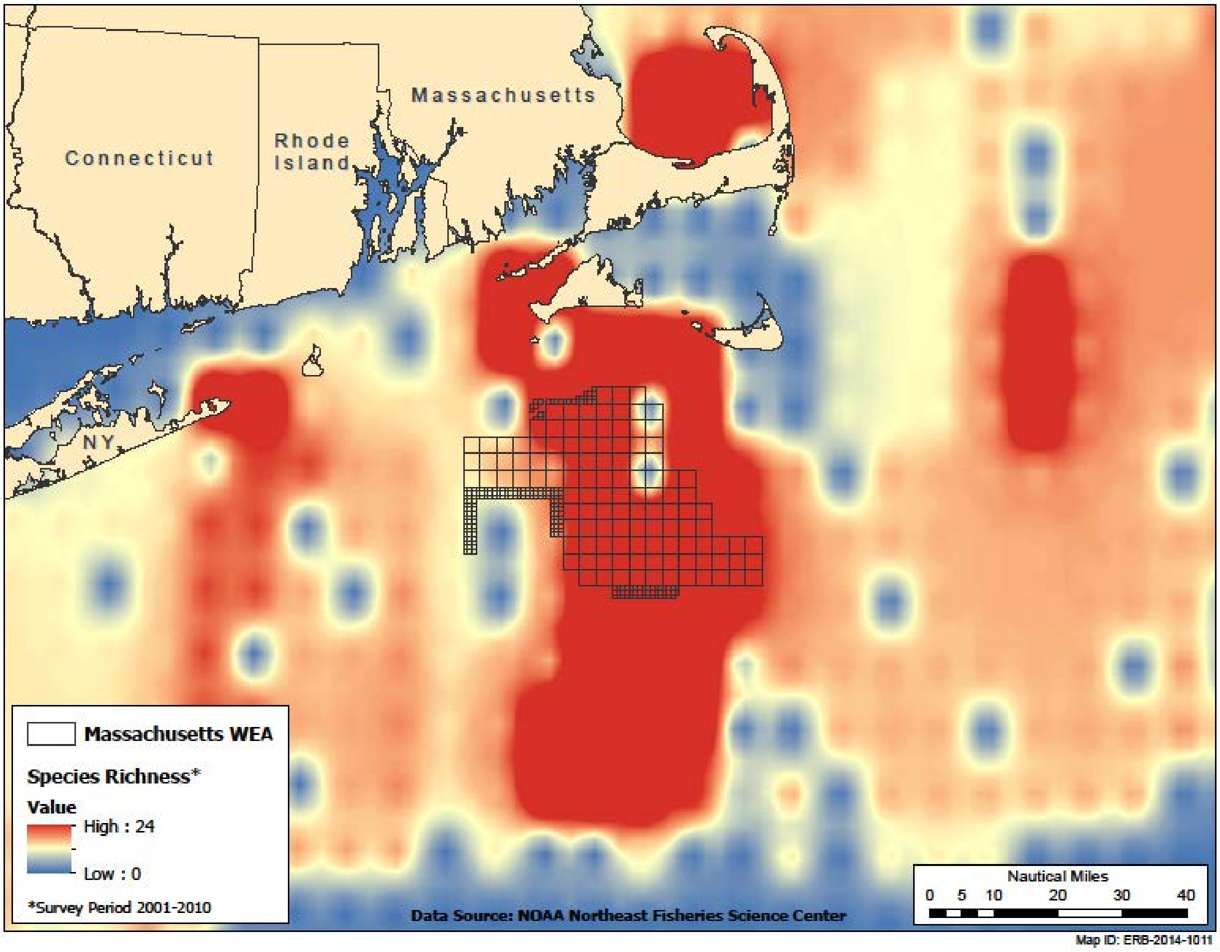


Figure 4-7. Total biomass (kg) of fish caught during the NEFSC Autumn Bottom Trawl Survey (2001-2011)



Source: Modified from Northeast Ocean Data, 2014

Figure 4-8. Species richness (number of vertebrate species) of fish caught during the NEFSC Autumn Bottom Trawl Survey (2001-2010)

Invertebrates

Important managed shellfish in the Northeast Continental Shelf include Atlantic sea scallop (*Placopecten magellanicus*), long-finned squid (*Loligo pealeii*), short-finned squid (*Illex illecebrosus*), Atlantic surf clam (*Spisula solidissima*), whelks, American lobster (*Homarus americanus*), and ocean quahog (*Artica islandica*).

Two species of squid, the northern shortfin squid and the longfin squid, are found in the vicinity of the MA WEA. Longfin inshore squid occur from Newfoundland to the Gulf of Venezuela, and occur in commercial abundance in the United States from Georges Bank to Cape Hatteras from March to October (Jacobson, 2005). The eggs of this species are generally in shallow waters (<164 ft [50 m] depths) and near shore, while the larvae are found in coastal and surface waters in spring, summer, and fall (Jacobson, 2005). Longfin squid hatchlings are found in surface water and then move deeper in the water column as they grow larger. The juveniles live in the upper 33 ft (10 m) of the water column in total depths from 164 to 328 ft (50 to 100 m) on the continental shelf; they are found in coastal inshore water in the spring and fall, and then move offshore in the winter. Both adult and juvenile longfin squid exhibit diel migration and move toward the surface at night (Jacobson, 2005). Northern shortfin squid use oceanic and neritic habitats, and adults are believed to make long-distance migrations between boreal, temperate, and subtropical waters. Data indicate that northern shortfin squid are distributed on the continental shelf of the United States and Canada, between Newfoundland and Cape Hatteras, NC (Hendrickson and Holmes, 2004). While Northern shortfin squid have not been found to spawn in the area of the WEA, their egg masses are transported northeasterly in the Gulf Stream (Hendrickson and Holmes, 2004). It is the pre-recruit stage of this species that migrates on to the U.S. continental shelf (Georges Bank to south of Cape Hatteras) beginning in the spring and into the summer, and migrates off the shelf in fall. The pre-recruits also undergo diel vertical migration with greater abundances occurring near the bottom during the day than at night. The recruits are in highest abundance at depths of 328 to 492 ft (100 to 150 m) along the shelf in spring and summer, with the lowest abundance during the winter when they are presumably in warmer water offshore and south of Cape Hatteras (Hendrickson and Holmes, 2004).

The American lobster is also present in the vicinity of the WEA. There are three stocks of American lobster, including the Gulf of Maine, Georges Bank, and Southern New England (SNE) stocks, identified based on regional differences in life history parameters (ASMFC, 2009). The Gulf of Maine and SNE areas are composed predominantly of inshore fisheries, while the Georges Bank area is predominantly an offshore fishery. The Massachusetts WEA is entirely within the SNE stock. According to the latest American lobster stock assessment (ASMFC, 2009), the SNE stock area had a mean of 5.8 million pounds (2,675 metric tonnes) in landings between 2005 and 2007, as compared to 4.9 million pounds (2,233 metric tonnes) for the Georges Bank stock and 77 million pounds (35,019 metric tonnes) for the Gulf of Maine stock during that same time period. Therefore, when compared to the Gulf of Maine, the SNE stock area does not contribute a major percentage of the national landings. However, the WEA does contain important lobster fishing grounds for the SNE stock area. In general, this species is distributed in coastal rocky habitats and muddy burrowing areas with sheltering habitats and offshore in the submarine canyon areas along the continental shelf edge. Lobsters have been found to use the following substrates: mud/silt, mud/rock, sand/rock, bedrock/rock, and clay (Cooper and Uzmann, 1980). However, firm, complex, rocky substrate is the preferred habitat for all life stages of the lobster. Post-larval and juvenile lobsters tend to stay in shallow, inshore waters (Lawton and Lavalli, 1995), but adolescent and adult lobsters are highly adaptable in their choice of substrate and can be found on nearly all substrate types.

The term “conch” is the generic classification for a variety of whelks found in Southern New England waters, including knobbed whelk (*Busycon carica*), channeled whelk (*Busycotypus canaliculatus*), and lightning whelk (*Busycon contrarium*). Channeled whelk, which are found in water depths of 1 to 131 ft (0 to 40 m) (Rosenberg, 2009), tend to be the most prevalent in commercial catches. Other shellfish with important commercial fisheries in the vicinity of the WEA include bay scallops (*Argopecten irradians)*, Atlantic sea scallops, blue mussels (*Mytilus edulis*), ocean quahogs, sea clams (various species), and soft shell clams (*Mya arenaria*) (ESS Group, Inc., 2006b; Malkoski, 2003). Bay scallops are found in the subtidal zone, sandy and muddy bottoms, and offshore in shallow to moderately deep water. Atlantic sea scallops are generally found from 82 to 650 ft (25 to 200 m) in waters south of Cape Cod, mainly on sand and gravel sediments where bottom temperatures remain below 68°F (20°C) (Hart, 2006). Blue mussels are most common in the littoral and sublittoral zones (< 325 ft [99 m] depths) of oceanic and polyhaline to mesohaline estuarine environments; however, the species can also be found in deeper and cooler waters (328 to 1,637 ft [100 to 499 m] depths; Newell, 1989). The greatest concentrations of ocean quahogs occur in offshore waters south of Nantucket to the Delmarva Peninsula (Cargnelli et al., 1999). Most ocean quahog individuals are found at depths from 82 to 167 ft (25 to 51 m); however, some are found at depths as shallow as 45 ft (14 m) and as deep as 840 ft (256 m) (Cargnelli et al., 1999). Adult softshell clams live in sandy, sand-mud, or sandy-clay bottoms, with their highest densities at depths of 10 to 13 ft (3 to 4 m) (Abraham and Dillon, 1986).

ESA-Listed Threatened and Endangered Fish

Several fish species on the continental shelf of the northwest Atlantic Ocean are federally listed as endangered, threatened, candidates for listing, or species of concern. Atlantic salmon (*Salmo salar;* Gulf of Maine population only), four populations of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*; New York Bight, Chesapeake Bay, Carolina, South Atlantic), and shortnose sturgeon (*Acipenser brevirostrum*) are the only fish species currently listed as endangered under the ESA that are found in the northwest Atlantic Ocean. The Gulf of Maine population of Atlantic sturgeon is considered threatened. All three species are anadromous, living much of their adult lives in the ocean but returning to rivers to spawn.

Other species have been proposed for endangered status and not deemed candidates—or are currently candidates for listing and the status determination has not been made yet; these species are known as Federal "species of concern" and are discussed in the section below. Table 4-9 lists all species with ESA designations in the vicinity of the WEA.

Table 4-9

Fish Species in the Northwest Atlantic Ocean Listed as Endangered, Threatened, Candidate Species, or Species of Concern under the ESA

Species	Status
Atlantic salmon (*Salmo salar*) – Gulf of Maine	E
shortnose sturgeon (*Acipenser brevirostrum*)	E

Species	Status
Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)–New York Bight	E
Chesapeake Bay	E
Carolina	E
South Atlantic	E
Gulf of Maine	T
Atlantic bluefin tuna (*Thunnus thynnus*)	S
Atlantic halibut *(Hippoglossus hippoglossus)*	S
Atlantic wolffish *(Anarhichas lupus)*	S
dusky shark *(Carcharhinus obscurus)*	S
porbeagle shark *(Lamna nasus)*	S
rainbow smelt *(Osmerus mordax)*	S
sand tiger shark *(Carcharias taurus)*	S
thorny skate *(Amblyraja radiata)*	S
alewife *(Alosa pseudoharengus)*	C/S
blueback herring *(Alosa aestivalis)*	C/S
cusk *(Brosme brosme)*	C/S
American eel (*Anguilla rostrata)*	C*
basking shark *(Cetorhinus maximus)*	C
great hammerhead shark (*Sphyrna mokarran)*	C
scalloped hammerhead shark *(Sphyrna lewini)*	C

*The USFWS is the lead Federal agency responsible for conservation of American eel

E = endangered
T = threatened
C = candidate
S = species of concern

Shortnose sturgeon can be found off the New England coast during oceanic life stages (Collette and Klein-McPhee, 2002). Shortnose sturgeon are not likely to be encountered in the WEA because they make very limited use of the offshore marine environment (Bain et al., 2007; Kynard, 1997). Therefore, they are not discussed further in this section.

It is possible that adult Atlantic salmon occur off the Massachusetts coast while migrating to rivers to spawn. Only certain Gulf of Maine populations of Atlantic salmon are listed as endangered, and it is unlikely that Gulf of Maine salmon would be encountered south of Cape Cod. Therefore they are not discussed further in this section.

The Atlantic sturgeon is an anadromous species that may be found in rivers and nearshore habitats throughout the Atlantic Coast. This long-lived species spends most of its life in saltwater

(Dunton et al., 2010). Little is known about its movements and residence when at sea, but it is known to stay largely in shallow (bottom depth <66 ft [<20 m]) coastal waters (Dunton et al., 2010). In Massachusetts waters, Atlantic sturgeon has been captured in offshore trawl and gillnet fisheries (Stein et al., 2004), but is rarely seen in State or Federal fishery-independent surveys (Dunton et al., 2010). Primary threats to Atlantic sturgeon include bycatch in trawl and gillnet fisheries, habitat degradation and loss, ship strikes, and general depletion from historical fishing (MADFW, 2008).

A status review for Atlantic sturgeon was completed in 2007 and eventually resulted in the listing of the Chesapeake Bay, New York Bight, Carolina, and South Atlantic populations of this species as endangered, and the Gulf of Maine population as threatened. Genetic analysis of Atlantic sturgeon collected through the NMFS Northeast Fishery Observer Program indicated that all five distinct population segments (DPSs) occur in the vicinity of the WEA (NMFS, 2013a). Based on this analysis, NMFS estimated that most sturgeon in or near the WEA would likely originate from the New York Bight DPS (51 percent), followed by the South Atlantic (22 percent), Chesapeake Bay (13 percent), Gulf of Maine (11 percent), and Carolina (2 percent) DPSs. Thus, all five DPSs may be affected by the proposed action. NMFS (2013a) provides a detailed review of life history information relevant to all five DPSs.

Species of Concern

Fish that are listed as species of concern under the ESA and are managed by the State and/or NOAA/NMFS in Massachusetts waters either have been deemed to not need additional Federal protection at this time or will be monitored for possible ESA listing in the future (Table 4-9; NMFS, 2010a). Those species are described below.

River herring: Alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*), collectively known as “river herring,” are species managed by the Commonwealth of Massachusetts under the DMF. Both species are anadromous, and their declining numbers are attributed to decreased access to spawning areas from the construction of dams and other impediments to migration, habitat degradation, fishing, and increased predation by the recovering striped bass populations (NMFS, 2009a). On November 2, 2011, NOAA announced a 90-day finding for a petition to list alewife and blueback herring as threatened under the ESA and that this petition may be warranted (76 FR 67652). NMFS determined, based on the best scientific and commercial information available, that listing alewife and blueback herring as threatened or endangered under the ESA was not warranted at this time (78 FR 48943, August 9, 2013).

Rainbow smelt (Osmerus mordax): Similar to herrings, this species is found throughout the northeastern United States. They remain close to shore in estuaries, swim up streams and rivers to enter spawning grounds, and then may migrate out to sea. Their decline is attributed to decreased access to spawning areas, habitat degradation, and fishing pressure (NMFS, 2007).

American eel (Anguilla rostrata): American eel are found in fresh, brackish, and coastal waters from Greenland to northeastern South America. American eels begin their lives as eggs hatching in the Sargasso Sea. They take years to reach freshwater streams where they mature, and then they return to their Sargasso Sea birth waters to spawn and die. As a migratory catadromous species, the American eel may pass through the WEA, but there is no data available to assess the population status in the WEA. Population status of the species in Massachusetts is considered stable. Threats to American eel include habitat loss attributed to riverine impediments, pollution, and nearshore habitat destruction, and fishing pressure (Greene et al., 2009). On September 29, 2011, USFWS announced a 90-day finding for a petition to list American eel as threatened under the ESA and that this petition may be warranted (76 FR 60431). A status review was initiated, and based on that review, USFWS will make a listing determination.

Atlantic bluefin tuna (Thunnus thynnus): Atlantic bluefin tuna is a highly migratory, pelagic species whose distribution in the western North Atlantic is from the Gulf of Mexico to Newfoundland in coastal and open ocean environments. Spawning is principally in the Gulf of Mexico and in the Florida Straits (NMFS, 2011a). Both adults and juveniles forage in the waters along the western Atlantic Coast, where they consume prey such as mackerel, herring, and squid (Collette and Klein-McPhee, 2002). As a highly migratory species, the Atlantic bluefin tuna may use the waters of the WEA as a foraging ground, but there is no distinct population in this area. Threats to the species are largely in the form of fishing pressure, bycatch, and pollution such as major oil spills (Collette et al., 2011).

A*tlantic halibut (Hippoglossus hippoglossus):* As the largest species of flatfish in the northwest Atlantic Ocean, Atlantic halibut is a long-lived, late-maturing flatfish distributed between Labrador to Southern New England (Bigelow and Schroeder, 1953; Brodziak and Col, 2006). The species was heavily overfished in the 19th and 20th centuries, and there has not been any recovery since then. As a result, this species is of concern because the Atlantic habitat stock in the Gulf of Maine and Georges Bank has remained in a depleted condition (Brodziak and Col, 2006).

Atlantic wolffish (Anarhichas lupus): Atlantic wolffish is a sedentary and mostly solitary species that occurs in the northwest Atlantic Ocean from Davis Straits off Greenland to Cape Cod, and sometimes occurs in southern New England and New Jersey waters (Collette and Klein-McPhee, 2002; Keith, 2006). While they are typically found in depths of 262 to 394 ft (80 to 120 m) in the Georges Bank-Gulf of Maine region, they are also found in waters from 131 to 787 ft (40 to 240 m) deep (Keith, 2006; Nelson and Ross, 1992). This species is of concern because biomass indices from the NEFSC spring and fall surveys and commercial landings are at extremely low levels (Keith, 2006). They have been listed as a species of concern for several reasons, one of which is that they are primarily taken as bycatch in the otter trawl fishery (NMFS, 2009b). At this time, though, there is no fishery management plan in place for Atlantic wolffish (Keith, 2006).

C*usk* (*Brosme brosme):* Cusk, a species managed federally by NOAA\NMFS, are slow-growing deepwater fish that range from New Jersey to the Strait of Belle Isle and on the Banks of Newfoundland. In the United States, cusk are distributed primarily in the deeper water of the central Gulf of Maine. The major threat to this species is commercial fishing activities (NMFS, 2009c). Threats to cusk include habitat degradation from trawls and dredges and fishing mortality due to bycatch of the trawl fishery (NMFS, 2009c).

Dusky shark (*Carcharhinus obscurus*): Dusky shark can live up to 40 years and reach sexual maturity at around 19 to 21 years. They occur from southern Massachusetts and Georges Bank to Florida, the Bahamas, and Cuba. Threats to the population include bycatch from longline gear and illegal landings in both recreational and commercial shark fisheries (NMFS, 2011b).

Basking shark (Cetorhinus maximus): In the northwestern Atlantic, basking sharks are typically found in coastal regions from April to October, with peak sightings between May and August (Kenney et al., 1985; NMFS, 2009d; Southall et al., 2005). Because this species is not commonly taken by fisheries, distribution data on this species is lacking. As a filter-feeding planktivore, individuals are typically seen at the surface from spring to autumn; however, some individuals form loose aggregations while feeding on the same patch of zooplankton (NMFS, 2009d; Sims et al., 2000). Large aggregations of basking sharks have been observed approximately 295 miles (75 km) south of Martha's Vineyard and 56 miles (90 km) south of Moriches Inlet, Long Island (Kenney et al., 1985; NMFS, 2009d).

Porbeagle shark (Lamna nasus): Porbeagles are lamnid sharks commonly found in the deep, cold waters of the North Atlantic, South Atlantic, and South Pacific Ocean, and are valued as food (NMFS, 2009d). It is an opportunistic piscivore, with teleosts and cephalopods making up the majority of their diet in the northwest Atlantic Ocean (NMFS, 2009d). The fishery for this species is targeted in northern Europe and along the northeastern United States. The stocks of this species, wherever they have existed, have been depleted over the course of a few years as a result of intensive fishing. This shows that the species cannot withstand heavy fishing pressure, and the species has been declared overfished (NMFS, 2009d).

Sand tiger shark (Carcharias taurus): Sand tiger sharks are large, coastal species. Mature males and juveniles are found between Cape Cod and Cape Hatteras, and mature and pregnant females are found in more southern waters between Cape Hatteras and Florida (Gilmore, 1993; NMFS, 2009d). Although fishing for this species in U.S. Atlantic waters has now been prohibited, it had been fished for its flesh and fins in coastal longline fisheries (NMFS, 2009d). Sand tiger sharks are very vulnerable to overfishing due to their large congregations in coastal areas during the mating season. They are also vulnerable because they have limited fecundity, only producing two pups per litter (NMFS, 2009d).

Great hammerhead shark (*Sphyrna mokarran*): The great hammerhead shark is a highly migratory species that can be found in the western Atlantic off Massachusetts (although it is rare north of North Carolina) south to Florida; it may also be found in the Gulf of Mexico, (NMFS, 2013b). There have been declines in the population of this species in areas throughout its range. However, because of their similarity in appearances, catches of great hammerheads are often grouped with those of other hammerhead shark species (e.g., smooth and scalloped), which confounds species-specific population trend analysis. Therefore, NOAA Fisheries/NMFS is currently conducting an ESA status review on this species and will provide more information on its status as it becomes available (NMFS, 2013b).

Scalloped hammerhead shark (Sphyrna lewini): While the scalloped hammerhead shark is listed as a species of concern in the northwest Atlantic Ocean, it is found more in warm waters from North Carolina to Florida (NMFS, 2009d). They would likely not be found in the vicinity of the WEA.

Thorny skate (Amblyraja radiata): Based on stock size assessment, the thorny skate is in an overfished condition; however, there is not enough information to declare whether overfishing is still occurring (NEFMC, 2009). Juvenile and adult thorny skates are found over bottom habitats with a substrate of sand, gravel, broken shell, pebbles, and soft mud in the Gulf of Maine and Georges Bank (NEFMC, 2009). They are found at depths between 59 and 6,562 ft (18 and 2,000 m), with the highest abundances at depths between 364 and 1,201 ft (111 and 366 m) (NEFMC, 2009).

Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act mandated that the NMFS, Regional Fisheries Management Councils, and other Federal agencies identify and protect important marine and anadromous fish habit. Thus, the Fisheries Management Councils, with assistance from NMFS, were required to delineate EFHs in fishery management plans or fishery management plan amendments for all federally managed fisheries. EFH is defined as "…those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." In this definition, "waters" refers to aquatic areas and their associated physical, chemical, and biological properties that are used by fish where appropriate. "Substrate" refers to sediment, hard bottom, structures underlying the waters, and associated biological communities. In the definition, "necessary" refers to the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. "Spawning, breeding, feeding, or growth to maturity" refers to the stages representing a species' full life cycle. Additionally, the EFH process involves the identification and designation of "habitat areas of particular concern" (HAPC) within fishery management plans. HAPCs are discrete subsets of

EFH that provide extremely important ecological functions or are especially vulnerable to degradation (NMFS, 1999). There are no HAPCs in the vicinity of the WEA. Species with EFH designations for one or more life stages in the WEA are listed below in Table 4-10.

Table 4-10

Species with EFH Designations for One or More Life Stages in the Massachusetts OCS WEA

New England Fishery Management Plan Species	
Scientific Name	**Common Name**
Clupea harengus	Atlantic herring
Melanogrammus aeglefinus	Haddock
Pollachius virens	Pollock
Merluccius bilinearis	Whiting
Urophycis chuss	Red hake
Urophycis tenuis	White hake
Glyptocephalus cynoglossus	Witch flounder
Pseudopleuronectes americanus	Winter flounder
Limanda ferruginea	Yellowtail flounder
Scophthalmus aquosus	Windowpane flounder
Macrozoarces americanus	Ocean pout
Placopecten magellanicus	Atlantic sea scallop
Lophius americanus	Monkfish
Leucoraja erinacea	Little skate
Leucoraja ocellata	Winter skate
Mid-Atlantic Atlantic Fishery Management Plan Species	
Scientific Name	**Common Name**
Scomber scombrus	Atlantic mackerel
Centropristis striata	Black sea bass
Pomatomus saltatrix	Bluefish
Peprilus triacanthus	Atlantic butterfish
Spisula solidissima	Surf clam
Artica islandica	Ocean quahog
Stenotomus chrysops	Scup
Squalus acanthias	Spiny dogfish
Paralichthys dentatus	Summer flounder
Illex illecebrosus	Short fin squid
Loligo pealei	Long fin squid

Atlantic Highly Migratory Species Fishery Management Plan Species	
Scientific Name	**Common Name**
Thunnus alalunga	Atlantic albacore
Thunnus thynnus	Atlantic bluefin tuna
Katsuwonus pelamis	Atlantic skipjack tuna
Thunnus albacares	Atlantic yellowfin tuna
Cetorhinus maximus	Basking shark
Prionace glauca	Blue shark
Carcharhinus obscurus	Dusky shark
Lamna nasus	Porbeagle
Carcharias taurus	Sand tiger shark
Carcharhinus plumbeus	Sandbar shark
Isurus oxyrinchus	Shortfin mako
Alopias vulpinus	Thresher shark
Galeocerdo cuvieri	Tiger shark
Carcharodon carcharias	White shark
Tetrapturus pfluegeri	Longbill spearfish
South Atlantic Fishery Management Plans Species	
Scientific Name	**Common Name**
Rachycentron canadum	Cobia
Scomberomorus maculatus	Spanish mackerel
Scomberomorus cavalla	King mackerel

4.2.2.5.2 Impact Analysis of Alternative A

Routine Activities

Acoustic Effects

This section summarizes what is known about sound sensitivity in marine fish and the impacts of sound that could result from site characterization and assessment activity in the WEA. Myrberg (1981) identified several categories of acoustic communication that fishes use. These include startle or warning sounds that may help protect individuals and groups from predation; sounds used by interceptor species to avoid predation or to locate prey; sounds overheard and used to competitive advantage by competitors; courting sounds used as part of mating behaviors including advertisement; swimming sounds made in schooling and aggregation; aggressive sounds used when competing for mates; and sounds used in other aggressive interactions (e.g., territorial defense).

Fish can perform the same basic auditory tasks, such as discrimination between sounds, determining the direction of a sound, and detecting biologically relevant sounds in the presence of noise as do terrestrial vertebrates (Thomsen et al., 2006). Popper et al. (2003) demonstrated that all species of fish tested were able to hear. However, hearing capabilities among species varied greatly (Table 4-11). Many fish have a swimbladder that is physically linked to the inner ear. The swimbladder is a gas-filled cavity that can act to transfer impinging sound-waves pressure information to the fish's otolith system. Fish of the family Clupeoidea, which includes herring (*Clupea harengus*), is an example of a fish having specialized auditory systems that include a structure called the prootic bulla, which improves sound receptivity (McCauley and Salgado Kent, 2008).

Table 4-11

Hearing Sensitivity Levels of a Variety of Fish Species

Species	Common Name	Family	Swimbladder connection
Clupea harengus	Herring	Clupeoidea	Prootic auditory bullae
Myoxocephalusscorpius	Sculpin	Cottidae	No swimbladder
Gardus morhua	Cod	Gadidae	None
Melanogrammus aeglefinus	Haddock	Gadidae	None
Scomber scomber	Atlantic mackerel	Sombridae	None

As discussed in more detail in Section 4.2.2.6.2 below, sound frequency is measured in Hz or kHz, magnitude is measured in dB in terms of mean square pressure per unit frequency, and sound pressure is measured in micro Pascals (µPa). The duration of a noise event typically ranges from seconds to weeks, depending on the source. The frequency of the ambient noise in the WEA is likely in the range of 1 Hz to 100 kHz and comprises both intermittent and continuous background noise (Cato, 1992; Wenz, 1962). The magnitude of noise in the present ambient acoustic environment is likely in the range of 20 to 100 dB re 1 $\mu Pa^2/Hz$ (Cato, 1992; Wenz, 1962).

Hastings et al. (1996) suggested that the inner ear of a fish may be injured by sounds at received levels of 90 to 140 dB above a fish's hearing threshold. This suggestion was supported in the findings of Enger (1981) in which injury to cod occurred after 1 to 5 hours of exposure to continuous synthesized sounds with an SPL of 180 dB re 1 µPa at 1 m. The fish in the Enger (1981) study were subjected to the sound at less than 3 ft (1 m) from the source. The data on species other than cod are much less extensive. Chapman and Hawkins (1973) found that ambient noise at higher sea states in the ocean have masking effects in cod, haddock, and pollock. Additionally, sound could also produce generalized stress (Wysocki et al., 2006). Thus, based on limited data, for fish communication, masking and stress may occur in fish exposed to this level of sound.

With respect to threatened and endangered species, Atlantic sturgeon is a federally listed fish species that could be found in the WEA, but at a very low probability. Sturgeon have a swimbladder. Gearin et al. (2000) reported that sturgeon did not respond to "pinger" sounds at 2 kHz or 20 kHz, and knowledge of specific sound tolerance levels (or sound levels which the species can tolerate without being affected) for Atlantic sturgeon are considered general at best (see Normandeau Associates Inc., 2012).

According to the *Endangered Species Act Section 7 Consultation Biological Opinion for the Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf in Massachusetts, Rhode Island, New York and New Jersey Wind Energy Areas* (Biological Opinion) (NMFS, 2013a), to assess behavioral effects of pile driving at several West Coast projects, NMFS has employed a 150 dB re 1 μPa root mean square (RMS) SPL criterion at several sites, including the San Francisco-Oakland Bay Bridge and the Columbia River Crossings. For the purpose of its consultation, NMFS advises the use of 150 dB re 1 μPa RMS as a conservative indicator of the noise level at which there is the potential for behavioral effects. However, the use of this threshold does not necessarily indicate that exposure to noise levels of 150 dB re 1 μPa RMS will always result in behavioral modifications or that any behavioral modifications will rise to the level of "take" (i.e., harm or harassment), but that there is the potential, upon exposure to noise at this level, to experience some behavioral response. Behavioral responses could range from a temporary startle to avoidance of an ensonified area.

With respect to elasmobranch sound detection, most studies have been done on sharks, which do not have swimbladders or any other air-filled cavity. Thus, they are incapable of detecting sound pressure; particle motion is assumed to be the only sound stimulus that can be detected. The hearing bandwidth for elasmobranchs has been measured between 20 Hz and 1 kHz, with similar thresholds in all species above 100 Hz (UNEP, 2012). Generally, elasmobranchs do not appear to be as sensitive to sound as teleost fish when measured in comparable ways.

The impacts of sound on marine fish species can be divided into three categories: (1) pathological effects, (2) physiological effects, and (3) behavioral effects. Pathological effects include lethal and sub-lethal physical damage to fish; physiological effects include primary and secondary stress responses; and behavioral effects include changes in exhibited behaviors of fish. Behavioral changes might be a direct reaction to a detected sound or a result of the manmade sound masking natural sounds that the fish normally detect and to which they respond. The three types of effects are often interrelated in complex ways. For example, some physiological and behavioral effects could potentially lead to mortality, which is the ultimate pathological effect.

Although some invertebrates also produce sound, most of these (e.g., spiny lobster, snapping shrimp, fiddler crabs) are found in southern and tropical coasts. However, New England (or blue) mussels, which are found in the vicinity of the WEA, are known to produce sound (Rountree, 2007). These sounds are created when the mussel moves, and are thus not intentionally produced or used as a mode of communication. While mussels are typically anchored to a substrate via their byssal threads, when they move, they have to snap off the threads one at a time and then re-anchor themselves with new threads. When hundreds or thousands of mussels do this simultaneously within mussel beds, a continuous crackling sound can be heard (Rountree, 2007).

HRG Survey Acoustic Effects

The impact that HRG survey noise would have on marine fish and invertebrates that could occur in the WEA is not well understood. Estimated SPLs during HRG surveys are expected to range from 212 to 226 dB re 1 µPa RMS at 3.3 feet (1 m). Generally, noise generated by HRG surveys may have physical and/or behavioral effects on fish near the area where the HRG surveys are being conducted. Effects on fish are generally expected to be limited to avoidance of the area around the HRG survey activities and short-term changes in behavior. The frequency heard best by the majority of fish, for which there are data available, is from 100 to 200 Hz up to 800 Hz. Being highly mobile, adult fish may be expected to quickly leave an area when disturbed, resulting in limited impacts. However, this is not the case for some of the less mobile shellfish (e.g., conch, quahogs, surf clams) that would be unable to quickly leave the area of disturbance. Noise effects on shellfish are not well understood. Similar to shellfish, fish eggs and larvae are often not able to move away from a sound source, and are at the mercy of currents and move very slowly, if at all (Hastings and Popper, 2005). Although data on the effects of sound on developing eggs and larvae are very limited, and most studies have used explosion or large mechanical shocks, the limited data suggest that developing larvae have different levels of sensitivity to mechanical stimulation at different stages of development (Hastings and Popper, 2005). Although an HRG survey may disturb more than one individual, surveys associated with Alternative A are not expected to result in population-level effects. Individuals disturbed by a survey would likely return to normal behavioral patterns after the survey finished or after the animal leaves the survey area.

Fish are not expected to be exposed to SPLs that could cause hearing damage. Based on fish hearing data, the only HRG survey tool—the boomer sub-bottom profiler—is expected to be detected by fish (Table 3-3). Given that some offshore survey contractors may elect to use a CHIRP sub-bottom profiler instead of a boomer system, the electromagnetic sounds may not be detected by fish during HRG survey work. Particle motion from the HRG survey activity is not well understood. Regardless, in most cases, few fish are expected to be present in the survey areas because of the limited immediate area of ensonification and short duration of individual HRG surveys that may be conducted during site assessment. Thus, potential population-level impacts on fish from HRG surveys are expected to be negligible.

Geotechnical Exploration Acoustic Effects

Acoustic levels from borehole drilling are expected to be below 120 dB. Previous estimates submitted to BOEM indicate geotechnical drilling produces source sound levels that do not exceed 145 dB at a frequency of 120 Hz (NMFS, 2009e). Previous submissions to BOEM also indicated that sound from drilling should attenuate to below 120 dB by the 492 ft (150 m) isopleth. Therefore, although fish are expected to sense the sound, the impacts are anticipated to be negligible because of short duration, low sound levels, and the ability of the fish to leave the immediate area of the drilling.

Meteorological Tower Pile-Driving Acoustic Effects

The extent of potential noise impacts on fish is not comprehensively understood. However, McCauley and Salgado Kent (2008) reported that intensive impulsive signals, such as those produced by pile drivers, can cause fish kills, and signals of a smaller magnitude can cause behavioral change. The normal behaviors of marine fish (e.g., feeding) could be disturbed by meteorological tower construction noise. Depending on several factors, including the sound source and physical oceanographic features, behavioral effects may be incurred at ranges of many miles, and impairment to hearing may occur at close range (Madsen et al., 2006a). Thomsen et al. (2006) concluded that the zone of physical damage is usually closest to the noise source where the received noise level is strong enough to cause tissue damage to auditory or other systems, or even mortality. High-intensity sounds produced by pile driving could damage hearing in elasmobranchs in the form of a Temporary Threshold Shift (TTS) and result in a temporary loss of sensitivity. Also, the impact of the hammer on the pile may cause barotrauma in elasmobranchs, which has recently been reported in some organs, including the liver and kidneys, in teleost fish. Demersal elasmobranchs, such as skates and rays, may also be damaged by the intense vibrations in the sediments caused by pile driving (UNEP, 2012).

In fact, Caltrans (2001) reported mortalities after pile driving in the course of the San Francisco Oakland Bay Bridge Demonstration Project at a distance of 328 to 656 ft (100 to 200 m) from the pile, with sound levels between 160 and 196 dB RMS re 1 μPa. Fish were found dead primarily within a range of 164 ft (50 m); the zone of direct mortality was about 33 to 39 ft (10 to 12 m) from pile driving, and the zone of delayed mortality was assumed to extend out to at least 492 ft (150 m) to approximately 3,280 ft (1,000 m) from the pile driving. However, Hastings and Popper (2005) reviewed these and other studies and concluded that the results were highly equivocal and that no clear correlation between the level of sound exposure and the degree of damage could be determined. As discussed in the impacts from HRG surveys, behavioral reactions may include avoidance of, or flight from, the sound source and its immediate surroundings, disruption of feeding behavior, and generalized stress (Wysocki et al., 2006).

The SOCs required by BOEM (see Appendix B) that are intended to reduce or eliminate the potential for adverse impacts on marine mammals and sea turtles would also benefit fish, including the implementation of a "soft start" procedure. This measure will be included as a condition on any leases and/or SAPs issued or approved under this proposed action. As a result of the "soft start" procedure, BOEM anticipates that the majority of fish would flee the area during the period of disturbance and return to normal activity in the area post-construction. Those fish that do not flee the immediate action area during the pile-driving procedure could be exposed to lethal SPLs. However, significant effects to fish populations are not anticipated. Similarly, impacts on EFH from acoustic disturbance (from all sources) would be negligible.

Benthic Effects

Section 4.2.2.3 discusses the benthic resources and associated impacts that would be anticipated from Alternative A. This section only discusses those impacts in relation to fish and their habitat. Benthic effects from Alternative A that would affect fish and fish habitat, including EFH, are anticipated to be temporary and limited to the immediate area surrounding the activity. Therefore, benthic fish habitats are not anticipated to experience significant negative impacts that could then impact fish populations.

Geotechnical Exploration

As stated in Sections 3.1.3.2 and 4.2.2.3, geotechnical exploration would result in a negligible temporary loss of some benthic organisms (i.e., less than 1 ft diameter would be disturbed in the areas where cores are sampled), and a localized increase in disturbance due to vessel activity, including noise and anchor cable placement and retrieval. This activity could affect adult marine fish by removing a small amount of forage items. However, given the small footprint (i.e., less than 1 ft [0.3 m] diameter that would be disturbed in the areas where cores are sampled), the temporary nature of the action, and availability of similar benthic habitat around the sampling location, BOEM expects that this activity would have negligible benthic effects that could affect fish species in the WEA.

Meteorological Tower and Buoy Installation

The installation of a meteorological buoy and/or construction of a meteorological tower would have temporary benthic effects. Construction of the tower would result in direct effects on benthic invertebrates by burying or crushing them. BOEM anticipates that some sediment would become suspended around deployed anchoring systems and around monopoles during the installation activity. This sediment would be dispersed and settle on the surrounding seafloor. Depending on the currents, this could potentially smother some benthic organisms. However, as discussed in Section 4.2.1.2, the WEA is in a relatively high-energy environment that sees much sediment transport in its natural state. BOEM expects that any sedimentation that would occur around an installed tower or buoy would have only minor temporary effects on the habitat and food availability for fish species in the WEA.

The loss of benthic habitat as a result of scour and/or scour control systems around foundations and moorings is discussed in Section 4.2.2.3. Sessile marine invertebrates, including molluscan shellfish, would be lost in the footprint of the foundation/mooring and any scour control system. However, a single meteorological tower or buoy in a lease area would not result in significant changes to the availability of habitat and forage items in the action area. Additionally, BOEM anticipates that fish would leave the area of the foundation and scour control system for adjacent, unaffected areas. Although moorings and meteorological tower foundations will adversely affect EFH, their overall footprint is small, and will not significantly affect the quality and quantity of EFH in the action area.

Meteorological Tower and Buoy Operation

BOEM expects that meteorological towers and large anchoring systems installed in soft sediment areas would introduce an artificial hard substrate often preferred by opportunistic benthic species for colonization. Additionally, minor changes in species associated with softer sediments could occur as a result of scouring around the pilings (Hiscock et al., 2002). Certain fish species (e.g., tautog, black sea bass, Atlantic striped bass) would likely be attracted to the newly formed habitat complex, and fish population numbers in the immediate vicinity of the anchors and monopoles are likely to be higher than in surrounding waters away from the structures. However, a single meteorological tower or buoy in a lease area is not expected to result in significant changes in local community assemblage and diversity, nor the availability of habitat, including EFH and forage items in the action area.

Meteorological Tower and Buoy Decommissioning

The decommissioning of meteorological towers and buoys is described in Section 3.1.4.1. Upon completion of site assessment activities, the meteorological tower would be removed and transported by barge to shore. During this activity, fish may be affected by noise and operational discharges as described for meteorological tower construction. Removal of the piles would be accomplished by cutting the piles (using mechanical cutting or high-pressure water jet) at a depth of 16 ft (5 m) below the seabed. Fish could be affected by noise produced by pile-cutting equipment, although cutting produces less intense noise than pile driving. Only fish in the immediate vicinity of the site (those that had not moved away from the area upon arrival of decommissioning vessels) would be affected during tower removal and transport and pile cutting. Disturbance of fish during decommissioning is expected to be minor, resulting in negligible impacts on fish.

Discharge of Waste Materials and Accidental Fuel Leaks

Fish could be exposed to operational discharges or accidental fuel releases from construction sites and construction vessels and to accidentally released solid debris. Operational discharges from construction vessels would be released into the open ocean, where they would be rapidly diluted and dispersed, or collected and taken to shore for treatment and disposal. Sanitary and domestic wastes would be processed through onsite waste treatment facilities before being discharged overboard. Deck drainage would also be processed prior to discharge. Thus, waste discharges from construction vessels would not be expected to directly affect fish or their habitat.

Fish can be adversely affected by the ingestion of, or entanglement with, solid debris. Fish that have ingested debris, such as plastic, may experience intestinal blockage, which in turn may lead to starvation, while toxic substances in the ingested materials (especially in plastics) could lead to a variety of lethal and sub-lethal toxic effects. Entanglement in plastic debris can result in reduced mobility, starvation, exhaustion, drowning, and constriction of, and subsequent damage to, limbs caused by tightening of the entangling material. The discharge or disposal of solid debris into offshore waters from OCS structures and vessels is prohibited by BOEM (30 CFR 250.300) and the USCG (33 CFR 151, Annex V, Public Law 100–220 [101 Stat. 1458]). Thus, entanglement in or ingestion of OCS-related trash and debris by fish would not be expected during normal operations.

Because of the limited duration and area of vessel traffic and construction activity that might occur with construction, operation, and decommissioning of a meteorological tower and/or meteorological buoy, the release of liquid wastes would occur infrequently. Accidental fuel release during site characterization activities is expected to be minimal. Thus, overall impacts on fish and their habitat, including EFH, from the discharge of waste materials or the accidental release of fuels during site assessment and site characterization activities are expected to be minor.

Non-Routine Events

Collisions between vessels and allisions between vessels and meteorological towers and buoys are considered unlikely (see Section 3.2.2 of this EA). However, in the unlikely event that a vessel allision or collision were to occur, and in the unlikely event that such an allision or collision results in a discharge, the most likely pollutant to be discharged would be diesel fuel. If a diesel spill were to occur, it would dissipate very rapidly in the water column, then evaporate and biodegrade within a few days (MMS, 2007b). BOEM expects that pelagic fish and larval fish high in the water column would be negatively affected by such a spill. However, the impacts would not be significant to these fish populations because of the temporary nature of a spill and the limited area it affects. The meteorological towers and buoys could also serve as attractants for fish, which would, in turn, attract recreational fishermen to the area. Therefore, there is some potential for collisions between recreational fishing vessels that could result in an accidental release of diesel fuel. Additionally, storms may cause allisions and collisions that could result in a spill; yet, the storm conditions would cause the spill and its effects to dissipate faster. Overall impacts on fish resources from diesel spills resulting from collisions and allisions, should they occur, are expected to be minimal and temporary.

As with any structure placed in the ocean, there is a chance that a vessel, other than a maintenance or construction vessel, could collide with the structure, causing catastrophic damage to the vessel, tower, or both. This type of collision is unanticipated because it would require a loss of vessel power or steerage, high winds, or a sea state that would drive the vessel toward the structure, and failure of the vessel's and/or structure's design to withstand the impact. Current regulatory measures require placement of structures outside of traffic lanes, lighting, and mariner notifications of the placement of structures that should prevent collisions of this type from occurring. If an unanticipated collision were to occur and a vessel's cargo were discharged, the impacts would depend on the type (oil, liquefied natural gas, chemicals, or other commodities) and amount of discharges.

During site assessment activities, there is a potential for natural and/or unanticipated events to affect the environment. In the case of a natural event, a hurricane or severe storm may impact meteorological towers or buoys at some time during the operation. Depending on the severity of the event, components of the facility could be damaged, destroyed, or cut loose, resulting in temporary sea hazards until the device can be retrieved (as in the case of a buoy being repaired or removed). Buoys have GPS systems that alert investigators if they move beyond their operating area. The USCG would be notified immediately, and the USCG would notify mariners, if this were to happen. Similar alerts would be issued if a meteorological tower were to experience severe damage.

4.2.2.5.3 Conclusion

Alternative A and the potential effects of HRG survey noise on marine fish are generally expected to be limited to avoidance around the HRG survey activities and short-term changes in behavior. Thus, potential population-level impacts, if any, on fish resulting from HRG surveys are expected to be negligible.

Similarly, while fish are expected to be able to sense the sound from geotechnical exploration, the impacts are anticipated to be negligible because of the short duration, low sound levels, and the ability of highly mobile adult fish to leave the immediate area of the drilling. Conversely, fish eggs, larvae, and less mobile shellfish may not be able to leave the area of disturbance caused by noise. The effects of noise on these less mobile organisms are not well understood, but would likely be minor because of the short duration of exposure.

Meteorological tower construction noise could disturb normal behaviors. As discussed in the analysis of HRG surveys, behavioral reaction may include avoidance of, or flight from, the sound source. Fish that do not flee the immediate action area during pile-driving procedures could be exposed to lethal SPLs. However, the SOCs (see Appendix B), including the implementation of a "soft start" procedure, will minimize the possibility of exposure to lethal sound levels.

As a result of the small geotechnical exploration footprint, BOEM expects this activity would have negligible benthic effects that could affect fish species and their habitat, including EFH, which may occur in the WEA. Impacts related to meteorological tower/buoy installation, operation, and decommissioning are expected to be minor and are not expected to result in changes in local fish community assemblage and diversity.

Fish could be exposed to operational discharges or accidental fuel releases from construction sites and construction vessels and to accidentally released solid debris. The entanglement in or ingestion of OCS-related trash and debris by fish would not be expected during normal operations. Impacts on fish and their habitat, including EFH, from the discharge of waste materials or the accidental release of fuels are expected to be minor because of the small number of structures and vessels involved with construction, operation, and decommissioning.

There is a potential for natural and/or unanticipated events to affect the environment during site assessment activities. A natural event such as a severe storm may impact meteorological towers or buoys at some point during operation. If unanticipated collisions were to occur, and a vessel's cargo were discharged, the impacts would depend on the type and amount of cargo discharged. Based on the limited number of structures anticipated and the considerations for their placement, the likelihood of impacts from natural and unanticipated events is low.

With respect to threatened and endangered species, Atlantic sturgeon is a federally listed fish species that could be found in the WEA. Impacts on this species are the same as those discussed for non-listed fish species and may include acoustic effects from meteorological tower construction noise, benthic effects from tower installation, and water quality effects from discharge of waste materials and accidental fuel leaks. Disturbance of Atlantic sturgeon from underwater noise generated by site characterization and site assessment activities may result in temporary displacement and other adverse consequences. NMFS discussed these consequences in the Biological Opinion, which included an Incidental Take Statement that exempts the incidental take (harassment) of Atlantic sturgeon from noise generated during the proposed geophysical surveys or pile-driving activities (NMFS, 2013a). Because Atlantic sturgeon typically occur in shallow waters (i.e., more shallow than the depths in the WEA), and this mobile species has the ability to avoid unfavorable stimuli, BOEM expects that any impacts on Atlantic sturgeon would be no more than minor. The ESA consultation with NMFS is further discussed in Section 5.3.1. In addition, SOCs (see Appendix B), such as the implementation of a "soft start" procedure to minimize noise impacts during pile driving, may further reduce the potential for impacts.

Similar to the direct and indirect impacts from site assessment and site characterization activities to fish that are expected to be negligible such as population effects of HRG survey noise, effects of sound from geotechnical exploration on highly mobile adult fish, and benthic effects from geotechnical exploration, impacts on EFH are expected to be temporary (in the case of acoustic disturbance and re-suspended sediment during pile driving and mooring placements). Although moorings and meteorological tower foundations may adversely affect EFH, their overall footprint is small and will not significantly affect the quality and quantity of EFH in the action area. Additionally, there are no EFH HAPCs in the WEA. The conclusion of BOEM's consultation with NMFS on the impacts to EFH is discussed in Section 5.3.2.

4.2.2.6 Marine Mammals

4.2.2.6.1 Description of the Affected Environment

The Northwest Atlantic OCS region is inhabited by 38 species of marine mammals, including 6 mysticetes (baleen whales), 28 odontocetes (toothed whales, dolphins, and porpoise), and 4 seals (Table 4-12). These species rely on OCS habitats for a variety of important life functions, including feeding, breeding, nursery grounds, socializing, and migration. Descriptions of marine mammal species that occur in the Northwest Atlantic can be found in the PEIS (MMS, 2007a); that information is incorporated here by reference. Thus, this section focuses on information specifically relevant to marine mammals in the vicinity of the Massachusetts WEA.

Marine mammals found on the Northwest Atlantic OCS are listed in Table 4-12, along with habitat preferences for each species. The relative occurrence for each species in the vicinity of the WEA is also provided. Those species most likely to occur in or near the WEA (i.e., coastal or OCS waters) are discussed in more detail in the following sections. Non-ESA-listed species and federally listed species are discussed under separate sections below.

The Massachusetts Clean Energy Center (MassCEC) is conducting surveys targeting marine mammals and turtles in and around the WEA (Kraus et al., 2013). These efforts include the collection of aerial survey sightings data and acoustic data. Kraus et al. (2013) reported results of surveys from November 2011 to October 2012, the first year of this 3-year study. The study area includes the WEA and surrounding waters, and is referred to as the Wind Energy Study Area (WESA) in the sections below. The MassCEC surveys provide valuable site-specific data for an area that has historically not been well surveyed.

Table 4-12

Marine Mammals in the North Atlantic OCS

Common Name	Scientific Name	[1]ESA Status	[2]Relative Occurrence in Region	Typical habitat		
				Coastal	OCS	Shelf Edge/Slope
Order Cetacea						
Suborder Mysticeti (Baleen whales)						
Family Balaenopteridae						
[3]North Atlantic right whale	*Eubalaena glacialis*	E	Common	x	x	x
Blue whale	*Balaenoptera musculus*	E	Rare		x	x
[3]Fin whale	*Balaenoptera physalus*	E	Common	x	x	x
[3]Sei whale	*Balaenoptera borealis*	E	Regular		x	x
[3]Minke whale	*Balaenoptera acutorostrata acutorostrata*		Common	x	x	x
[3]Humpback whale	*Megaptera novaeangliae*	E	Common	x	x	x
Suborder Odontoceti (Toothed whales and dolphins)						
Family Physeteridae						
[3]Sperm whale	*Physeter macrocephalus*	E	Common		x	x
Family Kogiidae						
Dwarf sperm whale	*Kogia sima*		Rare			x
Pygmy sperm whale	*Kogia breviceps*		Rare[7]			x
Family Ziphiidae						
[4]Cuvier's beaked whale	*Ziphius cavirostris*		Rare			x
[4]Blainville's beaked whale	*Mesoplodon densirostris*		Rare			x
[4]Gervais' beaked whale	*Mesoplodon europaeus*		Rare			x
[4]True's beaked whale	*Mesoplodon mirus*		Rare			x
[4]Sowerby's beaked whale	*Mesoplodon bidens*		Rare			x
Northern bottlenose whale	*Hyperoodon ampullatus*		Hypothetical			x
Family Delphinidae						
[3]Risso's dolphin	*Grampus griseus*		Common			x
Long-finned pilot whale	*Globicephala melas*		Common		x	x
Short-finned pilot whale	*Globicephala macrorhynchus*		Rare		x	x
Killer whale	*Orcinus orca*		Rare		x	x

Common Name	Scientific Name	[1]ESA Status	[2]Relative Occurrence in Region	Typical habitat		
				Coastal	OCS	Shelf Edge/Slope
Pygmy killer whale	*Feresa attenuata*		Hypothetical			x
False killer whale	*Pseudorca crassidens*		Rare			
Melon-headed whale	*Peponocephala electra*		Hypothetical			x
[3]White-beaked dolphin	*Lagenorhynchus albirostris*		Regular		x	x
[3]Atlantic white-sided dolphin	*Lagenorhynchus acutus*		Common		x	x
[3]Atlantic spotted dolphin	*Stenella frontalis*		Rare[7]/ Regular[6]		x	x
Pantropical spotted dolphin	*Stenella attenuata*		Rare			x
Clymene dolphin	*Stenella clymene*		Hypothetical			x
Spinner dolphin	*Stenella longirostris*		Hypothetical			x
[3]Striped dolphin	*Stenella coeruleoalba*		Rare/ Regular[7]			x
Rough-toothed dolphin	*Steno bredanensis*		Rare[6]		x	x
Fraser's dolphin	*Lagenodelphis hosei*		Data deficient			x
[3]Short-beaked common dolphin	*Delphinus delphis*		Common		x	x
[3]Bottlenose dolphin (coastal and offshore morphotypes)	*Tursiops truncatus*		Common	x	x	x
Family Phocoenidae						
[3]Harbor porpoise	*Phocoena phocoena*		Common	x	x	
Order Carnivora, Suborder Caniformia, Family Phocidae						
[5]Harbor seal	*Phoca vitulina concolor*		Common	x	x	
[5]Gray seal	*Halichoerus grypus*		Common	x	x	
[5]Harp seal	*Pagophilus groenlandicus*		Common	x		
Hooded seal	*Cystophora cristata*		Regular	x	x	

[1]ESA status E = endangered
[2]Based on occurrence within Rhode Island OSAMP Study Area: Common = greater than 100 records, Regular = 10–100 records, Rare = less than 10 records, Hypothetical = the remote possibility to occur in the region at some time (Kenney and Vigness-Raposa, 2010).
[3]Sightings per Unit Effort (SPUE) data available
[4]SPUE data are for beaked whales grouped together
[5]SPUE data are for all seals grouped together
[6]AMAPPS 2011 (http://www.nefsc.noaa.gov/psb/AMAPPS/docs/NMFS_AMAPPS_2011_annual_report_final_BOEM.pdf)
[7]Based on Waring et al., 2012a

The North Atlantic Right Whale Consortium (Right Whale Consortium) sightings database has the most comprehensive information available on the distribution and abundance of marine mammals in this region (Right Whale Consortium, 2014). This database contains thousands of sighting records for whales, dolphins, seals, and sea turtles in the North Atlantic Ocean. Although the vast majority of surveys are focused on right whales (with data for other species often reported), and survey efforts are concentrated in July through September, these data provide valuable information for understanding the distribution and abundance of marine mammals in and around the WEA.

The Right Whale Consortium and MassCEC provided Sightings per Unit Effort (SPUE) data, which are presented in Appendices E and F and discussed below. The Right Whale Consortium data are from October 1978 through May 2013 (depending on the dates of first and last sightings for each species) within the area bound by 39° to 42° N and -68° 15' to 72° 30' W (Right Whale Consortium, 2014). Recent data collected by MassCEC were combined with the Right Whale Consortium data to obtain the most comprehensive and current information available on the spatial and seasonal distribution of each species. The MassCEC data are from November 2011 to November 2013, within the area bounded by 40° 31' to 41°12' N and -69° 54' to -71° 11' W. These SPUE values represent animals sighted per 620 miles (1,000 km) of survey track, and were calculated by partitioning the study area into a regular grid based on latitude and longitude (in a 5 minute x 5 minute, or 5.8 mile x 4.3 mile [9.3 km x 7.0 km grid]) (Right Whale Consortium, 2014). All acceptable aerial and shipboard survey tracks were divided across the grids and the lengths within each cell were summed as effort. Sightings and individuals sighted were assigned to the cells and summed. SPUE was then calculated as 1000 x (animals/effort). Data points were mapped using ArcGIS and projected in the Massachusetts State Plane coordinate system (Island Zone, North American Datum of 1983, in meters). Some survey effort data were excluded because of weather conditions that were considered unacceptable for accurate sightings. This was done using sea state thresholds (on the Beaufort wind force scale) that were selected depending on the size and detectability of each species. For the large whales (right, humpback, fin, sei, and sperm) an upper limit of Beaufort 4 was used (i.e., data include all large whales observed in sea states of up to and including Beaufort 4). For sea turtles and porpoises that are smaller and more difficult to detect, an upper limit of Beaufort 2 was used, and for all other species, an upper limit of Beaufort 3 was used.

The SPUE index is designed to correct for the bias in raw sightings data due to the uneven spatial distribution of the survey effort (Kenney and Vigness-Raposa, 2010). Nonetheless, SPUE values must still be considered in light of the survey effort; data points combining very low effort with reported sightings may result in artificially high or low SPUE. Therefore, the SPUE maps are most useful for understanding the seasonal and geographical distribution of each species. Additional information on calculation methods is available in the Rhode Island OSAMP (Kenney and Vigness-Raposa, 2010).

The OSAMP also provided a key reference for occurrence data discussed herein. The "Rhode Island Study Area" defined in the OSAMP included the coastal and continental shelf and slope waters from Long Island to Nantucket and outer Cape Cod (including the Massachusetts WEA). Because marine mammals may be sensitive to anthropogenic noise at long distances from the source (Madsen et al., 2006b; Nieukirk et al., 2004), the distribution of species is discussed for both the delineated WEA area and an expanded area within 40 nm (74 km) from the WEA boundary.

Non-ESA-Listed Marine Mammals

The majority of marine mammals that potentially occur in the WEA are not federally listed as threatened or endangered under the ESA. These non-listed species include 1 species of mysticete, 27 species of odontocetes, and 4 species of seals. The following 9 non-listed species are most likely to occur in the WEA: minke whales (*Balaenoptera acutorostrata)*, long-finned pilot whales (*Globicephala melas*), short-beaked common dolphins (*Delphinus delphis),* Atlantic white-sided dolphins *(Lagenorhynchus acutus),* bottlenose dolphins (*Tursiops truncates),* Risso's dolphins (*Grampus griseus)*, harbor porpoise (*Phocoena phocoena)*, harbor seals (*Phoca vitulina concolor),* and gray seals (*Halichoerus grypus*) (Right Whale Consortium, 2014). It is also possible that harp (*Pagophilus groenlandicus*) and hooded seals (*Cystophora cristata*) occurred in the WEA and were included in the "unidentified seals" category, but were not identified to species. White-beaked dolphins (*Lagenorhynchus albirostris)* are likely to occur in the nearby waters surrounding the WEA (i.e., within 40 nm [74 km] from the WEA), but not in the WEA; beaked whales are likely to occur in the region to the south of the WEA, but not within 40 nm (74 km) of the WEA (Right Whale Consortium, 2014). Appendix E contains maps showing SPUE for these non-listed marine mammals, and each species is discussed briefly below.

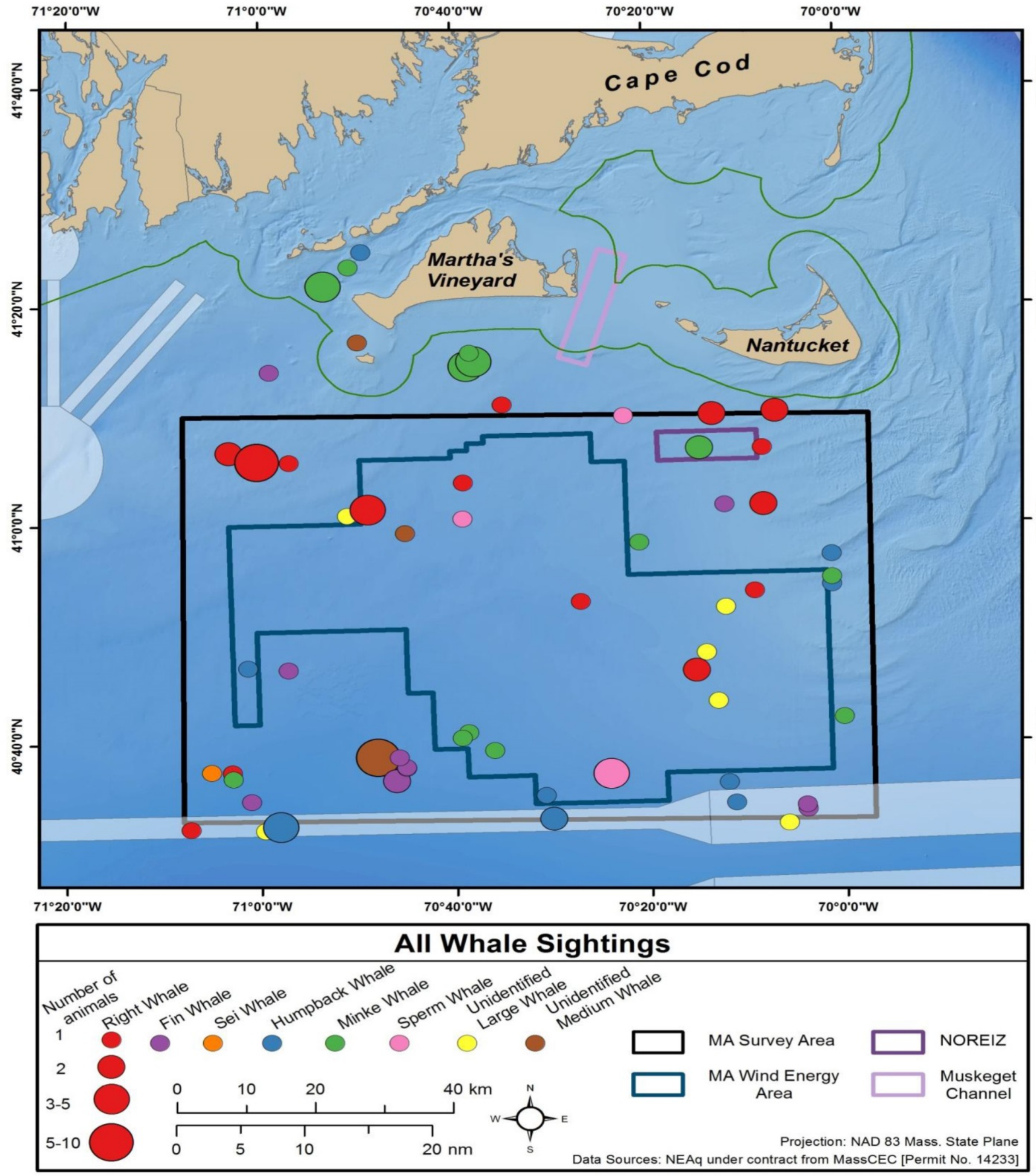
Minke Whales

In the North Atlantic, there are four separate populations of minke whales: the Canadian east coast, west Greenland, central North Atlantic, and northeast Atlantic. Minke whales off the east coast of the United States belong to the Canadian east coast stock (from Davis Strait to the Gulf of Mexico). The best abundance estimate from the Gulf of Maine to North Labrador is 20,741 (Waring et al., 2013).

Minke whales are widely distributed within the continental shelf waters, with the highest abundances in New England waters seen in the spring and summer. In this region, past survey data have indicated that few minke whales are typically present in the fall, and this species is nearly absent in the winter (Waring et al., 2013).

In the WEA, SPUE ranged from 0.1 to 35 whales per 620 miles (1,000 km) in the spring and summer, and there were no sightings in winter or fall (Appendix E, Figure 1; Right Whale

Consortium, 2014). Within 40 nm of the WEA, SPUE ranged from 0.1 to 80 whales per 620 miles (1,000 km) in the spring and 0.1 to 133 whales per 620 miles (1,000 km) in the summer, with most sightings occurring in the spring and few sightings in winter and fall (Appendix E, Figure 1; Right Whale Consortium, 2014). However, aerial and acoustic surveys focused on the MA WEA from November 2011 to October 2012 indicated that this species was present in the area for a longer period of time. While the aerial survey results were in agreement with the known occurrences in the region (a total of 13 sightings occurred in March through August), the acoustic data indicated their presence in the WEA and nearby waters in the WESA, for 10 months of the year (all months but December and October; Figure 4-9; Kraus et al., 2013). This is only 1 year's data, and conclusions about distribution patterns cannot be made from a single year; however, the authors suggest that these data may show a more realistic use of the area than the aerial surveys alone (Kraus et al., 2013).



Source: Kraus et al., 2013

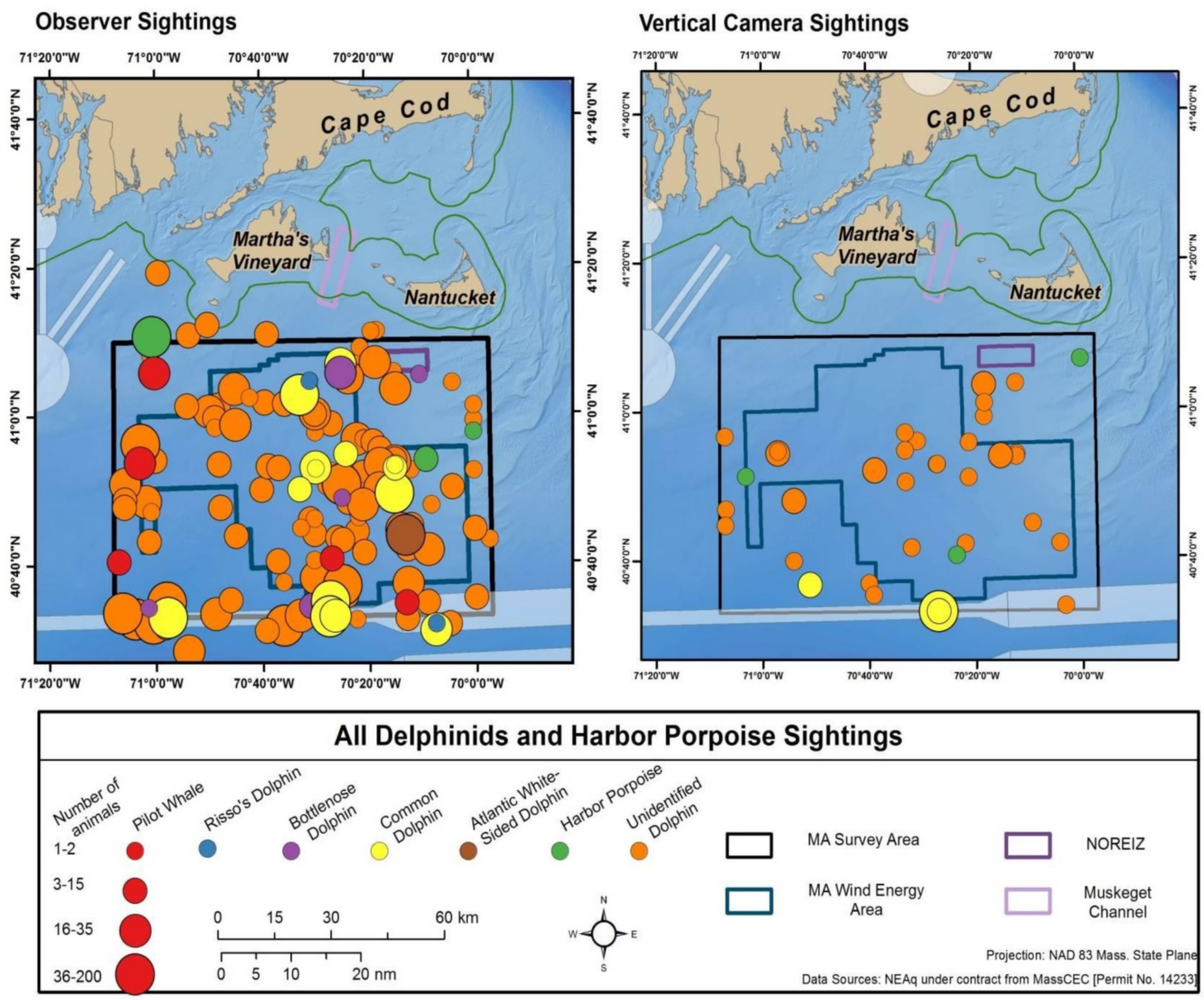
Figure 4-9. Large and medium whale sightings in the MA WEA during 2011-2012 aerial surveys; sighting location indicates the species and number of animals sighted at each location by the size and color of the circle

Pilot Whales

In the western Atlantic, both species of pilot whales are known to occur: the long-finned pilot whale (*Globicephala melas*) and the short-finned pilot whale (*G. macrorhynchus*). Pilot whales occurring north of the area between New Jersey and Cape Hatteras are likely to be long-finned, and those to the south are likely to be short-finned pilot whales. However, these species are difficult to differentiate at sea; therefore, some of the descriptions below refer to pilot whales, *Globicephala* sp. (Waring et al., 2011). The best estimate of abundance of western North Atlantic long-finned pilot whales (the portion of the population occupying U.S. waters) is 26,535 animals, with a minimum population estimate of 19,930 animals (Waring et al., 2014).

Long-finned pilot whales are typically distributed along the continental shelf edge, but may also occur within the continental shelf waters. This species has been observed in the Nantucket Shoals year round, but sightings from 1978 to 1992 indicate that the highest concentration of occurrence in the area is during the spring and summer (Abend and Smith, 1999). This is corroborated by the seasonal SPUE data. In the WEA, no sightings were reported in the fall or winter, and SPUE in the spring and summer ranged from 0.6 to 590 whales per 620 miles (1,000 km) (Appendix E, Figure 2; Right Whale Consortium, 2014). Within 40 nm (74 km) of the WEA, most sightings occurred in the spring and summer (Right Whale Consortium, 2014). SPUE ranged from 0.6 to 1,710 whales per 620 miles (1,000 km) in the spring and winter; 0.6 to 4,035 whales per 620 miles (1,000 km) in the summer; and 1711 to 4,035 whales per 620 miles (1,000 km) in the fall (Appendix E, Figure 2; Right Whale Consortium, 2014). SPUE data for long-finned pilot whales included sightings data for long-finned pilot whales, short-finned pilot whales, and unidentified pilot whales (Right Whale Consortium, 2014).

Pilot whales were observed on seven occasions during the aerial surveys in the MA WEA from November 2011 to October 2012. Group sizes ranged from 1 to 35 and were located in the western and southern portions of the WEA, and in the northwestern and southwestern portions of the survey area (outside the WEA delineated boundary; Figure 4-10; Kraus et al., 2013).



Source: Kraus et al., 2013

Figure 4-10. Delphinid and harbor porpoise sightings in the MA WESA during 2011-2012 aerial surveys; sighting location indicates the species and number of animals sighted at each location by size and color of the circle

Atlantic White-Sided Dolphins

White-sided dolphins in the WEA region belong to the Gulf of Maine stock and can be found in large numbers at intermediate densities; they have been observed primarily in shelf waters to 328 ft (100 m) from southern Georges Bank to southern Gulf of Maine (Waring et al., 2013). This species also occurs year round south of Georges Bank, but at lower densities (Waring et al., 2013). The best estimate of abundance for the North Atlantic stock (to which the Gulf of Maine stock belongs) is 48,819 dolphins, with a minimum population of 30,401 dolphins (Waring et al., 2013).

SPUE data corroborate that this species may occur in large groups. SPUE in the WEA ranged from 0.1 to 1,975 dolphins per 620 miles (1,000 km) in the spring and fall, and 0.1 to 900 dolphins per 620 miles (1,000 km) in the summer (Appendix E, Figure 3; Right Whale Consortium, 2014). Within 40 nm (74 km) of the WEA, sightings occurred during all four seasons on all sides of the WEA (Right Whale Consortium, 2014). SPUE ranged from 0.1 to 1,975 dolphins per 620 miles (1,000 km) in the winter and summer; from 0.1 to 900 dolphins per 620 miles (1,000 km) in the fall; and from 0.1 to 13,944 dolphins per 620 miles (1,000 km) in the spring (Appendix E, Figure 3; Right Whale Consortium, 2014). The high SPUE value of 13,944 dolphins per 620 miles (1,000 km) was near the outer southwest boundary line of the WEA.

Atlantic white-sided dolphins were observed on one occasion during the aerial surveys in the MA WEA from November 2011 to October 2012 in the southeastern section of the MA WEA (Figure 4-10; Kraus et al., 2013). Group size ranged from 36 to 200 animals (Kraus et al., 2013).

Short-Beaked Common Dolphins

Short-beaked common dolphins are one of the most widely distributed cetaceans, and are found worldwide in temperate, tropical, and subtropical waters. These dolphins are typically within continental shelf waters between the 328 ft and 1.2-mile (100 and 2,000 m) isobaths (Waring et al., 2013). The best estimated abundance for this species in the western North Atlantic is 173,486 animals, with a minimum population of 112,531 animals (Waring et al., 2014).

In the WEA, short-beaked common dolphins occurred in all seasons, with SPUE ranging from 0.2 to 1,600 dolphins per 620 miles (1,000 km) in each season (Appendix E, Figure 4; Right Whale Consortium, 2014). Within 40 nm (74 km) of the WEA, SPUE (mostly to the west and south of the WEA) were relatively high and regularly distributed in all seasons, with SPUE of 0.2 to 33,000 dolphins per 620 miles (1,000 km) in the winter, and 0.2 to 15,170 dolphins per 620 miles (1,000 km) in the spring, summer, and fall (Appendix E, Figure 4).

During the aerial surveys from November 2011 to October 2012, common dolphins were sighted on 21 occasions throughout the central region of the WEA and south of the WEA boundary, with group sizes ranging from 1 to 200 animals (Figure 4-10; Kraus et al., 2013).

Bottlenose Dolphins (Western North Atlantic Offshore Stock)

Bottlenose dolphins belonging to the western North Atlantic offshore stock can be found in coastal waters and throughout the continental shelf and slope waters. In the northeastern U.S. waters, their distribution is separated into two distinct morphotypes: coastal and offshore. Inshore sightings are concentrated near the Maryland and Virginia border, while offshore sightings are concentrated from Cape Hatteras to the eastern end of Georges Bank (Kenney, 1990). The best estimated abundance for the western North Atlantic offshore stock of bottlenose dolphins is 77,532, with a minimum population of 56,053 animals (Waring et al., 2014).

Bottlenose dolphins (western North Atlantic offshore stock) were sighted in five locations throughout the WEA during the summer and fall, and SPUE ranged from 1 to 600 dolphins per 620 miles (1,000 km) (Appendix E, Figure 5; Right Whale Consortium, 2014). Within 40 nm (74 km) of the WEA, most sightings were reported south of the WEA during the spring, summer, and fall; and SPUE ranged from 1 to 1,240 dolphins per 620 miles (1,000 km) in the spring and summer and from 1 to 7,120 dolphins per 620 miles (1,000 km) in the fall (Appendix E, Figure 5; Right Whale Consortium, 2014).

From November 2011 to October 2012, bottlenose dolphins were sighted a total of nine times, with group size ranging from 1 to 35 animals (Figure 4-10; Kraus et al., 2013). The largest group (16 to 35 animals) was located in the northeastern portion of the WEA (Kraus et al., 2013). Several smaller groups (ranging from 1 to 2 and 3 to 15 animals) were also observed within the WEA boundary and in the survey area, but outside the WEA boundary (Figure 4-10; Kraus et al., 2013).

Risso's Dolphins

Risso's dolphins are known to occur in the northwest Atlantic from Florida to Newfoundland. This species can be found along the continental shelf edge from Cape Hatteras north to Georges Bank in the spring, summer, and autumn (Waring et al., 2013). Currently, no information is available on the stock structure for this species in the western North Atlantic. The best abundance estimate for Risso's dolphins is 18,250 animals, with a minimum population of 12,619 animals (Waring et al., 2014).

Most sightings of Risso's dolphin occurred outside and to the south of the WEA. In the WEA, sightings of Risso's dolphin occurred in the spring, fall, and spring, with SPUE ranging from 0.3 to 50 dolphins per 620 miles (1,000 km) and 136 to 350 dolphins per 620 miles (1,000 km), respectively (Appendix E, Figure 6; Right Whale Consortium, 2014). Within 40 nm (74 km) south of the WEA, sightings were reported in all four seasons, primarily in the summer and fall, with several sightings in the spring ranging from 0.3 to 50 dolphins per 620 miles (1,000 km) and only one in the winter ranging from 666 to 9,162 dolphins per 620 miles (1,000 km). In the summer, SPUE ranged from 51 to 9,162 dolphins per 620 miles (1,000 km); and SPUE in the fall ranged from 136 to 9,162 dolphins per 620 miles (1,000 km) (Appendix E, Figure 6; Right Whale Consortium, 2014).

From November 2011 to October 2012, Risso's dolphins were observed on three occasions in the WEA area (Figure 4-10; Kraus et al., 2013). One sighting was of either one or two animals in the northern section of the WEA, and another was on the southeastern boundary of the WEA boundary (Kraus et al., 2013).

White-Beaked Dolphins

White-beaked dolphins in the WEA region can be found within the continental shelf and slope waters in the western Gulf of Maine and around Cape Cod. The best abundance estimate for this species in the western North Atlantic is 2,003 (Waring et al., 2011). This estimate is assumed to be negatively biased resulting from survey data from only part of the known habitat (Waring et al., 2011).

There were no sightings of white-beaked dolphins in the WEA. Within 40 nm (74 km) of the WEA, this species was sighted in two locations just off the northeast corner of the WEA in the spring, with SPUE ranging from 11 to 170 dolphins per 620 miles (1,000 km) (Appendix E, Figure 7; Right Whale Consortium, 2014). The other location was east of Nantucket, with SPUE of 36 to 60 dolphins per 620 miles (1,000 km) (Appendix E, Figure 7; Right Whale Consortium, 2014).

Harbor Porpoise

In the northwest Atlantic, this species consists of four separate stocks: Gulf of Maine/Bay of Fundy, Gulf of St. Lawrence, Newfoundland, and Greenland. During the fall (October to December) and spring (April to June), the Gulf of Maine/Bay of Fundy stock of harbor porpoises is widely distributed from New Jersey to Maine. This species is known to occur from the coastline to areas with bottom depths greater than 1.1 mile (1,800 m) (Waring et al., 2013). However, most of the population occurs over the continental shelf waters. The best abundance estimate for this species is 79,883, with a minimum population of 61,415 animals (Waring et al., 2013).

Harbor porpoise occurred in the WEA primarily during the spring (SPUE ranging from 0.2 to 120 porpoise per 620 miles [1,000 km]), but also occurred in the fall and winter (SPUE ranging from 31 to 65 porpoise per 620 miles [1,000 km] and 14 to 30 porpoise per 620 miles [1,000 km], respectively; Appendix E, Figure 8; Right Whale Consortium, 2014). Within 40 nm (74 km) of the WEA, harbor porpoise occurred primarily during the spring and were regularly distributed on all sides of the WEA (SPUE ranging from 0.2 to 697 porpoise per 620 miles [1,000 km]). In the summer, harbor porpoise occurred mainly to the east of the WEA (SPUE ranging from 0.2 to 697 porpoise per 620 miles [1,000 km]). This species showed variable distribution during fall and winter, with SPUE values ranging from 0.2 to 65 and 0.2 to 697 porpoise per 620 miles (1,000 km), respectively (Appendix E, Figure 8; Right Whale Consortium, 2014).

From November 2011 to October 2012, harbor porpoise were observed on six occasions in the WEA, with group size ranging from 3 to 15 animals in the eastern section of the WEA (Figure 4-10; Kraus et al., 2013). The other sightings were outside the WEA boundary, with the largest grouping sighted on the northwest WESA boundary consisting of 36 to 200 animals (Figure 4-10; Kraus et al., 2013).

Beaked Whales

Beaked whales are known to occur in deep, continental edge and slope waters, and live sightings are rare. Six species of beaked whales are known to occur in the western North Atlantic: *Ziphius cavirostris* (Cuvier's), four species of *Mesoplodon* (*M. europaeus* [Gervais'], *M. densirostris* [Blainville's], *M. mirus* [True's], and *M. bidens* [Sowerby's]), and *Hyperoodon ampullatus* (northern bottlenose whale). Beaked whales of the genus *Mesoplodon* are extremely difficult to differentiate at sea, and are referred to in sighting surveys as *Mesoplodon* spp. Distribution information for all species of beaked whales is primarily based on stranding data (Mead, 1989).

Strandings of Cuvier's beaked whales have been recorded from Nova Scotia to Florida along the east coast of the United States, and sightings of this species are almost exclusively on the continental shelf edge and slope (NMFS, 2014). The best estimate of abundance for Cuvier's beaked whales is 6,532, with a minimum population of 5,021 (NMFS, 2014). Sightings of *Mesoplodon* spp. beaked whales are also primarily along the shelf edge and slope, with most sightings recorded in the spring and summer, corresponding to when surveys have occurred (NMFS, 2014). Blainville's beaked whale is the most widely distributed species and can be found in tropical to temperate waters throughout the world (Mead, 1989), while Gervais' beaked whales are the most common *Mesoplodon* species to strand, and have been reported from Cape Cod to Florida along the U.S. east coast (NMFS, 2014). The best abundance estimate for *Mesoplodon* spp. beaked whales is 7,092, with a minimum population estimate of 4,632 (NMFS, 2014).

SPUE data for beaked whales were for all species of beaked whales combined, which included northern bottlenose whale, Cuvier's beaked whale, Blainville's beaked whale, Gervais' beaked whale, Sowerby's beaked whale, True's beaked whale, *Mesoplodon* sp., and unidentified beaked whales (Right Whale Consortium, 2014). Beaked whales have not been sighted in the WEA or within 40 nm (74 km) of the WEA; however, they have been reported along the shelf edge approximately 40 to 50 nm (74 to 93 km) south of the WEA (Appendix E, Figure 9; Right Whale Consortium, 2014). These sightings were recorded primarily during the summer months (SPUE ranged from 1 to 665 whales per 620 miles [1,000 km]), and a few in the spring and fall (1 to 155 and 1 to 70 whales per 620 miles [1,000 km], respectively; Appendix E, Figure 9; Right Whale Consortium, 2014).

Seals

Four species of seals are most likely to occur in the WEA: harbor seals, gray seals, harp seals, and hooded seals. Figure 10 in Appendix E presents SPUE combined data for harbor seals, gray seals, and unidentified seals (Right Whale Consortium, 2014). Seal SPUE in the WEA region almost certainly include four species (harbor, gray, harp, and hooded), but the majority are likely to be harbor and gray seals (Kenney and Vigness-Raposa, 2010).

Harbor Seals

Harbor seals are the most widely distributed species in the coastal waters of southern New England (Waring et al., 2013). This species is commonly found from Maine to New York during September through late May (Waring et al., 2013). From June through August, harbor seals are typically sighted along the coast north of New Hampshire (Waring et al., 2012a). Breeding and pupping for this species take place from mid-May through June; these activities occur mostly north of New Hampshire, but can occur as far south as Cape Cod (with recent records of pupping off Manomet, MA) (Waring et al., 2013). The best estimate of population is 70,142 animals, with a minimum population of 55,409 animals (NMFS, 2014). Stranding records between 2006 and 2010 indicate that of 1,400 harbor seals that stranded along the U.S. east coast from Maine to Florida, 351 were stranded in Massachusetts and 29 in Rhode Island (Waring et al., 2013).

Gray Seals

The western North Atlantic stock of gray seals ranges from New York to Labrador. In the western North Atlantic, gray seals give birth between January and February. This species was first observed in small numbers along the islands of Maine and Nantucket/Vineyard Sound, MA, in the 1980s. Currently, approximately 400 or more animals belong to a year-round breeding population on outer Cape Cod and Muskeget Island (Waring et al., 2013). One of three established pupping locations for this species is located on Muskeget Island, MA, with records of occasional sightings of mother/pup pairs recorded on Monomoy Island and Nomans Land Island (10 nm [18.5 km] north of the WEA; Waring et al., 2013). Recent aerial surveys indicate an increase in pupping, with an estimate of 2,095 pups born on Muskeget Island in 2008, and a maximum of 15,756 seals recorded in southeastern coastal waters in March 2011 (Waring et al., 2013). An estimate for the total western Atlantic population of gray seals is not available (Waring et al., 2013). From 2006 to 2010, most of the stranding mortalities along the U.S. coast from Maine to North Carolina were in Massachusetts (227 of 375 stranding mortalities; Waring et al., 2013).

Harp Seals

Harp seals are highly migratory and known to occur throughout most of the North Atlantic. The west North Atlantic stock is equivalent to the Front/Gulf stock, which is a combination of the Front herd that breeds off the coast of Newfoundland, and the Gulf herd that breeds near Magdalen Island in the Gulf of St. Lawrence (Waring et al., 2013). Pupping for this species occurs near the southern limits of their range from late February through mid-March. The best estimate of abundance for the western North Atlantic stock is 8.3 million seals (Waring et al., 2013). Data are not available for an estimate within U.S. waters. Beginning in the mid-1990s, harp seals have been observed from Maine to New Jersey, with these extralimital appearances and strandings (from January to May) occurring more frequently in recent years (Waring et al., 2013). According to the Massachusetts DMF, the harp seal is considered an "annual vagrant" to Dukes and Nantucket Counties (MADFW, 2012). From 2006 to 2010, 230 harp seals were stranded in Massachusetts and 29 in Rhode Island, amounting to approximately half of the total of 487 seals from Maine to North Carolina (Waring et al., 2013).

Hooded Seals

Hooded seals are known to occur throughout the North Atlantic and Arctic Oceans, preferring deep water farther offshore than harp seals (Waring et al., 2011). The Northwest Atlantic stock is one of three separate stocks for this species. This species is highly migratory and can be found as far south as Puerto Rico, with increased occurrence along the U.S. east coast from Maine to Florida (Waring et al., 2011). In New England waters, hooded seals are typically observed between January and May. The most current population estimate for the Western North Atlantic stock of hooded seals is 512,000 animals (Waring et al., 2011). Data are not available to estimate the abundance of seals in U.S. waters. From 2001 to 2005, a total of 138 hooded seals stranded along the U.S. east coast from Maine to North Carolina, 53 of which stranded in Massachusetts and 2 in Rhode Island (Waring et al., 2011).

In the WEA, seal sightings have occurred during the winter, spring, and summer, but mostly during the spring. SPUE for winter, spring, and summer ranged from 0.3 to 920 seals per 620 miles (1,000 km) (Figure 10 in Appendix E; Right Whale Consortium, 2014). Within 40 nm (74 km) of the WEA, seal sightings occurred in high numbers during the spring, summer, and fall in the waters between Martha's Vineyard and Nantucket and south of Cape Cod (Right Whale Consortium, 2014). SPUE ranged from 0.3 to 3,255 seals per 620 miles (1,000 km) in the fall and winter, and from 0.3 to 38,509 seals per 620 miles (1,000 km) during the spring and summer.

From November 2011 to October 2012, areas of high densities of seals were observed on and around seal haul-outs, such as Muskeget Channel and to a lesser extent on Nomans Land southwest of Martha's Vineyard (Kraus et al., 2013).

ESA-Listed Threatened and Endangered Marine Mammals

Six endangered species of whales occur within the waters of the North Atlantic OCS, five mysticetes and one odontocete: North Atlantic right whales, blue whales (*Balaenoptera musculus)*, humpback whales (*Megaptera novaeangliae)*, fin whales (*Balaenoptera physalus)*, sei whales (*Balaenoptera borealis)*, and the sperm whale (*Physeter macrocephalus*) (the odontocete). Five of these whale species, North Atlantic right whales, fin whales, sei whales, humpback whales, and sperm whales, are likely to occur in the vicinity of the WEA (Right Whale Consortium, 2014). In addition to SPUE data (Appendix F; Right Whale Consortium, 2014) and MassCEC survey data (Kraus et al., 2013), this section includes strandings and pertinent "serious injury" data when available for each species. Although the stranding location is not necessarily indicative of the location or area inhabited by the whale, strandings data for the south coast of Massachusetts and Rhode Island are included for two reasons: 1) as potentially showing a whale's presence in the area, and 2) as a baseline for serious injuries and mortalities to this species to be used when assessing potential risks from project activities. Serious injuries are defined as any injury leading to an apparent significant health decline (e.g., skin discoloration, lesions near the nares, fat loss, and increased cyamid [whale lice] load; Cole and Henry, 2013; Pettis et al., 2004).

North Atlantic Right Whales

The western North Atlantic right whale is known to inhabit continental shelf and coastal waters in the northeast United States, ranging from wintering and calving grounds in coastal Florida and Georgia, to summer feeding and nursery grounds in New England waters and northward to the Bay of Fundy and the Scotian Shelf (NOAA NCCOS, 2006). There are currently six critical habitat areas designated under the ESA for North Atlantic right whales: coastal waters off the southeastern United States, the Great South channel, Georges Bank/Gulf of Maine, Cape Cod and Massachusetts Bays, the Bay of Fundy, and the Scotian Shelf (Waring et al., 2013). NMFS is currently considering a proposed rule for expanding the critical habitat for right whale (75 FR 61690). Movements within and between habitats are extensive (Baumgartner and Mate, 2005; McLellan et al., 2004; Brown and Marx, 2000; Mate et al., 1997). The most current minimum population estimate for the North Atlantic stock is 455 whales (NMFS, 2014).

In the RI OSAMP, all marine mammal species likely to occur in the study area were prioritized on a scale from 1 to 5 (1 being the highest priority and 5 the lowest) for management purposes. Rank 1 is the only rank with two levels: level 1A, to which only North Atlantic right whales belong, and level 1B, to which the next highest priority species belong (humpback whales, fin whales, and leatherback sea turtles) (Kenney and Vigness-Raposa, 2010). North Atlantic right whales were ranked as Priority 1A; it is the only species in this highest-priority level. The other endangered whale species ranged in priority from 1B to 4 (Kenney and Vigness-Raposa, 2010). Kenney and Vigness-Raposa (2010) stated that "the North Atlantic right whale almost deserves to be in a category by itself" as it is one of the rarest mammals in the world, with serious concern about long-term population viability, and known anthropogenic mortality from vessel collision and entanglement in fisheries gear. In the right whale section of the Rhode Island OSAMP, Kenney and Vigness-Raposa (2010) concluded that right whales are most likely to occur in the area during their northward migration in the spring but are also likely to be present during the southward migration in the fall. Data show, however, that right whales could occur in the area during any season.

Right Whale Sightings Compiled from National Marine Fisheries Service, North Atlantic Right Whale Sightings Survey (NMFS NARWSS) Reports from 2002 to 2011

Right whale sightings documented in the NMFS NARWSS reports (from 2002 to 2011), are summarized in Table 4-13. These reports showed very high numbers in 2010 and 2011 in the nearby waters to the west of and within the WEA (Table 4-13). The 2010 event, with a total of 98 whales, triggered a dynamic management area (DMA). DMAs were also implemented off Nantucket in February, March, and April 2010 (Khan et al., 2011). DMAs are triggered when three or more right whales are sighted outside of a seasonal management area (SMA): "DMAs are put in place for two weeks and encompass an area commensurate to the number of whales present. Mariners are notified of DMAs via email, the internet, Broadcast Notice to Mariners (BNM), NOAA Project Weather Radio, and the Mandatory Ship Reporting system (MSR), and are requested to reduce their speed when transiting through DMAs. Unlike SMAs, compliance is voluntary for DMAs" (Khan et al., 2011). These data indicate that this region is, at a minimum, an occasional area of use, and possibly a regularly used area as nursery and opportunistic feeding grounds.

Table 4-13

Summary of Confirmed Right Whale Sightings Compiled from National Marine Fisheries Service, North Atlantic Right Whale Sightings Survey (NMFS NARWSS) Reports from 2002 to 2011

NARWSS Report Year	Months WEA Surveyed	[1]SPUE/Number of Sightings in WEA or within 40 nm	Reference
2002	March–July; September–November	SPUE = low (<0.25)	Cole et al., 2007
2003	April–December	1–4 Sightings	Rone et al., 2007a
2004	February–July; September–December	1–4 Sightings	Rone et al., 2007b
2005	April–December	1–2 Sightings	Niemeyer et al., 2007a
2006	January–December	1–2 Sightings	Niemeyer et al., 2007b
2007	January–March (only 1 transect line)	2–4 Sightings	Niemeyer et al., 2008
2008	None	1 Sighting (source = whale watch)	Khan et al., 2009
2009	None	0 Sightings	Khan et al., 2010
2010	April–June	21 Sightings (98 whales)[2,3]	Khan et al., 2011
2011	January, March, April, May, June, November	A total of 70 whales (which includes duplicate individuals sighted) at 12 locations	Khan et al., 2012

Sightings sources include aerial and shipboard surveys, whale watches, and opportunistic (i.e., the general public, U.S. Coast Guard, commercial ships, and fishing vessels). Unconfirmed reports were not included in the reports.

[1]Sightings reported as SPUE in 2002 and by count from 2003–2011; depending on presentation in report.

[2]DMA (triggered by ≥3 right whales outside a SMA) in Rhode Island Sound, April–May.

[3]Source: Kenney and Vigness-Raposa, 2010.

Right Whale Sightings near the WEA during 1998, 2010, and 2011

Kenney and Vigness-Raposa (2010) described what they called an "aggregation of feeding right whales just east of Block Island in April 1998" that lasted for at least 3 weeks. Eighteen whales were identified either against the right whale catalog or as uncatalogued individuals that were seen on multiple days. Most individuals were males. The rate of re-sightings was low, however, and observers suspected that there were substantially more than 18 individuals feeding in Rhode Island Sound during this period. Observers were not able to determine the spatial extent of this high-use area. Knowlton et al. (2005) noted that six individuals observed in Block Island Sound in 1998 had actually been recorded earlier in the year in the traditional winter/spring feeding grounds of Cape Cod Bay. No additional sightings of these particular individuals were made until they reached the Bay of Fundy in the summer.

During the week of April 23, 2010, 98 right whales were reported feeding in the waters between Martha's Vineyard and Block Island (Khan et al., 2011). From October 2010 through September 2011, a relatively high number of right whales were observed at 10 locations, ranging from 1 to 20 right whales being sighted at each location in the WEA (NMFS NEFSC, 2012b).

Right Whale Strandings and Documented Serious Injuries or Mortalities on the South Coast of Massachusetts and Rhode Island, 2000–2011

As mentioned above, strandings and mortalities are not necessarily indicative of a living whale's occurrence in the area; the location of the body may be a result of drifting and currents. However, these data are useful to add to the understanding of a whale's presence in the area, as well as to establish a baseline. From 2000 to 2011, four serious injuries and five mortalities have been documented for right whales in the south coast of Massachusetts and Rhode Island including the WEA (Table 4-14).

Table 4-14

Records of Individual Right Whales Stranded, with Serious Injuries, or Mortality on the South Coast of Massachusetts and the WEA Region from 2000 to 2011

Date	Location	Status /Cause (Stranded, Serious Injury, or Mortality)
19 January 2000	15 km southeast of Block Island	Mortality/Not Determined
12 October 2002	Nantucket	Mortality/Entangled in Fishery Gear
28 April 2005	Monomoy Island, MA	Mortality/Ship Strike
13 May 2005	39 km south of Martha's Vineyard	Mortality/Not Determined
21 May 2006	56 km south of Block Island	Mortality/Not Determined
9 March 2007	37 km southeast of Chatham, MA	Serious Injury/Entanglement
8 May 2007	105 km east southeast of Chatham, MA	Serious Injury/Entanglement

Date	Location	Status /Cause (Stranded, Serious Injury, or Mortality)
18 July 2009	63 km south of Nantucket	Serious Injury/Entanglement
22 April 2011	South of Martha's Vineyard	Serious Injury/Entanglement

Source: Henry et al., 2011; Cole and Henry, 2013; Kenney and Vigness-Raposa, 2010.

Note: The Cole and Henry (2013) report is the first year containing an updated version of determining Serious Injury, which is more conservative than those determined in the past (including Henry et al., 2012).

Sightings per Unit Effort through November 2013

Regionally, right whales occurred in relatively high densities in the Great South Channel east and southeast of Cape Cod, with the highest SPUE occurring in the spring and summer. SPUE ranged from 0.5 to 260 whales per 620 miles (1,000 km) in the spring and 0.3 to 532 whales per 620 miles (1,000 km) in the summer (Figure 1 in Appendix F; Right Whale Consortium, 2014). In the WEA, sightings occurred in the spring, concentrated in the northern two-thirds of the WEA, with SPUE ranging from 0.3 to 50 whales per 620 miles (1,000 km) (Figure 1 in Appendix F; Right Whale Consortium, 2014). The majority of sightings within 40 nm of the WEA occurred in the spring and winter, mostly north of the WEA, with an apparent seasonal pattern consisting of sightings more prevalent northwest of the WEA in the spring, and northeast of the WEA in the winter (Right Whale Consortium, 2014). SPUE were relatively high in the spring, ranging from 0.5 to 260 whales per 620 miles (1,000 km), 0.3 to 25 whales per 620 miles (1,000 km) in the summer and fall, and 0.3 to 50 whales per 620 miles (1,000 km) in the winter (see Figure 1 in Appendix F; Right Whale Consortium, 2014).

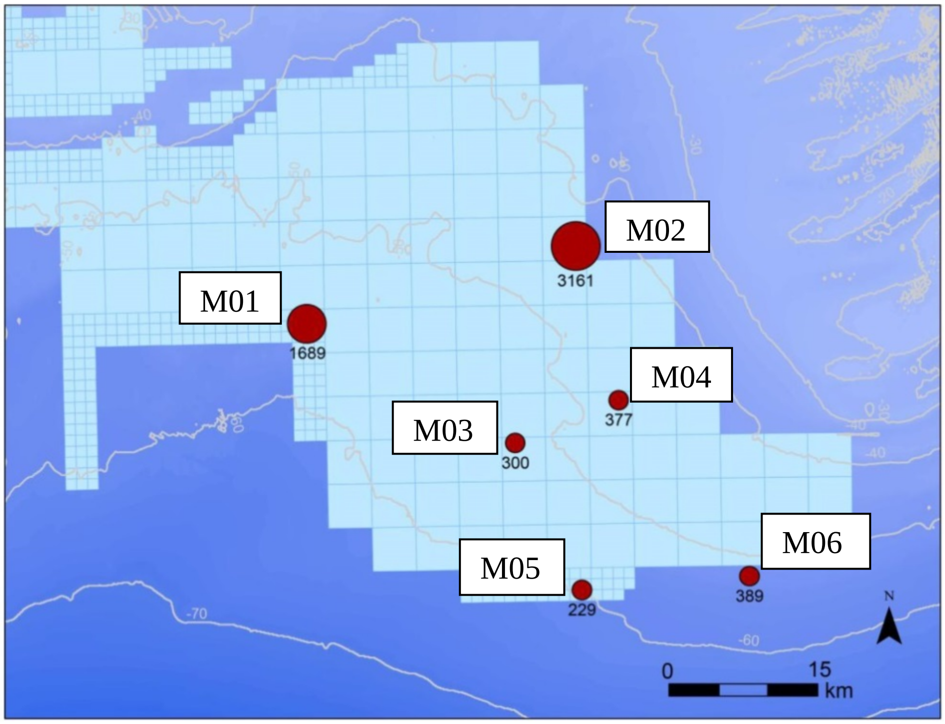
Right Whale Sightings and Acoustic Records In and Near the WEA November 2011 to October 2012

Pre-evaluation survey data of the MA WEA and nearby waters revealed a relative scarcity of marine mammal and sea turtle occurrence. Kraus et al. (2013) provide an assessment of the distribution and abundance of marine mammals and sea turtles in the MA WESA via a combination of concurrent aerial survey sightings and passive acoustic methods. This is a 3 year study, with just the first year, November 2011 to October 2012 published to date. As such, these results are a snapshot of 1 year's data that are not conclusive regarding distribution patterns, but do supplement previous data, and serve as the starting point for future studies. The acoustic and aerial data are for the most part in agreement about the most abundant six large whale species (right, fin, humpback, sei, sperm, and blue whales), although the acoustic data show longer residence time in the area than the sightings data for most species (Kraus et al., 2013). The authors also state that since this is the first acoustic data obtained in the area, it might be more representative of whale use of the area than the aerial surveys.

Aerial survey data indicated that right whales were present in the WEA in December, February, and March, while results of the acoustic study indicated that right whales were present in the WEA during 8 months (December through May and September and October; Kraus et al., 2013).

There were 24 to 28 individuals recorded visually, with 18 of those identified: 5 females (three known to be reproductive females), 10 males, and 3 of unknown sex. Right whale activities in the WEA consisted of Surface Active Groups, feeding, breaching, flipper slapping, and travelling (Kraus et al., 2013). Nine of the whales sighted had been observed in the same year in the southern Gulf of Maine, including several that appeared to be going back and forth between Cape Cod Bay, the Great South Channel, and the MA WESA (Kraus et al., 2013). One whale had been seen earlier in the year off the southeast U.S. wintering ground, suggesting that the MA WESA is a part of a migratory route for some right whales (Kraus et al., 2013).

Right whale sightings were recorded in all quadrants of the MA WESA and within the WEA boundary, with the largest numbers recorded in the northwest corner of the MA WESA (but outside the WEA boundary; Kraus et al., 2013; Figure 4-11). Acoustic presence of right whales was detected using software that automatically detects upcalls, which are the most commonly produced call by right whales (Morano et al., 2012). In some cases, contact calls could have been produced with enough intensity to have been recorded on six Marine Autonomous Recording Units (MARUs) (Kraus et al., 2013). To eliminate the possibility of pseudoreplication, and thus overestimation of a whale's acoustic presence, analysts carefully reviewed all contact calls using specialized viewing tools and recorded only the first arrival of the contact call (referred to below as first arrival contact calls; Kraus et al., 2013). Right whales were recorded acoustically at all six of the MARUs, with the most recorded at station M02 in the northeast corner of the WEA (3,161 calls) and station M01, 18.6 miles (30 km) to the southeast of M02 (1,689 calls; Figure 4-11; Kraus et al., 2013). The number of calls decreased at the MARUs on the southern boundary, with the lowest calls recorded at station M05 in the southwest (229 calls; Figure 4-11; Kraus et al., 2013). The authors concluded that from November 2011 to October 2012, right whales used the WEA primarily for feeding and social behavior (Kraus et al., 2013).



Source: Kraus et al., 2013

Figure 4-11. Number of first arrival right whale contact calls detected at each MARU for all days (November 10, 2011 to October 3, 2012)

In summary, SPUE data from historical aerial and shipboard surveys indicate that North Atlantic right whales have occurred in the WEA during the spring in densities ranging from 0.3 to 50 whales per 620 miles (1,000 km) (Right Whale Consortium, 2014). A combination of sightings (i.e., not corrected for effort) and acoustic data from November 2011 to October 2012 indicate that right whales were sighted in the WEA during January, March, and April, with the highest numbers occurring in March. Acoustic data from the same time period indicate that right whales were present in the WEA for 8 months, December through May, and September and October (Kraus et al., 2013). The most first arrival contact calls were recorded from January through May, with the peak number recorded in March (Kraus et al., 2013). These acoustic results support the SPUE and sightings data in that right whales are most likely to occur in the highest densities in the WEA during spring (Kraus et al., 2013). They also indicate that this species appears to be in the WESA for longer periods of time than previously known. More data are needed to determine a more accurate account of the number of whales occurring in the summer and fall months. Additionally, periods of high right whale activity in or near the WEA during 1998, 2010, and 2011 demonstrate that the current knowledge of migratory and feeding activities is incomplete, and that there is interannual variability in the timing and location of these activities.

Blue Whales

In the northwest Atlantic, blue whales are thought to belong to one stock, ranging from the Arctic to mid-latitude waters (Ramp et al., 2006; Waring et al., 2011). However, acoustic records of blue whales have been detected over the entire North Atlantic Ocean basin, with most records detected around the Grand Banks off Newfoundland and west of the British Isles (Waring et al., 2011). Reeves et al. (2004) reported that this species appears to have an east/west distribution pattern in tropical and temperate waters, and a more northerly distribution in the summer, but concluded that there is not enough data to detect trends in migratory timing and routes. In the Blue Whale Recovery Plan, NMFS (1998) determined that, based on sightings and strandings, blue whales occur along the U.S. east coast only occasionally. This species may be an occasional visitor to the WEA. Only one stranded blue whale has been recorded in the vicinity of the WEA in the past decades. In March of 1998, a dead male blue whale was brought into Rhode Island waters on the bow of a tanker. The cause of death was ship strike from the same tanker (Waring et al., 2011). The population estimate for blue whales in the western North Atlantic is 400 to 600 whales (R. Sears pers. comm. in Waring et al., 2011).

Blue Whale Acoustic Records In and Near the WEA November 2011 to October 2012

Blue whales were not observed during the aerial surveys in the MA WEA from November 2011 to October 2012. However, they were detected acoustically during 5 months of the year December through February, and August and September (Kraus et al., 2013). Their acoustic presence is temporally opposite from all the other large whales detected in the MA WEA, with the highest presence in the winter months and none in the spring (Kraus et al., 2013). This pattern suggests that blue whales may use the area as a migratory corridor rather than remain in the area for extended periods (Kraus et al., 2013). It is also possible that the whales detected were from other areas (farther away) because their calls can propagate a great distance (Kraus et al., 2013).

Fin Whales

Fin whales are very common over the continental shelf waters from Cape Hatteras, NC northward (Waring et al., 2013). According to Shoop and Kenney (1992), fin whales represent approximately 46 percent of large whales and 24 percent of all cetaceans sighted over the continental shelf. The most recent abundance estimate for the North Atlantic stock is 3,522, with a minimum population of 2,817 whales (Waring et al., 2013).

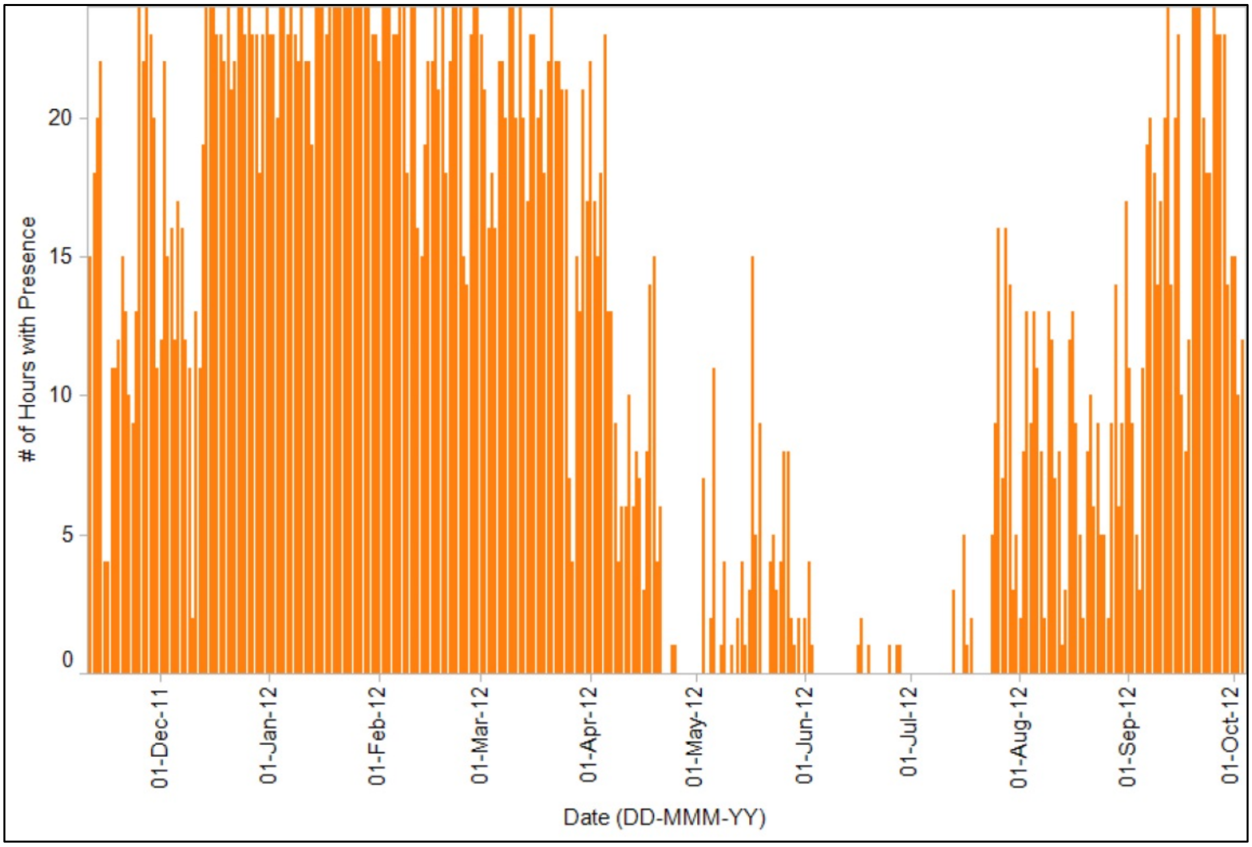
Within the Rhode Island OSAMP study area (continental shelf and slope waters from Long Island to Nantucket), the highest occurrence of fin whales was in the outer half of the area from south of Montauk Point to south of Nantucket. This area is “precisely the same area as the dense aggregations of sighting records from the whale watch boats” (Kenney and Vigness-Raposa, 2010). In other words, this area is targeted by whale watch boats because of the high probability of finding fin whales in the area. Fin whales feed intensely during summer months, when site fidelity has been associated with feeding grounds in New England (Waring et al., 2013). Summer sightings in the vicinity of the WEA suggest that fin whales may use this area each summer for feeding (Figure 2 in Appendix F).

Fin whales are the most commonly stranded large whale in the Rhode Island OSAMP study area, with 28 strandings recorded from 1970 to present (Kenney and Vigness-Raposa, 2010). Fin whale strandings are also common in Massachusetts (Kenney and Vigness-Raposa, 2010), with a majority of the strandings occurring on Cape Cod (Waring et al., 2012a). Strandings data from 2006 to 2010 indicate only one stranding in Massachusetts during that time period, recorded off Martha's Vineyard in 2007 (Henry et al., 2012).

Regionally, SPUE for fin whales were relatively high in all seasons along the 328 ft (100 m) isobaths southeast of Cape Cod, and along the continental shelf west, south, and east of the WEA, especially in the Great South Channel in the spring, summer, and fall. SPUE ranged from 0.3 to 665 whales per 620 miles (1,000 km) in the fall (Figure 2 in Appendix F; Right Whale Consortium, 2014). In the WEA, fin whales were sighted in all seasons, but most sightings occurred in the spring, with SPUE ranging from 0.3 to 50 whales per 620 miles (1,000 km). SPUE ranged from 0.3 to 135 whales per 620 miles (1,000 km) during the summer, and from 0.3 to 50 whales per 620 miles (1,000 km) during the winter and fall (Figure 2 in Appendix F; Right Whale Consortium, 2014). Within 40 nm of the WEA, fin whales were reported in all seasons, with the most sightings occurring in the spring (SPUE ranging from 0.3 to 135 whales per 620 miles [1,000 km]). SPUE ranged from 0.3 to 665 whales per 620 miles (1,000 km) in the summer, 0.3 to 350 whales per 620 miles (1,000 km) in the fall, and 0.3 to 904 whales per 620 miles (1,000 km) in the winter (Figure 2 in Appendix F; Right Whale Consortium, 2014).

Fin Whale Sightings and Acoustic Records In and Near The WEA November 2011 to October 2012

From November 2011 to October 2012, fin whales were sighted during 5 months, January, April through June, and September, but were the most acoustically present of all species (Kraus et al., 2013). Fin whales were acoustically detected during all 12 months of the survey, and during 8 of the 12 months, they were detected 100 percent of the days per month sampled (Figure 4-12; Kraus et al., 2013). However, the whales could have been vocalizing either near the MARUs in the MA WEA or up to hundreds of kilometers away, since their vocalizations are at a low frequency and can propagate a great distance (Kraus et al., 2013).



Source: Kraus et al., 2013

Figure 4-12. Number of hours in each day that fin whale 20-Hz song was detected for all days analyzed (November 10, 2011 to October 3, 2012)

Sei Whales

The Nova Scotia stock of sei whales is distributed across the continental shelf waters from the northeast U.S. coast to south of Nova Scotia, with spring being the period of greatest abundance in U.S. waters (Waring et al., 2013). According to Olsen et al. (2009), sei whales' movements appear to be associated with oceanic fronts, sea surface temperatures, and specific bathymetric features, and this species is typically sighted on the U.S. Atlantic mid-shelf and the shelf edge and slope. However, sei whales are also known to come inshore into more shallow waters episodically (Schilling et al., 1992). For example, a group of at least 40 sei whales, as part of a larger, multi-species group of whales, were sighted in the continental shelf waters off Cape Cod in Hydrographer Canyon in April 1981 (Kenney and Winn, 1987). Baumgartner et al. (2011) have observed sei whales in the Great South Channel during spring from 2004 to 2010, indicating that this species is more common in the area than previously thought. Over the past 5 years, there has been one record of a serious injury to a sei whale in the south coast of Massachusetts and Rhode Island, 58 miles (94 km) east of Chatham, MA (Cole and Henry, 2013). The best estimate of abundance for the Nova Scotia stock is 357, with a minimum population estimate of 236 whales (Waring et al., 2013).

Regionally, the highest SPUE for sei whales occurred in the Great South Channel during the spring (ranging from 0.1 to 100 whales per 620 miles [1,000 km]) and summer (ranging from 0.1 to 380 whales per 620 miles [1,000 km]) (Figure 3 in Appendix F; Right Whale Consortium, 2014). In the WEA, SPUE were at relatively low levels, with sightings in the spring (SPUE ranging from 0.1 to 100 whales per 620 miles [1,000 km]). Within 40 nm (74 km) of the WEA, sightings were rare in the summer and fall (SPUE from 0.1 to 25 whales per 620 miles [1,000 km]), and higher in the spring (ranging from 0.1 to 790 whales per 620 miles [1,000 km]) (Figure 3 in Appendix F; Right Whale Consortium, 2014).

Sei Whale Sightings and Acoustic Records In and Near the WEA November 2011 to October 2012

One sei whale was sighted in the WESA during the aerial surveys from November 2011 to October 2012 (Figure 4-9; Kraus et al., 2013). The whale was recorded approximately 4.3 miles (7 km) from the southwest corner of the WEA boundary (Figure 4-9; Kraus et al., 2013). Opportunistic detections of sei whale vocalizations were recorded during the study period, indicating the acoustic presence of this species in the MA WESA (Kraus et al., 2013).

Humpback Whales

Humpback whales in the North Atlantic belong to several discrete subpopulations; the most common subpopulation in the WEA is the Gulf of Maine stock (Barco et al., 2002; Waring et al. 2012b). According to Kenney and Vigness-Raposa (2010), humpback whale occurrence in significant numbers in southern New England is relatively unpredictable and likely dependent on prey availability, both locally and within the Gulf of Maine. Humpbacks are known to possess strong and consistent fidelity to specific foraging areas (Stevick et al., 2006). The amount of time spent at each site is related to the relative density of prey, and local changes in humpback abundance in the western North Atlantic are correlated to prey variation (Stevick et al., 2006). The minimum population estimate for the Gulf of Maine stock is 823 whales (Waring et al., 2013).

Over the past decades, 13 humpback whale strandings have been recorded in Massachusetts and Rhode Island; four of the strandings were recorded in Rhode Island from 2001 to 2005, and nine were recorded in Massachusetts waters (Kenney and Vigness-Raposa, 2010; Waring et al., 2013). Records from 2006 to 2011 indicate 14 serious injuries and two mortalities (one found on Martha's Vineyard) off Massachusetts and one in Rhode Island (Waring et al., 2013; Henry et al., 2012; Cole and Henry, 2013).

Regionally, SPUE for humpback whales were highest in the Great South Channel, with sightings occurring in all four seasons. The most sightings were during the summer and fall (summer SPUE ranged from 0.1 to 360 whales per 620 miles [1,000 km] and fall SPUE ranged from 0.1 to 550 whales per 620 miles [1,000 km]) (Figure 4 in Appendix F; Right Whale Consortium, 2014). In the WEA, humpbacks were present during winter, spring, and summer throughout the WEA, with most sightings reported in the spring and summer (Right Whale Consortium, 2014). SPUE ranged from 0.1 to 40 whales per 620 miles (1,000 km) in the winter and spring and 0.1 to 100 whales per 620 miles (1,000 km) in the summer (Right Whale Consortium, 2014). Within 40 nm (74 km) of the WEA, humpback whales were sighted in all seasons, with the spring and summer SPUE ranging from 0.1 to 360 whales per 620 miles (1,000 km), and in the fall and winter SPUE ranging from 0.1 to 40 whales per 620 miles [1,000 km] (Figure 4 in Appendix F).

Humpback Whale Sightings and Acoustic Records In and Near the WEA November 2011 to October 2012

From November 2011 to October 2012, a total of 12 humpback whales were sighted on nine occasions in several locations, mostly concentrated in the southern portion of the MA WEA and WESA (Figure 4-9; Kraus et al., 2013). The sightings occurred during 3 months, April, May, and October, with most whales (nine) sighted in April (Figure 4-9; Kraus et al., 2013). Humpback whale songs, however, were detected in all 12 months, with the highest number of vocalizations recorded during January and March through May, and the lowest number recorded in November (Kraus et al., 2013). The authors suspect that some humpback whales are migrating through this area (Kraus et al., 2013).

Sperm Whales

The overall distribution of sperm whales along the U.S. east coast is centered along the shelf break and over the slope (NMFS, 2010b). An exception to this distribution pattern is found in the shallow continental shelf waters of southern New England, where relatively high numbers of sightings have been reported (Scott and Sadove, 1997). Geographic distribution of sperm whales may be linked to social structure, with females and juveniles generally found in tropical and subtropical waters, and males ranging more widely (Waring et al., 2013).

Sperm whales occurring in the western North Atlantic likely represent only a fraction of the total North Atlantic stock (Waring et al., 2013). Whether or not the northwestern Atlantic population is discrete from the northeastern population is currently unresolved (Waring et al., 2013). There is no reliable estimate of the total sperm whale abundance in the western North Atlantic; however, the best available abundance estimate is 2,288 animals, with a minimum population of 1,815 animals (NMFS, 2014). Within the Rhode Island OSAMP study area, “sperm whales are predicted to be present in all four seasons, but in scattered and low abundance” (Kenney and Vigness-Raposa, 2010). There have been no sperm whale strandings in Rhode Island in recent decades, and only two in Massachusetts (from 2001 to 2005; Kenney and Vigness-Raposa, 2010; Waring et al., 2013).

SPUE data support this information, with the highest SPUE found along the continental shelf edge and slope south of the WEA in all seasons. The highest overall SPUE in the shelf waters occurred in the summer, purportedly ranging between 2 and 10,000 whales per 620 miles (1,000 km) (Figure 5 in Appendix F; Right Whale Consortium, 2014). However, note that in Figure 5 of

Appendix F, the upper limit of 10,000 is actually an artifact (and anomalous) of the sampling procedure when a whale is sighted within a grid cell containing very low effort (in this case 328 ft [0.1 km]; and while the calculation of one whale/0.1 km x 1,000 = 10,000 whales per 620 miles [1,000 km] is correct, it should be noted that there was only one whale at this location). Within the WEA, SPUE ranged from 1 to 125 whales per 620 miles (1,000 km) in the spring, summer, and fall (Figure 5 in Appendix F; Right Whale Consortium, 2014). Within 40 nm of the WEA, sperm whales occurred in all seasons. SPUE ranged from 1 to 125 whales per 620 miles (1,000 km) in the spring, summer, and fall, and from 1 to 335 whales per 620 miles (1,000 km) in the winter (Right Whale Consortium, 2014).

Sperm Whale Sightings and Acoustic Records In and Near the WEA November 2011 to October 2012

From November 2011 to October 2012, sperm whales were sighted on three occasions; two sightings were in the MA WEA (number of whales per sighting ranged from one to five), and one was on the aerial survey area boundary (one whale approximately 2.5 miles [4 km] from the MA WEA boundary line; Figure 4-9; Kraus et al., 2013). Opportunistic detections of sperm whale vocalizations were recorded during the study period, indicating the acoustic presence of this species in the MA WESA (Kraus et al., 2013).

Conclusions from the first year of sightings and acoustic data from the MA WESA, 2011-2012

The acoustic and sightings data are, for the most part, in agreement regarding the occurrence of the most abundant large whales (right, fin, humpback, sei, sperm, and minke whales), although the acoustic data potentially show longer residence times in the area for most species. Additionally, due to the proximity of shipping traffic in the southeast region of the WESA, masking in the low frequencies (where many whales produce sounds) may result in an underrepresentation of whale calls in the MA WESA (Kraus et al., 2013). The authors suggest that since this is the first year of acoustic data ever collected for the MA WESA, these data may show more accurate use of the area by these species than aerial surveys alone (Kraus et al., 2013). In summary, all whale species known for these waters did occur, indicating this area is frequently used and may be ecologically important for these species (Kraus et al., 2013).

4.2.2.6.2 Impact Analysis of Alternative A

In the section below, impacts on marine mammals from site characterization and site assessment activities are divided into two categories. The first category includes impacts from acoustic sources (i.e., HRG surveys, geotechnical exploration, pile driving for meteorological tower installation, and vessel traffic). The second category of impacts includes all other, non-acoustic impacts (i.e., benthic habitat, vessel collision, spills, waste discharge, and accidental fuel leaks). The analysis of all impact types for site characterization and assessment is based on the overlap of project work and important ecological considerations for each species.

Acoustic Impacts

Ambient sound levels in the WEA (principally within 18 to 62 miles (30 to 100 km) of Martha's Vineyard, MA, and Nantucket, MA) may be significantly higher than those in the deep ocean as a result of relatively high levels of human and marine life activity in these coastal waters (Normandeau Associates Inc., 2012). Marine mammals and many other marine organisms depend on sound to communicate information with conspecifics and to derive information about their environment.

The ambient acoustic environment (also called soundscape) is quantified using the frequency, magnitude, and duration of noise in the WEA, and these metrics are used to parameterize noise budgets, which are useful in determining the characteristics of the acoustic environment (Miller et al., 2008). Sound frequency is measured in Hz or kHz. Magnitude, conventionally termed spectrum density level, is measured in dB in terms of mean square pressure per unit frequency (e.g., dB re 1 $\mu Pa^2/Hz$), with sound pressure measured in µPa. The duration of a noise event typically ranges from seconds to weeks, depending on the source. The frequency of the ambient noise present in the WEA is likely in the range of 1 Hz to 100 kHz, and comprises both intermittent and continuous background noise (Cato, 1992; Wenz, 1962). The magnitude of noise in the present soundscape is likely in the range of 20 to 100 dB re 1 $\mu Pa^2/Hz$ (Cato, 1992; Wenz, 1962). The existing soundscape contains contributions from anthropogenic, physical, and biological sources.

Anthropogenic background noise in the WEA is dominated by ocean traffic, including commercial and industrial shipping, fishing vessel, and recreational boat traffic. These activities contribute to background noise levels as well as local and intermittent sound effects. Additionally, sound contributions from these sources display temporal and spatial variability, as the intensity of activities varies with weather and season. The sound from vessels is in the frequency range of 10 Hz to 10 kHz (Wenz, 1962), and the sound spectrum density level is in the range of 40 to 100 dB re 1 $\mu Pa^2/Hz$ (Cato, 1992; Wenz, 1962). Information on vessel traffic from military, commercial, and recreational activities in the lease area is provided in Section 4.2.3.8 of this EA.

Physical processes contribute to ambient sound in the WEA. Turbulent pressure fluctuations resulting from surface waves and water motions dominate the ambient noise at frequencies of 1 to 10 Hz (Normandeau Associates Inc., 2012). Noise from surface agitation (e.g., bubbles, spray) contributes to the ambient soundscape at frequencies above 100 Hz and is weather dependent, with the spectrum density level increasing as sea state increases (Wenz, 1962). Intermittent noise resulting from precipitation events would contribute frequencies in the range of 100 Hz to 20 kHz, with heavy precipitation contributing a spectrum density level of approximately 80 dB re 1 $\mu Pa^2/Hz$ (Wenz, 1962). Noise contributions from sediment transport would have an expected frequency of approximately 10 kHz, and the molecular agitation created by moving water molecules may produce frequencies of about 50 kHz (Mellen, 1952).

Biological noise in the existing soundscape contains contributions from marine mammals, fish, and invertebrates. The sound generated from biological sources is in the frequency range of around 10 Hz to greater than 100 kHz, with magnitudes of 50 to 90 dB re 1 $\mu Pa^2/Hz$ (Cato, 1992; Wenz, 1962). Contributions from marine mammals may be intermittent, as these species display temporal variability in occurrence within the WEA (see Section 4.3.2.6). The soundscape also includes vocalizations from fish species, particularly from the cod (Gadidae) and drum and croaker (Sciaenidae) families (Kaatz, 2002). Sounds produced by fish result from breeding, fighting, feeding, and swimming behaviors (Normandeau Associates Inc., 2012). Contributions to the ambient noise levels from biological sources fluctuate throughout the year as a result of the seasonality of noise-producing behaviors. There are potential ambient sound contributions from invertebrates within the WEA, especially from arthropods, mollusks, and echinoderms (Normandeau Associates Inc., 2012). As with other biological sound sources, the contribution to the soundscape from invertebrates varies temporally and spatially with the distribution and density of each species.

Ambient Noise Measurements Recorded from November 2011 to October 2012 in the MA WESA

Ocean ambient noise (including environmental, biological, and anthropogenic sound) measurements are now being calculated in different ecosystems to evaluate how marine animals may be affected by environmental and anthropogenic processes (Ellison et al., 2011). Kraus et al. (2013) provide results from continuous ambient noise measurements from the six MARUs in the WEA from 9 November, 2011 through 3 October, 2012. For a map of the MARU locations see Figure 4-11. Markedly louder ambient noise levels were recorded at M05 and M06, which are on the southern border of the WEA (closest to the Ambrose-Nantucket TSS), with similar levels of approximately 110 dB each (Kraus et al., 2013). Ambient sound levels at the two most northerly MARUs (M01 and M02) closest to shore, measured at similar levels of approximately 94 dB, and the two MARUs between the northern and southern pairs (M03 and M04) measured at intermediate levels of approximately 100 dB (Kraus et al., 2013).

Site characterization activities under Alternative A are likely to produce both intermittent noise (e.g., geotechnical exploration) and nearly continuous noise (e.g., sonar, vessel operation) during the work day. Survey durations would range from days to weeks within each of the OCS blocks. Additionally, sound generated by high-energy activities related to site assessment, such as pile driving, could produce noise pulses that would affect marine life. Changes to the pre-existing soundscape can be reasonably expected from site characterization surveys and the development and operation of meteorological and oceanographic data collection facilities, although the magnitude of the effects will be dependent on the type and duration of such activities. The site characterization methods for Alternative A include HRG, geotechnical, and biological surveys. Additionally, for site assessment, the installation of meteorological towers and foundations and deployment of meteorological buoys would require methods that would produce sound at higher levels than pre-existing levels. Vessel noise in the WEA would also be increased because of the traffic generated for survey and tower installation activities.

Underwater sound from Alternative A can be divided into two categories relevant to marine organisms (e.g., marine mammals, sea turtles, fish): (1) impulsive and (2) non-impulsive (Table 4-15). Impulsive noise can be a single pulse (single pile strike, single ping of certain sonars) or multiple pulses (sequential pile strikes). Impulsive noises are brief, broadband, atonal, and transient, with a rapid rise from ambient pressure to a maximal pressure followed by oscillating maximal and minimal pressures (Southall et al., 2007). Pile-driving noise is low frequency with a high source level, and low frequency sources tend to have a long propagation range . However, propagation is variable depending on multiple factors, including water temperature, water depth, and bottom type (Hildebrand, 2009).

Table 4-15

Summary of Noise Sources from Site Characterization and Assessment Work

Sound Source	Sound Type	Frequency	Source Level	Reference
Survey work, sonar	Non-impulsive	Narrowband	Generally 202–220 with a maximum of 242 dB re 1 µPa/m	NSF and USGS, 2011
Survey work, sonar	Impulsive (boomer)	0.2-16 kHz	212	BOEM, 2014
Pile driving	Impulsive (multiple pulse)	Broadband 20 Hz to > 20 kHz	>200 dB re 1 µPa RMS	Madsen et al., 2006a
Vessel noise	Continuous	Low frequency, 10–1,000 Hz	150–180 dB re 1 µPa/m	MMS, 2007a
Tug boat	Continuous	100–500 Hz	140–170 dB re 1 µPa/m	Shell U.K. Limited, 2012
Dynamic positioning Vessel[1]	Continuous	500–1,000 Hz	170–180 dB re 1 µPa/m	Shell U.K. Limited, 2012

[1]Source levels are during use of bow thrusters, not transit.

Hz = hertz, kHz = kilohertz, dB re 1 µPa/m = source level, received level measured or estimated 1 m from the source.

Noise model results from areas off Delaware and New Jersey and in Nantucket Sound for pile driving associated with offshore construction have been submitted to BOEM for previous lease applications and plans (BOEM, 2012a). These results indicate that underwater noise levels produced from pile driving may be greater than 180 dB re 1 µPa RMS at 1,640 to 3,280 ft (500 to 1,000 m) from the source, and more than 160 dB re 1 µPa RMS at 2.1 to 4.5 miles (3.4 to 7.2 km) from the source. However, the local environmental characteristics, sources of sound, and monopole diameters are variable, causing the isopleths to vary. Non-impulsive (continuous or intermittent) sound can be tonal, broadband, or both. Some non-impulsive sounds can be transient signals of short duration but without the rapid rise time (i.e., vessels and many active sonar systems). Although sonar sound is a “tone pulse,” it is considered non-impulsive because it is often narrowband (any sound that is a tone, rather than broadband; NSF and USGS, 2011). Non-impulsive sounds can have very long durations and can be received (audible) at a distance of tens of kilometers (Southall et al., 2007).

Source level of noise refers to the level of noise produced from the emitting source (i.e., vessel or pile strike), and received level of noise refers to the measurement of noise that the animal receives (accounting for noise propagation, attenuation, and distance of the animal from the noise source).

Hearing in Marine Mammals

Marine mammals use sound for many important biological functions, including foraging, orientation, response to predators, and social interactions (Southall et al., 2007). The impacts from noise and interference with these functions can cause a variety of responses ranging from mild behavioral changes to physical injury. Impacts on marine mammals from anthropogenic noise are dependent on multiple factors, including characteristics of the local acoustic environment (i.e., water depth and bottom type), novelty of sound to the animal, the individual animal's hearing sensitivity, and the animal's activity during the noise emission (NSF and USGS, 2011). Marine mammals may be affected if the frequencies of sound from project activities are generally similar to, or overlap, the frequency range of hearing for the animal exposed to the sound, and/or the SPLs are high enough for a sufficient duration (NSF and USGS, 2011).

To best analyze acoustic impacts on marine mammals, Southall et al. (2007) divided marine mammals into groups according to their hearing ranges (Table 4-16). For more details on underwater hearing and sound production for each species, summary tables for mysticetes, odontocetes, and seals are available in the *Final Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey* (NSF and USGS, 2011).

Table 4-16

Marine Mammal Hearing Group and Hearing Range for Those Species in the WEA

Marine Mammal Hearing Group	Species in WEA	Hearing Range
Low-frequency mysticetes	North Atlantic right, blue, fin, sei, humpback, minke whales	7 Hz to 22 kHz
Mid-frequency odontocetes	Sperm whales, dolphins, pilot whales, beaked whales, killer whales, northern bottlenose whales	150 Hz to 160 kHz
High-frequency odontocetes	Harbor porpoise, dwarf sperm whales, pygmy sperm whales	200 Hz to 180 kHz
Seals in water	Harbor, gray, harp, and hooded seals	75 Hz to 75 kHz
Seals in air (hauled out)	Harbor, gray, harp, and hooded seals	75 Hz to 30 kHz

Southall et al., 2007. Hz = hertz; kHz = kilohertz.

Current Noise Criteria for Behavioral Disturbance and Potential Injury

Auditory masking is defined as obscuring of sounds of interest by interfering sounds, generally at the same or similar frequency. Although not considered injurious, masking may nonetheless cause significant behavioral changes to exposed marine mammals. Two different levels of potential injury to marine mammal hearing sensitivity have also been defined: (1) Temporary Threshold Shift (TTS) is a non-permanent decrease in hearing sensitivity; (2) physical injury, or Permanent Threshold Shift (PTS) is a permanent decrease in hearing sensitivity.

Current NMFS criteria for determining impacts on marine mammals are based on the following received levels (not source levels): 1) behavioral disturbance or harassment from a *continuous* source of sound 120 dB re 1 µPa, 2) behavioral disturbance from a *non-continuous* source of 160 dB re 1 µPa, and 3) potential injury from received levels of 180 dB re 1 µPa. Additionally, Southall et al. (2007) have proposed and recommended the use of sound exposure level (SEL) to measure potential risks to marine mammals (Table 4-17). SEL is a cumulative measurement over the duration of a sound, measured as decibels referenced at 1 microPascal squared per meter (i.e., dB re 1 $\mu Pa^2/m$). This metric is the most useful for risk analysis because measurements for impulsive sound are cumulative (across pulse), and SEL characterizes sounds of different durations as total energy (Southall et al., 2007). However, because of differences in how the units are measured, the SEL threshold criterion for TTS of 183 dB re 1 $\mu Pa^2/m$ is not directly comparable to the NMFS criterion of 180 dB RMS (received level, single pulse; Southall et al., 2007). Measurements are not always available in SEL units, but may also be referred to (among other units of sound) in units of peak sound pressure and peak-to-peak sound pressure. Peak sound pressure is the maximum absolute value of instantaneous pressure during a specified time; peak-to-peak sound pressure is the algebraic difference between the maximum positive and maximum negative instantaneous peak pressure. NOAA is in the process of updating the criteria for assessing the effects of anthropogenic noise on marine mammals, and the report is currently in the draft phase awaiting public comment.

Table 4-17

Summary of Proposed Peak Pressure and Weighted SEL Threshold Criteria for Physical Injury (PTS)

	Sound Type	
	Multiple Pulse (Impulsive)	**[1]Non-Pulse/Continuous**
Cetaceans		
Low-Frequency Cetaceans		
Peak SPL	230 dB re 1 µPa (peak)	[1]230 dB re 1 µPa (peak)
SEL	187 dB re 1 μPa^2 –sec	198 dB re 1 μPa^2 –sec

	Sound Type	
	Multiple Pulse (Impulsive)	**[1]Non-Pulse/Continuous**
Mid-Frequency Cetaceans		
Peak SPL	230 dB re 1 µPa (peak)	[1]230 dB re 1 µPa (peak)
SEL	187 dB re 1 µPa^2 –sec	198 dB re 1 µPa^2 –sec
High-Frequency Cetacean		
Peak SPL	201 dB re 1 µPa (peak)	[1]230 dB re 1 µPa (peak)
Weighted SEL	161 dB re 1 µPa^2 –sec	172 dB re 1 µPa^2 –sec
Seals (in water)		
Peak SPL	218 dB re 1 µPa (peak)	218 dB re 1 µPa (peak)
SEL	192 dB re 1 µPa^2 –sec	197 dB re 1 µPa^2 –sec

Source: Southall et al., 2007; Finneran and Jenkins, 2012.
[1]Finneran and Jenkins (2012) do not provide peak SPL for continuous noise; SEL is used, rather than sound pressure level (SPL), because SEL includes the effect of the exposure duration, which is a key factor is the likelihood that a noise exposure will produce TTS/PTS (Finneran and Jenkins, 2012). Peak SPL are provided from Southall et al., 2007.

dB re 1 µPa (peak) = the maximum absolute value of instantaneous pressure during a specified time.

dB re 1 µPa^2 –sec = cumulative sum-of-square pressures over the duration of a sound.

Impacts of sound on marine mammals from site assessment and site characterization activities include the following activity and equipment types: site surveys (including single and multibeam depth sounders, multibeam and side-scan sonar, magnetometers, and shallow- [CHIRPs] and medium-penetration [boomers] sub-bottom profilers), pile driving, and vessel traffic noise. Each of the survey instrument types produce different sound sources depending on manufacturer and model, resulting in variable ranges of sound produced. Impacts from each of these activities are assessed by identifying similar or overlapping acoustic characteristics for each hearing group with those of the acoustic sources generated by the project activity.

HRG Survey Acoustic Effects

Details of HRG surveys for the proposed action are described in Section 3.1.3.1, and the typical (i.e., expected) noise contribution to the pre-existing soundscape from each HRG survey method is shown in Table 3-3. The increase in both instantaneous and cumulative background noise in the WEA would be directly proportional to the duration of HRG surveys, currently estimated at 1,500 vessel round trips (14,250 hours) to survey the entire WEA, non-inclusive of vessel transit to/from survey locations. Vessel speeds during survey operations would be relatively low (approximately 7 to 9 km/hour), but would likely be higher during transit to and from the lease block areas. The spatial extent of the noise contribution for HRG surveys would be proportional to the area covered by such surveys, and attenuation of noise away from the source vessel would be influenced by local weather (sea state), oceanographic characteristics or features, and geological attributes of the seafloor. Digital dual-frequency side-scan sonar systems in the 100 to 900 kHz range would increase high frequency noise compared to the assumed pre-existing soundscape. These frequencies are outside the hearing range of baleen whales (mysticetes) and seals, but are within the hearing limits of toothed whales (odontocetes; both mid- and high-frequency cetaceans) (see Table 4-16).

Sub-bottom profiling of the WEA using CHIRP systems would introduce sound frequencies of 3.5 kHz, 12 kHz, and 200 kHz at an estimated broadband source level of 222 dB re 1 µPa at 3.3 ft (1 m) from the source. Although the sound frequencies produced by CHIRP sampling systems are within the expected pre-existing soundscape, the sound pressure produced by these systems may exceed ambient levels. The attenuation of sound pressure from the source would vary depending on the CHIRP system used and sampling site conditions. When calculated using the short pulse duration (received level) of the source, the 180 dB radius for the CHIRP sub-bottom profiler is 85 to 115 ft (26 to 35 m) and the 160 dB radius is 787 to 2,260 ft (240 to 689 m) from the source (BOEM, 2014). Medium penetration sub-bottom profiling using boomers (impulse type) is expected to produce sound frequencies in the range of 200 Hz to 16 kHz at an estimated broadband source level of 212 dB re 1 µPa RMS at 3.3 ft (1 m). The sound frequency used by boomers would be within the range of the pre-existing soundscape, while the SPL produced using boomer systems would exceed pre-existing SPLs. CHIRP and boomer sub-bottom profiling would not likely be done by the same vessel (it is an either/or scenario between sub-bottom profiling types). BOEM assumes that sub-bottom profiling systems will increase noise above ambient levels during their use. The impact potential of active sonar (multibeam echosounders, side-scan sonar, and sub-bottom profilers) depends on several factors, including type and model of equipment, power output (source level, dB), beam width, duty cycle of the device (percentage of time the source is emitting sound), frequency of sound, and the particular sound transmission characteristics of the local marine environment (NSF and USGS, 2011). The potential for impact also depends on the animal’s distance from and position relative to the sonar beam, the received level of sound, and the animal’s hearing frequency range and activity during the production of noise (NSF and USGS, 2011).

As shown in Table 4-18, boomer and CHIRP sub-bottom profiler operating frequencies overlap with the hearing frequency ranges for all marine mammal hearing groups (Table 4-16), and are thus audible to all marine mammals (BOEM, 2014). Side-scan sonar overlaps with hearing frequencies only for odontocetes, while frequency level for multibeam depth sounders is above the frequency hearing range for all marine mammals, and thus would not be audible (BOEM, 2014). Peak source levels for these instruments reach high levels, ranging from 212 to 226 dB re 1 µPa at 3.3 ft (1 m). The SOCs in Appendix B, including monitoring of an exclusion zone of 656 ft (200 m) for all marine mammals, are designed to decrease the potential for any animals to incur injury, i.e., PTS (180 dB).

Sound propagation modeling for acoustic sources used during HRG surveys was conducted and described in Appendix D of the *Atlantic OCS Proposed Geologic and Geophysical Activities Mid-Atlantic and South Atlantic Planning Areas Final Programmatic Environmental Impact Statement* (BOEM, 2014). Based on peak source levels for each electromechanical source, the 180 dB radii are estimated to be within the 656 ft (200 m) exclusion zone, and therefore no physical injuries are expected for marine mammals in the area (Table 4-18). The separation distance of 1,640 ft (500 m) for right whales includes the 160 dB isopleth for all electromechanical sources except potentially CHIRP sub-bottom profilers, which may exceed the separation distance in shallow water (Table 4-18). In the unlikely event that right whales are within 1,640 ft (500 m) of HRG survey activities, received levels of 160 dB may cause behavioral changes or harassment, but are not expected to cause injury to the whales.

Table 4-18

Summary of Potential Acoustic Impacts During HRG Surveys

Survey Method	Peak Source Level (dB re 1 µPa at 1 m)	Operating Frequency within Cetacean Hearing Range (Y=yes; N=no)	Hearing Group with Frequency Overlap	Radial Distance[2] to 180 dB (RMS) Isopleth from Single Pulse (m)	Radial Distance[2] to 160 dB (RMS) Isopleth from Single Pulse (m)
Boomer	212	Y (0.2–16 kHz)	Mysticetes,[1] Odontocetes, Pinnipeds	<5	16
Side-scan sonar	226	Y (100 kHz) N (400 kHz)	Odontocetes	65–96	337–450
CHIRP sub-bottom profiler	222	Y (3.5 kHz, 12 kHz) N (200 kHz)	Mysticetes, Odontocetes, Seals	26–35	240–689
Multibeam depth sounder	213	N (240 kHz)		<5	12

Source: BOEM, 2014

Gray shaded cell indicates potential for sound level to exceed harassment level of 160 dB beyond the exclusion zone.

[1]Mysticetes = low-frequency hearing group; Odontocetes = mid-frequency and high-frequency hearing group.

[2]Radial distances represent recalculated values to account for short pulse duration.

dB re 1 µPa at 1 m = source level, received level measured or estimated 1 m from the source

dB (RMS) = sound pressure level, decibel measurements of the average of the squared pressure (RMS = root mean square) over some duration

kHz = kilohertz

A study on right whales' reactions to alarm and vessel noise indicated that artificial alarm signals (made specifically for the study) consisting of tonal down sweeps elicited a strong behavioral reaction from right whales (Nowacek et al., 2004). These alarm signal SPLs were as low as 130 to 150 dB re 1 µPa, with frequency levels that overlap those in boomers and CHIRP sub-bottom profilers. Ten whales were tagged to record received sound and measure movement in three dimensions during sound exposure. Five of the six exposed whales reacted strongly (i.e., stopped foraging and swam rapidly to the surface; Nowacek et al., 2004). These whales remained at or near the surface for the duration of the exposure (an abnormally long surface time), which most likely increased their risk of ship strike (Nowacek et al., 2004). The sixth whale showed no detectable response. In addition to the increased strike risk, there is a negative energetic consequence for the whales responding the way the first five did, both by losing foraging time and expending extra energy during the high-powered ascent and subsurface swimming (Nowacek et al., 2004). Because five of six whales responded with the same, relatively extreme manner to a low received level, the cause for alarm is clearly not the sound level. Instead, this study suggests that the novelty or specific type/characteristics of the sound were *interpreted* as alarming (Nowacek et al., 2004).

A recent study indicates that in some cases, sound sources at lower received levels than those potentially causing injuries (i.e., 120 dB re 1 μPa) at lower frequency levels, including 12 kHz, have the potential to cause unusual behavioral reactions, which can make animals leave the ensonified area to a potentially more dangerous area or situation (Southall et al., 2013). These behavioral reactions can occur up to 18.6 to 21.7 miles (30 to 35 km) from the sound source (Southall et al., 2013). In May and June 2008, approximately 100 melon-headed whales stranded in the Loza Lagoon system in northwest Madagascar. An Independent Scientific Review Panel (ISRP) began a formalized process to investigate the cause of the stranding several years after the event (Southall et al., 2013). The ISRP systematically excluded or deemed highly unlikely all but one potential reason for the stranding: the use of a high-power 12 kHz multibeam echosounder operating intermittently (during transmission and calibration) by a survey vessel moving along the shelf break the day before the stranding event. The ISRP concluded that the use of a 12 kHz multibeam echosounder in a directed manner parallel to shore may have trapped the animals between the sound and shore, and this appeared to be the most likely initial behavioral trigger causing the whales to enter unfamiliar (and extralimital) lagoon waters. This entrapment, as well as a variety of secondary factors, potentially resulted in the mass stranding and mortalities (Southall et al., 2013; BOEM, 2013).

Table 4-18 summarizes the frequency levels for various equipment that could be used during HRG surveys. As mentioned above, frequency levels for multibeam echosounders (240 kHz) would be expected to be above the hearing range for all marine mammals, and would thus not be expected to have any impacts. However, some of the other equipment, boomers (frequency of 0.2 to 16 kHz, impulsive sound) and CHIRP sub-bottom profilers (3.5 kHz; 12 kHz, non-impulsive sound) would be audible to all marine mammals including mysticetes, odontocetes, and pinnipeds, particularly if the ambient noise levels are similar to those recorded by the MARUs in November 2011 to October 2012.

Southall et al. (2013) suggest that adverse behavioral impacts to marine mammals from HRG surveys could occur under some situations. The potential for behavioral impacts is highest for harbor porpoise (due to their ability to hear high frequencies), although endangered whale species may also be affected. Nowacek et al. (2013) suggest that the critical elements of a robust mitigation and monitoring plan include integrated acoustic and visual monitoring during operations.

The SOCs in Appendix B are designed to prevent or reduce any possible impacts to protected species from HRG sound sources, considering the scope and duration of the surveys. The SOC requirement of a 1,640 ft (500 m) separation distance for right whales will encompass the 160 dB isopleth for a majority of survey equipment within which harassment may occur. The 656 ft (200 m) exclusion zone for all marine mammals will encompass the 180 dB isopleth, providing protection from physical injuries.

The distance to Level B harassment levels (160 dB) ranges from 0.22 to 1.3 miles (359 to 2,138 m), depending on the type of HRG equipment being used. Taking into account the SOCs that will be implemented (see Appendix B), effects on whale behavior are generally expected to be temporary disruption of normal behaviors (foraging, migrating, resting) while they move to avoid the area around the HRG survey, and changes in vocalizations due to masking from the additional background noise. As whales are mobile species, they have the ability to move away from the sound should disturbance occur. This displacement may limit access to favorable habitat for foraging and other activities. It is expected that areas avoided by whales during noise producing activity would be available and used by whales after the survey had left the area. Once an area has been surveyed, it is not likely that it will be surveyed again, therefore reducing the likelihood of repeated HRG-related impacts within the survey area. Thus, the exposure to noise that equates to Level B harassment is expected to be temporary.

Geotechnical Exploration Acoustic Effects

Samples to characterize bottom surface composition (<9.8 ft [3 m] below seafloor) would be collected using methods such as piston or gravity coring, grab sampling, and dredging. These geotechnical exploration surveys do not use high-energy sound sources; therefore, the mechanical surveys themselves would have minimal, if any, impact on the soundscape. Noise generation related to bottom surface sampling would result from stationary vessel engine noise for maintaining position while samples are taken, and noise from generators and hydraulics necessary to operate (e.g., raise, lower) sampling equipment. The cumulative vessel noise generated would be dependent on the time necessary for sufficient sample collection.

Geotechnical exploration can be conducted using Vibracoring, deep boring, or CPT techniques. If one or more of the geotechnical exploration techniques proposed for Alternative A is used, a maximum of 2,700 geotechnical samples (one sample per nm) could be collected for site characterization studies. The shallow bottom sampling methods do not produce high-energy sound (see Section 3.1.3.2). Vibracore sampling would likely produce sound frequencies in the 10 Hz to 10 kHz range, which is within the frequency range of the pre-existing ambient soundscape (Reiser et al., 2011). This indicates that any alteration to the soundscape from Vibracore sampling would be related to total sound pressure rather than the introduction of new frequencies. Measurements taken in the Chukchi and Beaufort Seas during Vibracore sampling were as follows: a source level of 187.4 dB re 1 µPa at 3.3 ft (1 m), and the received RMS SPLs and corresponding distances to threshold levels; 160 dB re 1 µPa at 226 ft (69 m), 140 dB re 1 µPa at 4,921 ft (1,500 m), and 120 dB re 1 µPa at 18.6 mi (30,000 m) (Reiser et al., 2011). The time that the coring equipment is on the sea bottom would be approximately 5 to 15 minutes, with correspondingly short-duration broadband noise. Deep geologic borings can be expected to produce sound levels in the range of 118 to 145 dB at a frequency of 120 Hz.

The noise produced during Vibracoring would also include vessel noise (approximately 45 ft [13.7 m] vessel). During vessel positioning, prior to boring, noise may be produced from a jack-up barge, four-point anchoring system, or dynamic positioning. During sampling using the CPT method, noise produced may include a medium vessel, jack-up barge, barge with four-point anchoring system, or dynamic positioning. Geotechnical exploration vessels, dynamic positioning vessels, and support vessels, may all produce noise levels ranging from 150 to 180 dB re 1 µPa/m (Table 4-15). Noise levels from these project vessels may remain above the 120 dB level up to several kilometers from the source (NMFS, 2010d). As described in Section 4.2.3.8 of this EA, vessel traffic in this area is relatively high; marine mammals are presumably habituated to this noise. In a recent Biological Opinion for the Neptune Deepwater Port in Massachusetts Bay, NMFS (2010d) considered sound levels above 120 dB (the continuous noise threshold used to determine harassment under the MMPA) to constitute a take for North Atlantic right whales, humpback whales, fin whales, and sei whales. However, NMFS determined that this would be a permittable action, stating that “while whales may experience temporary impairment of behavior patterns, no significant impairment resulting in injury (i.e., ‘harm’) is likely” (NMFS, 2010d).

Noise would be produced from borehole drilling in addition to the vessels, both continuous sounds for which the NMFS threshold for harassment is at the 120 dB level. Previous noise estimates submitted to BOEM for borehole drilling ranged from 118 to 145 dB at 120 Hz frequency, with indications that the sound would attenuate to below 120 dB at 492 ft (150 m) from the source (NMFS, 2009e). Noise generated by drilling is not likely to negatively affect any marine mammals in the area because the distance of attenuation to 120 dB is less than the zone of exclusion.

Sound produced during geotechnical exploration and the increase in vessel traffic may also cause behavioral disturbance to marine mammals in the WEA, potentially causing some animals to leave the area during the work period. The species most at risk from this activity is the right whale because of potential loss of feeding habitat (from avoidance of vessels, not from sea floor disturbance) and an increased risk of vessel strike during transit to and from the WEA when vessel speeds may be relatively high. The Vessel Strike Avoidance Measures outlined in Appendix B, and visual monitoring of the 1,640 ft (500 m) radius separation distance for right whales, 328 ft (100 m) radius for all non-delphinoid cetaceans, and 164 ft (50 m) radius for delphinoid cetaceans, are expected to minimize impacts during vessel transit and drilling during geotechnical exploration.

Meteorological Tower Pile-Driving Acoustic Effects

The installation of meteorological towers under Alternative A is assumed to require impact pile-driving for foundation placement (see Section 3.1.4.1). Pile driving uses high-energy sources that can produce high sound pressure in excess of 200 dB re 1 μPa/m and broadband frequencies ranging from 20 Hz to >20 kHz to drive foundation piles into the sea floor (Madsen et al., 2006a; Thomsen et al., 2006), and can, therefore, be expected to generate more noise than pre-construction ambient sound levels. Increased vessel traffic and continuous presence in the WEA would be required for transportation of equipment to meteorological tower and buoy installation sites, as well as onsite operation of vessels during installation and maintenance. Approximately 900 hours of onsite vessel time would be required per meteorological tower installation (Table 3-5), although the intensity of vessel operation onsite would depend on the work required. Although vessel noise would be in the frequency range assumed for pre-existing ambient levels, any stationary vessel operation at a construction site would increase the cumulative sound for the duration of the operation. This noise increase would be directly proportional to the number of vessels operating onsite at a given time.

Pile driving is an activity with great potential for adverse impacts to marine mammals (Madsen et al., 2006a). A study of wind turbine noise on harbor porpoises, bottlenose dolphins, harbor seals, and North Atlantic right whales indicated that "pile-driving sounds are audible to these marine mammals at very long ranges of more than 100 km, and possibly up to more than a thousand kilometers" Madsen et al. (2006a). The frequency range for pile-driving sound overlaps with the hearing frequency for all marine mammals, and thus would be audible to all hearing groups up to 9 to 31 miles (15 to 50 km) (Carstensen et al., 2006; Tougaard et al., 2008), and potentially causing TTS or PTS within 328 ft (100 m) (Bailey et al., 2010). Lower levels of noise from pile driving could interfere with foraging or social behavior, potentially leading to avoidance of a preferred habitat (Bailey et al., 2010).

Pile-driving noise levels depend on multiple factors, such as the size and type of hammer and monopole, and the properties of the sea floor. Acoustic impacts for marine mammals from pile-driving operations depend on the source level, the transmission-loss properties of the habitat, and the hearing abilities of the animal (Madsen et al., 2006a). A summary table of known and anticipated effects of seismic and other noise can be found in the *Atlantic OCS Proposed Geologic and Geophysical Activities Mid-Atlantic and South Atlantic Planning Areas Final Programmatic Environmental Impact Statement* (BOEM, 2014) and the *Final Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey* (NSF and USGS, 2011).

In Alternative A, each leasehold area may contain from zero to one meteorological tower (with a total of up to five meteorological towers for the entire WEA), and one to two meteorological buoys (total of up to 10 buoys for the WEA). If each pile would take a maximum of 8 hours to place, and assuming the maximum of four piles per tower, the total duration of pile-driving sound generated would be a maximum of 32 hours per tower. Thus, a maximum of 4 days per tower and 20 days of pile driving and associated acoustic effects could be expected for the WEA.

Mysticetes

Information on the response of mysticetes to pile driving is not available. However, airguns, which produce a similar type of sound as pile driving, have been studied, and these studies provide an indication of the impacts. In general, mysticetes (blue, fin, sei, and minke whales) tend to avoid seismic sounds from airguns by remaining significantly farther from the sound source during seismic activity than non-seismic periods (Stone and Tasker, 2006). However, behavioral reactions appear to be dependent on the activity of the whale. Migrating bowhead whales (which belong to the same family as right whales) showed significant behavioral disturbance, avoidance out to a distance of 11 to 16 nm (20 to 30 km) from a medium-sized airgun with multiple pulses at received levels of approximately 120 to 130 dB re 1 μPa RMS (Southall et al., 2007). During foraging in the summer, bowhead whales were not as sensitive to seismic sounds and typically began to show avoidance at received levels of 160 to 170 dB re 1 μPa RMS, presumably because of the higher energetic cost to stop foraging (NSF and USGS, 2011). Assuming the right whale responds the same way as its congener, the bowhead whale, right whales would be at greater risk of exposure from these sound types and levels while feeding. For all other low-frequency cetaceans (including bowhead whales not migrating), the onset of behavioral reaction was around 150 to 160 dB re 1 μPa (Southall et al., 2007).

The potential risk of exposure from pile driving or temporary avoidance of critical habitat depends on several factors, including the species and time of year. According to the SPUE data, spring was the only season in which at least one sighting of all mysticete species was recorded within the WEA. Only fin whales appear to occur in the WEA during the fall and winter, and humpbacks occur during the winter (Kraus et al., 2013). The time of year in which right whales are expected to be present in the WEA in the highest numbers, and thus be at the highest risk of acoustic impacts from pile driving, would be primarily during the late winter and spring. BOEM has implemented the most conservative protective measures for all ESA-listed species by prohibiting pile-driving operations from November 1 through April 30, thus avoiding the period when most species are present in the WEA. Under the proposed action, the mysticete species that may be affected by pile-driving noise are right whales in the fall and early summer, fin and humpback whales in the summer, fin whales in the fall, and minke whales in the summer. However, exposure of mysticetes to high levels of pile-driving noise from May 1 to October 31 will be minimized by the required monitoring of an exclusion zone of 3,281 ft (1,000 m) for all marine mammals, and by the "soft start" method to warn animals away from the vicinity.

Odontocetes

The frequency range for pile driving overlaps the frequency hearing range for all odontocetes, and pile-driving noise would therefore be audible. However, the limited data on effects of multiple pulse noise, such as pile driving, on mid-frequency cetaceans indicate variable reactions between and within species (Southall et al., 2007). For example, in certain conditions, multiple pulses at low received levels of 80 to 90 dB re 1 µPa caused sperm whales to stop vocalizing (Southall et al., 2007). In other cases with slightly different stimuli, received levels of 120 to 180 dB re 1 µPa elicited no observable reaction (Southall et al., 2007). According to Barkaszi et al. (2012), during seismic activities, sperm whales nearest to the seismic activity appeared to exhibit more surface behavior than those farther away.

Bailey et al. (2010) predicted the following sound levels and distances from pile-driving activities for which behavior reactions are expected: 1) bottlenose dolphins at an SPL of 140 dB re 1 µPa = 31-mile (50 km) range; and 2) harbor porpoise at an SPL of 90 to 155 dB re 1 µPa = 12- to 43-mile (20 to 70 km) range. Pile driving would be capable of masking strong vocalizations by bottlenose dolphins within 6.2 to 9.3 miles (10 to 15 km), and weak vocalizations up to 25 miles (40 km). In a study to determine physiological responses to similar exposures, Romano et al. (2004) observed significant differences in aldosterone and monocyte counts in dolphins with exposures ranging from 213 to 226 dB re 1 µPa (peak-to-peak). Aldosterone is one of the primary stress hormones in cetaceans and may be a more sensitive indicator to stress than cortisol (Romano et al., 2004).

Sperm whales are known to occur in the WEA during the spring, summer, and fall; however, because pile-driving would occur only in summer and fall, the potential risk of noise exposure from pile driving would decrease for sperm whales in the spring. In general, the season in which most other odontocetes are expected to occur in the WEA is the spring, with only the short-beaked common dolphin, bottlenose dolphin, and harbor porpoise expected to occur in the WEA in the winter. The seasonal restriction on pile driving (from November 1 to April 31) eliminates impacts from pile-driving noise on marine mammals during this time. Although impacts would be minimized by the seasonal limitation, pile-driving noise may still affect the following odontocete species known to occur in the WEA during the following seasons: sperm whale during the summer and fall; Atlantic white-sided dolphin, bottlenose dolphin, and short-beaked common dolphin during the summer and fall; Risso's dolphin and harbor porpoise during the fall; and harbor porpoise and long-finned pilot whales in the summer (Right Whale Consortium, 2014). However, exposure of odontocetes to high levels of pile-driving noise from May 1 to October 31 will be minimized by the required monitoring of an exclusion zone of 3,281 ft (1,000 m) for all marine mammals and by the "soft start" method to warn animals away from the vicinity.

Seals

The frequency range for pile driving overlaps with both the underwater and in-air frequency hearing ranges known for seals, and would, therefore, be audible underwater during pile driving. Results from studies on behavioral reactions of seals to seismic signals (including pile driving) are variable. In a study in the German Bight with peak SPLs from pile driving measuring 189 dB re 1 µPa, behavioral responses were possible up to 12.4 miles (20 km) from the source, masking was possible up to 129 miles (80 km), and hearing loss may have been a concern at 1,312 ft (400 m) for seals (Thomsen et al., 2006). In a different study, however, predicted sound levels and distance from pile-driving noise expected to elicit a behavioral response in harbor and gray seals was 143 dB re 1 µPa at 705 ft to 8.7 miles (215 m to 14 km) (Bailey et al., 2010). Additionally, pile-driving activities appear to have a significant effect on the haul-out behavior of harbor seals. Madsen et al. (2006a) reported a 10 to 60 percent reduction in the number of seals hauled-out approximately 6.2 miles (10 km) from the pile driving, compared to periods with no pile driving.

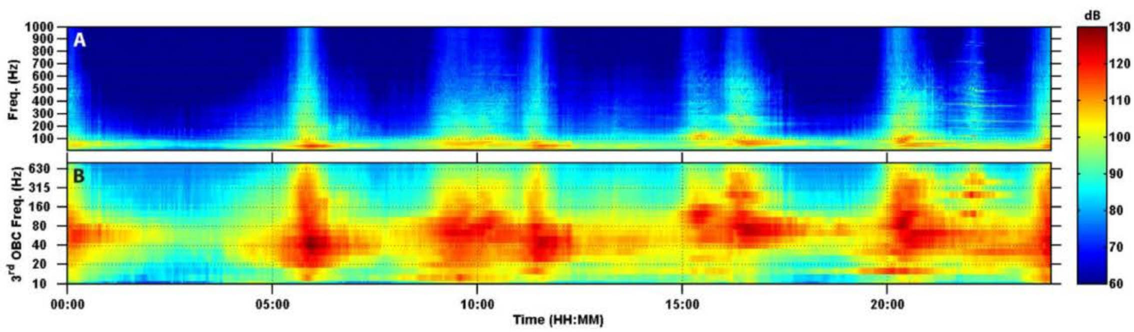
According to the SPUE data, harbor and gray seals (and likely hooded and harp seals) occur in the WEA in the spring and to a lesser extent during the winter and summer (Right Whale Consortium, 2014). The limitation of pile driving during the winter and spring would eliminate impacts during those seasons, resulting in a very small potential for exposure to pile-driving noise in the summer. SOCs including an exclusion zone of 3,281 ft (1,000 m) and the use of "soft start," are expected to minimize the likelihood of acoustic impacts from pile driving for any seals in the WEA from May 1 to October 31.

Vessel Traffic Acoustic Effects

The human activity that emits the most sound energy into the ocean is vessel noise (Weilgart, 2007). Vessel noise may have several impacts on marine mammals, including reduced communication, interference with predator/prey detection, and avoidance of habitat areas (Southall, 2005). Ship engines and vessel hulls themselves emit broadband, continuous sound, generally ranging from 150 to 180 dB re 1 µPa/m, at low frequencies below 1,000 Hz (NSF and USGS, 2011). The frequency range for vessel noise overlaps the hearing frequency range for all marine mammals. Ellison et al. (2011) suggest that there is compelling evidence that factors other than received sound level strongly affect the probability of a behavioral response. These factors include the activity state of the animals exposed, the nature and novelty of a sound, and spatial relations between sound source and receiving animals (i.e., the exposure context; Ellison et al., 2011). The authors also indicate the need for new assessment metrics that emphasize relative sound levels (i.e., ratio of signal to background noise and noise level above hearing threshold) (Ellison et al., 2011).

"The combined analysis of biological acoustic activity in relation to different anthropogenic or environmental sound levels offers the opportunity to examine how increases in noise levels may impact behavior of vocal and non-vocal species" (Kraus et al., 2013). Acoustic recordings in the MA WESA indicate that ambient noise from November 2011 to October 2012 varied temporally and spatially, and that the survey area represents a dynamic ambient noise environment with contributions from a diverse biological community of vocalizing animals and periodic anthropogenic sources of sound at varying levels of sound (Kraus et al., 2013). At times, recorded shipping events occurred simultaneously with a vocalizing whale, making the biological signal indistinguishable from the shipping noise, thus decreasing the detection probability of the call both to other whales and the MARU (Kraus et al., 2013).

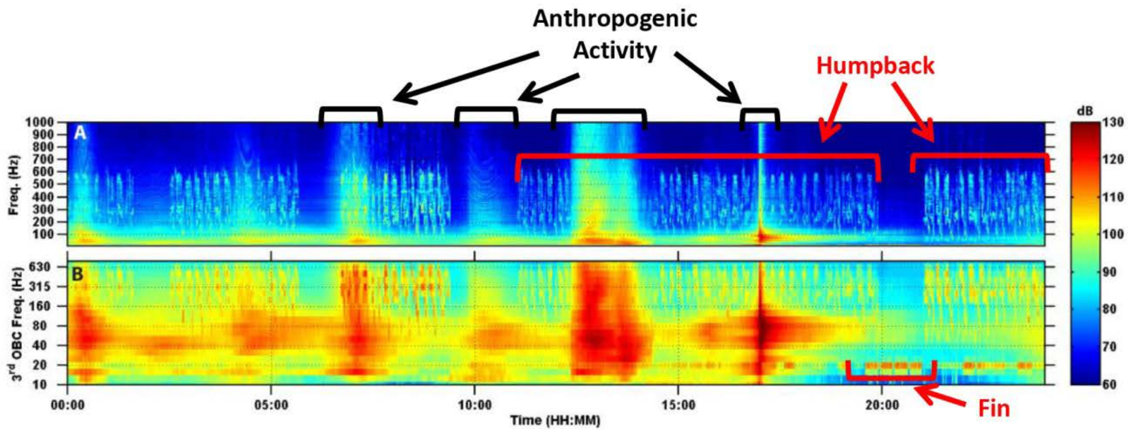
Results from the acoustic survey in the MA WEA during November 2011 to October 2012 include several spectrograms illustrating the variability in acoustic activities, with some days relatively quiet, and some days louder from shipping noise (Figure 4-13), and some days with both biological sounds (e.g., whale calls) and vessel traffic noise (Figure 4-14). In Figure 4-14, shipping noise exceeded the amplitude of the humpback song at times, preventing the humpback song from being distinguishable from the shipping noise on the spectrogram (Kraus et al., 2013). Since whales rely on acoustics for communication, navigation, and predator/prey detection (Clark et al., 2009), it is thought that masking may have significant ecological impact for these species (Kraus et al., 2013).



Source: Kraus et al., 2013

Figure 4-13. Ambient noise for a 24-hour recording period at site M06 on May 28, 2012

Figure 4-13 illustrates increased noise from anthropogenic activities such as shipping, which appear as red and yellow events in the spectrogram (Kraus et al., 2013). The top panel is a spectrogram with a 10 to 1,000 Hz linear range on the y-axis and linear time scale on the x-axis. The bottom panel has a 3rd octave frequency scale (10-708 Hz) on the y-axis and linear time scale on the x-axis.



Source: Kraus et al., 2013

Figure 4-14. Ambient noise for a 24-hour recording period at site M06 on March 14, 2012

Figure 4-14 illustrates a variety of both anthropogenic and biological acoustic events, with some overlap between the two (Kraus et al., 2013). The top panel is a spectrogram with a 10 to 1,000 Hz linear range on the y-axis and linear time scale on the x-axis. The bottom panel has a 3rd octave frequency scale (10-708 Hz) on the y-axis and linear time scale on the x-axis.

Potential acoustic impacts from vessel noise during site assessment and characterization activities will consist of vessel noise produced during vessel transit to and from ports as well as the vessel noise produced during the HRG surveys, geotechnical exploration, and construction, maintenance, and decommissioning of meteorological buoys and towers. Vessels for this project may be transiting from 10 major ports and 21 minor ports throughout a region where heavy vessel traffic already exists. To what extent the increase of up to 6,500 vessel round trips (the maximum trips anticipated for site characterization and site assessment) would add to the acoustic environment in the region is unknown.

Mysticetes

Possible effects from vessel noise are variable and can depend on species, location, a whale's activity, novelty of the noise, vessel behavior, and habitat. North Atlantic right whales are known to produce a variety of sounds with most of the energy below 1,000 Hz (Parks and Tyack, 2005) overlapping with the energy of vessel noise. In a study investigating North Atlantic right whales' reactions to shipping noise, tagged whales showed no response to playback of vessel noise and were approached to within less than 1 nm (1.85 km) by actual passing vessels (Nowacek et al., 2004). This lack of response suggests that whales are unlikely to respond to the sounds of oncoming vessels even when they hear them, thereby increasing their risk of ship strike (Nowacek et al., 2004). This is particularly a problem for whales swimming below the surface where they are less likely to be observed by mariners.

Three-dimensional propagation models of ships' acoustic signature was used to understand mysticetes acoustic-based detection of four classes of ship (cruise ships, high speed craft, catamarans, and fishing vessels; Allen et al., 2012). All four classes of ships exhibited peak broadband source levels aft (orientation >90°), and minimum broadband levels at the bow (orientation <60° at 82 ft [25 m]; Allen et al., 2012). All ships exhibited an increase of 1 to 15 (±2.8) dB in 15° broadband source levels relative to bow broadband source levels at 16 ft [5 m], while no patterns were detected from the bow to 15° at the other depths (Allen et al., 2012). These results are consistent with bow-null effect acoustic shadow zones, or in other words, lower levels of sound emitted from the bow (Allen et al., 2012). The authors conclude that this acoustic shadow effect at the bow of ships is important to mysticetes near the surface, resulting in an increased difficulty detecting and therefore avoiding oncoming ships (Allen et al., 2012). This may be particularly relevant to right whales that are feeding in the area. A study of tagged right whales indicated that feeding right whales spent the majority (mean = 84 percent, range = 62 to 98 percent) of the time just below the surface where they cannot be seen, but are vulnerable to ship strike (Parks et al., 2012).

A recent study suggests that vessel noise increases stress in right whales (Rolland et al., 2012). The reduced ship traffic in the Bay of Fundy following the events of September 11, 2001 resulted in a 6 dB (primarily below 150 Hz) noise reduction in underwater noise (Rolland et al., 2012). The noise reduction corresponded to decreased levels of glucocorticoids (stress-related fecal hormone metabolites) in right whales (Rolland et al., 2012). Additionally, estimates from data modeling and analytical methods indicated that acoustic communication space of calling right whales was reduced by 84 percent by passage of only two commercial ships over 13.2 hours (Clark et al., 2009). Communication space for singing fin and humpback whales was also decreased, but to a lesser extent because of species-specific differences in acoustic signals (Clark et al., 2009). Ellison et al. (2011) suggest that effective management requires assessment of chronic effects, such as effects on hearing over the long term and the effect of masking on communication.

As described in Section 4.2.1.3.8 of this EA, the current level of vessel traffic is relatively high in the project area, and thus whales in the area are presumably habituated to vessel noise. Although received levels of vessel noise may at times be above the continuous sound, Level B, criterion for harassment (120 dB), right whales are known to continue to feed in Cape Cod Bay and Great South Channel in spite of frequent disturbance from passing vessels (NMFS, 2007). Most of the time during site characterization and site assessment work (i.e., during the actual survey work), vessels would be traveling at reduced speeds (4 to 5 knots), which would produce lower noise levels than at higher speeds. Additionally, the Vessel Strike Avoidance Measures and Reporting for Mariners, including maintaining a distance of 1,640 ft (500 m) from right whales and 328 ft (100 m) from all other mysticetes, combined with a vigilant watch for marine mammals by vessel operators and crew at all times, will reduce the likelihood of marine mammals coming near vessels where the noise levels are the highest. Thus, the effects of project-related vessel traffic noise on mysticetes are expected to be negligible.

Odontocetes

A relatively large number of odontocetes have been observed responding to vessel noise in field and laboratory studies. Several studies suggest sperm whales within 1,476 ft (450 m) of whale-watching vessels respired significantly less frequently, had shorter surface intervals, and took longer to start clicking at the start of the dive descent compared to when vessels were absent (Gordon et al., 1992). The source level recorded was 157 dB re 1 µPa/m, with received levels of 104 dB re 1 µPa at 1,476 ft (450 m) over a bandwidth of 100 to 600 Hz (Gordon et al., 1992). Results from studies on acoustic impacts from vessel noise for odontocetes indicate that small vessels at a speed of 5 knots in shallow coastal water can reduce the communication range for bottlenose dolphins within 164 ft (50 m) of the vessel by 26 percent (Jensen et al., 2009). Pilot whales in a quieter, deep-water habitat could experience a 50 percent reduction in communication range from a similar size boat and speed (Jensen et al., 2009). Nonetheless, given current traffic levels in the region, the short-term nature of surveys, SOCs, and the Vessel Strike Avoidance measures (Appendix B), the effects of project-related vessel traffic noise on odontocetes are expected to be negligible.

Seals

The effects of non-pulse exposures (vessel noise) on pinnipeds in water are poorly understood, and studies of behavioral responses to vessel noise in pinnipeds are lacking (Southall et al., 2007). The range of frequency for hearing in seals in water (75 Hz to 75 kHz) overlaps with the frequency range for vessel noise. Studies of impacts from vessel noise on seals indicate that seals are likely to avoid vessels at 328 to 1,640 ft (100 to 500 m) (Jansen et al., 2010). Exposures to non-pulsed sound in water between 90 and 140 dB re 1 µPa generally do not appear to elicit strong behavioral responses in pinnipeds (Southall et al., 2007). In a study of harbor seals in captivity, no response was indicated from 80 to 100 dB re 1 µPa exposure, and a single avoidance behavior was recorded for exposure to sound levels of 100 to 110 dB re 1 µPa (Kastelein et al., 2009). However, in a study on the effects of human disturbances on harbor seal haul-out behavior, Lelli and Harris (2001) found that “the level of boat traffic was, by far, the single strongest predictor of harbor seal haul-out number, accounting for 27% of its variability.” In 122 days of observation, 85 incidents in which the harbor seals were flushed off their haul-out ledges were observed; of these, 93 percent were caused by boats (Lelli and Harris, 2001). Nevertheless, based on current traffic levels in the region, seals are presumably habituated to vessel noise. Also, the WEA is over 9 nm (16 km) from the nearest land (Nomans Land Island) where seals may haul out. Thus, the effects of project-related vessel traffic noise on seals are expected to be negligible.

Non-Acoustic Impacts

Benthic Habitat Effects

Impacts on benthic habitats for marine mammals are considered negligible. Short-term and temporary disturbance to the benthic community would occur during geotechnical exploration and meteorological tower/buoy installation. These activities may cause an indirect loss of a small number of benthic prey organisms for the fish species that seals and some whale species prey on (i.e., herring, sand lance, and mackerel). Meteorological tower/buoy installation would also cause re-suspension and subsequent increased turbidity, which is also expected to be temporary, and negligible for marine mammals in the WEA.

Vessel Collision Effects

Collisions with ships resulting in serious injury or death are not uncommon with cetaceans and are a significant threat to the recovery of the North Atlantic right whale (Kraus et al., 2005). The highest risk for vessel strike for right whales is most likely during the transit to and from the WEA (and specific lease blocks) because of vessel speeds above 10 knots (Vanderlaan and Taggart, 2007; Conn and Silber, 2013). The potential risk for ship strike during survey work is lower because vessel speeds range from 4 to 5 knots. Vessels transiting between the leasehold and shore at night may pose a potential strike risk to right whales. Right whales are challenging to detect visually, with their black coloration, absence of a dorsal fin and at/subsurface logging behavior, and are even less observable at night. Additionally, tagging studies indicate that feeding right whales spent the majority (mean = 84 percent, range = 62 to 98 percent) of the time just below the surface where they cannot be seen, but are vulnerable to ship strike (Parks et al., 2012).

The total number of vessel round trips over 5 years for site characterization and site assessment is estimated to be a maximum of 6,500. This would increase the vessel traffic rate in an area with existing high levels of vessel traffic by approximately 3.2 vessel roundtrips per day ([6,500 vessel roundtrips/5.5 years] x 365 days). The results of a recent study on the effectiveness of mandatory vessel speed limits for protecting North Atlantic right whales suggest the vessel speed limit rule has been effective at reducing right whale deaths (Laist, et al., 2014). The Vessel Strike Avoidance Measures (which include mandatory vessel speed limits) and Reporting for Mariners outlined in Appendix B of this report are expected to minimize the potential for ship strikes to all marine mammals.

Spills

As discussed in Section 3.2.3, the severity of an oil or fuel spill depends on the material, size, and location of the spill, as well as the current meteorological conditions. If a vessel oil spill occurred, the estimated spill size would be 123 gallons (USCG, 2012), which is relatively small, and would, therefore, contribute a negligible potential for negative impacts on marine mammals. The most likely material to be spilled from a vessel would be diesel fuel, which would be expected to dissipate rapidly in the water column, then evaporate and biodegrade within a few days (MMS, 2007b).

Discharge of Waste and Accidental Fuel Leaks

The operational waste from site characterization and assessment work, including bilge and ballast water, trash debris, and sanitary and domestic waste, would be disposed of per regulations discussed in Section 3.1.3.5. All project operators, employees, and contractors would be briefed on marine trash and debris awareness elimination as outlined in Appendix B; thus, negative impacts for marine mammals from waste discharge and accidental fuel leaks are not likely.

Meteorological Tower Decommissioning

Details regarding decommissioning the meteorological towers are described in Section 3.1.4.1. The potential effects from decommissioning work include sound and operational discharges similar to those during meteorological construction. Noise levels and vessel traffic rates are expected to be similar to meteorological tower construction, with the exception of pile driving. Piles and foundations would be removed using non-explosive methods such as mechanical cutting or high-pressure water jets at a depth of 15 ft (4.6 m) below the mudline. Noise levels associated with these methods have not been established in this region. SOCs for meteorological tower decommissioning include those outlined for construction and the Vessel Strike Avoidance Measures and Reporting for Mariners outlined in Appendix B.

4.2.2.6.3 Conclusion

The SOCs (e.g., monitoring by trained observers, exclusion zones, vessel speed restrictions, vessel strike avoidance, and prohibition periods) applicable to vessel transit, survey work (BOEM, 2013), and pile driving are expected to minimize impacts on marine mammals from site characterization and site assessment activities (see Appendix B). Most marine mammal species are present in the WEA during spring; therefore, the seasonal prohibition of pile-driving activities (no pile driving from November 1 to April 30; see Appendix B) would greatly minimize the potential effects for all species.

Reasonably foreseeable adverse impacts on marine mammals under Alternative A may still exist for the following activities under certain circumstances: 1) acoustic effects from pile-driving activities, HRG surveys, and vessel traffic and 2) increased potential for vessel strike, especially during transit to and from the WEA as a result of potential speeds above 10 knots, and/or transits at night or when visual detection is impaired. The increased potential for vessel strikes during transit will be reduced by the seasonal speed limit restrictions (10 knots or less from November 1 through July 31) contained in the Vessel Strike Avoidance Measures (Appendix B). These restrictions only apply to vessels 65 ft (19.8 m) or larger, because this is the size of vessel to which severe and fatal injuries to North Atlantic right whales are attributed (Silber and Bettridge, 2012). These restrictions also apply to all survey vessels within NMFS-designated DMAs. These measures are anticipated to reduce the potential for vessel strikes on all marine mammal species, particularly the North Atlantic right whale. Although the seasonal prohibition on pile driving would significantly reduce the risk for pile-driving noise to impact right whales, right whales could potentially be present in the WEA from May 1 through October 31. Biological surveys (including passive acoustic monitoring, i.e., the second and third years of the Mass CEC study) are expected to confirm this species' seasonal occurrence in the region.

Disturbance of marine mammals from underwater noise generated by site characterization and site assessment activities would likely result in temporary displacement and other behavioral or physiological consequences. NMFS discussed these consequences in the Biological Opinion as follows: "We have concluded that the proposed actions are likely to result in take of North Atlantic right, humpback, fin and sei whales in the form of harassment, when increased underwater noise will temporarily impair normal behaviors. This harassment will occur in the form of avoidance or displacement from preferred habitat and behavioral and/or metabolic compensations in response to short-term masking or stress" (NMFS, 2013a). Because the SOCs in Appendix B are expected to minimize potential effects to right whales and other marine mammals, no major impacts on marine mammals are anticipated as a result of the proposed action.

4.2.2.7 Sea Turtles

4.2.2.7.1 Description of the Affected Environment

Five species of sea turtles may potentially occur in the northwest Atlantic waters: Kemp's ridley (*Lepidochelys kempii)*, loggerhead (*Caretta caretta)*, green (*Chelonia mydas)*, hawksbill (*Eretmochelys imbricate)*, and leatherback sea turtle (*Dermochelys coriacea)*. All five species of these sea turtles are listed as threatened or endangered under the ESA (Table 4-19). Kemp's ridley, hawksbill, and leatherback turtles are listed as endangered. Loggerhead sea turtles are separated into nine DPSs, and the Northwest Atlantic DPS of this species is listed as threatened. Green sea turtles are divided into two "listed populations" (these populations were listed prior to the 1978 ESA amendment restricting population listings to DPS). The Florida and Mexican Pacific coast breeding colonies are listed as endangered, and all others are listed as threatened.

Table 4-19

Sea Turtles in the North Atlantic OCS

Common Name	Scientific Name	Distinct Population Segment (if applicable)	ESA Status	[1, 2]Relative Occurrence within Rhode Island OSAMP Study Area
Family Cheloniidae				
Loggerhead sea turtle	*Caretta caretta*	Northwest Atlantic	Threatened	Common
[3]Green sea turtle	*Chelonia mydas*	Florida breeding colonies	Endangered	Unknown
		All others	Threatened	Rare
Kemp's ridley sea turtle	*Lepidochelys kempii*		Endangered	Rare
Hawksbill sea turtle	*Eretmochelys imbricata*		Endangered	Remote Possibility
Family Dermochelyidae				
Leatherback sea turtle	*Dermochelys coriacea*		Endangered	Common

[1]Common = more than 100 records, Regular = 10–100 records, Rare = less than 10 records, Remote Possibility= the remote possibility to occur in the region at some time (Kenney and Vigness-Raposa, 2010).

[2]The WEA is included in the RI OSAMP.

[3] Because it is not known which breeding population any one individual occurring in the WEA may belong to, it is assumed that all individuals encountered are endangered.

Four of the sea turtle species above are likely to occur in the WEA: Kemp's ridley, loggerhead, green, and leatherback sea turtles. These four species are highly migratory and are known to occur in the coastal waters of the northeast United States in the summer and fall. Hawksbill sea turtles are rare in Massachusetts, and not likely to occur in the WEA; therefore, they are not considered further in this EA.

Sightings data for sea turtles are difficult to obtain, and data for the WEA are sparse. Sea turtles are very difficult to observe in the water, in part because they are typically underwater for an average of 92 percent of each day (Morreale and Standora, 1998). Several sightings of sea turtles (34 leatherback and 3 Kemp's ridley) have been recorded from Block Island to the east coast of Nantucket from June to mid-October 2003 to 2011 (Massachusetts Audubon, 2012a). These sightings indicate that sea turtles may be affected by increased vessel traffic associated with survey work in the most nearshore waters, including ports in Massachusetts, Rhode Island, Connecticut, and New York.

Sea Turtle Strandings in the WEA and Surrounding Waters

Although information for sea turtle abundance and distribution are sparse in the WEA, data are available for the nearby Cape Cod Bay because a relatively large number of cold-stunned sea turtles are known to wash ashore there each fall. Green, loggerhead, Kemp's ridley, and leatherback sea turtles are known to forage in Cape Cod Bay from June to October (Massachusetts Audubon, 2012a), and these species could, therefore, be expected to occur in the WEA region during the same period.

Another dataset of sea turtle strandings by State can be found at the NMFS Sea Turtle Stranding and Salvage Network. This dataset includes sea turtle stranding data for Massachusetts and Rhode Island from 1986 through 2007, including species, year, month, and location by county. NMFS Southeast Fisheries Science Center (SEFSC) has verified all data through 2005, and may make changes as needed for 2006 and 2007 data. Compared to the Cape Cod Bay strandings data, relatively few sea turtles have stranded on either Martha's Vineyard (Dukes County) or Nantucket, the nearest land to the WEA (NMFS SEFSC, 2012; Table 4-20). A total of 39 turtles stranded (not necessarily from cold-stunning) on Martha's Vineyard and Nantucket from 1986 to 2007; 1 green, 3 Kemp's ridley, 20 leatherback, and 15 loggerheads (NMFS SEFSC, 2012). Sea turtles are less likely to become stranded from cold-stunning on the south side of Martha's Vineyard and Nantucket because there is no geologic impediment (i.e., "land trap") to the turtles' southward migration in response to declining temperatures.

Table 4-20

Species of Sea Turtles Stranded in Dukes and Nantucket Counties, MA, from 1986 to 2007

Species	Number	Months	Location[1] (County)
Green	1	November	Nantucket
Kemp's Ridley	3	August–December	Dukes and Nantucket
Leatherback	20	January, July–December	Dukes and Nantucket
Loggerhead	15	June–December	Dukes and Nantucket

Source: NMFS SEFSC, 2012

[1]Dukes County strandings were on Martha's Vineyard, and Nantucket County strandings were on Nantucket Island

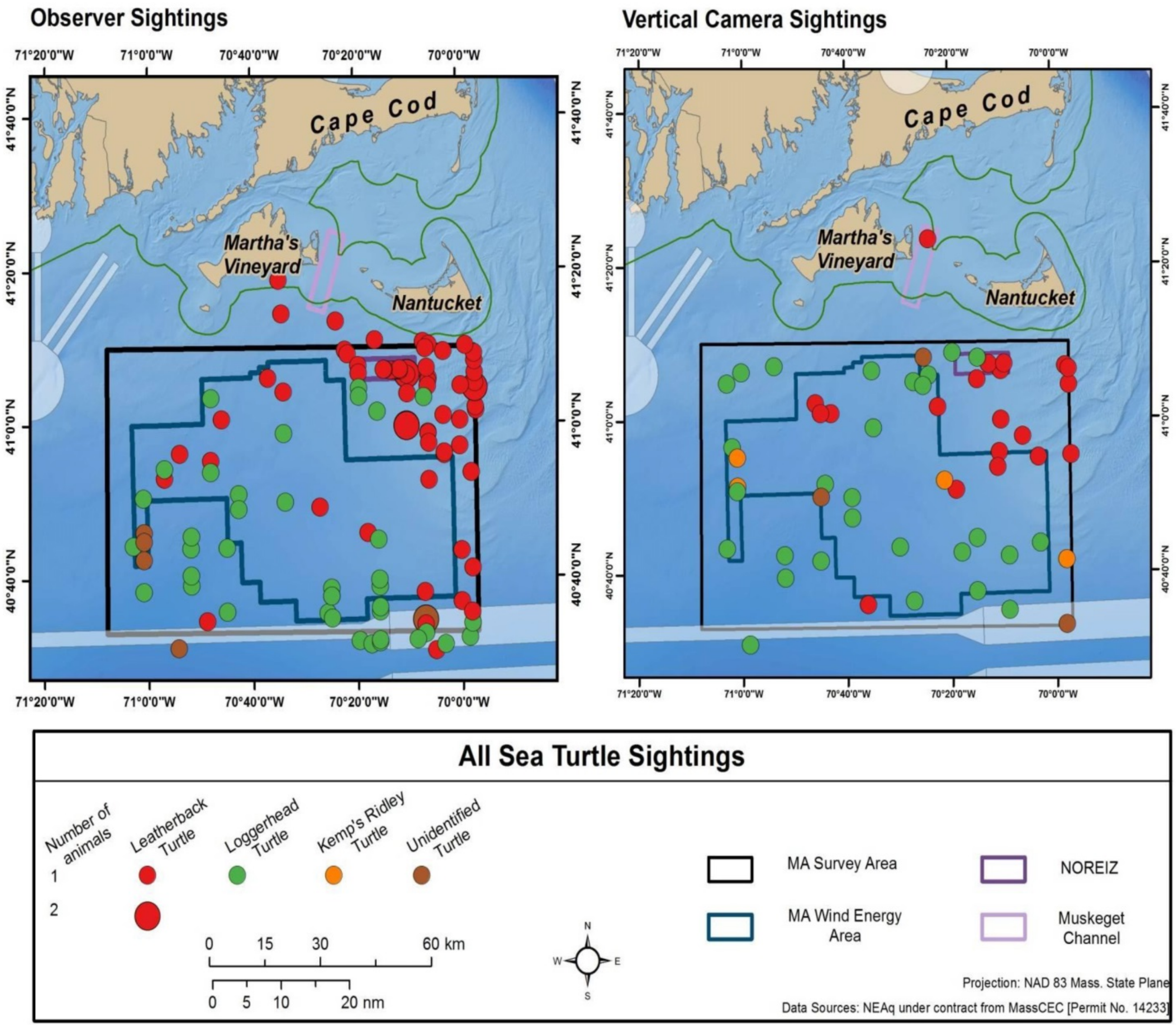
Loggerhead Sea Turtle

Loggerheads can be found throughout the global oceans in subtropic and temperate waters (NMFS, 2012b). This species is known to occur within essentially all shelf waters of the northwest Atlantic from Florida to Nova Scotia (NMFS and USFWS, 2008). Adult and juvenile loggerhead turtles forage in coastal areas from Florida to Cape Cod from June to mid-September and into the fall. However, most loggerheads in southern New England waters are juveniles, ranging in length from 15 to 36 inches (38 to 91 cm) and in weight from approximately 24 to 99 pounds (11 to 45 kilograms [kg]) (Massachusetts Audubon, 2012a). As of 2009, the estimated number of nesting females in the Northwest Atlantic DPS is approximately 30,000, and if the adult sex ratio is 1:1, the resulting estimated number of adult loggerheads in this DPS is approximately 60,000 (TEWG, 2009). The most recent regional abundance estimate for this species was in 2010. The preliminary regional abundance was approximately 588,000 individuals based on only positive identifications of loggerhead sightings, and approximately 801,000 individuals based on positive identifications and a portion of unidentified turtles from the survey (NMFS NEFSC, 2011).

Stranding data for Cape Cod Bay indicate that loggerheads are relatively common in southern New England waters. Among the 279 loggerheads known to have stranded in Massachusetts from 1986 to 2007, 10 were stranded on Martha’s Vineyard and 5 were stranded on Nantucket (NMFS SEFSC, 2012). SPUE data support this information, with loggerhead turtles distributed relatively evenly in the WEA, but with most sightings occurring in the fall (Figure 6 in Appendix F; Right Whale Consortium, 2014). SPUE in the WEA ranged from 0.1 to 85 turtles per 620 miles (1,000 km) in the spring and summer, to 0.1 to 190 turtles per 620 miles (1,000 km) in the fall (Figure 6 in Appendix F; Right Whale Consortium, 2014). Loggerhead turtles occurred in relatively high densities in the summer and fall on all four sides outside the WEA boundary (Right Whale Consortium, 2014). SPUE ranged from 0.1 to 475 turtles per 620 miles (1,000 km) in the summer and 0.1 to 300 turtles per 620 miles (1,000 km) in the fall. The highest SPUE value, 475 turtles per 620 miles (1,000 km), was located on the southern boundary of the 40 nm delineation (Figure 6 Appendix F; Right Whale Consortium, 2014). SPUE are likely to be underestimated for this species as a result of the relatively small size of the turtles and their long submergence time, which make visual detection of this species difficult.

Loggerhead Sightings in the MA WESA from November 2011 to October 2012

From November 2011 to October 2012, loggerhead turtles were observed on 76 occasions from April 6 to November 26, which is 2 months earlier than what was previously known for the region (Figure 4-15) (NMFS, 2012b; Massachusetts Audubon, 2012a; and NMFS SEFSC, 2012; Kraus et al., 2013). This is likely due to the use of the aerial vertical photography method, designed to detect smaller marine animals (Kraus et al., 2013). Loggerhead turtle sightings were located throughout the MA WEA and concentrated in the southern portion of the WESA (Kraus et al., 2013).



Source: Kraus et al., 2013

Figure 4-15. Sea turtle sightings in the MA WESA during 2011–2012 aerial surveys

Figure 4-15 shows the species and number of animals sighted at each location by size and color of the circle (Kraus et al., 2013). Observer sightings are plotted in the panel on the left, and vertical camera sightings are plotted in the panel on the right.

Kemp's Ridley Sea Turtle

Kemp's ridley sea turtles inhabit the Gulf of Mexico and northwest Atlantic as far north as the Grand Banks and Nova Scotia (NMFS USFWS and SEMARNAT, 2011). During the summer and early fall, this species can be found inshore along the Atlantic seaboard from Florida to New England, but only juveniles (12 to 15 inches [30 to 38 cm] and approximately 4.4 pounds [2 kg]) have been reported in New England (Massachusetts Audubon, 2012a). Adults are rare in New England waters (TEWG, 2000). When inshore, Kemp's ridleys can be found in waters less than

50 m deep. The most recent population estimate is 7,000 to 8,000 nesting females (NMFS and USFWS, 2007a). This species is female biased, but there are likely an additional several thousand males (NMFS and USFWS, 2007a).

Although the numbers of Kemp's ridley strandings are relatively high in Massachusetts (more specifically Cape Cod Bay), the stranding numbers are low near the WEA, with two on Martha's Vineyard, one on Nantucket, and four in Rhode Island from 1986 to 2007 (NMFS SEFSC, 2012).

SPUE are likely to be underestimated for this species as a result of the relatively small size of the turtles and their long submergence time, which make visual detection of this species difficult. SPUE for Kemp's ridley sea turtles support the general seasonal patterns previously reported for the area, with only three sighting locations within the WEA in the fall (Right Whale Consortium 2014; Figure 7 in Appendix F). Two of the sighting locations were in the western portion of the WEA, and the other sighting location was in the eastern portion (Right Whale Consortium, 2014). Within the 40 nm (74 km) boundary of the WEA, SPUE ranged from 3 to 25 turtles per 620 miles (1,000 km) in the summer and fall, with one sighting location to the east, and the other location to the southwest of the WEA (Right Whale Consortium 2014; Figure 7 in Appendix F).

During the survey from November 2011 to October 2012, Kemp's ridley sea turtles were observed on six occasions from August 23 to September 17 in the WEA (Figure 4-15; Kraus et al., 2013). Interestingly, none of the Kemp's ridleys were sighted from the standard aerial surveys, but rather were detected with the aerial vertical photography method (Figure 4-15; Kraus et al., 2013).

Green Sea Turtle

Green sea turtles are known to occur in tropical and sub-tropical waters, with occasional occurrence in cooler, temperate waters (NMFS and USFWS, 2007b). Only juvenile green turtles have been recorded in New England (Massachusetts Audubon, 2012a). Green turtles probably frequent Cape Cod Bay waters with some degree of regularity but would not be considered common because, on average, only one strands per year (Massachusetts Audubon, 2012b). According to Kenney and Vigness-Raposa, (2010), green sea turtles tend to be too small to be observed during aerial surveys, and densities have not been calculated because sightings are too rare (RICRMC, 2010). The population, estimated by the number of nesting females from 1999 to 2003, ranges from 17,402 to 37,290 (NMFS and USFWS, 2007b). SPUE data are not available for this species.

Leatherback Sea Turtle

Leatherback sea turtles nest in the tropics and remain in warmer southern waters as juveniles (NMFS and USFWS, 1992). Once they become subadults or adults (at approximately 39 inches

[100 cm] curved carapace length), they head north to feeding grounds near the Arctic Sea where they feed primarily on jellyfish (Eckert, 2002). Adult leatherback sea turtles are known to occur within a wide range of water temperatures, and have been observed along the entire U.S. east coast from Maine to Puerto Rico and the U.S. Virgin Islands (NMFS, 2012a). Leatherbacks are the only species of sea turtle that can regulate their body temperature to some degree, and generally do not strand as a result of cold-stunning. Population estimates (total number of adults) of leatherbacks in the Atlantic (estimated from the seven nesting sites within the Atlantic from the Caribbean to Florida) range from 34,000 to 94,000 (NMFS and USFWS, 2007c; TEWG, 2007).

A tagging study of 38 leatherbacks off Nova Scotia during the summers of 1999 through 2003 showed that these turtles' movements are concentrated in the waters off eastern Canada and the northeastern United States in June through December, although most turtles left the area for the southward migration during October (James et al., 2005). The Continental Shelf waters south of Cape Cod were among the highest areas visited among the tagged leatherbacks. Similar to previous findings, Dodge et al. (2014) reported that adult and subadult leatherbacks tagged off of Massachusetts utilized the shelf waters of the northeast U.S. during summer through early fall and then moved to more southerly latitudes from late fall through spring.

SPUE in the WEA region ranged from 1.2 to 35 turtles per 620 miles (1,000 km) in the summer and fall (Right Whale Consortium, 2014; Figure 8 in Appendix F). In the 40 nm (74 km) boundary around the WEA, SPUE ranged from 1.2 to 105 turtles per 620 miles (1,000 km) in the summer and 1.2 to 322 turtles per 620 miles (1,000 km) in the fall (Right Whale Consortium, 2014; Figure 8 in Appendix F). According to Kara Dodge of the Large Pelagics Research Center (pers. comm., 2012), the area of Nantucket Shoals south of Martha's Vineyard and Nantucket is considered a "hot spot" for leatherbacks from at least July (and maybe June) through September.

Leatherback sea turtle strandings have been recorded for Rhode Island and Massachusetts. Leatherback sea turtles are the most common species to strand in Rhode Island, with 144 records from 1986 to 2007 (NMFS SEFSC, 2012). Among the 159 leatherbacks known to have stranded in Massachusetts from 1986 to 2007, 29 were stranded on Martha's Vineyard and 4 were stranded on Nantucket (NMFS SEFSC, 2012), within 40 nm (74 km) of the WEA.

During the survey from October 2011 to September 2012, 93 leatherback turtles were observed during summer and fall, from June to November (Figure 4-15; Kraus et al., 2013). Sighting locations were both within and outside the WEA boundary, concentrated in the northeast quadrant of the MA WESA (Kraus et al., 2013).

4.2.2.7.2 Impact Analysis of Alternative A

Impacts on sea turtles from site characterization and site assessment activities are divided into two categories: acoustic and non-acoustic impacts. Acoustic impacts include the following activities: HRG surveys, geotechnical exploration, pile driving for installation of meteorological towers, and vessel traffic (including decommissioning of meteorological tower and buoys). Non-acoustic impacts associated with Alternative A activities are subdivided into the following categories: 1) effects to benthic foraging habitat, 2) vessel strike or entanglement with towed acoustic gear, and 3) discharge of waste and accidental fuel leaks.

Important ecological considerations for sea turtles that affect their vulnerability to these impacts in the WEA region include foraging, migration, diving at depth for extended periods of time, and possibly extended rest periods on the ocean bottom. Because of their high submergence rate, sea turtles are difficult to spot during surveys, and their occurrence in the WEA is likely underestimated. Data from the Right Whale Consortium (2014) database indicate that sea turtles are expected to be in the area foraging and migrating during the summer and fall and, therefore, could be affected by Alternative A during that time period (Section 4.2.2.7.1). Additional discussion of impacts on sea turtles from site characterization and site assessment activities is available in the PEIS (MMS, 2007a; Section 5.2.12.2).

Acoustic Impacts

Hearing in Sea Turtles

Studies indicate that hearing in sea turtles is confined to lower frequencies, below 1,600 Hz, with the range of highest sensitivity between 100 and 700 Hz and a peak near 400 Hz (Lenhardt, 1994; Bartol et al., 1999; Dow Piniak et al., 2012). Current data for hearing range frequencies by species is summarized in Table 4-21. Studies of behavioral reactions have elicited startle response from sea turtles at frequencies between 200 and 700 Hz (Samuel et al., 2005). The project activities that have potential acoustic impacts for sea turtles are medium-depth sub-bottom profilers (boomers), pile driving, and vessel noise, which overlap with sea turtles' hearing frequency range.

Table 4-21

Hearing Ranges for Sea Turtles

Sea Turtle Species	Sound Production Frequency Range (Hertz)	Hearing Range (Hertz)	Most Sensitive Hearing Range (Hertz)	Reference
Green	NA	100–800; 50–1,600	200–400 subadult; 600–700 juvenile	Bartol and Ketten, 2006; Dow et al., 2008
Hawksbill	NA	NA	NA	NA
Loggerhead	NA	25–1,000	250	Bartol et al., 1999; O'Hara and Wilcox, 1990
Kemp's ridley	NA	100–500	100–200	Bartol and Ketten, 2006
Leatherback hatchling	300–4,000	50–1,200	100–400	Cook and Forrest, 2005; Dow Piniak et al., 2012

Current Noise Criteria for Behavioral Disturbance and Potential Injury

Currently, there are no noise criteria for sea turtles. NMFS, during its Section 7 ESA consultations, typically applies the criteria for marine mammals to evaluate the potential for similar impacts. The current NMFS criterion for Level A harassment of cetaceans is a received SPL of 180 dB re 1 μPa and 160 dB re 1 μPa for Level B harassment (BOEM, 2014). However, the USGS and the Navy (Finneran and Jenkins, 2012) use a 166 dB re 1 μPa threshold for Level B harassment in their assessment of survey activities and acoustic and explosive affect analysis, respectively, based on a study by McCauley et al. (2000) (*as cited in* Finneran and Jenkins, 2012), which showed behavioral responses to airgun pulses in a tank setting at or above 166 dB re 1 μPa.

SVT Engineering Consultants (2010) calculated a value of 222 dB re 1μPaPeak as a conservative estimate of the underwater noise levels that may cause injury to sea turtles during pile driving operations. This caluculation was made using the safety range formulas developed by Young (1991), and Keevin and Hempen (1997), and converting back to sound pressure levels using the "Ross Formula (Ross 1987)." The study by SVT Engineering Consultants (2010), however, did not provide an estimated RMS value of underwater noise levels that may result in injury to sea turtles. As the sea turtle behavioral thresholds noted above are measured using the RMS of the sound source, to be consistent, BOEM estimated the RMS value from the estimated peak level of underwater noise associated with possible sea turtle injury (i.e., 222 dB re 1μPaPeak). The RMS of a sound source is approximately 15 dB lower than the peak level of underwater noise for that sound source (developed by J. Stadler and D. Woodbury for NMFS pile driving calculations; see http://www.dot.ca.gov/hq/env/bio/fisheries_bioacoustics.htm). Based on this information, BOEM has estimated an RMS value for injury of 207 dB re 1μPa RMS (207 dB RMS). This value, like the peak value estimated by SVT Engineering Consultants (2010), is a conservative estimate of the level of underwater noise, resulting from pile driving that may cause injury to sea turtles. Based on this, BOEM believes that underwater noise levels at or above 207 dB RMS have the potential to injure sea turtles.

HRG Survey Acoustic Effects

The HRG surveys of renewable energy sites would use only electromechanical sources such as side-scan sonar, boomer and CHIRP sub-bottom profilers, and multibeam depth sounders. The effects from these sources on sea turtles are expected to range from no effect to negligible, based on the audibility of the source to sea turtles (which may be a function of distance). Sea turtles are unlikely to hear the electromechanical sources except perhaps the boomer, which has an operating frequency range of 200 Hz to 16 kHz, at very close range. However, the boomer has a very short pulse length (180 microseconds) with a radius of less than 16 ft (5 m) for the 180 dB isopleth, and 52 ft (16 m) for the 160 dB isopleth. The SOC included in Appendix B requires a vessel transit separation distance of 164 ft (50 m) for sea turtles, the confirmation of no sea turtles within the 656 ft (200 m) exclusion zone 60 minutes prior to startup and shutdown provisions if sea turtles are seen within the 656 ft (200 m) exclusion zone during operations. Therefore, impacts from HRG surveys using boomer sub-bottom profilers on sea turtles are expected to range from negligible to minor, based on the distance of the individual sea turtle from the sound pulse (BOEM, 2014).

Geotechnical Exploration Acoustic Effects

Continuous noise would be produced from geotechnical exploration activities (borehole drilling, CPTs, and vibracoring), and from the vessels used for these activities. There are no continuous noise thresholds currently established for sea turtles. Previous noise estimates submitted to BOEM for borehole drilling ranged from 118 to 145 dB at 120 Hz frequency, with indications that the sound would attenuate to below 120 dB at 492 ft (150 m) from the source (NMFS, 2009e). Reiser et al. (2011) reported that vibracoring noise attenuates to 160 dB at 226 ft (69 m). Noise generated by drilling or vibracoring is not likely to negatively impact any sea turtles in the area because the distance of attenuation to below 166 dB is less than the 656 ft (200 m) exclusion zone.

Meteorological Tower Pile-Driving Acoustic Effects

High-intensity SPLs generated during pile driving are known to exceed 200 dB re 1 μPa. These SPLs are above the Level A harassment criteria used by NMFS for sea turtles (207 dB). Response of sea turtles to pile driving has not been documented. It is reasonable to assume, however, that turtles could react the same way they do to seismic sounds at the same frequency. National Science Foundation (NSF) and USGS (2011) reported that sea turtles responded to seismic sounds with behavioral changes, including a startle response, increased swim speed, and avoidance of the sound source.

Pile driving for meteorological towers will take place for a relatively short time (a maximum of 4 days per tower for five towers). However, the work would occur during May through October, when sea turtles are known to be in the WEA. The SOCs (see Appendix B), including monitoring the exclusion zone of 3,281 ft (1,000 m) for sea turtles, limiting pile-driving activities to daylight hours, implementing "soft start" to warn sea turtles away from the immediate area, and requiring a 60-minute observation period before beginning activities, are expected to minimize the potential negative effects from exposure to high levels of noise.

Meteorological Tower Decommissioning

Details regarding decommissioning the meteorological towers are described in Section 3.1.4.1. The potential effects from decommissioning work include sound and operational discharges similar to those described during meteorological tower construction. Noise levels and vessel traffic rates are expected to be similar to meteorological tower construction, with the exception of pile driving. Piles and foundations would be removed using non-explosive methods such as mechanical cutting or high-pressure water jets at a depth of 15 ft (4.6 m) below the mudline. Noise levels associated with these methods have not been established in this region. SOCs for meteorological tower decommissioning include those outlined for meteorological towers and the Vessel Strike Avoidance Measures and Reporting for Mariners outlined in Appendix B.

Vessel Traffic Acoustic Effects

Potential acoustic impacts from vessel noise during site assessment and characterization activities would consist of vessel noise produced during vessel transit to and from ports, as well as the vessel noise produced during the HRG surveys; geotechnical exploration; and construction, maintenance, and decommissioning of meteorological buoys and towers. Sea turtles are known to forage in coastal waters, and are likely to encounter vessel traffic noise both in the WEA (Figure 4-15) and in nearshore areas along the transit routes to and from the WEA. Vessels for this project may be transiting from 10 major ports and 21 minor ports throughout a region where heavy vessel traffic already exists. To what extent the increase of up to 6,500 vessel round trips would add to the acoustic environment in the region is unknown.

The frequency range for vessel noise (for example, transiting engine noise, dynamic positioning systems, and propeller noise) overlaps with sea turtles' known hearing range and would therefore be audible. However, Hazel et al. (2007) suggest that sea turtles' ability to detect approaching vessels is vision-dependent, not acoustic. Sea turtles may respond to vessel approach and/or noise with a startle response and a temporary stress response (NSF and USGS, 2011). The potential effects of vessel noise from site characterization and assessment work on sea turtles are expected to be short-term and minimal. In addition, the SOCs detailed in Appendix B require a

164 ft (50 m) separation distance from sea turtles for project-related vessels.

Non-Acoustic Impacts

Benthic Habitat Effects

Project activities known to disturb the sea floor bottom and near-bottom, such as sediment sampling, pile driving, and buoy anchoring, may indirectly affect sea turtle habitat and associated prey. However, these activities would affect a very small percentage of the total area of the WEA and would not be significant. Geotechnical exploration would result in a temporary loss of benthic or near-benthic organisms, including potential prey species for sea turtles, as a result of anchor placement and removal of the core sample. However the affected area would be extremely small (less than 1 ft [0.3 m] diameter), and potential loss of habitat area would be negligible.

Potential effects during meteorological tower/buoy installation and operation include the loss of bottom area from each meteorological foundation (less than 2,745 square ft [255 square m]) and/or the buoy anchor (6 square ft [0.5 square m]), and chain drag (8.5 acres [3.4 hectares]). During foundation and anchor installation, re-suspension of sediment resulting in temporary and localized increased turbidity is expected. The meteorological tower foundation would add an area of vertical, hard substrate to a soft bottom habitat. The surface area of the artificial substrate would be too small to change the diversity or structure of the existing benthic community dramatically. The potential effects on benthic habitat during meteorological tower/buoy installation and operation are expected to have negligible effects on sea turtles.

Vessel Collision Effects

Propeller and collision injuries from boats and ships are common in sea turtles. Vessel strike data from 1997 to 2005 for loggerhead sea turtles indicate that 14.9 percent of all stranded loggerheads in the U.S. Atlantic and Gulf of Mexico had evidence of some type of propeller or collision injuries, although the proportion of these injuries that were post- or ante-mortem is unknown (NMFS and USFWS, 2008). The incidence of propeller wounds in the U.S. Atlantic and Gulf of Mexico rose from approximately 10 percent in the late 1980s to a record high of 20.5 percent in 2004 (NMFS and USFWS, 2008).

Sea turtles are likely to be most susceptible to vessel collision in coastal waters, where they are known to forage, during transit from ports when vessel speed may exceed 10 knots. The increase of up to 6,500 vessel round trips in the region is likely to increase the relative risk of vessel strike for sea turtles. However, the Vessel Strike Avoidance Measures outlined in Appendix B are designed to minimize the potential for vessel strikes for sea turtles by proposed action vessel traffic.

Spills

As discussed in Section 3.2.3, the severity of an oil or fuel spill depends on the material, size, and location of the spill, as well as the current meteorological conditions. If a vessel oil spill occurred, the estimated spill size would be 123 gallons (USCG, 2012), which is relatively small, and would, therefore, contribute a negligible potential for negative impacts on sea turtles. The most likely material to be spilled from a vessel would be diesel fuel, which would dissipate rapidly in the water column, then evaporate and biodegrade within a few days (MMS, 2007b). If a sea turtle surfaced within the spill, there is a potential for ingestion. However, the overall potential risk for spills to occur and subsequently impact sea turtles is extremely small.

Discharge of Waste and Accidental Fuel Leaks

Debris, plastics, and other foreign material present a serious risk of injury to sea turtles by ingestion or entanglement. The operational waste from site characterization and assessment work, including bilge and ballast water, trash debris, and sanitary and domestic waste, would be disposed of per regulations discussed in Section 3.1.3.5. All vessel operators, employees, and contractors would be briefed on marine trash and debris awareness elimination as outlined in Appendix B; thus, negative impacts for sea turtles from solid debris, waste discharge, and accidental fuel leaks are not likely.

4.2.2.7.3 Conclusion

The seasonal occurrence of leatherback, loggerhead, and Kemp's ridley sea turtles in the WEA region overlaps with the timeframe for activities under Alternative A that occur from May 1 through October 31. Thus, these species could be exposed to potential negative acoustic effects from HRG surveys, pile driving, and vessel noise, and an increased potential for vessel strike. Although SPUE data are not available for green sea turtles, BOEM assumes that any of these species of sea turtles occurring in the WEA from May through October may also be at risk from project activities during this time. The SOCs in Appendix B, including monitoring of exclusion zones during operations by trained observers, vigilant watch for protected species during vessel transits, a 60-minute clearance period prior to noise-producing activities, and shutdown protocols, are expected to reduce the potential for harassing levels of noise. Nonetheless, disturbance of sea turtles from underwater noise generated by site characterization and site assessment activities may result in temporary displacement and other behavioral disruptions. NMFS discusses these consequences in the Biological Opinion, which includes an Incidental Take Statement that exempts the incidental take (harassment) of sea turtles from noise generated during the proposed geophysical surveys or pile-driving activities (NMFS, 2013a). Overall, most effects on sea turtles within the WEA and surrounding waters are expected to be short term and minor. Population-level impacts are not expected to occur.

4.2.3 Socioeconomic Resources

4.2.3.1 Cultural Resources

Both site characterization (i.e., HRG survey and geotechnical exploration) and site assessment activities (i.e., installation of meteorological towers and/or buoys) have the potential to affect historic and post-contact historic properties. Construction activities associated with the placement of site assessment structures that disturb the ocean bottom have the potential to affect archaeological sites and traditional cultural properties on or under the seabed. Vessel traffic associated with surveys and structure construction, although indistinguishable from existing ocean vessel traffic could, at times, be visible from coastal areas of Massachusetts, potentially impacting historic sites, structures, districts, and traditional cultural properties onshore (historic properties). Similarly, although indistinguishable from other lighted structures on the OCS, some meteorological towers and/or buoys might be visible from historic properties onshore. The information presented in this section is based on existing and available information, and it is not intended to be a complete inventory of historic properties within the WEA. BOEM requires that lessees submit results of HRG surveys in SAPs and COPs to identify historic properties and to consider the effects of those undertakings on historic properties (see Section 3.1.3).

4.2.3.1.1 Description of the Affected Environment

An overview of the cultural resources that might be expected on the Atlantic OCS is presented in Section 4.2.19 of the PEIS (MMS, 2007a). Both shipwrecks from the 17th to 20th centuries—particularly ocean-going and coastal sailing vessels and steamers, fishing vessels, and small vernacular craft—as well as submerged pre-contact sites could be located in the WEA (Albion et al., 1972; Bauer, 1988; MA CZM, n.d.(a); MA CZM, n.d.(b); MA EOEEA, 2009; Mather and Jensen, 2010; McLoughlin, 1978; NOAA Office of Coast Survey, n.d.; Rhode Island Shipwreck Database, n.d.; RICRMC, 2010; Robinson et al., 2003; TRC Environmental Corporation, 2012).

The potential for finding shipwrecks increases in areas of historic shipping routes, harbor approaches, fishing grounds, and narrow straits, reefs, and shoals. Positioned between larger ports in Boston and New York, the WEA is situated in an area that has experienced extensive regional and national maritime activity from the 17th century to the present. Archaeological material discovered on the outer reaches of Cape Cod suggests that European settlers were trading goods with native inhabitants from the early-17th century up to 1620 (MHC, 1987:63-5). As coastal development increased, maritime shipping and packet routes were established between the mainland and the islands south of Cape Cod. The waters south and west of the islands contain one of the primary shipping channels for southbound vessel traffic going into New Bedford and New York that was used from the mid-18th century up to the present (MHC, 1987:93). During the 19th century, several maritime industries thrived in the region, including passenger and cargo transportation, whaling, fishing (fin and shell fish), tourism, and shipbuilding (commercial and naval). This extensive maritime history increases the potential for the presence of shipwrecks within the WEA (Bauer, 1988; Mather and Jensen, 2010). Accordingly, BOEM’s Atlantic OCS Shipwreck Database identifies the WEA as located in a region of high probability for shipwreck presence (TRC Environmental Corporation, 2012). BOEM’s Atlantic OCS Shipwreck Database currently lists 762 known or reported wrecks offshore the State of Massachusetts. Within the current boundaries of the WEA, there are 21 known shipwrecks, obstructions, or objects of unknown character.

Submerged pre-contact cultural resources also could exist in the WEA. The area is designated as having a high potential for the presence of such sites (TRC Environmental Corporation, 2012), although the potential for the preservation of these sites is complex and localized (Merwin and Bernstein, 2003; Merwin, Lynch, and Robinson, 2003; Stanford and Bradley, 2012). Around 18,000 before present day (BP), the glaciation began receding, and by about approximately 16,500 BP, portions of the southern New England area were exposed as dry land (Boothroyd and August, 2008; Coleman and McBride, 2008; Peck and McMaster, 1991; RICRMC, 2010). Relative sea level and isostatic rebound in southern New England indicate that the WEA would have been subaerial prior to ~13,000 BP (Oakley, 2012). By 12,300 BP (sea level 200 ft [60 m] below present), marine water began to inundate the southern end of the WEA. Shoreline transgression and sea level rise through the southern half of the WEA would have been relatively consistent (approximately 3.3 ft [1 m]/1,000 years) based on the eustatic curve of Peltier and Fairbanks (2006), and approximately half of the site was inundated by 11,500 BP (sea level 165 ft [50 m] below present) (Oakley, 2012). Sea level rise across the northern half of the WEA would have been relatively rapid between 11,500 and 11,000 BP (sea level 165 ft [50 m] to 130 ft [40 m] below present) (Bard et al., 2010). The entire WEA was inundated by 10,000 BP (sea level 100 ft [30 m] below present) (Oakley, 2012; Oakley and Boothroyd, 2012).

During the time period that these portions of the OCS were exposed as dry land the region experienced varying levels of sea level rise. The highest rate of sea level rise during a period of known prehistoric occupation along North America is currently estimated as taking place at 11,600 to 11,100 years BP. This period, which based on sea level curves for the region corresponds to 180 to 138 ft (55 to 42 m) isobaths and encompasses all of the WEA, experienced rapid sea level rise averaging 79 to 118 inch (200 to 300 cm) per year (Lowery, 2009). This period was followed by a much slower rate of sea level rise (approximately 0.31 inch [0.8 cm] per year) until ca. 7,000 BP, after which the rate of sea level rise slowed even further (0.08 inch [0.2 cm] or less per year). The area of the WEA is likely to have been drowned by 10,000 BP. Therefore, the potential exists for submerged pre-contact archaeological sites within the WEA to range from the pre-Clovis times (earlier than 13,000 BP) and Clovis Paleoindian times (between 13,000 and 11,500 BP), to Early Archaic times (between 11,500 BP to 9,000 BP) (RICRMC, 2010, Robinson et al., 2004; TRC Environmental Corporation, 2012). Oldale and O’Hara (1980) estimate submergence of the inner continental shelf (and the WEA) began 11,000 BP during the

Early Archaic, and younger sites would not be expected in the WEA (see also Blanchon, 2011; Boothroyd and August, 2008).

4.2.3.1.2 Impact Analysis of Alternative A

Section 5.2.19 of the PEIS discusses possible impacts on potential cultural resources that could occur as a result of site characterization and assessment activities (MMS, 2007a). Potential cultural resources offshore of Massachusetts that could be impacted by leasing, site characterization, and site assessment associated with Alternative A are discussed below.

Routine Activities

Site Characterization

As detailed in Section 3.5.2 of the PEIS (MMS, 2007a), site characterization activities entail "integrated marine geophysical/hydrographic surveys and geotechnical/sediment sampling programs." Geophysical surveys do not impact the bottom and, therefore, have no ability to impact cultural resources. Geotechnical/sediment sampling does impact the bottom and, therefore, does have the ability to impact cultural resources. However, if the lessee conducts HRG surveys prior to conducting geotechnical/sediment sampling, the lessee may avoid impacts on historic properties by relocating the sampling activities away from potential cultural resources. Therefore, BOEM would require the lessee to conduct HRG surveys prior to conducting geotechnical/sediment sampling, and, when a potential historic property is identified, the lessee will be required to avoid it. Inclusion of the following elements in the lease(s) will ensure avoidance of historic properties. Language including the following elements would be included in leases issued within the WEA under the Smart from the Start Initiative:

> The lessee may only conduct geotechnical exploration activities, including geotechnical sampling or other direct sampling or investigation techniques, in areas of the leasehold in which an analysis of the results of geophysical surveys has been completed for that area. The geophysical surveys must meet BOEM's minimum standards (see GGARCH [BOEM OREP, 2012]), and the analysis must be completed by a qualified marine archaeologist who both meets the Secretary of the Interior's Professional Qualifications Standards (48 FR 44738–44739) and has experience analyzing marine geophysical data. This analysis must include a determination whether any potential archaeological resources are present in the area and the geotechnical (sub-bottom) sampling activities must avoid potential archaeological resources by a minimum of 164.0 ft (50.0 m). The avoidance distance must be calculated from the maximum discernible extent of the archaeological resource. In no case may the lessee's actions impact a potential archaeological resource without BOEM's prior approval.

Additionally, during all ground-disturbing activities, including geotechnical exploration, BOEM requires that the lessee observe the unanticipated finds requirements stipulated in 30 CFR 585.802. If the lessee, while conducting activities, discovers a potential cultural resource such as the presence of a shipwreck (e.g., a sonar image or visual confirmation of an iron, steel, or wooden hull, wooden timbers, anchors, concentrations of historic objects, piles of ballast rock), pre-contact artifacts, and/or relict landforms within the project area, then the SOCs would be followed (see Appendix B, Section B.1).

Finally, vessel traffic associated with survey activities, although indistinguishable from existing ocean vessel traffic, could at times be within the viewshed of onshore historic properties. These effects would be limited and temporary (see Section 4.2.3.4).

Site Assessment

For site assessment activities, this EA considers the impacts of construction and operation of up to five meteorological towers and up to 10 meteorological buoys. Although the construction of meteorological towers and buoys impacts the bottom, the lessee's SAP must be submitted to and approved by BOEM prior to construction. To assist BOEM in complying with the National Historic Preservation Act (NHPA) (see Section 5.3.4) and other relevant laws (30 CFR 585.611(a),(b)(6)), the SAP must contain a description of the archaeological resources that could be affected by the activities proposed in the plan. Under its Programmatic Agreement (Appendix G), BOEM will then consult to ensure potential effects to historic properties are avoided, minimized, or mitigated under Section 106 of the NHPA.

BOEM anticipates that bottom disturbance associated with the installation of meteorological towers and buoys would disturb the seafloor in a maximum radius of 1,500 ft (450 m) or 162 acres (65 hectares) around each bottom-founded structure. This includes all anchorages and appurtenances of the support vessels. Impacts on archaeological resources within 1,500 ft (450 m) of each meteorological tower and buoy would result from direct destruction or removal of archaeological resources from their primary context. Although this would be extremely unlikely given that site characterization surveys described above would be conducted prior to the installation of any structure (see e.g., 30 CFR 585.610 and 585.611), should contact between the activities associated with Alternative A and a historic or pre-contact site occur, there may be damage or loss to archaeological resources.

Should the surveys reveal the possible presence of an archaeological resource in an area that may be affected by its planned activities, the applicant would have the option to demonstrate through additional investigations that an archaeological resource either does not exist or would not be adversely affected by the seafloor/bottom-disturbing activities (see 30 CFR 585.802(b) and the PA in Appendix G). Although site assessment activities have the potential to affect cultural resources either on or below the seabed or on land, existing regulatory measures, coupled with the information generated for a lessee's initial site characterization activities and presented in the lessee's SAP, make the potential for bottom-disturbing activities (e.g., anchoring, installation of meteorological buoys and/or towers) to damage to cultural resources very low.

Meteorological towers installed under Alternative A would likely not be visible from shore based on the narrow profile of the structure; distance from shore; and earth curvature, waves, and atmosphere (see Section 4.2.3.4 Recreation and Visual Resources). Existing ports and other onshore infrastructure are capable of supporting site assessment activities with no expansion (see Section 3.1.2). Visual impacts to onshore cultural resources would be limited and temporary in nature and would consist predominately of vessel traffic, which most likely also would not be distinguishable from existing vessel traffic. Therefore, the likelihood of impacts on onshore cultural resources from meteorological structures and from construction vessel traffic also would be very low (see Appendix H).

4.2.3.1.3 Conclusion

Bottom-disturbing activities have the potential to affect historic and post-contact historic properties. However, existing regulatory measures, information generated for a lessee's initial site characterization activities, and the unanticipated discoveries requirement make the potential for bottom-disturbing activities (e.g., coring, anchoring, installation of meteorological towers and buoys) to have an adverse effect (i.e., cause significant impact or damage) on historic properties very low. Visual impacts on onshore cultural resources from meteorological structures and vessel traffic associated with surveys and structure construction are expected to be negligible and temporary in nature.

4.2.3.2 Demographics and Employment

4.2.3.2.1 Description of the Affected Environment

This section describes the socioeconomic characteristics of the counties around the ports that may be used by lessees for activities under the proposed action. The ports occur in Massachusetts, Rhode Island, Connecticut, and New York (Table 4-22).

Table 4-22

Population and Economic Data by State and County

Ports	County	Population (2000)	Population[1] (2012)	Establishments[2,3] (2011)	Employment[4] (2012)	Annual Payroll in Thousands[2,5] (2011)
Massachusetts						
Fall River, Fairhaven, New Bedford	Bristol County	534,678	551,082	12,637	260,287	7,727,245
Falmouth	Barnstable County	222,230	215,423	8,116	100,064	2,766,165
Rhode Island						
Galilee, North Kingstown, Quonset Point	Washington County	123,546	125,946	3,754	64,901	1,684,778
Newport	Newport County	85,433	82,036	2,713	40,522	1,124,624
Providence	Providence County	621,602	628,323	15,561	298,320	11,179,195
Connecticut						
New Haven Harbor	New Haven County	824,008	862,813	19,261	410,919	15,242,931
Clinton, Westbrook	Middlesex County	155,071	165,602	4,139	88,525	2,538,946
New London, Stonington, Avery Point	New London County	259,088	274,170	5,675	133,662	4,777,065
New York						
Montauk, Hampton Bays, Greenport, Islip, Sag Harbor, Orient Point	Suffolk County	1,419,369	1,499,273	47,668	724,626	26,443,450

[1]Source: U.S. Census Bureau, 2014

[2]Source: U.S. Census Bureau, 2013

[3]An establishment is a single physical location where business is conducted, or where services are performed.

[4]Source: U.S. Census Bureau, 2012a

[5]Annual payroll includes all forms of compensation, such as salaries, wages, commissions, bonuses, vacation allowances, sick-leave pay, and the value of payments inkind (e.g., free meals, lodgings) paid during the year to all employees.

Suffolk County, NY, reported the highest population in 2012. All counties in New York and Connecticut reported an increase in population between 2000 and 2012 (U.S. Census Bureau, 2014). One county each in Massachusetts (Barnstable County) and Connecticut (Newport County) reported a slight decrease in population between 2000 and 2012.

The highest annual payroll was reported by Suffolk County at nearly $26.5 million for 2011. New Haven County, CT, and Providence County, RI, were the other two counties that reported high payroll figures during the same period. The proximity of these counties to some of the Nation's active robust labor markets such as New York City and other markets spread over New Jersey and Connecticut accounts for the high annual payroll figures. Many of the counties reported higher median household incomes and per-capita incomes when compared to the State.

Tourism and recreation are a large part of the Dukes County, MA, (Martha's Vineyard) and Nantucket County, MA, (Nantucket) economy. The arts, entertainment, and recreation, and accommodation and food services sector employed 15.3 percent of the Nantucket workforce and 10.6 of Martha's Vineyard workforce between 2008 and 2012 (U.S. Census Bureau, 2012b). The construction sector was the single largest employer between 2008 and 2012 in Nantucket County with 21.4 percent of total employment. Some of the construction was tourism-related (e.g., hotels, restaurants) so the tourism economy is indirectly supported by the construction sector. Educational service, health care, and social assistanmce was the single largest employer between 2008 and 2012 in Dukes County with 18.0 percent of total employment (U.S. Census Bureau, 2012b).

Based on 2013 data for the month of July, Dukes County and Nantucket County reported unemployment rates of 4.2 percent and 2.8 percent respectively, which are lower when compared to the national average of 7.7 percent (BLS, 2013a).

In 2013, the average wage in Dukes County was $812 per week/$42,224 per year and in Nantucket County was $898 per week/$46,696 per year; these wages were lower than the national average wage of $921 per week/$47,892 per year in 2013 (BLS, 2013b).

4.2.3.2.2 Impact Analysis of Alternative A

Temporary and minor increases in employment from proposed action activities, such as surveying, tower and buoy fabrication, and construction would occur in various local economies associated with onshore- and offshore-related industry in the New England area, and particularly in the coastal counties of Massachusetts, Rhode Island, Connecticut, and New York. Additionally, site assessment, including operation and maintenance of the meteorological towers and buoys, would be limited and intermittent and is not expected to affect local employment numbers; therefore impact would be negligible. Spending necessary to carry out proposed action activities (e.g., ship supplies, upkeep, maintenance of ships, crew accommodations such as hotels and meals) would temporarily stimulate the local economies. Impacts on employment and demographics from the proposed action would, therefore, result in minor short-term effects and negligible long-term effects on the local economies.

4.2.3.2.3 Conclusion

BOEM anticipates that the proposed action would have minor, beneficial, short-term impacts on local communities primarily within coastal communities in Massachusetts, Rhode Island, Connecticut, and New York from site characterization and negligible impacts on local economies from site assessment activities. Minor increases in temporary employment and population associated with the proposed action would result in spending on support services for the duration of activities associated with the proposed action.

4.2.3.3 Environmental Justice

4.2.3.3.1 Description of the Affected Environment

EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations…" (Subsection 1-101). If such effects are identified, appropriate mitigation measures must be implemented. The 2007 PEIS contains a complete description of the method of analysis (MMS, 2007a).

Median household income and demographics data for the study area counties were reviewed to better understand the income levels of residents within the counties surrounding the ports. Table 4-23 presents demographics and income data for the study area counties.

Table 4-23

Demographics and Median Household Income by State and County

Ports	County	Percent of White Persons	Median Household Income[1]
Massachusetts			
N/A	State of MA	83.7	$66,658
N/A	Dukes	91.2	$65,896
N/A	Nantucket	89.5	$83,546
Fall River, Fairhaven, New Bedford	Bristol County	91.1	$55,995
Falmouth	Barnstable County	94.0	$60,424
Rhode Island			
N/A	State of RI	85.9	$56,102

Ports	County	Percent of White Persons	Median Household Income[1]
Galilee, North Kingstown, Quonset Point	Washington County	94.1	$72,391
Newport	Newport County	91.1	$69,826
Providence	Providence County	80.7	$49,213
Connecticut			
N/A	State of CT	82.0	$69,519
New Haven Harbor	New Haven County	79.6	$62,234
Clinton, Westbrook	Middlesex County	90.0	$76,659
New London, Stonington, Avery Point	New London County	84.6	$68,310
New York			
N/A	State of NY	71.2	$57,683
Montauk, Hampton Bays, Greenport, Islip, Sag Harbor, Orient Point	Suffolk County	85.8	$87,778

Source: 2012 data from U.S. Census Bureau, 2014

[1]Source: 2008-2012 data from U.S. Census Bureau, 2014

Because White persons made up the majority of the populations in the coastal counties with potential port facilities that would be used to support the proposed action, Table 4-23 only shows the percentage of White persons. The percentage of White persons among all counties listed in Table 4-23 ranges from a low of 80.7 percent in Providence County, RI, to a high of 94.1 percent in Washington County, RI. There are four federally recognized Tribes in the project area—reasonably foreseeable impacts on these Tribes are discussed in Section 4.2.3.1 and consultation is described in Section 5.3.4. Median household income data (Table 4-23) shows that incomes for most coastal counties were higher than the state median household income, and overall were higher than the national average median household income of $53,046 (U.S. Census Bureau, 2012b).

4.2.3.3.2 Impact Analysis of Alternative A

Because the WEA would be located over 10 nm (18 km) from the nearest shoreline, site characterization and site assessment activities within the WEA are not anticipated to have disproportionately high or adverse environmental or health effects on minority or low-income populations. Work at existing fabrication sites, staging areas, and ports to support the proposed action would be short-term and is not anticipated to result in expansion of existing onshore facilities, so no residents or businesses would be displaced or adversely affected. Therefore, BOEM does not anticipate any effects on minority or low-income populations from Alternative A.

4.2.3.3.3 Conclusion

BOEM does not anticipate disproportionally high or adverse environmental or health effects for minority or low-income populations from Alternative A based on the distance of the WEA from shore, the short duration of onshore and nearshore activities, and the use of existing fabrication sites, staging areas, and ports.

4.2.3.4 Recreation and Visual Resources

4.2.3.4.1 Description of the Affected Environment

In order to assess visual resources, a viewshed, which is the area that is visible from a fixed vantage point, must be defined. The viewsheds that may be affected—i.e., areas where meteorological towers may be seen—include the southern coastlines of Martha's Vineyard and Nantucket and the open ocean surrounding the WEA. The scenic and aesthetic values of these coastal areas play an important role in attracting visitors. Martha's Vineyard and Nantucket are both well-known tourist locations. Recreation and tourism-related industries provide almost one-quarter of the employment and wages in Nantucket and Dukes Counties, which include Nantucket and Martha's Vineyard, respectively. See Section 4.2.3.2 for a more detailed discussion of the tourism-related economy.

A mix of public, private, and residential beaches are located on Martha's Vineyard and Nantucket. Martha's Vineyard has 19 beaches: 14 are public, 4 are for town residents only, and 1 is off limits (Martha's Vineyard Chamber of Commerce, 2013). Seven of these beaches are on the south side of Martha's Vineyard looking towards the WEA (Figure 4-16). Nantucket has 10 public beaches (Nantucket Island Chamber of Commerce, 2011), 4 of which are on the south side of the island looking towards the WEA (Figure 4-17). Both Martha's Vineyard and Nantucket have walking and biking paths accessible to the public along the southern coasts of the islands. There are five lighthouses on Martha's Vineyard, but only one is on the southern side of the island, the Gay Head Lighthouse, which is open to the public. Of the three lighthouses on Nantucket, none are on the south side of the island. Resorts, a golf course (near Miacomet on Nantucket), and natural areas on the southern coast have open views to the ocean.

Figure 4-16. Recreational areas and viewpoints on Martha's Vineyard looking toward WEA

Figure 4-17. Recreational areas and viewpoints on Nantucket looking toward WEA

Several locations on Martha's Vineyard and Nantucket were selected as potentially sensitive viewsheds as a result of their popularity with tourists and/or importance to the islands' character. These locations are described in Table 4-24 and shown on Figures 4-16 and 4-17.

Table 4-24

Locations on Martha's Vineyard and Nantucket Looking toward WEA

Viewpoint	Description
Martha's Vineyard	
Gay Head Cliffs	Cliffs are located on western-most part of island. They are designated as a National Natural Landmark (NPS, 2011). Local and Federal laws forbid touching or climbing the cliffs.
Gay Head Lighthouse	The Gay Head Lighthouse dates back to 1844, but today is maintained by the Martha's Vineyard Historical Society under a 30-year lease with the USCG.
Aquinnah Cultural Center	The Aquinnah Cultural Center is located at the top of the Gay Head Cliffs and provides a place for the Aquinnah Wampanoag Tribe of Gay Head to preserve, interpret, and document the Aquinnah Wampanoag self-defined history, culture, and contributions.
Aquinnah Public Beach (Moshup Beach)	Aquinnah Public Beach is at the base of the Aquinnah clay cliffs.

Viewpoint	Description
Philbin Beach	Philbin Beach is located off Moshup Trail near the clay cliffs on the western portion of Martha's Vineyard. It is open to Aquinnah residents only.
Squibnocket Beach	A surf beach on the western side of the island.
Lucy Vincent Beach	Relatively empty beach open only to Chilmark residents and guests. The tide here is calmer than in other sections of the island. There are small cliffs in the background and large boulders are scattered throughout the beach.
Long Point Wildlife Refuge Beach	One of the largest public beaches in Martha's Vineyard, and is part of the 632-acre Long Point Wildlife Refuge that also includes dunes, woodlands, and prairies.
Katama Beach/South Beach State Park	Popular and well-known public beach. A 3-mile-long (4.8-km-long) barrier beach. Home to a small community of houses and an ocean-side resort. Representative photographs from Martha's Vineyard were taken from this location and can be seen in Appendix H.
Norton Point Beach	The only island beach permitting oversand driving. The beach provides an important nesting area for shorebirds.
Wasque Point on Chappaquiddick Island	Wasque Point**,** at the southeastern end of Chappaquiddick Island, is a nature reserve with picnic tables, good surf-casting, and a beach.
Nantucket	
Madaket Beach	Madaket Beach is a popular tourist destination. Portions of the long beach, such as Smith's Point, the westernmost portion of Madaket, are only accessible via four-wheel-drive vehicles or boats. The beach has been heavily eroded in the past couple of years causing these access points to be closed occasionally. Consistent with the other southern beaches in Nantucket, Madaket has heavy, sometimes dangerous, surf. Representative photographs from Nantucket Island were taken from this location and can be seen in Appendix H.
Cisco Beach	Located at the southwest end of the island, just east of Madaket, Cisco is a relatively flat beach. It can be accessed via car or a bike trail. The surf is strong and a popular spot for surfers—Cisco Beach is the home of Nantucket Island Surf School. Houses in this community are as close as 0.8 miles (1.3 km) from the shoreline.
Miacomet Beach and Pond	The surf and rip currents are strong oceanside.
Surfside Beach	Surfside is the southernmost settlement in Massachusetts. Parts of the beach are four-wheel-drive-accessible and others have beach-accessible wheelchairs. Surf is heavy. Beach is within walking distance of communities.
Tom Nevers	Surf can be heavy. No lifeguard or facilities. Access onto the beach can be difficult.
Nobadeer	Wide beach near the airport. Parking is available, but accessing the beach is difficult. Plenty of surf. No lifeguard and no facilities.
Nantucket Conservation Foundation Properties: Sanford Farm, Head of the Plains, Cisco, Madequecham	The Nantucket Conservation Foundation is a nonprofit conservation organization that protects land on Nantucket. The area is divided into 210 property parcels dispersed over the island. A few of the areas (Sanford Farm/Ram Pasture/The Woods, Head of the Plains, Cisco, and Madequecham) are on the south side of Nantucket and include views of the ocean.
Miacomet Golf Club	The Miacomet Golf Course greens are approximately ½ mile (0.8 km) from the shore and have open views of the ocean to the south.

Source: Martha's Vineyard Chamber of Commerce, 2013 and Nantucket Island Chamber of Commerce, 2011

The overall aesthetic character of Martha's Vineyard and Nantucket are that of a small-town landscape with little to moderate urban development. The horizon looking south towards the WEA from the coasts is typically defined by a view of the open ocean. Because of the development and infrastructure at some of the viewpoints, manmade lighting results in some light pollution, but most viewpoints are typical of beaches and natural areas without much development. Lights from boats/ships can be seen from all locations of the coastline on the ocean horizon on most nights, except in extremely foggy conditions. The intensity and size of the lights varies depending on the distance of the boat from the shore, and remains within the view different amounts of time depending on the direction and speed of the vessel. Photographs in Appendix H show typical views of the WEA from a representative location on each island.

Recreational fishing is discussed in Section 4.2.3.5 of this EA. Recreational vessels, including power boats, sailboats, and cruise ships also transit through the WEA—see Section 4.2.3.8 of this EA for further discussion.

4.2.3.4.2 Impact Analysis of Alternative A

As described in Section 5.2.21.2 of the PEIS (MMS, 2007a), a meteorological tower in a typical seascape could introduce a vertical line that would contrast with the horizon line and would introduce a geometrical manmade element into a natural landscape. However, the main concerns related to visual impacts of meteorological towers would be those presented by the deck (the widest and most substantial portion of the tower—approximate diameter between 16 and 40 ft [5 and 12 m]) rather than the relatively slender mast (approximate diameter between 3 to 10 ft [1 to 3 m] depending on height above the water) (GL Garrad Hassan, 2012). Visual impacts are contingent on the distance from shore, earth curvature, wave height, and atmospheric conditions that could screen some or all of the deck from view (MMS, 2007a).

Distances at which a meteorological tower could be seen from shore were calculated using the methodology described in Section 5.2.21.4 of the PEIS (MMS, 2007a). As described in the PEIS, a visibility table (Table 4-25) allows calculation of the maximum viewing distance of a structure for a given distance, structure height, and viewer elevation. For example, the theoretical maximum viewing distance for a 370 ft (112 m) tower viewed by a person 6 ft (1.8 m) tall standing at the shore is 25.4 nm (47 km). If the viewer was located on a 100 ft (30 m) headland, the theoretical viewing distance would be 34.2 nm (63.3 km). However, at these maximum distances, the tips of the towers would appear just over the horizon, with the rest of the structure below the horizon. Because atmospheric haze reduces visibility, sometimes significantly, and the presence of waves obscure objects very low on the horizon, maximum theoretical viewing distances typically exceed what is experienced in reality. Furthermore, limits to human visual acuity reduce the ability to discern objects at great distances, suggesting that even the tips of the towers may not be discernible at the maximum distances, although they theoretically would be visible.

Table 4-25
Visibility Table

Height (feet)	Distance in Geographic or Nautical Miles	Height (feet)	Distance in Geographic or Nautical Miles	Height (feet)	Distance in Geographic or Nautical Miles	Height (feet)	Distance in Geographic or Nautical Miles	Height (feet)	Distance in Geographic or Nautical Miles	Height (feet)	Distance in Geographic or Nautical Miles
1	1.2	23	5.6	45	7.8	135	13.6	340	21.6	620	29.1
2	1.7	24	5.7	46	7.9	140	13.8	350	21.9	640	29.5
3	2.0	25	5.9	47	8.0	145	14.1	360	22.2	660	30.1
4	2.3	26	6.0	48	8.1	150	14.3	370	22.5	680	30.5
5	2.6	27	6.1	49	8.2	160	14.8	380	22.8	700	31.0
6	2.9	28	6.2	50	8.3	170	15.3	390	23.1	720	31.4
7	3.1	29	6.3	55	8.7	180	15.7	400	23.4	740	31.8
8	3.3	30	6.4	60	9.1	190	16.1	410	23.7	760	32.3
9	3.5	31	6.5	65	9.4	200	16.5	420	24.0	780	32.7
10	3.7	32	6.6	70	9.8	210	17.0	430	24.3	800	33.1
11	3.9	33	6.7	75	10.1	220	17.4	440	24.5	820	33.5
12	4.1	34	6.8	80	10.5	230	17.7	450	24.8	840	33.9
13	4.2	35	6.9	85	10.8	240	18.1	460	25.1	860	34.3
14	4.4	36	7.0	90	11.1	250	18.5	470	25.4	880	34.7
15	4.5	37	7.1	95	11.4	260	18.9	480	25.6	900	35.1
16	4.7	38	7.2	100	11.7	270	19.2	490	25.9	920	35.5
17	4.3	39	7.3	105	12.0	280	19.6	500	26.2	940	35.9
18	5.1	40	7.4	110	12.3	290	19.9	520	26.7	960	36.3
19	5.1	41	7.5	115	12.5	300	20.3	540	27.2	980	36.6
20	5.2	42	7.6	120	12.8	310	20.6	560	27.7	1000	37.0
21	5.4	43	7.7	125	13.1	320	20.9	580	28.2		
22	5.5	44	7.8	130	13.3	330	21.3	600	28.7		

Explanation: The line of sight connecting the observer and a distant object is at maximum length tangent with the spherical surface of the sea. It is from this point of tangency that the tabular distances are calculated. The table must accordingly be entered twice to obtain the actual geographic visibility of the object—first with the height of the object, and second with the height of the observer's eye—and the two figures so obtained must be added. Thus, if it is desired to find the maximum distance for which a powerful light may be seen from the bridge of a tangent vessel where the height of the eye of the observer is 55 feet above the sea, from the table: 55 feet height of observer (visible) = 8.7 nautical miles, 200 feet of light (visible) = 16.5 nautical miles, and the distance the structure is visible = 25.2 nautical miles. Modified from Seascape Energy Ltd., 2002.

To evaluate impacts on visual resources, daytime and nighttime simulations of a meteorological tower were developed from Katama Beach/South Beach on Martha's Vineyard and Madaket Beach on Nantucket. These locations were chosen to illustrate views of the WEA from representative viewpoints if the towers were installed in the closest possible location from shoreline. The photographs and simulations are included in Appendix H along with a description of the visual simulation methodology. Animations showing the FAA standard obstruction lighting (AC 70/7460-1K) on the meteorological towers were created to illustrate what the tower will look like at nighttime. This animation is available for viewing at http://www.boem.gov/Renewable-Energy-Program/State-Activities/Massachusetts.aspx. The final color, intensity, and timing of tower lights would be determined in consultation with and receiving final approval from the USCG (33 CFR 66.01–11) and FAA.

Impacts on recreational resources are not anticipated in connection with Alternative A. As discussed in Section 4.2.3.5, existing port facilities would be used to support the proposed action and expansion of these facilities is not anticipated. Vessel traffic associated with Alternative A would use established nearshore traffic lanes to the extent possible, and would not travel close to the shoreline except when leaving and entering a port or dock. Therefore, any adverse impact on tourism and recreation from the additional vessels associated with the proposed action is unlikely. Spills from vessels (typically diesel spills from collisions/allisions or during refueling) or a tower or buoy during construction, operation, or maintenance activities could have the potential for adverse impacts on recreation if the spill reached shore. If a spill were to occur, it would be expected to dissipate very rapidly and biodegrade within a few days (MMS, 2007b). Therefore, because the WEA is over 12 nm (22 km) from the nearest shoreline, a spill would not likely reach the shore in quantities that would result in impacts on recreation.

Additionally, given the limited nature of the proposed activities and their distance from shore, recreational beaches would not likely be affected by waterborne trash as a result of Alternative A. Any beached litter and debris as a result of Alternative A is unlikely to be perceptible to beach users or administrators given the amount of vessel traffic and debris currently traversing the coastal areas. To reduce or eliminate the risk of intentional and/or accidental introduction of debris into the marine environment, all vessel operators, employees, and contractors actively engaged in offshore operations would be required to be briefed on marine trash and debris awareness and elimination. The lessee would also be required to ensure that its employees and contractors are made aware of the environmental and socioeconomic impacts associated with marine trash and debris and their responsibilities for ensuring that trash and debris are not intentionally or accidentally discharged into the marine environment.

4.2.3.4.3 Conclusion

As shown in the daytime visual simulations from both viewpoints, the widest portion of the meteorological tower (the deck) would be below the visual horizon and would not be visible from shore. In addition, given the width of the tower and the distance from the viewpoints, the mast of the tower would not be discernible by the naked eye in the best visibility conditions (a clear, low humidity day). Overall, visual impacts to onshore viewers of meteorological towers in daylight would be expected to be negligible to minor.

Although the lights on the tower can be seen by the naked eye in the nighttime simulations, there are multiple lights on the horizon in the Nantucket simulation, so it is difficult to know which of the lights can be attributed to the tower. Only the lit tower can be seen in the Martha's Vineyard nighttime simulation, indicating that no boats/ships were within view when the photography was taken. Lighting markers at the top of the tower would likely be visible on clear nights from the shoreline. However, boats/ships frequently appear on the horizon, making it difficult to distinguish the tower from the other lights. Weather conditions such as fog, haze, clouds, or rough seas would also greatly limit the visibility of the towers and lighting from the shore. Therefore, the presence of a flashing light or lights on a meteorological tower at night would result in minor impacts when no other lights could be seen on the horizon and negligible impacts if other lights were present. Because meteorological buoys would be at the same approximate height of the meteorological towers' decks, the visual impacts from the buoys are anticipated to be negligible.

A meteorological tower or buoy could dominate views from vessels traveling within and around the WEA, but because boats/ships are generally moving, the close-up views, and any associated impacts, would be brief. Therefore, visual impacts from vessels would likely be negligible.

Given the distance of the proposed lease areas from shore, the fact that no new coastal infrastructure would be necessary, and the small amount of vessel traffic associated with the proposed action that would be present in any given recreational area, no impacts on coastal recreational resources from the proposed action are anticipated. While adverse impacts could occur from marine trash and debris, with implementation of the mitigation discussed under the impacts analysis above, impacts would be short-term and negligible. Impacts on recreational fishing are discussed in Section 4.2.3.5.2.

4.2.3.5 Commercial and Recreational Fisheries

4.2.3.5.1 Description of the Affected Environment

The area encompassed by the Massachusetts WEA is used for both commercial and recreational fishing. The following section discusses fishing activities in the context of the proposed action in the WEA, focusing on the economic value of these fisheries to the ports where they originate.

Recreational Fishing

Much recreational fishing takes place in the waters of southern New England. Anglers go out in search of recreationally permitted species from shore, via personal vessels, and on "party" and charter vessels. Fishing occurs onshore from piers and beaches to Federal waters greater than 3 nm (5.5 km) offshore. In 2012, Massachusetts had more than 2.8 million estimated angler trips across all fishing modes (Table 4-26). Of these, 137,763 (5 percent) were greater than 3 nm (5.5 km) offshore in Federal waters (Table 4-27). The large majority of Massachusetts recreational effort is characterized as "inland," or "ocean (<=3 miles [4.8 km])" (NMFS OST, 2014a). The charter and party boat trips that occurred in the WEA during recent years were confined to the extreme western portion of the WEA (Figures 4-18 and 4-19). The last 10 years have shown a decline in recreational angler trips in the Federal Exclusive Economic Zones (Figure 4-20).

The top recreational fish species caught by weight in Massachusetts in 2012 was striped bass, followed by scup, bluefish, and black sea bass (Table 4-28; NMFS OST, 2014a).

Table 4-26

Recreational Effort by State and Fishing Mode for the Year 2012

State	Fishing Mode	Angler Trips
Connecticut	Shore	474,677
	Party Boat	9,409
	Charter Boat	17,371
	Private/Rental Boat	824,786
Massachusetts	Shore	1,151,202
	Party Boat	82,567
	Charter Boat	120,516
	Private/Rental Boat	1,470,662
Rhode Island	Shore	575,173
	Party Boat	18,344
	Charter Boat	21,985
	Private/Rental Boat	461,111

Source: NMFS OST, 2014a

Table 4-27

Massachusetts Fishing Effort in 2012 by Mode and Area

Fishing Mode	Fishing Area	Angler Trips
Shore	Ocean (<= 3 nm)	179,385
	Inland	971,817
Party Boat	Ocean (<= 3 nm)	3,056
	Ocean (> 3 nm)	22,056
	Inland	53,002
	Unknown	4,454
Charter Boat	Ocean (<= 3 nm)	31,179
	Ocean (> 3 nm)	42,411
	Inland	44,732
	Unknown	2,194
Private/Rental Boat	Ocean (<= 3 nm)	260,104
	Ocean (> 3 nm)	73,296
	Inland	1,137,261

Source: NMFS OST, 2014a

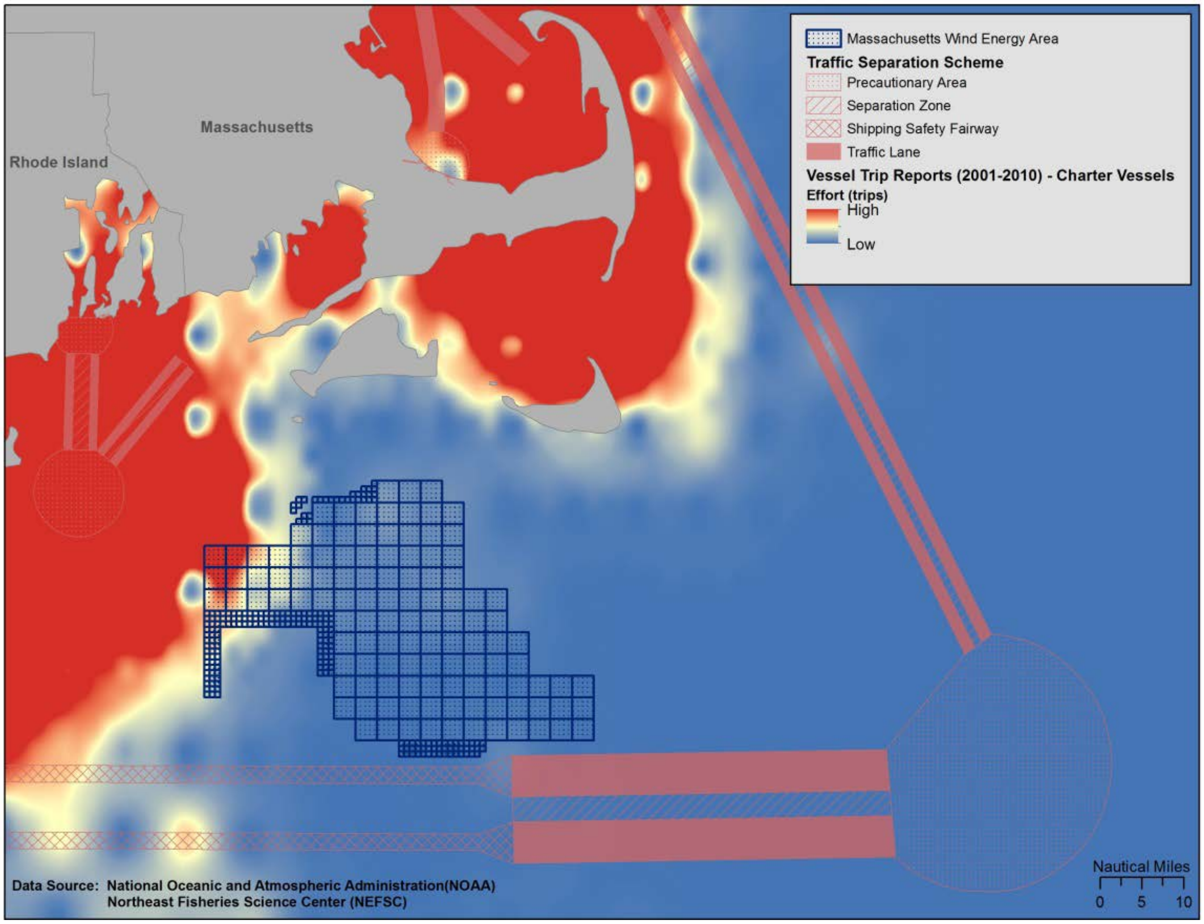
Table 4-28

Recreational Fishery Landings by Species in 2012 for Massachusetts

Species	2011 Massachusetts landings
Striped bass	5,441,893
Scup	1,795,634
Bluefish	1,298,116
Black sea bass	1,049,251
Atlantic cod	924,453
Pollock	670,593
Atlantic mackerel	623,767
Bluefin tuna	461,757
Haddock	355,237
Summer flounder	175,103
Tautog	94,699
Cusk	72,760

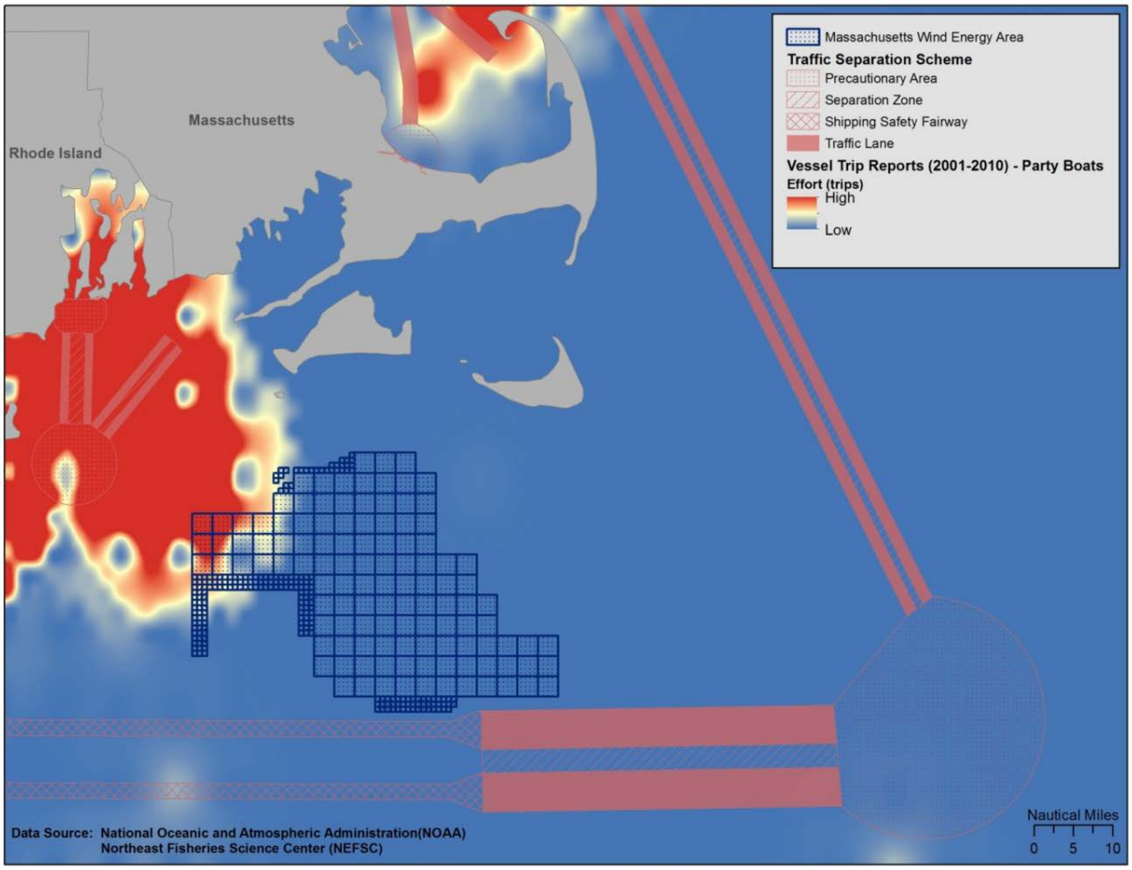
Species	2011 Massachusetts landings
Winter flounder	47,698
Atlantic bonito	28,818
False albacore	6,248

Source: NMFS OST, 2014a



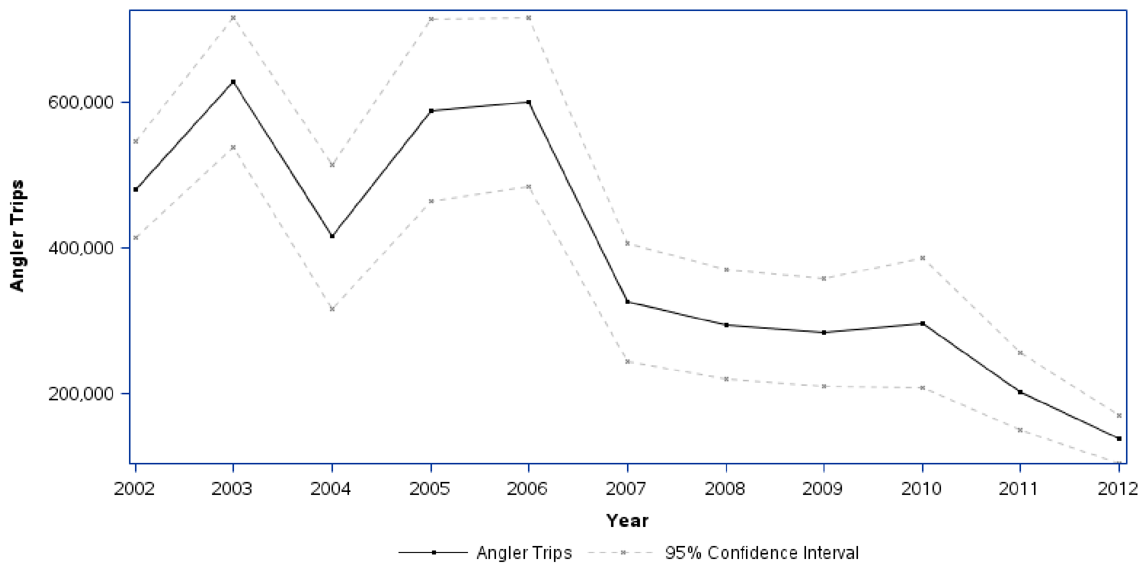
Source: NOAA Fisheries Northeast Fisheries Science Center Fishing Vessel Trip Reports 2001-2010

Figure 4-18. Vessel trip report data for charter vessels in the area of the Massachusetts WEA between 2001 and 2010



Source: NOAA Fisheries Northeast Fisheries Science Center Fishing Vessel Trip Reports 2001-2010

Figure 4-19. Vessel trip report data for party boats in the area of the Massachusetts WEA between 2001 and 2010



Source: NMFS OST, 2014a

Figure 4-20. Angler effort for recreational fisheries in Federal waters based out of Massachusetts between 2002 and 2012

Commercial Fishing

The fisheries resources in the Federal waters off the New England States provide a significant amount of revenue to the United States (Table 4-29). Some species are available in great quantities and sold for low prices (i.e., menhaden), and others are harvested more sparingly and fetch high prices (i.e., Atlantic sea scallops). A majority of fisheries in Federal waters off Massachusetts are managed by the NEFMC, though some are managed jointly between the NEFMC and the Mid-Atlantic Fishery Management Council. Other stocks and species are managed by the Atlantic States Marine Fisheries Commission, international fishery organizations, or a combination of bodies.

Table 4-29

Total Commercial Fishery Landed Weight and Value by State for the 2011 Fishing Year

State	Metric Tons	Pounds	Dollar Value
Connecticut	3,216.2	7,090,444	$19,662,230
Maine	113,165.2	249,483,953	$412,142,686
Massachusetts	119,991.6	264,533,439	$571,599,497
New Hampshire	5,585.9	12,314,743	$23,483,332
Rhode Island	34,793.5	76,705,752	$75,539,565
Total	276,752.4	610,128,331	$1,102,427,310

Source: NMFS OST, 2014b

The most important species by dollar value present in and around the Massachusetts WEA is the sea scallop (Table 4-30; NMFS OST, 2014b). In 2011, more than 15,000 metric tons of scallops were landed in the State of Massachusetts, totaling more than $330 million. However, the State where the catch is landed may not reflect the area from which the fishery is prosecuted. The major sea scallop port is located in New Bedford, MA (Table 4-31). The location of this port suggests transit to fishing grounds on Georges Bank may occur via the WEA. Several other high ranking ports in terms of seafood landings in dollar value are located in New England (Table 4-31).

Table 4-30

Commercial Landings by Weight and Value for All Species Contributing over $1 million in Massachusetts in 2011

Species	Metric Tons	Pounds	Dollar Valuee
Sea scallop	15,011.0	33,093,208	330,958,872
American lobster	6,071.8	13,385,954	53,366,939
Atlantic cod	6,809.5	15,012,175	27,582,793
Haddock	5,511.9	12,151,584	15,814,175
Goosefish	4,600.7	10,142,780	13,430,685
Atlantic surf clam	5,290.3	11,663,022	10,014,049
Eastern oyster	104.9	231,312	9,079,097
Pollock	5,348.8	11,792,014	9,000,698
Atlantic herring	30,161.9	66,494,993	8,716,940
Ocean quahog clam	5,660.4	12,478,860	7,995,143
Winter flounder	2,031.0	4,477,544	7,773,424
Bluefin tuna	361.1	796,085	6,668,154
Channeled whelk	432.9	954,379	5,943,552
Silver hake	3,747.4	8,261,597	5,012,900
White hake	2,396.6	5,283,622	4,808,661
Softshell clam	374.5	825,582	4,724,819
Yellowtail flounder	1,595.1	3,516,492	4,126,781
Atlantic plaice flounder	1,290.2	2,844,375	3,983,283
Northern quahog clam	355.4	783,515	3,961,428
Jonah crab	2,440.3	5,379,794	3,648,514
Witch flounder	780.8	1,721,397	3,581,709
Skates	6,025.7	13,284,301	3,570,273

Species	Metric Tons	Pounds	Dollar Valuee
Crabs	1,631.4	3,596,476	3,486,698
Striped bass	527.9	1,163,875	3,188,447
Acadian redfish	1,947.6	4,293,767	2,636,857
Summer flounder	513.6	1,132,192	2,559,852
Swordfish	335.9	740,635	2,249,718
Bay scallop	71.5	157,593	1,957,430
Spiny dogfish shark	4,114.9	9,071,662	1,932,190
Longfin squid	638.8	1,408,248	1,809,694

Source: NMFS OST, 2014b

Table 4-31

2011 Commercial Fishery Landings by Port Ranked by Dollars for All Ports in the New England States

Rank*	Port	Millions of Pounds	Millions of Dollars
1	New Bedford, MA	116.7	368.8
19	Gloucester, MA	77.0	60.7
23	Stonington, ME	19.4	47.8
30	Point Judith, RI	40.8	40.3
39	Portland, ME	61.1	28.3
42	Provincetown-Chatham, MA	17.9	26.8
45	Jonesport, ME	35.7	24.6
49	Rockland, ME	38.2	23.5
56	Boston, MA	13.3	17.4
58	Vinalhaven, ME	8.0	17.0
65	North Kingstown, RI	21.0	13.1
72	Spruce Head, ME	4.0	11.0
80	New London, CT	2.9	9.0
83	Stonington, CT	3.1	8.8
91	Newport, RI	5.6	7.5

*Ports are ranked out of 112 based on all ports reporting $1 million or more in landings.
Source: NMFS OST, 2014b

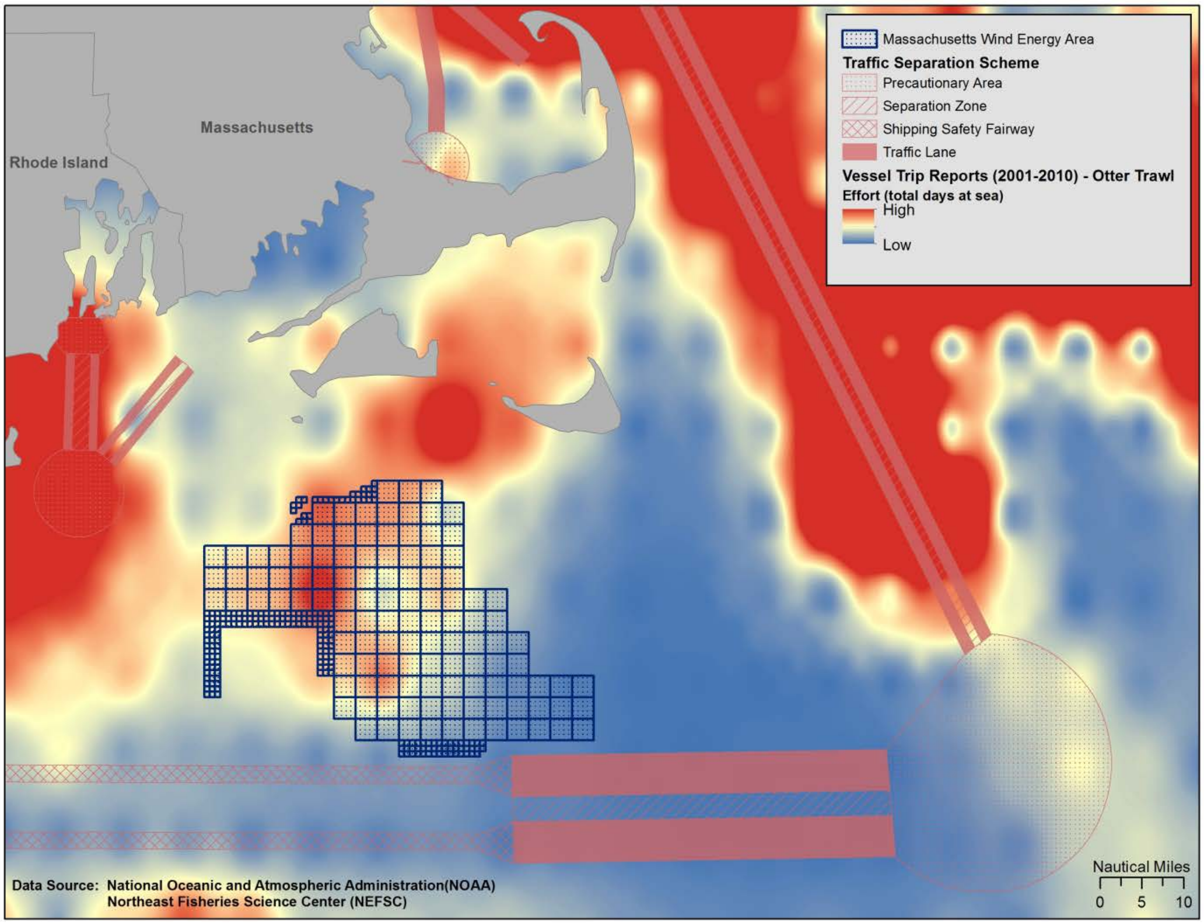
Within the State waters of Massachusetts, the commercial effort and landings data for various statistical areas, including those closest to the WEA, are presented in the Ocean Planning Work

Group Reports associated with the Massachusetts Ocean Management Plan (MA EOEEA, 2009). State commercial fishing effort is considered “low” to “medium” in State waters south of Martha’s Vineyard, adjacent to the location of the WEA. Species considered most important from this area are striped bass, fluke (summer flounder), black sea bass, and scup. The same areas are considered of “medium” and “high” importance to Massachusetts fisheries resources based on State survey data.

Commercial fishing in federal waters brings in a large amount of money for the state of Massachusetts, and the port of New Bedford has been the most valuable in the United States for much of the 2000s (NMFS, 2010c). Species with more than $5 million in annual landings in Massachusetts from federal waters in 2007 included sea scallop, lobster, monkfish, cod, haddock, winter flounder, Atlantic sea herring (*Clupea harengus*), yellowtail flounder, skates, and witch flounder (*Glyptocephalus cynoglossus*) (MA DMF, 2009 as cited in MA EOEEA, 2009).

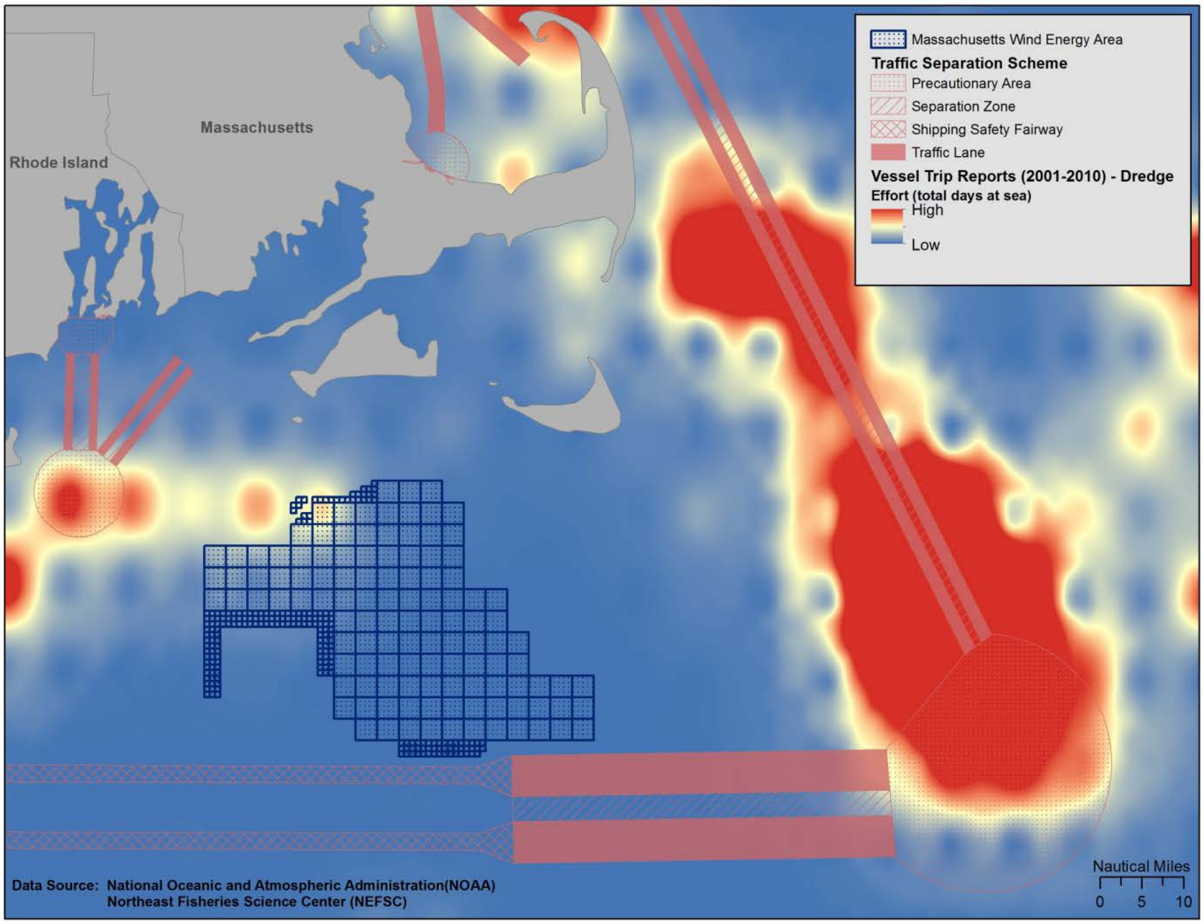
Commercial otter trawl trips reported from federally mandated vessel trip reports show the fishing effort inside the WEA to be concentrated in the central and western portions (Figure 4-21). This effort is small compared to that in the regional fishing grounds located outside the WEA. In addition, relatively little commercial trawl effort occurs to the south or east of the WEA.

Commercial scallop dredge vessel trip reports show very little effort in the WEA (Figure 4-22). A small amount of effort occurs in the northwest corner of the WEA compared to the effort on other fishing grounds outside the WEA.



Source: NOAA Fisheries Northeast Fisheries Science Center Fishing Vessel Trip Reports 2001-2010

Figure 4-21. Vessel trip report data for commercial otter trawl effort in the area of the WEA between 2001 and 2010



Source: NOAA Fisheries Northeast Fisheries Science Center Fishing Vessel Trip Reports 2001-2010

Figure 4-22. Vessel trip report data from scallop dredge vessels in the area of the WEA between 2001 and 2010

4.2.3.5.2 Impact Analysis of Alternative A

Potential effects on commercial and recreational fishing include two broad categories: (1) displacement of fishing activities, and (2) alteration of target species availability. Impacts on fish or fish habitat could affect the availability of target species. There is also the possibility that installation of meteorological towers or buoys will create additional habitat for species that use structures as habitat, which could have an indirect beneficial effect on fisheries for those species. Higher abundances of target species around meteorological towers or buoys could attract fishermen to these areas as a result of higher catch likelihood and catch rates. This could impact both commercial and recreational fisheries positively, but is more likely to impact hook-and-line fisheries.

Fisheries impacts are discussed below for both routine and non-routine (unexpected) activities associated with Alternative A. Fisheries impacts are evaluated with a focus on displacement of fishing activities; additional discussion of impacts that could affect the availability of target species is provided in Section 4.2.2.5. Section 5.2.23.2 of the PEIS (MMS, 2007a) provides additional analysis of impacts from site characterization and assessment activities on commercial and recreational fishing.

Routine Activities

The proposed site characterization and assessment activities involve installation of meteorological towers and buoys inside the WEA and surveys for site characterization. These activities would result in increased boat traffic in the area and the temporary exclusion/displacement of vessels during activities on the leasehold to prevent conflicts and collisions with survey vessels and gear. Alternative A includes installation of a maximum of five meteorological towers or 10 meteorological buoys, which take approximately 1 to 10 weeks and 1 to 3 days, respectively, to complete, and would comprise a circular area 3,000 ft (914 m) in diameter around each tower or buoy to vessel traffic during that time (see Section 3.1.4.4). Exclusion/displacement as a result of survey activities involving geotechnical exploration, etc. is expected to be on a scale of hours and confined to the immediate area around the survey ship. Vessels not related to the site characterization or site activities that may be transiting the area could use local notices to mariners to avoid the areas where towers/buoys are being installed. Site characterization and assessment activities are expected to take place in the spring and summer months, which would overlap with commercial and recreational fishing seasons. Commercial and recreational fishing will not be broadly excluded from the areas inside the WEA but rather within the immediate footprint of characterization and assessment activity itself. Noise associated with the installation of met towers/buoys and site characterization could reduce the catchability of some fish species during the duration of the noise producing activity (Normandeau Associates, Inc. 2012).

Prior to selection of the final WEA, major areas of fishing interest were removed to minimize potential conflict between activities. Commercial fishing vessels may transit the WEA en route to historical fishing grounds, but survey activities or construction activities (projected to temporarily occupy less than one percent of the WEA) would not likely interfere with access to active fishing grounds beyond the WEA outside of the need to change transit routes slightly to avoid survey and construction vessels and installed equipment. Once meteorological towers and buoys are decommissioned and removed, the proposed sites would pose no obstacle to commercial or recreational fishing.

There are numerous port and marina locations shoreward of the WEA that may be used by commercial fishing vessels, recreational vessels, and project vessels. The projected number of vessel trips for site characterization and site assessment activities at any of these ports or marinas would be up to approximately 6,500 (see Sections 3.1.3.4 and 3.1.4.4). These trips are expected to bring revenue to some businesses in fishing ports without interfering in the day-to-day operations of the fishing fleet, resulting in a small beneficial impact.

Non-Routine Events

The impacts of non-routine events on water quality are discussed in Section 4.2.1.5. Diesel fuel would be present in vessels, generators, and pile-driving hammers, all of which have the potential to be damaged in non-routine events such as collisions, allisions, and storms. Based on data from 2000 to 2011, the average oil spill size for vessels other than tank ships and tank barges was 123 gallons (USCG, 2012), so BOEM anticipates that the average volume of any potential spill caused by Alternative A would be similar. If such a diesel spill occurred, the fuel would be expected to dissipate rapidly, evaporate, and biodegrade within a few days (MMS, 2007b) because of physical oceanographic features and diesel fuel properties, resulting in negligible impact to the ecosystem and, therefore, the fishing resource and fisheries.

4.2.3.5.3 Conclusion

The proposed action would consist of vessel traffic and activities related to the installation/operation of the meteorological towers and buoys that would not measurably impact commercial or recreational fishing activities. Areas in which commercial and recreational fishermen would be excluded are small in relation to the fishing grounds, and changes to navigation necessary to reach fishing areas beyond the WEA would be minimal. Localized fishing displacement and/or target species availability/catchability within the immediate area of proposed activities may occur during the initial stages of Alternative A, but these would be temporary and confined to a limited area, resulting in a negligible, if detectible, impact to fishing. Observational equipment that would be installed under Alternative A could provide habitat for some target fish species in the area, which may have a small beneficial impact on fisheries.

4.2.3.6 Aviation

4.2.3.6.1 Description of the Affected Environment

Airport Facilities

The closest public airports to the WEA are Nantucket Memorial Airport on Nantucket Island, and Katama Airfield and Martha’s Vineyard Airport, both located on Martha’s Vineyard. Private airports nearby include Tuckernuck and Muskeget Island Airport (located on islands between Nantucket and Martha’s Vineyard). Major airports located on the mainland include Logan International Airport in Boston, MA, Providence T.F. Green Airport in Providence, RI, and Long Island near New York, NY. In addition, there is military air traffic associated with Otis Air National Guard Base on Cape Cod, MA.

Nantucket Memorial Airport and Martha’s Vineyard Airport are included in the ten system airports in Massachusetts with air traffic control towers and support both general aviation and commercial service/charter activities. Martha's Vineyard Airport is a municipal airport that serves as a vital transportation link to the mainland and to Nantucket. Because Nantucket Memorial Airport can accommodate single and multi-engine aircraft as well as corporate jets and helicopters, it is busier than Martha's Vineyard Airport, and is the second busiest airport in Massachusetts after Logan International Airport. Eight airlines currently provide service at Nantucket Memorial Airport, five of which provide seasonal service only (June–September). Approaches to these airports are over the WEA (FAA, 2012).

Aviation Corridors and Air Traffic

General aviation (not commercial airlines or freight) traffic varies throughout the year but increases during the summer season along with the tourism season on Martha's Vineyard and Nantucket. High Altitude Jetways occur at 18,000 ft (5,486 m) above mean sea level. Air traffic at lower altitudes is managed by the FAA with Low Altitude Instrument Flight Rules (IFR) routes, and with Visual Flight Rules (VFR), which generally don't have designated routes. High performance jet and turbo prop aircraft generally follow IFR routes, with planes in the proposed action area typically flying at altitudes between 3,000 to 7,000 ft (914 to 2,134 m). General aviation often uses VFR. Pilots flying under VFR assume responsibility for their separation from all other aircraft and obstructions; low flying aircraft operating under VFR are required to maintain a minimum 500 ft (152.5 m) clearance from any structure or vessel (14 CFR 91.119). There are no minimum altitude restrictions over water in the absence of any structures or vessels.

The FAA designates air space for military activities, including training routes, operating areas (OPAREAs), restricted airspace, and warning areas. There are no military OPAREAs or training routes in the airspace over the WEA (FAA, 2012). The majority of the WEA is within a U.S. Navy Aviation Warning Area, which is a type of Special Use Airspace where flight operation may be restricted at times. Warning areas extend from 3 nm (5.5 km) outward from the coast over international waters and in international airspace, but because they occur over international waters, there are no restrictions on nonmilitary aircraft. The purpose of designating such areas is to warn nonparticipating pilots of the potential danger. When in use for military exercises, the controlling agency notifies civil, general, and other military aviation organizations through notice-to-airmen and notice-to-mariner advisories, which specify the current and scheduled status of the area and warn other aircraft. Aircraft operations conducted in warning areas primarily involve air-to-air combat training and are rarely conducted at altitudes below 5,000 ft (1,524 m). The closest restricted airspace occurs around a small island that is approximately 2.8 nm south of the western end of Martha's Vineyard and approximately 6.5 nm (12 km) north of the WEA (U.S. Navy, 2007).

Additionally, the airspace above the WEA may be used by USCG or other government and private aircraft for data collection (such as the avian surveys associated with this proposed action) and search and rescue operations.

4.2.3.6.2 Impact Analysis of Alternative A

Routine Activities

Meteorological towers and buoys would be considered Private Aids to Navigation, which are regulated by the USCG under 33 CFR 66.01. Marking and lighting of meteorological towers and buoys in accordance with USCG and FAA regulations would mitigate risks to commercial, private, and government aircraft using the airspace above the WEA. If the anticipated meteorological towers are taller than 199 ft (61 m), as BOEM anticipates, each lessee would be required to file a “Notice of Proposed Construction or Alteration” with the FAA (14 CFR 77.13). Any meteorological tower more than 199 ft (61 m) tall also would require an obstruction evaluation analysis by the FAA to determine whether a meteorological tower would pose a hazard to air traffic and a Determination of Hazard/No Hazard issued by the FAA if within 12 nm (22 km) of shore. Should BOEM receive a SAP for a meteorological tower outside of FAA jurisdiction (i.e., further than 12 nm [22 km] from shore), BOEM would determine whether the proposed meteorological tower would pose a threat to air navigation. With implementation of mitigation measures and appropriate FAA review and approvals, BOEM anticipates that impacts on aviation under Alternative A would be negligible.

Radar

Meteorological towers could affect nearby radar use and accuracy because radar devices, such as avian detection/tracking radar, shipping vessel traffic-monitoring radar, and lightning detection sensors, are often on the towers themselves. Radar interference effects would depend on the type of radar, specific characteristics of meteorological towers, and the distribution of the meteorological towers. BOEM would conduct evaluations of impacts on radar systems during the SAP phase, once details about where towers would be placed within the WEA and what devices would be on the towers are known. Evaluation of impacts of meteorological towers on military and civilian radar systems would be included in any Determination of Hazard/No Hazard by the FAA (if within 12 nm [22 km] of shore). BOEM would consult with DOD on any meteorological towers outside of FAA jurisdictional authority to determine impacts of meteorological towers greater than 12 nm (22 km) from shore on military and civilian radar systems. Any meteorological tower more than 199 ft (61 m) tall and within 12 nm (22 km) of shore would require an Obstruction Evaluation and a Determination of Hazard/No Hazard by the FAA and each lessee would be required to file a “Notice of Proposed Construction or Alteration” with the FAA in accordance with Federal aviation regulations (14 CFR 77.13). According to the FAA, specific lighting requirements or recommendations, a radar impact analysis (including any existing windshear detection radar(s)), and recommendations for potential mitigation measures would be applied on a case-by-case basis (Page, personal communication, 2012).

Non-Routine Events

An aircraft (associated with survey activities, commercial airplane, or other) colliding with the meteorological structures could result in adverse impacts from the spillage of diesel fuel, oil-based lubricants, or hydraulic oil, and present a risk to the health and safety of pilot(s) and passengers.

4.2.3.6.3 Conclusion

Installation/operation of the meteorological towers and buoys would not measurably impact current or projected future military or aviation activities for several reasons. An aircraft colliding with meteorological towers is unlikely because the towers would be constructed following USCG and FAA requirements relating to marking and lighting of towers. BOEM would consult on impacts on military and civilian radar systems once project specific details are known.

4.2.3.7 Military Use Areas

4.2.3.7.1 Description of the Affected Environment

Military Use Areas, established in numerous areas off all U.S. coastlines, are required by the U.S. Air Force, Navy, Marine Corps, and Special Operations Forces to conduct various testing and training missions. Military OPAREAs define where the U.S. Navy conducts surface and subsurface training and operations. The WEA is within the Narragansett Bay OPAREA. The Navy conducts various training activities at sea, such as sinking exercises of surface targets and mine warfare exercises. The Navy also conducts shakedown cruises for newly built ships, and for ships completing overhaul or extensive repairs in shipyards located along the coasts.

The USACE has established surface danger zones and restricted areas in many areas adjacent to U.S. coastlines. These danger zones and restricted areas are typically shown on nautical charts. Danger zones are defined as water areas used for a variety of hazardous operations and may be closed to the public on a fulltime or intermittent basis. A restricted area is a defined water area for the purpose of prohibiting or limiting public access. Restricted areas generally provide security for Government property and/or protection to the public from the risks of damage or injury arising from the Government's use of that area. The regulations pertaining to the identification and use of these areas are found at 33 CFR Part 334. There are no danger zones or restricted areas within the WEA; the closest danger zone/restricted area to the WEA under Alternative A is the restricted air space over Nomans Land Island that is approximately 10 nm north of the WEA. Nomans Land Island is also designated as a danger zone for naval operations (33 CFR 334.70) because unexploded ordnance is suspected to be present (NOAA Office of Coast Survey, 2009) and public access is not permitted.

Two OCS blocks within the WEA do contain unexploded ordnance (Martin, personal communication)–Blocks 6070 and 6284.

The FAA also designates military training routes, military OPAREAs, restricted airspace, and warning areas. There are no military training routes or restricted airspaces directly over the WEA. However, as discussed above, the Narragansett Bay OPAREA occurs over the WEA. In addition, a U.S. Navy aviation warning area occurs over the majority of the WEA. See Section 4.2.3.6 under "Air Corridors and Air Traffic" for a more detailed discussion of this warning area.

Numerous military and civilian radar systems provide radar coverage along the coast of New England. The FAA evaluates structures for their potential hazard to radar when a "Notice of Proposed Construction or Alteration" is filed for a specific action (in this case, a lessee's plans to construct a meteorological tower greater than 199 ft (61 m) tall within FAA jurisdiction [up to 12 nm (22 km) offshore]). The FAA would then conduct an obstruction evaluation analysis to determine whether a meteorological tower would pose a hazard to air traffic radar, and would issue a Determination of Hazard/No Hazard.

4.2.3.7.2 Impact Analysis of Alternative A

Routine Activities

Impacts on military radar from the proposed action and future consultation with DOD and FAA are discussed under impacts on aviation in Section 4.2.3.7.2 above.

Vessel traffic in the area of the WEA, in the area of grid transmission cable routes, and ports used to support Alternative A would increase compared to existing conditions; this increase in traffic could conflict with military uses of the OCS. Direct impacts on military activities, including vessels and aircraft in the designated OPAREA from routine activities may occur as a result of increased vessel traffic. BOEM would consult with DOD on any activities that may affect military activities to determine the extent of impacts. Specific DOD requirements or recommendations for SOCs or further mitigation measures may be necessary to eliminate or reduce impacts on military activities and would also be applied on a case-by-case basis.

Prior to starting any surveying activities in OCS Blocks 6070 and 6284, where UXO are documented, BOEM would coordinate with DOD to determine the specific locations that should be avoided to mitigate the potential for encountering UXO.

Non-Routine Events

A military aircraft colliding with the meteorological structures could result in adverse impacts from the spillage of diesel fuel, oil-based lubricants, or hydraulic oil, and present a risk to the health and safety of pilot(s) and passengers.

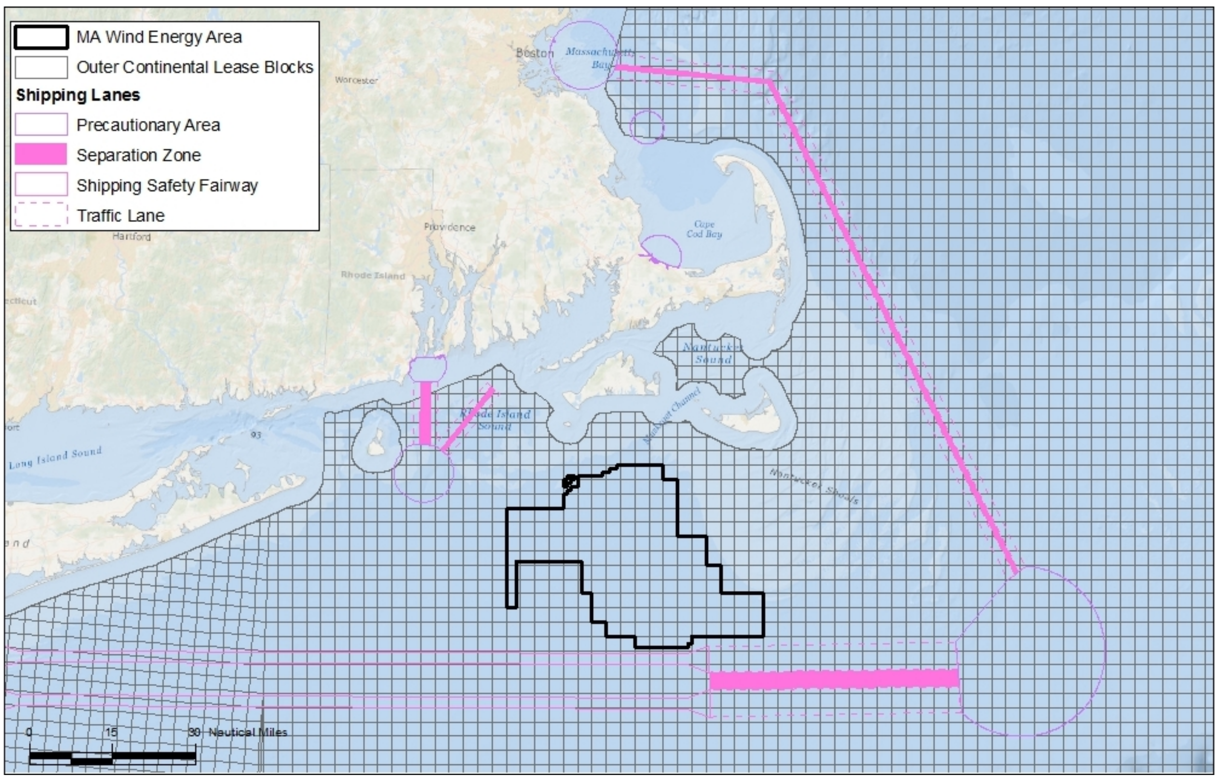
4.2.3.7.3 Conclusion

BOEM consulted with DOD on Alternative A of this EA. DOD responded that the impact on the Navy's training areas and other DOD activities from site characterization surveys and installation, operation, and decommissioning of meteorological towers/buoys offshore Massachusetts could be mitigated by site-specific stipulations designed in consultation with DOD. Therefore, impacts would be negligible and avoidable when coordinated with DOD.

4.2.3.8 Navigation/Vessel Traffic

4.2.3.8.1 Description of the Affected Environment

This section describes navigation/vessel traffic in the vicinity of the WEA. As shown in Figure 4-23, the WEA is surrounded by Routing Measures (IMO, 2010; TSS, i.e., shipping lanes) on the west, east, and south. To the north, the area is bounded by Martha's Vineyard and Nantucket. The WEA represents a crossroads between multiple heavily used waterways, including Narragansett Bay, Long Island Sound, Buzzards Bay, Vineyard and Nantucket Sounds, and offshore shipping lanes. Vessels using these ports and navigation routes include cargo ships such as tankers, bulk carries, and tug and barge units; passenger ferries; naval vessels; government research, enforcement, and search and rescue vessels; pilot boats; and fishing and recreational crafts.



Source: Modified from Northeast Ocean Data, 2014

Figure 4-23. Location of shipping channels and the WEA

Vessel traffic in the vicinity of the WEA is supported by a network of navigation features, including shipping lanes, TSS, and navigational aids. Based on the navigation chart, there are four major TSSs near the WEA; two are at the Buzzards Bay entrance, one is east of the lease area (the Nantucket to Boston TSS), and one is south of the lease area (the Nantucket to Ambrose TSS). These TSSs consist of a north/south or east/west approach and inbound and outbound lanes, marked by precautionary areas (see Figure 4-23). The Nantucket to Ambrose TSS is an offshore shipping lane that serves the New York harbor between the latitudes of 40°22’ and 40°36’ N. The southern boundary of the WEA is located about 1 nm north of this shipping lane. The Nantucket to Boston TSS serves Boston Harbor. Designed to enhance safety for commercial shipping entering/exiting ports, these Routing Measures are not mandatory.

The USCG is expected to provide additional navigational safety recommendations when the Atlantic Coast Port Access Route Study (ACPARS) is complete. The main purpose of the ACPARS is to enhance navigational safety by examining existing shipping routes and waterway uses and, to the extent practicable, reconcile the paramount right of navigation within designated port access routes. The ACPARS will include information about current vessel traffic density, fishing vessel traffic, and agency and stakeholder experience in vessel traffic management, navigation, ship handling, and effects of weather.

Shipping densities and vessel types vary with the highest vessel density levels associated with access routes to the 10 major and 21 minor ports listed in Section 3.1.2. Commercial shipping involves the transport of goods such as petroleum products, coals, and cars, while pilot boats and government enforcement and search and rescue vessels provide critical support to commercial vessel operation. Recreational and fishing vessels are also common in the vicinity of the WEA and use the same navigational features. According to a USACE report on traffic at the entrance to Narragansett Bay during the calendar year of 2011 (USACE, 2011b), a total of 1,244 vessel transits were headed to and from Providence, of which 132 transits were for dry cargos, 244 transits were for tankers, 132 transits were for tow boats, and 736 transits were for barges. The number of cargo vessels has declined over the past two decades, although the total cargo tonnage has remained relatively constant, indicating that the size of cargo vessels have increased. The data gathered during the ACPARS and its analysis results may suggest that the USCG modify the existing routing measures, create one or more precautionary areas, and/or identify area(s) to be avoided.

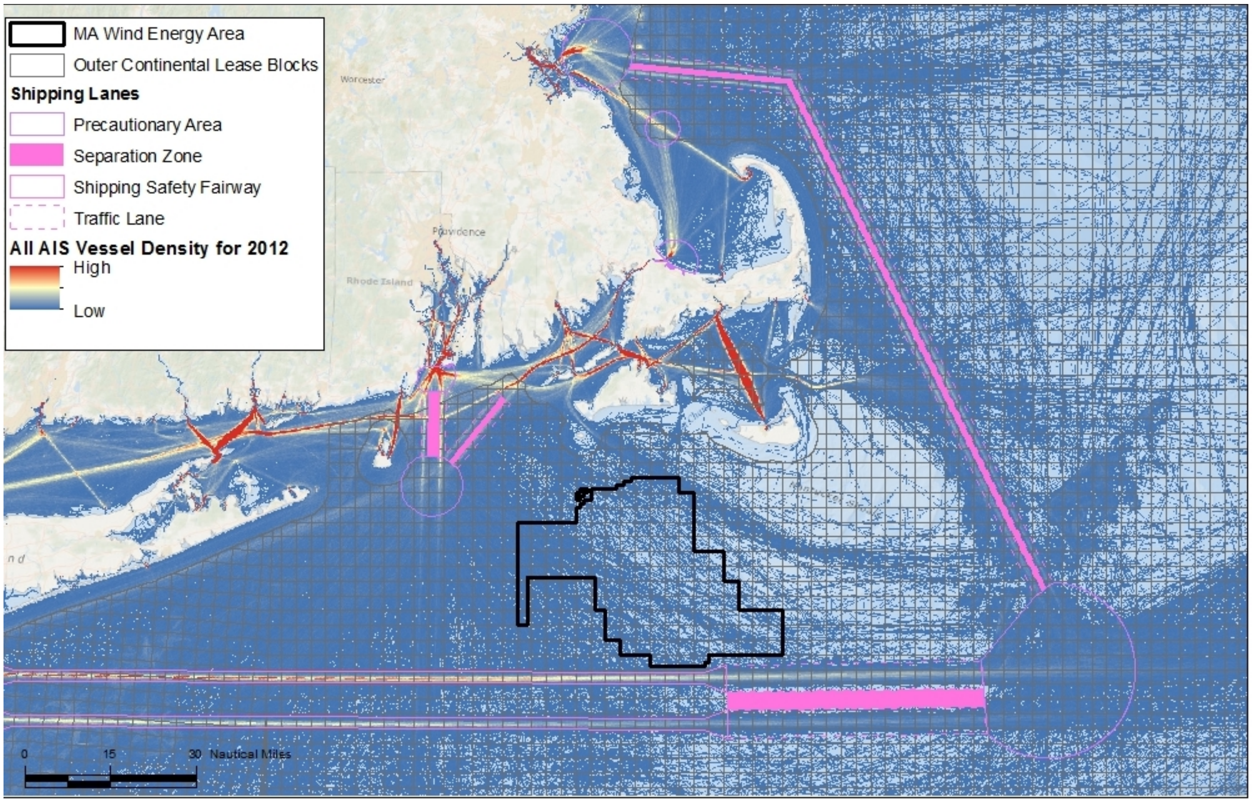
In 2010, 72 cruise ships from 17 cruise lines were scheduled to stop in Newport, RI, during April to November (Discover Newport, 2010). Most cruise ships transiting into/out of Narragansett Bay use the Recommended Vessel Route (i.e., the Bay entrance TSS).

Naval ships heading to the Naval Station Newport also enter Narragansett Bay via the Bay entrance TSS. Northeast Marine Pilots provided pilots for Navy vessels 7 times in 2006, 6 times in 2007, 10 times in 2008, and 5 times in 2009, indicating an annual average of about 7 port visits or 14 total transits (RICRMC, 2010).

Maritime commercial ship traffic is an important component of U.S. commerce. However, according to the U.S. Department of Transportation Maritime Administration (USDOT MARAD), none of the 10 major ports listed in Section 3.1.2 was included in the top ten United States ports in 2011 (USDOT MARAD, 2013). Though port usage in this region is low relative to national levels,U.S. freight tonnage is expected to grow 73 percent from 2008 levels by 2035 (USDOT MARAD, 2011).

The Northeast Ocean Data Working Group is a partnership of government agencies, non-government organizations, and private sector businesses that designs and maintains the Northeast Ocean Data Portal (Northeast Ocean Data, 2014). This is a decision support information system for the region from the Gulf of Maine to Long Island Sound, which includes vessel traffic information based on Automatic Identification Systems[5] (AIS), Vessel Monitoring System (VMS), and Vessel Trip Report (VTR) data. Figure 4-24 shows the vessel traffic density analyzed from 2012 AIS data, which indicates shipping traffic was concentrated on areas near the shipping lanes in the vicinity of the entrance to Narragansett Bay and offshore shipping lanes located south of the WEA. Though vessel traffic is generally dispersed throughout the WEA, it remains low. A two-way traffic route is visible at the entrance of the Narragansett Bay, which is more than 10 nm (18.5 km) from the WEA. The other major high-vessel-density area is the offshore shipping lane that serves the New York harbor. This shipping lane also consists of an inbound and outbound route. Some traffic approaches or departs this lane to the entrance of the Narragansett Bay; therefore, crossing the WEA.

[5] AIS is a maritime safety communications system standardized by the International Telecommunications Union and adopted by the International Maritime Organization (IMO) that provides vessel information, including type, position, course, speed, and other safety-related information automatically to appropriately equipped shore stations, other ships, and aircraft (USCG Navigation Center, 2011). It is required equipment on all vessels greater than 300 gross tons. Since AIS transponders are not required on vessels <300 gross tons, its usefulness in analysis is limited and reflects only a portion of total vessel traffic.



Source: Modified from Northeast Ocean Data, 2014

Figure 4-24. Vessel traffic density aggregated over 2012 derived from AIS data, shipping channels, and the WEA

Because Figure 4-24 represents the traffic density based only on AIS data, traffic information from vessels that weigh less than 300 tons is lacking. VMS provides additional data from fishing vessels that are required to declare into a fishery program based on regulations stipulated by NOAA National Marine Fishery Services (NMFS) (Figure 4-25).

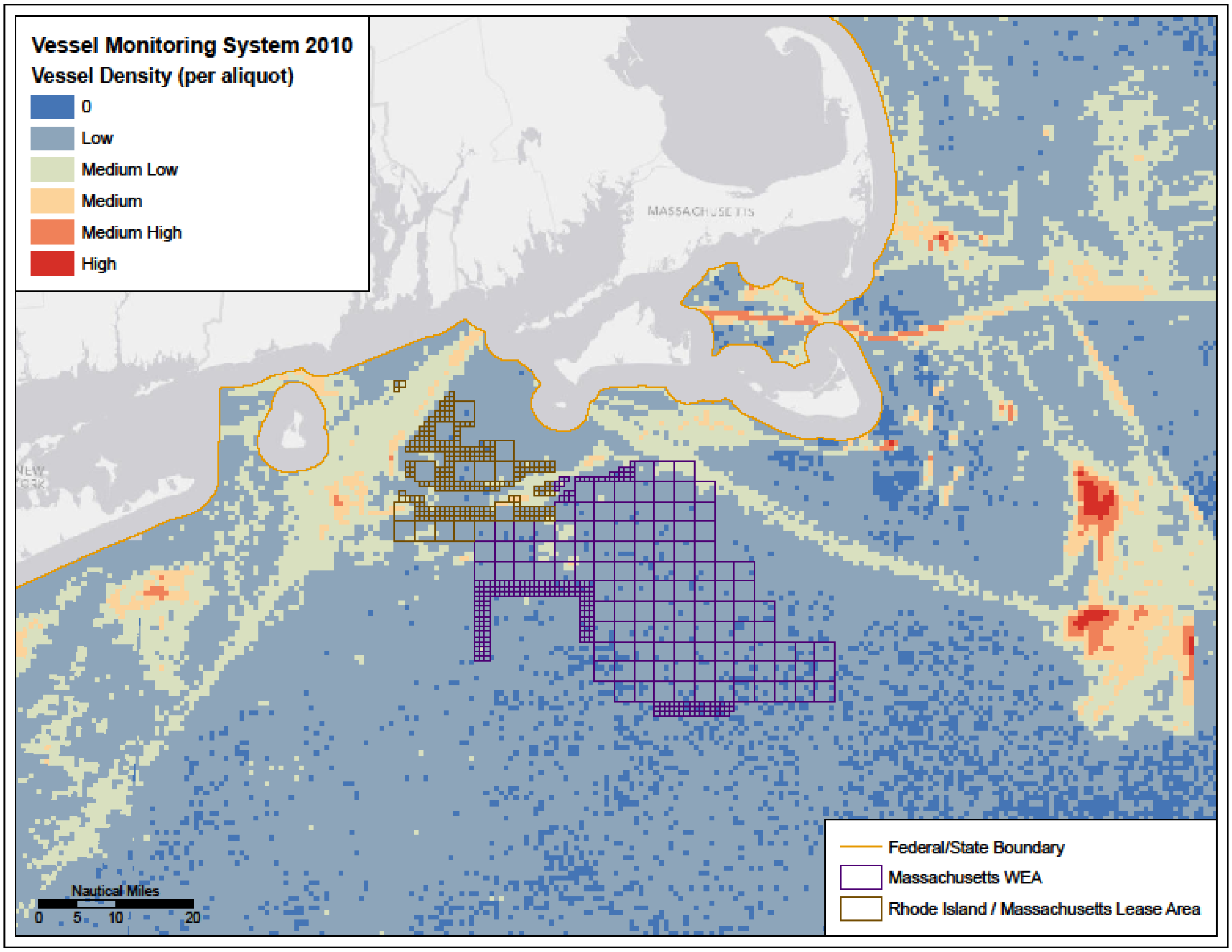
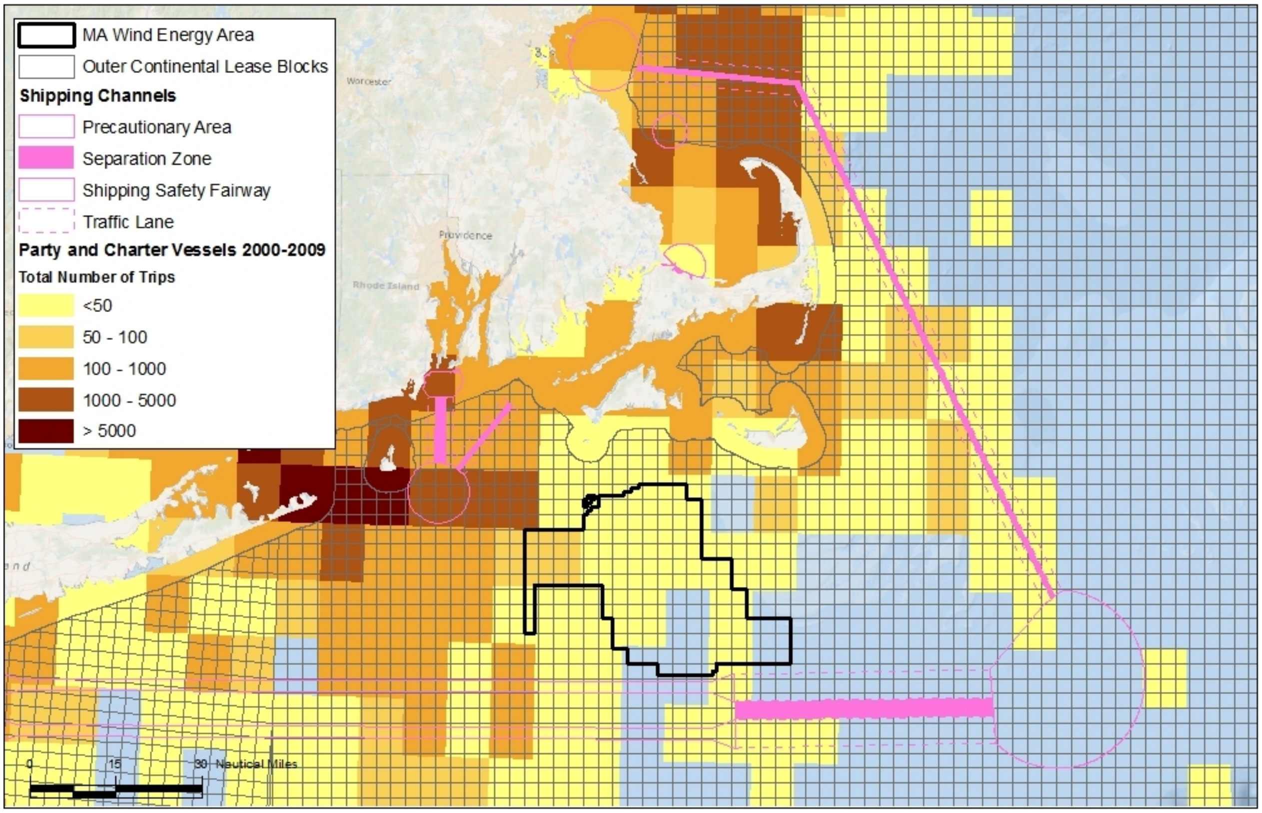


Figure 4-25. Vessel traffic density derived from VMS 2010 density data and the WEA

Figure 4-26 shows the total number of trips for recreational vessels during the years of 2000 to 2009 (Northeast Ocean Data, 2014). The areas with higher vessel traffic–greater than 100 trips during 2000-2009–are not located in the vicinity of the WEA. Most of the WEA experienced less than 50 party or charter trips for the 10-year period, with the exception of the western section which experienced between 50 and 100 recreational fishing trips. Some regions in the south and southeastern portion of the WEA had no recreational fishing traffic based on VTRs during that decade.



Source: Modified from Northeast Ocean Data, 2014

Figure 4-26. Number of recreational vessel trips, shipping channels, and the WEA

4.2.3.8.2 Impact Analysis of Alternative A

Alternative A has two primary activities that could impact navigation/vessel traffic. These activities are routine activities (e.g., deployment and operation of a meteorological buoy or construction of a meteorological tower, vessel traffic from survey) and non-routine activities (e.g., collision between vessels, allision with structures, accidental fuel discharge). Increased vessel traffic from these routine and non-routine activities would increase vessel traffic within the WEA and between the WEA and shore. This increase in traffic has the potential to directly impact coastal and offshore vessel traffic.

Routine Activities

Increased vessel traffic associated with site characterization surveys, and the construction, operation, and decommissioning of meteorological tower/buoys would be anticipated as a result of Alternative A. BOEM assumes that one or two survey vessels would be active in the WEA at any given time to conduct site characterization activities. During the time when meteorological tower/buoy construction, operations, and decommissioning are being conducted, more activities would be expected, such as a vessel to tow and assist in buoy placement, a specialized jack-up vessel for installing foundation pilings for a tower, or during routine maintenance, which results in two to three vessels at any given time. These trips could occur within and nearby the heavily trafficked areas, such as the entrance of the Narragansett Bay during the time period of the proposed action. These heavily trafficked areas are already expecting additional increases in traffic density (USDOT MARAD, 2011).

Because the additional vessel activity associated with the proposed action within the WEA is expected to be relatively small (one to two additional survey vessels during characterization and two to three vessels during the site assessment activities in a given time/space over a period of 5.5 years), BOEM does not anticipate that the number of vessels passing through the WEA for these activities would significantly increase vessel traffic density levels when compared with the existing and projected future vessel traffic in the WEA. In addition, ferry operations should not be affected by the proposed action as the ferries come no closer than 10 nm (18.5 km) from the lease area.

Although the WEA is not located within designated routing measures, meteorological towers/buoys may still pose an obstruction to navigation. The lease blocks are located within 1 nm of the heavily trafficked offshore shipping lane to New York Harbor. However, any placement of meteorological towers/buoys would be mitigated by USCG-required marking and lighting, including avoidance of heavily trafficked areas within the WEA. Meteorological towers/buoys would also be considered Private Aids to Navigation, which are regulated by the USCG under 33 CFR 66.01. A Private Aid to Navigation is a buoy, light, or day beacon owned and maintained by any individual or organization other than the USCG. These aids are designed to allow individuals or organizations to mark privately owned marine obstructions or other similar hazards to navigation. Therefore, through the use of these aids, impacts on navigation from the placement of meteorological towers and buoys are expected to be minor.

Non-Routine Events

The AIS data in Figure 4-24 indicates that the majority of large commercial vessels including cargo vessels, container vessels, and oil tankers operate within and near the TSS lanes, and follow distinct patterns to approach/depart these lanes. The WEA was designed to avoid the major shipping lanes and the heavier trafficked approach/departure areas associated with those lanes. When BOEM considers an individual SAP, it will further consider vessel traffic patterns to make sure the tower/buoy placement would reduce the already small likelihood of vessel collision or allision with structures. In addition, a fuel/oil spill resulting from a collision or allision between a vessel/tanker and a meteorological tower/buoy is not reasonably foreseeable as a result of the proposed action because of the strong likelihood that a meteorological tower/buoy would collapse or become destroyed without serious damage to an oil tanker.

According to USDOT MARAD (2013), 98 percent of the oil and gas tanker calls in the United States were by double-hulled vessels, which are much less likely to release oil from collision and/or allision than single-hulled tankers. In addition, the vessel traffic associated with site characterization surveys, and the construction, operation, and decommissioning of meteorological towers/buoys in very close proximity to the major shipping lanes and ports would not substantially increase the probability of a vessel collision(s) and/or allision(s). However, vessels servicing or decommissioning towers/buoys could collide with a tower, buoy, or other vessels. The water quality effects of non-routine events such as allisions/collisions and spills are described in Sections 3.2.2 and 3.2.3, respectively.

4.2.3.8.3 Conclusion

Impacts on vessel traffic and navigation as a result of site characterization surveys and the construction, operation, and decommissioning of meteorological and oceanographic data collection towers and buoys associated with Alternative A will be negligible and minor. Because the additional vessel activity associated with the proposed action is expected to be relatively small, the number of vessels passing through the WEA is not expected to significantly increase vessel traffic density when compared to existing and projected future vessel traffic in the WEA. Based on the use of aids, such as Private Aids to Navigation, impacts on navigation from the placement of meteorological towers and buoys are expected to be minor. In addition, because the WEA was designed to avoid the major shipping lanes, the risk of allisions with structures causing oil spills is low; in the event of an allision, a meteorological tower/buoy would likely collapse or become destroyed without serious damage to an oil tanker.

4.3 ALTERNATIVE B – NORTH ATLANTIC RIGHT WHALE AREA EXCLUSION

4.3.1 Summary of Alternative B

Alternative B would exclude approximately 233 square nm (799 square km) of the north-eastern portion of the WEA. This alternative was developed to reduce the likelihood of impacts on right whales by excluding an area of the WEA that has a relatively high known historical occurrence for right whales in the spring (see Section 4.2.2.6.1). As shown below in Table 4-32, Alternative B would result in 65 percent of the vessel traffic that would occur under Alternative A (a 35 percent reduction when compared to Alternative A). The description of the affected environment under Alternative A for all resources remains the same under Alternative B.

Table 4-32

Vessel Round Trips Anticipated under Alternative B

Activity	Number of round trips (minimum–maximum)	Percent of Trips Compared to Alternative A
Site characterization surveys	1,616–3,196	67
Construction, operation and decommissioning of meteorological towers and/or buoys (i.e., site assessment)	132–1,020	60
Total	1,748–4,216	65

4.3.2 Impact Analysis of Alternative B

As described in Section 4.2.2.6.2, significant impacts on right whales as a result of Alternative A are not expected due to SOCs. However, reasonably foreseeable adverse impacts on right whales under Alternative A may still exist for the following activities under certain circumstances: 1) acoustic effects from pile-driving activities and HRG surveys for whales present and not detected, and 2) increased potential for vessel strike especially during transit to and from the WEA as a result of potential speeds above 10 knots and/or transits at night or when visual sight detection is impaired.

Although the seasonal limitation on pile driving would reduce the risk of related noise impacts on right whales, right whales could be potentially present in the WEA during a time of year when they are not known to occur in the area (May 1 through October 31). BOEM anticipates that under Alternative B there would be three total leaseholds, which is two fewer leaseholds than the five anticipated under Alternative A. This would result in fewer meteorological towers and/or meteorological buoys under Alternative B (three meteorological towers, six buoys, or a combination of towers and buoys). Pile driving for construction of towers, which is anticipated to occur for approximately 32 hours (4 days) per tower (see Section 4.2.2.6.2), also has the potential to produce acoustic effects that may result in impacts on right whales. Therefore, because construction of three towers under Alternative B would result in 12 days of pile driving compared to 20 days of pile driving for construction of five towers under Alternative A, the risk of acoustic impacts to right whales from pile driving under Alternative B would be reduced when compared to Alternative A.

Alternative B would result in another substantial reduction in risk for impacts on right whales compared to Alternative A because of a 35 percent reduction in vessel traffic as shown in Table 4-32. As with Alternative A, the amount of vessel traffic is based on the assumption that the entire lease area would be leased and the maximum amount of site characterization surveys would be conducted. This substantial reduction of vessel traffic, coupled with SOCs such as vessel strike avoidance measures, would reduce the risk of vessel collisions with right whales when compared to Alternative A.

The risk from all of the activities is even further reduced because BOEM would remove areas of known right whale occurrences from leasing consideration under Alternative B, thus eliminating areas where project activities are more likely to interact with right whales. However, while there would be no project-specific investigations within the right whale exclusion area under Alternative B, support vessels en route to or from the southern portion of the WEA may pass through the excluded area if it is the most direct route to their port of origin.

4.3.2.1 Resources with Different Impacts than Alternative A

For several resources, although the type (beneficial or adverse) and duration (short- or long-term) of impacts would be similar to Alternative A, the context (site-specific, local, or regional) and/or intensity (negligible, minor, moderate, or substantial) of impacts would be reduced when compared to Alternative A. Those resources are discussed below.

Air Quality

Section 4.2.1.1, which describes the reasonably foreseeable impacts of Alternative A on air quality, concludes that adverse effects on ambient air quality could be reasonably expected from routine activities anticipated under Alternative A due to the large size and relative remoteness of the WEA. The reduced amount of activities under Alternative B would result in fewer emissions (primarily as a result of approximately 35 percent fewer vessel trips) in the vicinity of the lease area compared with Alternative A. Once SAPs have been submitted, BOEM would determine if a General Conformity evaluation is necessary.

Geology

The disturbance of small areas of the seafloor as a result of geotechnical exploration and the construction and deployment of meteorological towers and buoys is expected to result in a localized disturbance similar to that caused by commercial fishing, such as bottom trawls. During the deployment and operation of towers and buoys, scour of sediment adjacent to tower support piles embedded in the seabed is expected to occur. However, BOEM assumes that scour prevention methods would be deployed to prevent scour occurrence at all tower foundations; thus, causing these impacts to be minimal. Given the reduced amount of activities anticipated under Alternative B as compared to Alternative A, the associated impacts on geological resources are anticipated to be minor.

Water Quality

Activities associated with Alternative B that would affect coastal and marine water quality include vessel discharges (including bilge and ballast water and sanitary waste), tower/buoy installation and removal, and spills from non-routine events such as allisions/collisions. However, because the total amount of vessel activity under Alternative B would be approximately 65 percent of that under Alternative A, the amount and intensity of these impacts would be less than Alternative A.

Birds

Fewer site characterization and site assessment activities would occur in the Alternative B lease area compared to Alternative A, resulting in less impacts on birds. Although birds could be affected by vessel discharges, the presence of meteorological towers and buoys, and accidental fuel releases, adverse impacts on the population are not anticipated. The risk of collision with towers would be minor given the smaller number of meteorological towers proposed compared to Alternative A, the size of the towers, and their distance from shore and each other. The impact of meteorological buoys on ESA-listed and non-ESA-listed migratory birds (including pelagic species) would be less than Alternative A and is expected to be negligible.

Bats

Should migratory bats occur in the lease area, they would likely display avoidance or attraction responses to the meteorological towers and meteorological buoys, or research vessels present during site characterization activities. These avoidance or attraction effects would only occur during the night when bats are active, and are expected to be negligible to bats that may occur in the lease area. Because fewer site characterization and site assessment activities are anticipated under Alternative B compared to Alternative A, no adverse impacts on bats are anticipated.

Benthic Resources

The primary reasonably foreseeable impacts resulting from routine activities on benthic communities would be direct contact by anchors, driven piles, and scour protection that could cause crushing and smothering. BOEM anticipates that that the bottom disturbance associated with installation of three towers under Alternative B would result in approximately 486 acres (197 hectares) of impacted seafloor in the lease area, which is about 320 acres (130 hectares) less impact than anticipated under Alternative A. Should all lessees decide to install two meteorological buoys on their leases instead, the maximum area of disturbance would be approximately twice that of the towers, resulting in approximately 970 acres (393 hectares) of impacted seafloor, compared to 1,620 acres (656 hectares) under Alternative A. If the proposed maximum of three meteorological towers under Alternative B were built, the total area expected to be impacted by scour control systems or actual scour would be approximately 0.14 acres (0.06 hectare) (2,000 square ft x three meteorological towers), compared to approximately 0.23 acres (0.09 hectare) under Alternative A. Impacts on benthic communities would be short term (likely less than a year [Continental Shelf Associates, Inc., 2004]), and negligible in extent. These impacts would be localized, given the extent of the benthic habitat types on the continental shelf. The data collected during HRG surveys would indicate the presence of any potential benthic resources, so that sensitive habitat types, such as hard-bottom and live-bottom habitats, could be avoided by the lessee during geotechnical exploration and when the meteorological facility siting decisions are made.

Coastal Habitat

Because the size of the WEA under Alternative B would be reduced, less vessel traffic would be associated with site assessment and site characterization activities. Therefore, the potential for impacts on coastal habitats such as wake-induced erosion and associated sediment suspension in the port areas, or an incidental diesel fuel spill, would be less than the "negligible, localized, and temporary" impacts described under Alternative A.

Sea Turtles

SPUE data indicate that the potential risk to leatherback sea turtles would likely be reduced compared to Alternative A in the fall and summer, when this species is historically known to occur in relatively large numbers in the portion of the WEA excluded in Alternative B (Right Whale Consortium, 2014). Risk to loggerhead, Kemp's ridley and hawksbill sea turtles would also be reduced in the fall (Right Whale Consortium, 2014). Green sea turtles are uncommon in the portion of the WEA excluded in Alternative B (Right Whale Consortium, 2014), and, therefore, a decrease in potential risk within the exclusion area is not expected for these species.

Mitigation measures of exclusionary zones and surveillance by trained observers during vessel transit, survey work, and pile driving would further minimize impacts on sea turtles. There may be a small potential for acoustic impacts from HRG surveys, geotechnical exploration, and pile driving if turtles are present but undetected in the lease area. Overall under Alternative B, the short term and minimal to negligible risk of harassment of sea turtles within the lease area and surrounding waters would be slightly reduced when compared to Alternative A.

Other Marine Mammals

Historical sightings data suggest that Alternative B may result in a small decrease in potential risk for short beaked common dolphins in all four seasons; humpback whales in the spring summer, and winter; harbor porpoise in the spring, fall, and winter; bottlenose dolphins in the summer and fall; fin whales in the summer and winter, long-finned pilot whales in the spring and summer; seals in the spring and winter; and minke, right, sei whales and Risso's dolphin and Atlantic white-sided dolphin in the spring (Right Whale Consortium, 2014; see Section 4.2.2.6.1). A decrease in potential risk within the Alternative B exclusion area is not expected for sperm whales or white-beaked dolphins, because these species are not historically known to occur in that area of the WEA. Whale and dolphin species travelling to and from the northeast sector (i.e., Alternative B exclusion area) may be impacted by site characterization and site assessment activities.

Marine mammals, including right whales, occurring in the southwest portion of the lease area would be subject to the same impacts under Alternative B as they would under Alternative A.

Cultural Resources

Bottom-disturbing activities associated with the proposed action (e.g., coring, anchoring, installation of meteorological towers and buoys) would have a similar potential to affect historic and post-contact historic properties, compared to Alternative A. The reduced size of the WEA under Alternative B compared to Alternative A would not reduce the potential for impacts. Existing regulatory measures, information generated for a lessee's initial site characterization activities, and the unanticipated discoveries requirement (30 CFR 585.802) make the potential for bottom-disturbing activities to have an adverse effect on cultural resources very low. Because the reduced WEA under Alternative B would result in fewer meteorological structures and less surveying traffic compared to Alternative A, visual impacts under Alternative B on onshore cultural resources from meteorological structures and vessel traffic associated with surveys and structure construction would be reduced when compared to Alternative A.

Recreation and Visual Resources

Alternative B reduces the size of the WEA and, thus, the impacts on visual resources. In particular, the excluded area under Alternative B effectively eliminates any daytime view of meteorological towers in the lease area from Nantucket when compared to Alternative A. Although a viewer could theoretically see a tower from Martha's Vineyard during the daytime under clear, sunny conditions, BOEM anticipates that the average viewer under normal conditions (i.e., with some haze) would not be able to discern the structure. Nighttime views of a tower from Martha's Vineyard would also be more difficult under Alternative B compared to Alternative A because a tower would be located farther from the shoreline as a result of the extent and location of the excluded OCS blocks.

Navigation/Vessel Traffic

Section 4.2.3.8, which describes the reasonably foreseeable impacts of Alternative A on navigation and vessel traffic, concludes that the increase in vessel traffic associated with the proposed action would not measurably impact current or projected future shipping or navigation. Because the offshore area associated with Alternative B is smaller than the WEA under Alternative A and there would only be three meteorological towers constructed or six buoys deployed (compared with five towers and 10 buoys under Alternative A), Alternative B would have approximately 65 percent of the vessel traffic associated with Alternative A, and the intensity of impacts on vessel traffic under Alternative B would be less than the impacts described for Alternative A.

4.3.2.2 Resources with No Substantial Difference Compared to Alternative A

For the resources listed below, there is no substantial difference between the anticipated impacts of Alternative B and Alternative A, thus no additional discussion is provided:

- Physical Oceanography;
- Finfish, Shellfish, and Essential Fish Habitat;
- Demographics and Employment;
- Environmental Justice;
- Commercial and Recreational Fisheries;
- Aviation; and
- Military Use Areas.

4.3.3 Conclusion

Alternative B would result in a substantial reduction in risk for impacts on right whales compared to Alternative A. When compared to Alternative A, impacts on the following resources would also be reduced as a result of Alternative B: Air Quality, Water Quality, Geology, Birds, Bats, Benthic Resources, Coastal Habitat, Sea Turtles, Other Marine Mammals, Visual and Recreational Resources, and Navigation/Vessel Traffic. There is no substantial difference between the anticipated impacts of Alternative B and Alternative A for the following resources: Physical Oceanography, Finfish, Shellfish, and Essential Fish Habitat, Cultural Resources, Demographics and Employment, Environmental Justice, Commercial and Recreational Fisheries, Aviation, and Military Uses.

4.4 ALTERNATIVE C – AREAS WITHIN 15 NAUTICAL MILES OF THE INHABITED COAST EXCLUDED

4.4.1 Summary of Alternative C

Under Alternative C, any OCS blocks within 15 nm (28 km) of the inhabited coastline are excluded from leasing to reduce potential visual impacts to cultural resources.

As with Alternative A, BOEM anticipates that Alternative C would result in the issuance of up to five leaseholds and, therefore, the installation of five meteorological towers, 10 buoys, or a combination of towers and buoys. Alternative C would result in the vessel round trips shown in Table 4-33 in connection with site characterization and assessment activities over 5 years.

Table 4-33

Vessel Round Trips Anticipated under Alternative C

Activity	Number of round trips (minimum–maximum)	Percent of Trips Compared to Alternative A
Site characterization surveys	2,520–4,588	96
Construction, operation and decommissioning of meteorological towers and/or buoys (i.e., site assessment)	220–1700	100
Total	2,740–6,288	97

The amount of vessel traffic is based on the assumption that the entire lease area would be leased and the maximum amount of site characterization surveys would be conducted. Alternative C would result in approximately 97 percent of the trips anticipated under Alternative A. The description of the affected environment under Alternative A for all resources is the same for Alternative C.

4.4.2 Impact Analysis of Alternative C

Because the size of the WEA under Alternative C is similar to the WEA under Alternative A, the same number of meteorological towers/buoys would be constructed/deployed (five towers, 10 buoys, or a combination). As such, the type (beneficial or adverse), duration (short- or long-term), context (site-specific, local, or regional), and/or intensity (negligible, minor, moderate, or substantial) of impacts under Alternative C would be near identical to Alternative A with the exception of Recreation and Visual and Cultural Resources, which are discussed below.

Although the same number of meteorological towers could be constructed under Alternative C as for Alternative A, the exclusion of OCS blocks within 15 nm (28 km) of the shoreline from the WEA would result in towers being constructed farther from the Martha's Vineyard and Nantucket shores. Even though a viewer could theoretically see a tower beyond 15 nm from the shoreline during the daytime under clear, sunny conditions (see Section 4.2.3.4), BOEM anticipates that the average viewer under normal conditions (i.e., with some haze) would not be able to discern the tower. Nighttime views of a meteorological tower from the shoreline would also be more difficult under Alternative C compared to Alternative A because towers would be located farther from the shoreline as a result of the extent and location of the excluded OCS blocks. Because the reduced WEA under Alternative C would result in meteorological towers being constructed farther offshore than under Alternative A, visual impacts on onshore cultural resources from meteorological towers and buoys are expected to be less than compared to Alternative A. Similar to Alternative A, the potential for visual impacts from Alternative C would be very low; however any impacts are expected to be slightly reduced from the minor anticipated impacts under Alternative A. Possible viewshed impacts from commercial development would be considered at a later date under the environmental review of a COP, if received.

4.4.3 Conclusion

Alternative C would result in reduced visual impacts to onshore cultural and recreational resources from meteorological towers/buoys and vessel traffic compared to Alternative A. Under Alternative C, impacts on these resources are expected to be negligible and less than the anticipated impacts under Alternative A. All other resources are anticipated to have no substantial different level of impacts than under Alternative A.

4.5 ALTERNATIVE D – AREAS WITHIN 21 NAUTICAL MILES OF THE INHABITED COAST EXCLUDED

4.5.1 Summary of Alternative D

Under Alternative D, any OCS blocks within 21 nm (39 km) of the inhabited coastline are excluded from leasing. Alternative D was developed to reduce possible visual impacts on cultural resources. As discussed below in the Impacts Analysis of Alternative D (Section 4.5.2), the exclusion OCS blocks within 21 nm (39 km) of the inhabited shoreline, and therefore construction of towers farther offshore than under Alternative A, substantially reduces impacts on visual and therefore cultural and recreational resources compared to Alternative A.

BOEM anticipates that Alternative D would result in the issuance of up to three leaseholds and, therefore, the installation of three meteorological towers, six buoys, or a combination of towers and buoys, compared to five towers/10 buoys under Alternative A. Alternative D would result in the vessel round trips shown in Table 4-34 in connection with site characterization and assessment activities over 5 years.

Table 4-34

Vessel Round Trips Anticipated under Alternative D

Activity	Number of round trips (minimum–maximum)	Percent of Trips Compared to Alternative A
Site characterization surveys	1,624–3,236	67
Construction, operation and decommissioning of meteorological towers and/or buoys (i.e., site assessment)	132–1,020	60
Total	1,756–4,256	65

As with Alternative A, the amount of vessel traffic is based on the assumption that the entire lease area would be leased and the maximum amount of site characterization surveys would be conducted. Alternative D would result in approximately 65 percent of the trips anticipated under Alternative A. The description of the affected environment under Alternative A for all resources is the same for Alternative D.

4.5.2 Impact Analysis of Alternative D

Alternative D excludes any OCS blocks within 21 nm (39 km) of the inhabited shoreline from the WEA and, thus, substantially reduces impacts on visual and therefore cultural and recreational resources when compared to Alternative A. As described in Section 4.2.3.4, the theoretical maximum viewing distance of a meteorological tower would be 25.4 nm (47 km) from the shoreline under clear, sunny conditions. However, at that distance, the tips of the towers would appear just over the horizon, with the rest of the structure below the horizon. Because atmospheric haze reduces visibility, sometimes significantly, and the presence of waves obscure objects very low on the horizon, maximum theoretical viewing distances typically exceed what is experienced in reality. Furthermore, limits to human visual acuity reduce the ability to discern objects at great distances, suggesting that even the tips of the towers may not be discernible at the maximum distances. Under Alternative D, the blinking light on the top of a meteorological tower may be faintly discernible at nighttime under clear skies; however, the lights of vessels would be seen much more readily. Although meteorological towers could theoretically be seen under Alternative D during daytime and nighttime, atmospheric conditions on most days would make the towers difficult if not impossible to discern. In addition, the 35 percent reduction in vessel traffic under Alternative D would result in less visual impacts from vessels transiting through and to and from the WEA when compared to Alternative A. Therefore, an unencumbered view from the shoreline would occur on most days and impacts on visual resources under Alternative D are anticipated to be negligible and reduced compared to impacts under Alternative A. Possible viewshed impacts from commercial development would be considered at a later date under the environmental review of a COP, if received.

4.5.2.1 Resources with Different Impacts than Alternative A

For several resources, although the type (beneficial or adverse) and duration (short- or long-term) of impacts would be similar to Alternative A, the context (site-specific, local, or regional) and/or intensity (negligible, minor, moderate, or substantial) of impacts would be different than described under Alternative A. Those resources are discussed in this section.

Air Quality

Section 4.2.1.1, which describes the reasonably foreseeable impacts of Alternative A on air quality, concludes that adverse effects on ambient air quality could be reasonably expected from routine activities anticipated under Alternative A due to the large size and relative remoteness of the WEA. The reduced amount of activities under Alternative D would result in fewer emissions (primarily as a result of approximately 35 percent fewer vessel trips) in the vicinity of the lease area compared with Alternative A. Once SAPs have been submitted, BOEM would determine if a General Conformity evaluation is necessary.

Geology

The disturbance of small areas of the seafloor as a result of geotechnical exploration and the construction and deployment of meteorological towers and buoys is expected to result in a localized disturbance similar to that caused by commercial fishing, such as bottom trawls. During the deployment and operation of towers and buoys, scour of sediment adjacent to tower support piles embedded in the seabed is expected to occur. However, BOEM assumes that scour prevention methods would be deployed to prevent scour occurrence at all tower foundations; thus, causing these impacts to be minimal. Given the reduced amount of activities anticipated under Alternative D as compared to Alternative A, the associated impacts on geological resources are anticipated to be minor.

Water Quality

Activities associated with Alternative D that would affect coastal and marine water quality include vessel discharges (including bilge and ballast water and sanitary waste), tower/buoy installation and removal, and spills from non-routine events such as allisions/collisions. However, because the total amount of vessel activity under Alternative D would be approximately 65 percent of that under Alternative A, the amount and intensity of these impacts would be less than Alternative A.

Birds

Fewer site characterization and site assessment activities would occur in the Alternative D lease area compared to Alternative A, resulting in fewer impacts on birds. While birds could be affected by vessel discharges, the presence of meteorological towers and buoys, and accidental fuel releases, adverse impacts on the population are not anticipated. The risk of collision with towers would be minor given the smaller number of meteorological towers proposed compared to Alternative A, the size of the towers, and their distance from shore and each other. The impact of meteorological buoys on ESA-listed and non-ESA-listed migratory birds (including pelagic species) would be less than Alternative A and is expected to be negligible

Bats

Should migratory bats occur in the lease area, they would likely display avoidance or attraction responses to the meteorological towers and meteorological buoys, or research vessels present during site characterization activities. These avoidance or attraction effects would only occur during the night when bats are active, and are expected to be negligible to bats that may occur in the lease area. Because fewer site characterization and site assessment activities are anticipated under Alternative D impacts to bats would be reduced when compared to potential impacts under Alternative A; therfore, no adverse impacts on bats are anticipated.

Benthic Resources

The primary reasonably foreseeable impacts resulting from routine activities on benthic communities would be direct contact by anchors, driven piles, and scour protection that could cause crushing and smothering. BOEM anticipates that that the bottom disturbance associated with installation of three towers under Alternative D would result in approximately 486 acres (197 hectares) of impacted seafloor in the lease area, which is about 320 acres (130 hectares) less impact than anticipated under Alternative A. Should all lessees decide to install two meteorological buoys on their leases instead, the maximum area of disturbance would be approximately twice that of the towers, resulting in approximately 970 acres (393 hectares) of impacted seafloor, compared to 1,620 acres (656 hectares) under Alternative A. If the proposed maximum of three meteorological towers under Alternative D were built, the total area expected to be impacted by scour control systems or actual scour would be approximately 0.14 acres (0.06 hectare) (2,000 square ft x three meteorological towers), compared to approximately 0.23 acres (0.09 hectare) under Alternative A. Impacts on benthic communities would be short term (likely less than a year [Continental Shelf Associates, Inc., 2004]), and negligible in extent. These impacts would be localized, given the extent of the benthic habitat types on the continental shelf. The data collected during HRG surveys would indicate the presence of any potential benthic resources, so that sensitive habitat types, such as hard-bottom and live-bottom habitats, could be avoided by the lessee during geotechnical exploration and when the meteorological facility siting decisions are made. Under Alternative D, fewers acres would be impacted when compared to Alternative A, therefor potential impacts to benthic resources under Alternative D would be reduced when compared to Alternative A.

Coastal Habitat

Because the size of the WEA under Alternative D would be reduced, less vessel traffic would be associated with site assessment and site characterization activities. Therefore, the potential for impacts on coastal habitats such as wake-induced erosion and associated sediment suspension in the port areas, or an incidental diesel fuel spill, would be less than the “negligible, localized, and temporary” impacts described under Alternative A.

Marine Mammals

The lease area under Alternative D is smaller than the WEA under Alternative A, therefore, the impacts on marine mammals would likely be less compared to Alternative A. Some of the OCS blocks excluded under Alternative D are in an area of relatively high known historical occurrence for right whales in the spring (see Section 4.2.2.6.1). Consequently, the elimination of this area is likely to result in a decrease in potential risks from site characterization activities for right whales. Historical sightings data also suggest that Alternative D may result in a decrease in potential risk for sperm whales, harbor porpoise, and Atlantic white-sided dolphin in the spring and fall; fin whales in the spring and winter; humpback whales in the spring and summer; short-beaked common dolphins in the summer and fall; and bottlenose dolphins in the fall (Right Whale Consortium, 2014; see Section 4.2.2.6.1). In addition to a decrease in risk for right whales, Alternative D may result in a decrease in potential risk for sei whales, minke whales, Risso's dolphins, and seals in the spring (Right Whale Consortium, 2014). A decrease in potential risk is not expected for pilot whales or white beaked dolphins, because these species are not historically known to occur in the area of the WEA excluded from Alternative D (Right Whale Consortium, 2014). Whale and dolphin species travelling to and from the north-northeast sector (i.e., the Alternative A OCS blocks excluded from Alternative D) may be impacted by site characterization and site assessment activities. Marine mammals, including right whales, occurring in the southwest portion of the lease area would be subject to the same impacts under Alternative D as they would under Alternative A.

Sea Turtles

SPUE data indicate that the potential risk to leatherback sea turtles would likely be reduced compared to Alternative A in the summer and fall, and loggerhead sea turtles in the fall, when these species are historically known to occur in relatively large numbers in the portion of the WEA excluded in Alternative D (Right Whale Consortium, 2014). Green Kemp's ridley, and hawksbill sea turtles are uncommon in the portion of the WEA excluded in Alternative D (Right Whale Consortium, 2012), and, therefore, a decrease in potential risk within the exclusion area is not expected for these species.

Mitigation measures of exclusionary zones and surveillance by trained observers during vessel transit, survey work, and pile driving would further minimize impacts on sea turtles. There may be a small potential for acoustic impacts from HRG surveys, geotechnical exploration, and pile driving if turtles are present but undetected in the lease area. Overall, under Alternative D, the short term and minimal to negligible risk of harassment of sea turtles within the lease area and surrounding waters would be slightly reduced when compared to Alternative A.

Cultural Resources

Because the reduced WEA under Alternative D would result in meteorological towers being constructed farther offshore compared to Alternative A, visual impacts on onshore cultural resources from meteorological towers are expected to be negligible, which is less than the anticipated minor impacts under Alternative A. Additionally, impacts from bottom-disturbing activities (e.g., coring, anchoring, installation of meteorological towers and buoys) that would have the potential to affect historic and post-contact historic resources, would also be less than the potential impacts under Alternative A because of fewer samples being taken and fewer towers/buoys being installed. Existing regulatory measures, information generated for a lessee's initial site characterization activities, and the unanticipated discoveries requirement (30 CFR 585.802) further reduce the potential for bottom-disturbing activities to have an adverse effect on cultural resources under both Alternative D and Alternative A.

Navigation/Vessel Traffic

Section 4.2.3.8, which describes the reasonably foreseeable impacts of Alternative A on navigation and vessel traffic, concludes that the increase in vessel traffic associated with the proposed action would not measurably impact current or projected future shipping or navigation. Because the offshore area associated with Alternative D is smaller than the WEA under Alternative A and there would only be three meteorological towers constructed or six buoys deployed (compared with five towers and 10 buoys under Alternative A), Alternative D would have approximately 65 percent of the vessel traffic associated with Alternative A, and the intensity of impacts on vessel traffic under Alternative D would be less than the impacts described for Alternative A.

4.5.2.2 Resources with No Substantial Difference Compared to Alternative A

For the resources listed below, there is also no substantial difference in between the anticipated impacts of Alternative D and Alternative A, thus no additional discussion is provided:

- Physical Oceanography,
- Finfish, Shellfish, and Essential Fish Habitat,
- Demographics and Employment,
- Environmental Justice,
- Commercial and Recreational Fisheries,
- Aviation, and
- Military Use Areas.

4.5.3 Conclusion

Alternative D would result in reduced visual impacts to onshore cultural and recreational resources from meteorological towers/buoys and vessel traffic compared to Alternative A. Under Alternative D, impacts on these resources are expected to be negligible and less than the anticipated impacts under Alternative A. In addition, impacts from bottom-disturbing activities (e.g., coring, anchoring, installation of meteorological towers and buoys) that would have the potential to affect historic and post-contact historic resources would also be less than the potential impacts under Alternative A because of fewer samples being taken and fewer towers/buoys being installed. Compared to Alternative A, impacts on the following resources would be reduced under Alternative D; Air Quality, Water Quality, Geology, Birds, Bats, Benthic Resources, Coastal Habitat, Sea Turtles, Marine Mammals, and Navigation/Vessel Traffic. There is no substantial difference between the anticipated impacts of Alternative D and Alternative A for the following resources; Physical Oceanography, Finfish, Shellfish, and Essential Fish Habitat, Demographics and Employment, Environmental Justice, Commercial and Recreational Fisheries, Aviation, and Military Uses.

4.6 ALTERNATIVE E – NO ACTION

Under the No Action Alternative, no commercial leases to develop wind energy would be issued and there would be no approval of site assessment activities within the WEA offshore Massachusetts at this time. Opportunities for the collection of meteorological, oceanographic, and biological data offshore Massachusetts would not occur or would be postponed. Site characterization surveys would also not occur. Therefore, the potential environmental and socioeconomic impacts described in Section 4.2 of this EA would not occur or would be postponed.

4.7 CUMULATIVE IMPACTS

4.7.1 Overview

Cumulative impacts are the incremental effects of the proposed action on the environment when added to other past, present, or reasonably foreseeable future actions taking place within the region of the WEA, regardless of what agency or person undertakes the actions (see 40 CFR 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a given period. This section summarizes the cumulative impacts over the 5-year life of the proposed action (2014–2019), focusing on the incremental impact of Alternative A when added to other current and reasonably foreseeable future actions.

The spatial boundary of the cumulative impacts assessment focuses primarily on the Southern New England region where existing and planned projects/activities have the most potential for resulting in incremental impacts on resources described in this EA. The Southern New England region comprises the OCS area south of Cape Cod, MA to the northern border of New Jersey; this region is a sub-area of the Northeast U.S. Continental Shelf Large Marine Ecosystem (Link et al., 2002). However, the geographic scope of the cumulative analysis varies depending on the resources being evaluated; for example, water quality is only likely to be affected locally within the Southern New England region, but migratory species such as sea turtles would be affected by other cumulative actions at much greater distances (e.g., the entire Atlantic coast).

4.7.2 Existing and Future Reasonably Foreseeable Activities and Projects

4.7.2.1 Activities/Projects within the Atlantic OCS Southern New England Region

Block Island Wind Farm

Deepwater Wind, LLC is proposing to construct a 30 MW wind farm approximately 3 miles (4.8 km) offshore of Block Island, RI, in State waters (Deepwater Wind LLC, 2014a). See Figure 4-27. The Block Island Wind Farm would consist of five wind turbines that would produce more than 125,000 MW-hours annually. This demonstration-scale wind farm would provide power primarily to Block Island, supplying most of its electricity needs, and exporting excess electricity to the Rhode Island mainland via a subsea transmission cable traversing both State and Federal waters. Construction of the project is estimated to begin in 2014 (Deepwater Wind LLC, 2014a).

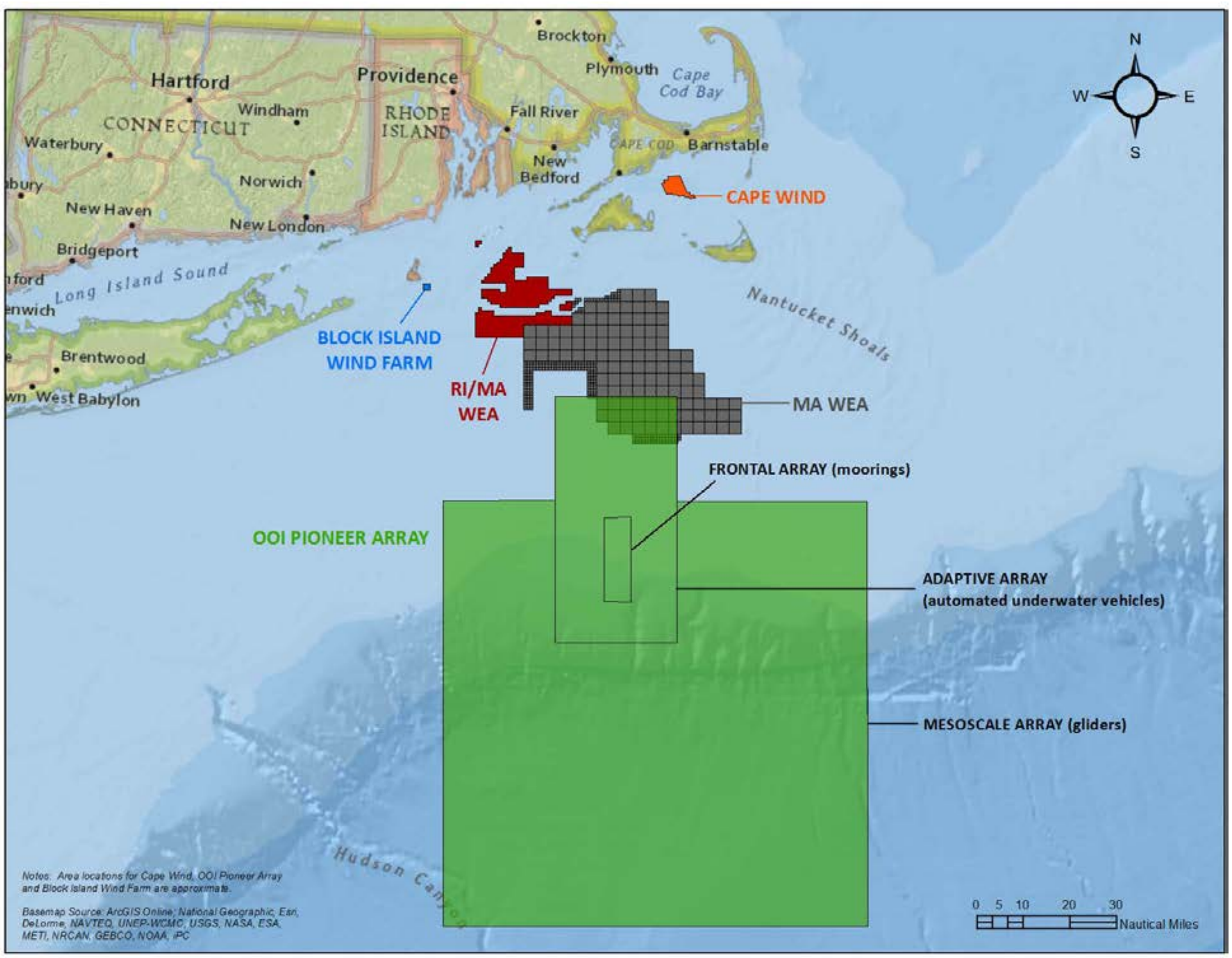


Figure 4-27. Projects considered under cumulative impacts

Deepwater Wind, LLC is collecting wind, avian, and bat data from the radar systems and meteorological mast located on Block Island and conducting terrestrial surveys for the onshore route of the cables on both Block Island and the Rhode Island mainland. In September 2011, marine surveys involving several vessels equipped with sonar, depth finders, and magnetometers were conducted; further offshore avian and bat surveys related to the Block Island Wind Farm project are not anticipated be conducted (Deepwater Wind LLC, 2014b).

Vessel traffic in both Rhode Island and Block Island Sounds will increase once construction of the Block Island Wind Farm commences. Because the Port of Quonset Point is the proposed staging area, as well as the entrance and exit site for construction and operation activities, there will also be increased vessel traffic in Narragansett Bay.

Existing Vessel Traffic and Offshore Structures

Offshore waters from the shoreline to the WEA are trafficked by commercial, private, and military vessels (see Section 4.2.3.8). According to a USACE report on traffic at the entrance to Narragansett Bay during the calendar year of 2011 (USACE, 2011b), a total of 1,244 vessel transits were headed to and from Providence, of which 132 transits were for dry cargos, 244 transits were for tankers, 132 transits were for tow boats, and 736 transits were for barges. Therefore, assuming a similar rate of vessel traffic per year, approximately 13,000 military, commercial, and recreational vessel trips are projected to occur during the 5-year period (Section 4.2.3.8). AIS data (see Section 4.2.3.8) indicate that the majority of vessel traffic traveling to/from the ports within the New England States operates within and near TSS lanes and follows distinct patterns to approach/depart these lanes. There are no meteorological towers or buoys currently located in the WEA, but meteorological, oceanographic, and navigational buoys are located in the waters between the WEA and shore.

Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic OCS Offshore Rhode Island and Massachusetts

In September 2013, BOEM issued two leases, both to Deepwater Wind New England, LLC for site assessment and site characterization activities in a WEA on the OCS offshore Rhode Island and Massachusetts (BOEM, 2014). The Rhode Island/Massachusetts WEA is adjacent to the western side of the offshore Massachusetts WEA (Figure 4-27). The proposed action covers the same activities discussed in this EA. The Rhode Island/Massachusetts WEA contains 13 whole OCS lease blocks and 29 partial OCS lease blocks that cover 164,750 acres. As assumed for this EA, BOEM also assumes that for each Rhode Island/Massachusetts WEA lease, zero to one meteorological tower, one to two buoys, or a combination, would be constructed, resulting in up to four meteorological towers or eight meteorological buoys. The Rhode Island/Massachusetts WEA will be leased for site assessment and site characterization activities for a 5-year period from 2014 to 2019.

Cape Wind Energy Project

The Cape Wind Energy Project would produce 468 MW from 130 wind turbines (Cape Wind Associates, LLC, 2014) that are proposed for construction in the center of Nantucket Sound on Horseshoe Shoal (see Figure 4-27) by the developer Energy Management Inc. Project construction, including additional surveys, is expected to begin in 2014 and end in 2016. Cape Wind Associates, LLC (the developer) will conduct pre- and post-construction avian and bat monitoring studies. Other types of studies have been/will be conducted for the following resources/environments: avian resources, marine mammals, benthic infauna and shellfish, EFH, commercial and recreational fisheries, air and water quality, visual resources, noise, alternative site analysis, marina archaeological and cultural resources, air and sea navigation, local meteorological conditions, sediment transport patterns, local geological conditions, and economics.

The four phases of construction include: manufacturing turbines, installing upland (land) cable, installing offshore electric cabling, and constructing the wind farm in Nantucket Sound (Cape Wind Associates, LLC, 2012b). Two phases of construction would contribute to increased vessel traffic: installing offshore electric cabling and constructing the wind farm. Cables from individual turbines would connect to an electrical service platform, which would connect to the Northeast electrical grid via two undersea cables. The service platform would also serve as an offshore maintenance facility.

Ocean Observatories Initiative Pioneer Array

The Ocean Observatories Initiative is a long-term, National Science Foundation-funded program to provide 25 to 30 years of sustained ocean measurements to study climate variability, ocean circulation and ecosystem dynamics, air-sea exchange, seafloor processes, and plate-scale geodynamics. The Pioneer Array, operated by the Woods Hole Oceanographic Institution, is a network of platforms and sensors that will be centered approximately 70 nm (130 km) south of Martha's Vineyard, MA, at the shelf break in the Middle-Atlantic Bight (see Figure 4-27). The array will include a network of 10 moorings and autonomous, robotic vehicles that can be programmed to monitor waters of the continental shelf and slope (Woods Hole Oceanographic Institution, 2011). The array will be located at seven sites in a rectangular pattern in water depths from about 328 ft (100 m) to 1,640 ft (500 m). Some of the moorings will incorporate a surface buoy with multiple sources of power generation and multiple surface and subsurface communications systems (Woods Hole Oceanographic Institution, 2012). The Pioneer Array is currently under construction and is expected to be fully operational by 2015.

Panamax Project and Expansion of Port Facilities

The "Panamax" project is the expansion of the Panama Canal. Canal expansion will allow larger vessels to travel through the canal, which will result in an increase in vessel traffic and the size of vessels on the East Coast. Vessels that were previously unable to get through the canal and would, therefore, dock on the West Coast and have their goods sent via truck or rail across the United States, will now be able to go through the Panama Canal and dock directly at East Coast ports. Several East Coast ports have been deepening harbors and expanding cargo-handling facilities to accommodate and attract the larger vessels.

Submerged Aquaculture Longline Area near Horseshoe Shoals

As of September 3, 2012, the USACE is currently reviewing a permit application under Section 10 of the Rivers and Harbors Act of 1899 to create a 30-acre (12-hectare) submerged aquaculture longline area in Federal waters on the OCS. Initially, three 393-ft (120-m) longlines would be deployed for shellfish farming to the east of Horseshoe Shoal in Nantucket Sound with possible build-out of up to 25 longlines. Depth of the site would be between 50-65 ft (15-20 m) below the water surface.

4.7.2.2 Activities/Projects Outside of the Atlantic OCS Southern New England Region

Because some resources, primarily migratory species, travel outside of the Southern New England region, they would be affected by impacts from a variety of projects and activities occurring all along the Atlantic Coast. The types of projects that could result in incremental impacts when combined with the proposed action include but would not be limited to the following:

- Undersea cables and transmission lines;
- Liquid Natural Gas facilities and operations;
- Water degradation/pollution from coastal discharges and offshore activities;
- Sand and gravel mining;
- BOEM’s commercial lease issuance for site assessment and site characterization activities in Maine, New Jersey, Delaware, Maryland, and Virginia; and
- Renewable energy projects.

4.7.3 Reasonably Foreseeable Cumulative Impacts

The following section addresses only those resources that have the potential to be affected from the incremental effects of the proposed action in combination with existing and future reasonably foreseeable projects and activities during the 5-year proposed action period (2014–2019). BOEM does not anticipate cumulative impacts on the following resources, and therefore they are not discussed in this section: physical oceanography, environmental justice, recreation and visual resources, and military use areas.

Some of the potential impact-producing factors of the proposed action include discharges; bottom disturbance during surveying, anchoring, and structure placement; disturbance and collision risk from an increase in vessel traffic (including noise from vessels and HRG surveys); and disturbance, space-use conflicts, and collision risk due to the presence of meteorological towers.

4.7.3.1 Physical Resources

Air Quality

Comparatively, the additional air emissions from the 2,808 to 6,500 vessel round trips associated with Alternative A would be relatively small (see Section 3.1.3.8) compared with the existing and projected future vessel traffic in the vicinity's heavily used waterways and ports.

Global Climate Change

Cumulative activities, which include Alternative A, could impact global climate change. Section 7.6.1.4 of the PEIS (MMS, 2007a) describes global climate change with respect to renewable energy development. The following is a summary of that information and incorporates new information specific to Alternative A.

The temperature of the earth's atmosphere is regulated by a balance between the radiation received from the sun, the amount reflected by the earth's surface and clouds, the amount of radiation absorbed by the earth, and the amount re-emitted to space as long-wave radiation. Greenhouse gases (GHGs) keep the earth's surface warmer than it would otherwise be because they absorb infrared radiation from the earth and, in turn, radiate this energy back down to the surface. Although these gases occur naturally in the atmosphere, there has been a rapid increase in concentrations of GHGs in the earth's atmosphere from human sources since the start of industrialization, which has caused concerns over potential changes in the global climate. The primary GHGs produced by human activities are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and halocarbons (MMS, 2007a).

The surveying, construction, and decommissioning activities associated with Alternative A would produce GHG emissions. As GHGs are relatively stable in the atmosphere and are essentially uniformly mixed throughout the troposphere and stratosphere, the climatic impact of GHG emissions does not depend upon the source location. Therefore, regional climate impacts are likely a function of global emissions. The causes and effects of climate change can be summarized as follows. First, GHGs are emitted into the atmosphere, causing global warming (i.e., an aggregate average increase in the temperature of the earth's atmosphere). Second, global warming induces the climate to change in disparate ways at various places around the globe, altering global precipitation regimes, decreasing the salinity of the oceans, and altering the seasons. Finally, climate change leads to direct impacts on the environment, such as changes in the structure of an ecosystem, changes in air quality, a reduced supply and increased cost of food, warming polar regions, higher precipitation totals, sea level rise, extreme temperatures, and severe weather events (EPA, 2012). Additionally, uptake of CO_2 in marine waters decreases the pH buffering capacity of the ocean.

In general, the GHG emissions associated with the site characterization surveys and site assessment activities under Alternative A can be assumed to contribute to climate change; however, these contributions would be so small (i.e., 6,990 metric tonnes) compared with the aggregate global emissions of GHGs that they cannot be deemed significant, if their impact could even be detected. The additional GHG emissions anticipated from Alternative A, over the 5-year period, would have a negligible incremental contribution to existing GHG emissions and, therefore, would have an exceedingly minor effect on the environment via contributions to climate change.

Geology

The WEA area on the continental shelf is dominated by sand, silt, and clay-sized unconsolidated sediment that responds to currents generated by tides and winds. Currents generated during tropical storms, hurricanes, and nor'easters can result in significant transport of these sediments. Construction and deployment of meteorological towers and buoys in the WEA combined with construction and deployments of other reasonably foreseeable actions in the region, would not have a significant cumulative impact on geology. Impacts from buoy or tower deployment are small in scale (a few meters square to a few tens of meters square) and are similar to effects occurring during storms or by commercial fish trawls.

Water Quality

The cumulative increase in military, commercial, and recreational vessel traffic would collectively contribute to discharges adversely affecting water quality.

The ports used by activities under Alternative A (Section 3.1.2) would be accessed by the Atlantic Ocean, Narragansett Bay, and Buzzards Bay. The two bays are part of the Atlantic Intracoastal Waterway system and are ecologically and commercially important to the region. The Narragansett Bay National Estuarine Research Reserve, in the heart of Narragansett Bay, protects approximately 4,400 acres (1780 hectares) of land and water (NBNERR, n.d.). Like Narragansett Bay, Buzzards Bay and its watershed is in one of the 28 national estuary programs in the United States created for the protection and restoration of water quality and living resources (Buzzards Bay National Estuary Program, 1997). Although Alternative A would result in additional vessel traffic in the coastal waters and bays, the increase in traffic would be negligible compared to existing/future commercial, private, and military traffic. Therefore, cumulative impacts on water quality from Alternative A would be negligible.

4.7.3.2 Biological Resources

Birds

Birds could be adversely affected by vessel discharges, the presence of meteorological towers and buoys, and accidental fuel releases. The risk of allision with towers or buoys would be minor given the small numbers proposed, their size, and their distance from shore and each other. Adherence to BOEM's SOCs (Appendix B) regarding tower lighting would reduce impacts. Thus, Section 4.2.2.1.2 concludes that any impacts from Alternative A on birds, including ESA-listed species, are expected to be negligible.

Birds within the Southern New England region have historically been, and will continue to be, subject to a variety of anthropogenic stressors, including allisions with manmade structures, commercial and recreational boating activity, pollution, disturbance of marine and coastal environments, hunting, habitat loss of breeding and wintering grounds, and climate change (NABCI, 2011). Migratory birds are affected by similar factors over much broader geographical scales. Impacts on birds (e.g., birds striking towers, accidental spills) that may result from Alternative A would add to the cumulative effects from past, present, and foreseeable anthropogenic activities in the region. Based on the low level of impacts on birds anticipated from Alternative A, BOEM expects that any incremental contributions to cumulative impacts would be negligible to minor.

Bats

Impacts on bats include avoidance or attraction to meteorological towers or buoys, or allisions with these structures, especially during storms. Although migratory tree bats are the most likely species to be found in the WEA, all bats would be considered rare in this offshore environment, and measureable impacts on bats are unlikely. Section 4.2.2.2.2 concludes that any impacts from Alternative A on bats are expected to be negligible.

Bats that may occur in the Southern New England region are subject to a variety of anthropogenic stressors including allisions with manmade structures. Hibernating bat species (considered much less likely to be found offshore than migratory species) have experienced high mortality rates from White Nose Syndrome. Impacts on bats (e.g., allisions with towers) that may result from Alternative A would add to the cumulative effects from past, present, and foreseeable anthropogenic activities in the region. Based on the low level of impacts on bats anticipated from Alternative A, BOEM expects that any incremental contributions to cumulative impacts would be negligible to minor.

Benthic Resources

As described in Section 4.2.2.3, the primary reasonably foreseeable impacts from site Alternative A would be direct contact by anchors, driven piles, and scour protection that could cause crushing and smothering. However, these impacts would be 1) short term with recovery likely occurring within a year; 2) take place primarily during meteorological tower/buoy installation and decommissioning; and 3) be localized in space (in approximately 0.1 to 0.2 percent of the WEA) given the extent of the benthic habitat types on the continental shelf. Therefore, impacts on benthic resources from Alternative A are expected to be negligible in extent. Similarly, for the other activities and projects within the Southern New England region (e.g., Block Island Wind Farm, Alternative A for the Rhode Island/Massachusetts WEA), the effects are expected to be short term and localized to the area of the specific activity. Therefore, anticipated deployment of meteorological towers and buoys in the WEA and future such deployments in the surrounding area would not have a significant cumulative impact on benthic resources.

Coastal Habitats

As discussed in Section 4.2.2.6, although the coastal areas of New England have a range of diverse coastal habitats, much of the Atlantic shoreline in these States has been altered in some degree, and most of the coastal habitats have been impacted by human activities. Much of this alteration has been from development, agriculture, maritime activities, beach replenishment, or shore-protection structures such as groins and jetties (MMS, 2007a). Because Alternative A would be supported by several existing port facilities , the proposed action would add a relatively minor amount of additional vessel traffic over a 5-year period, and as a result the cumulative impacts on coastal habitats from onshore activities associated with Alternative A is expected to be negligible.

Finfish, Shellfish, and Essential Fish Habitat

Marine fish and shellfish could be affected by Alternative A by noise generated by HRG surveys, geotechnical surveys, and pile driving and cutting during meteorological tower/buoy installation and decommissioning. Marine fish would generally experience short-term behavioral changes and avoid the sound source. Individuals that do not leave the area could be exposed to potentially lethal SPLs. However, the implementation of a “soft start” procedure would minimize the possibility of exposure to lethal sound levels. BOEM anticipates that the impacts per activity would be localized.

Because of the small, localized geotechnical exploration footprints occurring from the activities associated with the existing and proposed projects in the Southern New England region, benthic effects impacting fish species and their habitat, including EFH, when combined with Alternative A are expected to be negligible. Therefore, cumulative impacts are expected to be minor and would not result in changes in local fish community assemblage and diversity.

The existing and proposed meteorological structures in the area, including those proposed for Alternative A in this WEA, would form new habitat complexes that would attract certain fish species such as tautog and black sea bass. This would likely result in a cumulative increase in fish population numbers closer to the structures in multiple locations.

Although vessel traffic in the area would cumulatively increase as a result of activities associated with Alternative A and the other existing and proposed projects, the risk of discharge of waste materials or the accidental release of fuels is still expected to be low given the relatively limited number of structures and vessels that would be involved. Impacts on fish and their habitat, including EFH, from the discharge of waste materials or the accidental release of fuels are also expected to be minor because they would be temporary in nature and would occur in a limited area. If a diesel spill occurred (the most likely pollutant to be discharged), the diesel would dissipate very rapidly in the water column, and then evaporate and biodegrade within a few days (MMS, 2007b). Therefore, the cumulative effect of spills as a result of activities from Alternative A and the other existing and proposed projects is expected to be minor.

Other stresses that could cause cumulative impacts on fish, shellfish, and fisheries are fisheries harvest levels and harvest methods. There is some indication that Atlantic fisheries are already experiencing impacts of climate change. For instance, Nye et al. (2009) examined whether recent oceanographic changes associated with climate change in the Northeast U.S. continental shelf ecosystem had caused changes in spatial distribution of marine fish over time. In the analysis of temporal trends of fish stocks from 1968 to 2007, Nye et al. (2009) found stocks (especially in the southern extent of the survey area) exhibited poleward shifts in center of biomass and some occupied habitats in increasingly deeper waters.

In summary, the overall cumulative effects on finfish, shellfish, and EFH from Alternative A and the other existing and proposed projects in the area are expected to be minor because they would be short term and localized.

Marine Mammals

Marine mammals could be adversely affected by noise from HRG surveys, geotechnical exploration, pile driving for meteorological tower installation, and vessel traffic. Currently, quantifying the incremental increase in noise produced from Alternative A, or the direct effects such an increase would produce in marine mammals, is not possible. In addition to acoustic impacts, the potential for vessel collisions is an important concern for marine mammals. Other impacts on marine mammals include effects on benthic habitat, waste discharge, and accidental fuel leaks or spills. Adherence to BOEM’s SOCs (Appendix B) regarding vessel strike avoidance measures and exclusion zones to minimize acoustic impacts would reduce the potential for impacts on marine mammals, including ESA-listed species.

Due to high historical and current anthropogenic use of the Southern New England region, marine mammals have been, and will continue to be, subject to a variety of anthropogenic impacts including collisions with vessels (ship strikes), entanglement with fishing gear, anthropogenic noise, pollution, disturbance of marine and coastal environments, hunting, and climate change. Many marine mammal species migrate long distances and are affected by similar factors over broad geographical scales. For example, the critically endangered right whale migrates annually between calving areas off the southeastern coast of the United States and primary feeding areas off the coast of Canada and in the Gulf of Maine. Although large numbers of right whales are generally not thought to spend considerable amounts of time in the WEA region, in April of 2010, 98 right whales were reported feeding in the waters near the WEA (Khan et al., 2011). Cumulative impacts on right whales from a potential ship strike, or from noise levels that may alter feeding behavior, could be more significant for right whales than for other marine mammals because of the low population levels of this endangered species.

Impacts on marine mammals (e.g., vessel strikes, acoustic impacts) that may result from Alternative A would add to the cumulative effects from past, present and foreseeable anthropogenic activities in the region. Based on the mitigation measures outlined in BOEM's SOCs for Protected Species (Appendix B), the incremental contributions from Alternative A to cumulative impacts are expected to be minor, and mostly resulting from noise associated with site characterization and site assessment activities.

Sea Turtles

All sea turtle species are ESA-listed, and the following four are most likely to occur in the WEA: Loggerhead, leatherback, green, and Kemp's ridley. These sea turtles could be adversely affected by noise from HRG surveys, sub-bottom reconnaissance, pile driving for meteorological tower installation, and vessel traffic. In addition to acoustic impacts, other impacts on sea turtles include vessel strike, entanglement with towed acoustic gear, discharge of waste, accidental fuel leaks or spills, and effects to benthic foraging habitat. Adherence to BOEM's SOCs (Appendix B) regarding vessel strike avoidance measures and exclusion zones to minimize acoustic impacts would reduce the potential for impacts on sea turtles.

Sea turtles that may occur within the Southern New England region are all highly migratory. These turtles have long been subject to a variety of anthropogenic impacts throughout their range. Human impacts on sea turtles include collisions with vessels (ship strikes), entanglement with fishing gear, anthropogenic noise, pollution, disturbance of marine and coastal environments, disturbance of nesting habitat, hunting, and climate change. Impacts on sea turtles (e.g., vessel strikes, acoustic impacts) that may result from Alternative A would add to the cumulative effects from past, present and foreseeable anthropogenic activities in the region, and throughout the range of these species. Based on the mitigation measures outlined in BOEM's SOCs for Protected Species (Appendix B), the incremental contributions from Alternative A on cumulative impacts are expected to be minor, and mostly resulting from vessel traffic associated with site characterization and site assessment activities.

4.7.3.3 Socioeconomic Resources

Cultural Resources

The projects discussed in Section 4.6.2 would collectively contribute to bottom disturbances from anchoring and construction that could impact offshore cultural resources. However, surveying and avoidance of any offshore resources would mitigate impacts. Minor cumulative visual impacts would occur to onshore cultural resources from the presence of vessels associated with Alternative A when combined with the presence of vessels associated with other projects discussed in Secton 4.6.2; however, impacts would be temporary temporary in nature.

Demographics and Employment

Although the beneficial impacts on employment from Alternative A would be negligible compared with the other projects/activities in the Southern New England region, all the actions combined would result in substantial beneficial impacts on employment from the creation of new jobs to support the actions and from retaining staff in existing companies/industries. The impacts would be temporary, but would result in benefits to local coastal economies and the industries supporting offshore development and actions (e.g., surveying, design and installation/construction of structures and instrumentation, vessel maintenance, vessel fueling). No impacts on demographics are expected from Alternative A; therefore, Alternative A would not contribute to cumulative impacts.

Recreation and Visual Resources

Cumulative visual impacts would occur to onshore recreational resources from the presence of vessels associated with Alternative A when combined with the presence of vessels associated with other projects discussed in Secton 4.6.2; however, impacts would be negligible and temporary temporary in nature.

Commercial and Recreational Fisheries

BOEM anticipates that commercial and recreational fishing activities and recreational boating would continue to use the area surrounding the proposed meteorological towers. Therefore, because commercial and recreational fisheries would not be adversely affected or restricted from the proposed action, there would be no adverse cumulative impacts. Fishing vessels with a home port in southern New England and the mid-Atlantic often have a fishing range well beyond their home port and thus use much of the U.S. exclusive economic zone from Maine to North Carolina. These vessels could be impacted by site assessment and site characterization activities throughout their fishing range. However, the total increase in vessel traffic from renewable energy leasing, as well as other sources, is not likely to impede fishing as a whole along the Atlantic coast.

Aviation

Construction of towers and wind turbines associated with the Block Island Wind Farm and Cape Wind Energy Project, when combined with Alternative A would have the potential to adversely affect aviation, including risk of allisions with the structures or interference with radar. However, adherence to USCG and FAA lighting (33 CFR 66.01–11) and marking requirements along with FAA and DOD consultations regarding effects on radar for each of these projects would substantially reduce impacts. Therefore, BOEM anticipates cumulative impacts on aviation would be negligible.

Navigation/Vessel Traffic

The military, commercial, and recreational vessel traffic associated with the activities and projects discussed in Section 4.2.3.8, when combined with Alternative A, would collectively contribute to increases in vessel traffic in the region of the WEA and port facilities used to support the site characterization and site assessment activities. The WEA represents a crossroads between multiple heavily used waterways, including Narragansett Bay, Long Island Sound, Vineyard and Nantucket Sounds, and offshore shipping lanes. However, the WEA was designed to avoid the major shipping lanes and the heavier trafficked approach/departure areas associated with those lanes.

The number of trips associated with site characterization and assessment activities in this EA (up to 6,500 vessel round trips over 5 years) would be relatively minor compared with the vessel trips from the projects discussed in Section 4.2.3.8 and the existing military, commercial, and recreational traffic over the same 5-year period. Because only a few towers/buoys that would be constructed/deployed under Alternative A and they would be spread out across the WEA, no adverse impacts on navigation are anticipated when added to the existing structures in the Southern New England region. USCG marking and lighting requirements for these structures, based on 33 CFR 66.01–11, would minimize impacts on safety and navigation.

4.7.4 Conclusion

BOEM anticipates that the incremental contribution of Alternative A when combined with other reasonably foreseeable projects and activities during the 5-year site assessment period from 2014 to 2019 would result in cumulative impacts on the environment. However, with implementation of SOCs (Appendix B), following USCG and FAA lighting and marking requirements, and consultations with appropriate agencies (e.g., DOD, USFWS, NMFS, FAA), BOEM anticipates that cumulative impacts would be negligible to minor. The proposed action and alternatives would facilitate the collection of meteorological, oceanographic, and biological data for the environment offshore Massachusetts, which would lead to a better understanding of the wind resources and allow for better planning of wind energy development in that area.

5 CONSULTATION AND COORDINATION

BOEM conducted early coordination with appropriate Federal and State agencies and other concerned parties to discuss and coordinate the identification of the WEA under the Secretary's "Smart from the Start" initiative (see Sections 1.1.1 and 1.5 of this EA). Formal consultations and cooperating agency exchanges are detailed below. In addition, BOEM regularly coordinated with the Federal and State agencies noted on an informal basis through dialogue, teleconferences, and in-person meetings. Key agencies included the EOEEA, the Rhode Island Coastal Resources Management Council (RICRMC), the State Historic Preservation Offices (SHPOs) of Rhode Island and Massachusetts, the Advisory Council on Historic Preservation (ACHP), the Mashpee Wampanoag Tribe, the Wampanoag Tribe of Gayhead (Aquinnah), Shinnecock Indian Nation, the Narragansett Indian Tribe, NMFS, USFWS, DOD, FAA, USACE, USCG, EPA, and NPS.

5.1 PUBLIC INVOLVEMENT

5.1.1 Notice of Intent

On February 6, 2012, BOEM announced the NOI to prepare this EA in the *Federal Register* (77 FR 5830). The NOI solicited public input on issues and alternatives to be considered and analyzed in the EA. BOEM accepted comments until March 22, 2012. A total of 32 comments were received during the 45-day comment period. Issues identified to be analyzed included integration of CMSP tools into the EA; seasonal prohibitions on some or all survey and site characterization activities; mitigation measures to reduce or eliminate the chance of vessels striking right whales; evaluation/timing of alternative project locations, configurations/scales, and energy-generation technology scenarios; proper characterization of environmental impacts of activities proposed by developers in SAPs; implementation of best management practices, adaptive management, and monitoring programs; analysis of conflicts with vessel traffic; EFH assessment; impacts on current and future fishing activities; and analysis of noise impacts and collision risk. The comments can be viewed at regulations.gov by searching for docket ID BOEM-2011-0116.

5.1.2 Notice of Availability and Public Meetings

The Notice of Availability for review of this EA was published in the *Federal Register* on November 1, 2012. BOEM solicited comments on the EA for 30 days following publication of the Notice of Availability. Comments were submitted to regulations.gov in docket ID BOEM-2012-0086, or directly to BOEM. The EA was posted on BOEM's Web site at http://www.boem.gov/Renewable-Energy-Program/Smartfrom-the-Start/Index.aspx at the start of the public comment period. Intergovernmental Renewable Energy Task Force members were notified of the availability of the EA directly by email. In addition, BOEM held public information sessions in Massachusetts to provide an overview of the recently published EA, solicit public comment, and discuss next steps in the environmental and leasing processes. The meetings were held on November 13 in Boston and New Bedford, November 14 in Vineyard Haven, and November 15 in Nantucket.

5.1.3 Public Comments Received on the EA

A total of 25 public comment submittals were received from private citizens, Federal and State agencies, non-governmental organizations (NGOs), and other interested stakeholders. BOEM identified 187 discrete comments or issues within the 25 submittals. The analysis presented in this section considers the individual comments or issues raised rather than the individual letters or submittals because many submittals raised similar topics or issues.

Table 5-1 provides an overview of the stakeholders who submitted comments along with their affiliation and place of residence.

Table 5-1

List of Commenters and Their Affiliation

From	Affiliation	Type of Organization	Residence
Eric Lawrence	Aeolus Energy Services, Inc.	Industry	Rochester, MA
Susan Reid	Conservation Law Foundation	NGO[1]	Boston, MA
Danielle Falzon	Environment Massachusetts	NGO	Boston, MA
Timothy Timmermann	U.S. Environmental Protection Agency	Agency	Boston, MA
David Frulla	Kelley Drye & Warren LLP on behalf of Fisheries Survival Fund	NGO	Washington, DC
Richard Sullivan Jr	Massachusetts Exeutive Office Of Energy and Environmental Affairs	Agency	Boston, MA
Mark London	Martha's Vineyard Commission	Agency	Martha's Vineyard, MA
Dan Martino	Private Citizen/Martha's Vineyard Productions		Martha's Vineyard, MA
Ernie Steinhauer	Mass Audubon	NGO	Nantucket, MA
John Clarke	Mass Audubon	NGO	Boston, MA
Missy Morrison	National Park Service	Agency	Philadelphia, PA
Jennifer Janssen	National Wildlife Federation	NGO	Ann Arbor, MI

From	Affiliation	Type of Organization	Residence
Justin Allegro	National Wildlife Federation	NGO	Washington, DC
Patricia Montanio	National Oceanic and Atmospheric Administration	Agency	Silver Spring, MD
John Bullard	National Marine Fisheries Service	Agency	Silver Spring, MD
Jim Lanard, Tom Vinson	Offshore Wind Development Coalition, American Wind Energy Association	NGO	Washington, DC
Randi Allfather	Private Citizen		Nantucket, MA
Don Mallinson	Private Citizen		Falmouth, MA
Chris Parsons	Society for Conservation Biology	NGO	Washington, DC
Carl Borchert	Sound Transport, Inc	Industry	Nantucket, MA
Sharon Young	The Humane Society of the United States	NGO	Washington, DC
Wayne Klockner	The Nature Conservancy	NGO	Boston, MA
Edward Markey	U.S. House of Representatives Committee on Natural Resources		Washington, DC
William Bridwell	Vineyard Power Cooperative	NGO	Edgartown, MA
Mark Snider	Winnetu Oceanside Resort	Industry	Edgartown, MA

[1] Non-Governmental Organization

As indicated in Table 5-1, most of the commenters are affiliated with NGOs and State and Federal agencies. A few private citizens submitted comments directly to BOEM, but the majority of comments from private citizens were provided in an attachment to a National Wildlife Federation letter. A total of 753 individuals signed the National Wildlife Federation letter, which expressed support for efforts to advance offshore wind in general. Of those 753 individuals, 11 submitted specific comments; these 11 are analyzed as part of the 187 individual comments/issues identified by BOEM.

5.1.3.1 Topics Raised by Commenters

BOEM reviewed all comments submitted on the EA and categorized them into common topic categories. Figure 5-1 below illustrates the frequency that each topic was raised.

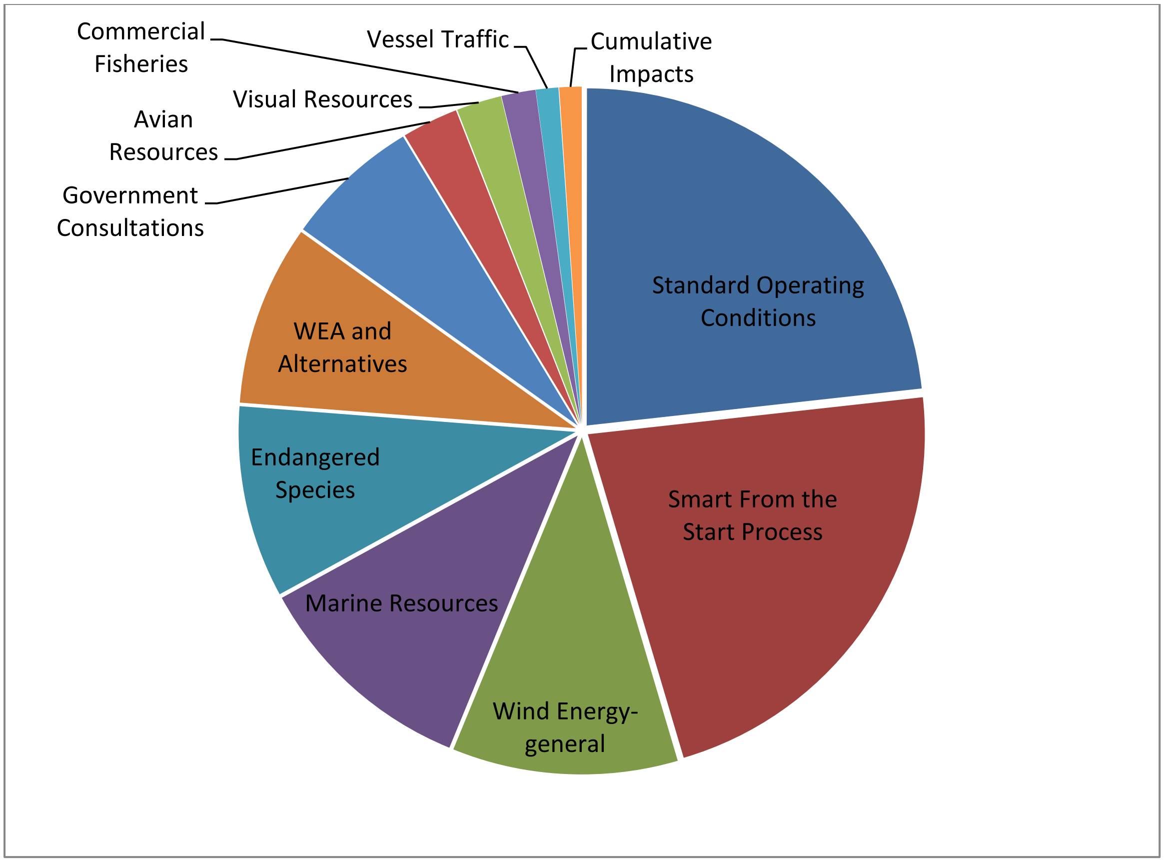


Figure 5-1. Comments received on the EA categorized by topic

A summary of the comments received within each topic is included below (in alphabetical order). BOEM's responses to frequently raised topics are included in Section 3 of this report.

Avian Resources

Commenters, mainly Mass Audubon and the Conservation Law Foundation, urged BOEM to incorporate results of ongoing and future avian studies in and around the Massachusetts WEA in future NEPA documentation. Commenters expressed an interest in information regarding the presence, abundance, distribution, and behavior or bird species within the WEA, in particular the Long-tailed Duck and the federally listed Roseate Tern.

Commercial Fisheries

Comments received under this topic concerned the potential impact of wind energy facility development in the area, which is beyond the scope of this EA. Please see Section 3.2.

Cumulative Impacts

The Humane Society of the United States and the Society for Conservation Biology submitted comments regarding the evaluation of cumulative impacts of lease activities throughout the east coast.

Endangered Species

Several organizations submitted comments regarding endangered species, such as the right whale and the fin whale, and regarding EFH. The comments ranged from asking for the WEA boundary to be retraced to provide a wider buffer from areas where fin whales have been observed to concerns regarding displacement or disturbance of right whales during site characterization activities.

Government Consultations

Commenters consisting of mostly government agencies expressed an interest in continuing to work with BOEM as the Smart from the Start process moves forward. Commenters made specific comments on the SOCs included in the EA, and asked BOEM to share data obtained during site assessment and characterization activities.

Marine Resources

Commenters, mainly NGO's, submitted comments regarding marine resources (not including endangered species) in and around the WEA. Resources mentioned in the comments include scallop fisheries and habitat, harbor porpoise, Atlantic Sturgeon, and benthic habitat. Many of the comments were general in nature and concerned new studies, survey guidelines, and the Smart from the Start process. The majority of these comments are addressed in Section 3.1 of this report.

Smart from the Start process

Most commenters submitted at least one comment regarding the Smart from the Start process. Comments ranged from support for the process in general and the intent of the EA in particular. Other comments made specific suggestions for SOCs, lease requirements, or changes to the WEA. Several comments categorized under this topic addressed the next steps of the process, and thus are outside the scope of the EA. These comments are addressed in Section 3.2 of this report.

Standard Operating Conditions

Many of the commenters raised questions on the SOCs. Comments ranged from concerns regarding whether adequate protection is provided for North Atlantic right whales, in particular the role of seasonal restrictions instead of, or in addition to, geographic restrictions. Many commenters asked if and how new technologies would be included in lease requirements and SOCs and raised questions about mitigation and monitoring, mentioning specific mitigation measures that should be included in the SOCs, such as additional marine mammal observers.

Commenters representing the wind development industry, such as the Offshore Wind Coalition, commented on the need to ensure SOCs allow developers some flexibility to adjust to changing conditions during the site assessment and site characterization phase, while still meeting regulatory requirements.

Vessel Traffic

The Humane Society submitted comments regarding BOEMs evaluation of vessel traffic increases as a result of the site assessment and site characterization activities and the resulting impacts on the North Atlantic right whale.

Visual Resources

A few NGOs raised concerns regarding the future visual impacts of offshore wind turbines. In response to BOEM's conclusion that visual impacts of the meteorological towers would be "negligible to minor" under Alternative A, one commenter urged BOEM not to exclude the OCS blocks within 15 and/or 21 miles (24 and/or 33 km) from shore.

WEA and Alternatives

BOEM received several comments supporting Alternative A, and several noting a preference for Alternative B over Alternative A. Concerns about impacts on marine mammals were the primary driver for the support of Alternative B. Some commenters raised questions regarding the process of developing the WEA. Other commenters suggested additional mitigation and/or monitoring measures be added to the Alternatives.

Offshore Wind Energy – general

Private citizens, NGOs, and some agencies submitted comments in support of the development of offshore wind energy in general and the WEA specifically. Numerous private citizens mentioned climate change, clean energy, and the production of local jobs as reasons for supporting offshore wind energy.

5.1.3.2 Keywords

In addition to topics, BOEM classified comments by keywords to find themes that spanned several topics. Across the topics, the most frequently used keyword was "North Atlantic right whale." This keyword was mentioned in comments classified under the topics "cumulative impacts," "endangered species," "marine resources," "Smart from the Start process," "SOCs," "vessel traffic," and "WEA and alternatives." Similarly, project support was mentioned in comments classified under the topics "Smart from the Start process," "WEA and alternatives," and "Offshore Wind Energy – general."

Figure 5-2 illustrates the most frequently raised keywords, ranked by percentage of times used in comments.

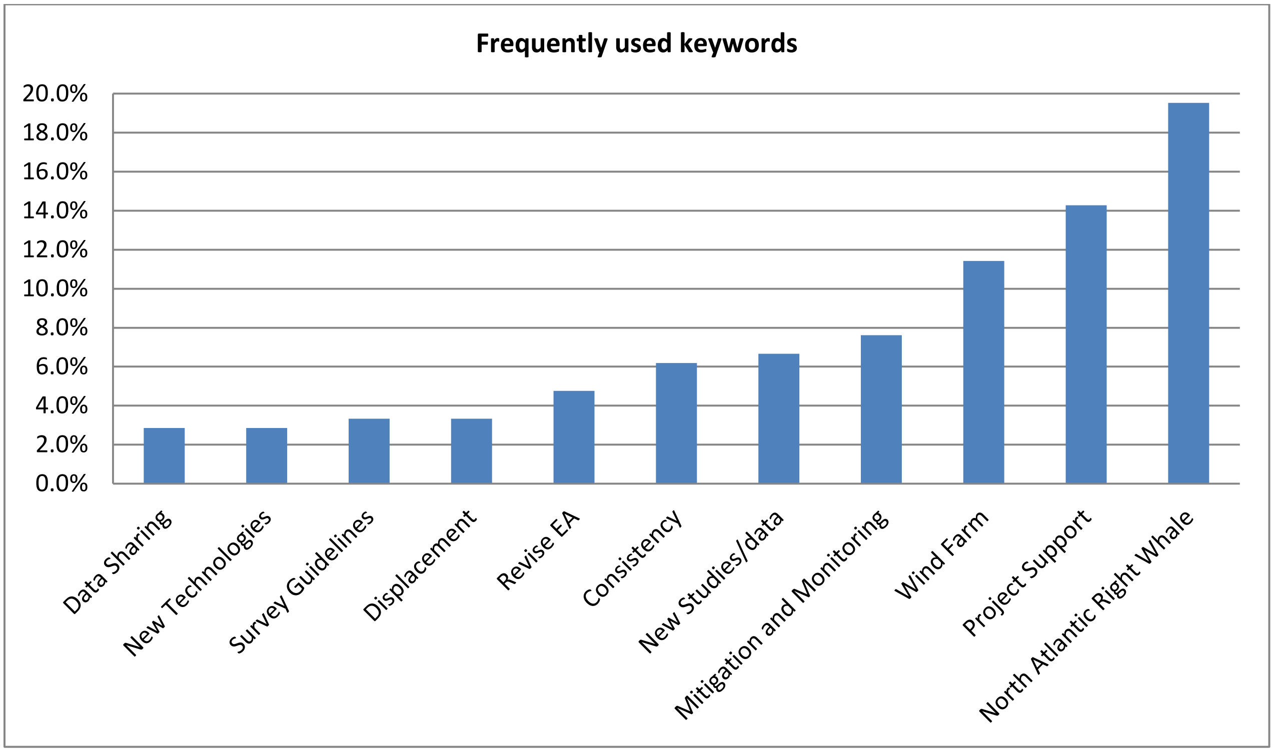


Figure 5-2. Frequently raised keywords across topics

5.1.3.3 BOEM Responses to Frequently Raised Topics and Themes

Common topics include the SOCs, marine resources (including protected species), and development and extent of the WEA. Section 5.1.3.3.1 below includes a summary of these comments as well as a consolidated BOEM response. Some of the commonly raised questions or issues are outside of the scope of the EA, such as general comments on the Smart from the Start process, comments on impacts from a future wind energy facility, or BOEM's plans for conducting studies and incorporating new research data into the ongoing process for commercial lease issuance in the MA WEA. Section 3.2 includes BOEM's consolidated responses to these comments.

5.1.3.3.1 Responses to Comments within the Scope of the EA

Standard Operating Conditions

The largest number of comments were received on BOEM's SOCs presented in the EA. Commenters mentioned the use of seasonal instead of geographic restrictions to protect marine mammals and raised questions and provided recommendations regarding how monitoring should be conducted. Recommendations of new technologies and questions regarding how new technologies could be incorporated into the SOCs were included in some responses. Commenters representing wind developers had concerns that the SOCs are too restrictive and would reduce a lessee's ability to conduct site characterization and assessment within the required timeframe. Commenters representing environmental organizations raised concerns that the SOCs are not protective enough, particularly for the North Atlantic right whale.

BOEM's Response to Standard Operating Conditions Comments

The SOCs (see Appendix B) were designed based on current scientific data to provide protection to all marine mammals, including North Atlantic right whales, fin whales, harbor porpoise, and other species. BOEM developed the SOCs through consultation with State and Federal agencies (e.g., NMFS and USFWS) to ensure that the measures would minimize impacts from project activities.

For project activities (other than pile driving) occurring throughout the year, monitoring of exclusion zones by trained observers is designed to prevent injury and minimize any possible harassment to all marine protected species by requiring shutdown or power-down of the equipment if a marine protected species should be observed within the exclusion zone. Therefore, BOEM anticipates that any potential impacts would be minimized.

Additionally, the vessel strike avoidance measures in the SOCs state that a lessee must reduce vessel speed to 10 knots or less in DMAs, as well as prescribing minimum separation distances and avoidance measures for all survey vessels when any right whale is observed during any time of the year.

BOEM has considered the fact that displacement of marine mammals or behavioral disturbance/avoidance may result in the effective loss of access to preferred habitat, including potential feeding habitat, however, the MA WEA does not fall within any known feeding grounds or critical habitat and seasonal operation restrictions, as stated in the SOCs, have been adopted to avoid and minimize impacts on marine mammals, including displacement.

The SOCs also state that if a lessee intends to conduct geological and geophysical (G&G) survey operations at night or when visual observation is otherwise impaired, an alternative monitoring plan detailing the alternative monitoring methodology (e.g., active or passive acoustic monitoring technologies) must be submitted to BOEM for consideration. BOEM may, after consultation with NMFS, decide to allow the lessee to conduct G&G surveys at night or when visual observation is otherwise impaired using the proposed alternative monitoring methodology.

As more information regarding project activities and impacts becomes available through new studies and monitoring efforts, BOEM's process of Smart from the Start provides opportunities for further development of SOCs, which can be applied to each specific lease agreement (see Section 2.6). BOEM will continue to analyze and develop SOCs that minimize impacts on marine protected species in subsequent NEPA documentation based on new/current data.

Marine Resources and Endangered Species

Numerous comments were received regarding marine resources, including endangered species, in particular the North Atlantic right whale. Commenters raised concerns about possible displacement of marine mammals as a direct or indirect consequence of site assessment activities, with particular mention of right whales and porpoises. Commenters also raised concerns regarding the quality and extent of existing data and how new studies would be incorporated into subsequent NEPA documents.

BOEM's Response to Marine Resources and Endangered Species Comments

BOEM recognizes the importance of protecting the North Atlantic right whale. This species has been given careful consideration in the EA, and in the development of the SOCs. Although survey work and other project activities may disturb individual marine mammals, these activities would be conducted at various times and locations over a 5-year period. Considering this timing, and the primarily localized noise sources, project activities are not expected to have population-level effects. Once an area has been surveyed, it is unlikely that it would be surveyed again, thereby reducing the likelihood of repeated survey-related impacts within the WEA and surroundings. Also, based on the short time of the survey operations within the WEA, and mitigation measures in SOC's (see Appendix B), BOEM does not expect that surveys would prevent any marine mammals from using, or returning to use, the survey area.

BOEM has considered the potential that right whales and other marine mammals may leave a particular area if they are disturbed. As discussed in EA Section 4.2.2.6.2, this displacement (or behavioral disturbance/avoidance) may result in the effective loss of access to preferred habitat, including potential feeding habitat or local migration routes.

BOEM anticipates that displacement due to project activities will temporarily disrupt behavioral patterns of some marine mammals. Nonetheless, BOEM does not expect that any possible displacement would result in serious injury or death of any marine mammals. Displaced animals may move to areas with either lower or higher probability for dangerous encounters, such as ship strike or entanglement in fishing gear; however, in considering the protections afforded by the mitigation measures within the SOC's (see Appendix B), there is little evidence to suggest that any possible displacement would necessarily result in either one of these outcomes.

The SOCs were designed based on current scientific data to provide protection to all marine mammals. Because North Atlantic right whales migrate north from Georgia during November 1 – April 30, and are present in MA waters, operations requiring pile driving (the loudest sound source) , will not be allowed during this period. In addition, during permitted operations, observers will be present on vessels to ensure that equipment is shutdown or powered-down if any protected species is observed within the exclusion zone.

Development of the WEA and Alternatives

BOEM received comments regarding the WEA and alternatives, including suggestions that BOEM consider revising the WEA boundary or modifying the alternatives to the proposed action. Several commenters indicated their support for, or opposition to, individual alternatives. Alternatives A and B received the most support, while Alternatives C and D were not commented on as frequently.

BOEM's Response to Comments about Development of the WEA and Alternatives

The WEA boundary and EA alternatives are the result of extensive meetings with the intergovernmental Massachusetts Renewable Energy Task Force, relevant consultations with Federal, State, and local agencies and potentially affected Federally Recognized Tribes, and extensive input from the public and potentially affected stakeholders. The WEA was developed based on careful consideration of the marine resources in the area, which led BOEM to reduce the RFI Area by over 50 percent (See Section 1.5.2 of the EA).

In this EA, Alternative A was analyzed as BOEM's preferred alternative because it allows the greatest flexibility for determining where to site meteorological towers and buoys while also protecting natural resources through implementation of the SOCs as described in Appendix B of this EA.

Alternative B was developed to evaluate whether excluding portions of the WEA where the North Atlantic right whale is known to occur would have different environmental impacts when compared to Alternative A. Analysis in the EA found that Alternative B does not offer better protection to right whales compared with Alternative A when the SOCs are taken into consideration. BOEM is aware that patterns of habitat use may change over time and will, therefore, continue to review new information from surveys, research, and studies to increase the understanding of right whales in and around the WEA and will modify the SOCs as needed.

BOEM developed Alternatives C and D based on requests from residents of Martha's Vineyard and the Wampanoag Tribe of Gay Head (Aquinnah) to remove lease blocks within 15 and 21 nm, respectively, of the inhabited Massachusetts coastline because of potential visual impacts. After modeling visual impacts in the EA, BOEM determined that construction of meteorological towers for all alternatives would result in negligible to minor visual impacts. Thus, Alternative A remains BOEM's preferred alternative.

5.1.3.3.2 Responses to comments addressing topics outside the scope of the EA

Smart from the Start

Nearly one-quarter of all comments received on the EA addressed BOEM's Smart from the Start process, with many of the comments applauding BOEM's proactive efforts to include agencies, stakeholders, and the public in the development of WEAs and in the overall commercial wind energy leasing process. Several commenters requested that BOEM continue to involve these groups as the leasing process moves forward, with specific requests that BOEM share data and information that is obtained by BOEM and the lessees during site characterization and site assessment. Some comments had suggestions for how BOEM could involve stakeholders, such as requests for certain workshops and meetings, while other comments requested that BOEM develop a better framework for stakeholders to be involved at the SAP phase. A few comments asked how BOEM would incorporate new studies and data into the Smart from the Start process and whether adaptive management would be implemented.

BOEM's Response to Comments about Smart from the Start

The purpose of the Smart from the Start initiative is to allow BOEM to move forward with OCS leasing for renewable energy in a manner that allows for viable economic development in an environmentally responsible manner. As outlined in Sections 1.3.2 and 1.5 in the EA, BOEM worked and continues to work very closely with stakeholders to ensure all factors are considered. BOEM will continue to involve the intergovernmental Massachusetts Renewable Energy Task Force, relevant Federal, State, and local agencies and potentially affected Federally Recognized Tribes, potentially affected stakeholders, and the public as the process moves forward for issuing commercial wind energy leases, approving SAPs, and assessing and approving COPs. This collaboration includes incorporating new data/studies into the planning process and working with individual agencies/organizations as needed on specific issues.

BOEM's Renewable Energy Program State Activities Web site (http://www.boem.gov/Renewable-Energy-Program/State-Activities/Index.aspx) provides the public with information related to wind energy development across all BOEM planning areas. This Web site summarizes the status and activity of offshore renewable energy projects, including coordination with Intergovernmental Task Forces and the NEPA process. Each State-specific page includes links to publicly available documents prepared during the NEPA process, such as public meeting presentations and EAs. The Web site also indicates where BOEM is conducting combined joint planning and NEPA analysis for more than one State. BOEM maintains this Web site as a way to actively deliver information, achieve transparency, and provide a forum for public/stakeholder input in a "one-stop-shop" manner so the public can easily determine what is happening across BOEM's jurisdiction in relation to offshore renewable energy.

New Studies and Data

Many commenters encouraged BOEM to continue to analyze and incorporate new information received from a variety of sources into the lease planning and lease issuance process. Commenters requested that BOEM and lessees supplement information obtained from site characterization in the WEA with new research, studies, and other data sources as these new studies and data become available, and to use all information to make informed decisions regarding lease requirements and surveying methodology. Several requests were made to include the MassCEC studies and for BOEM to fill data gaps through its own research, including collaboration with other State and Federal agencies.

BOEM's Response to Comments about New Studies and Data

As discussed in Section 3.1.3.3 of the EA, lessees are required to characterize biological resources within their lease area and to include this information in their SAPs. The specific technical details of biological survey requirements for a lease will be developed using the best available data and technologies when lessees submit a SAP.

BOEM will continue to incorporate information from these and other new studies, research, and data that are relevant to the Massachusetts WEA throughout the process of issuing commercial wind energy leases on the Atlantic OCS. These studies and information may come from a wide variety of sources, including European studies on the effects of construction and operation of meteorological towers, wind facilities, and surveying activities on a variety of species; research in and near the WEA; recommendations from meetings such as the recent International Whaling Commission's Scientific Committee (2012); and others.

BOEM is actively involved in collecting data on biological resources in the WEA and is currently funding the ongoing MassCEC studies for a second and third year. The MassCEC research will provide valuable data to increase the understanding of biological resources within the WEA, including data on birds, fish, marine mammals, and sea turtles. The goal of the MassCEC whale surveys is to better understand the spatial and temporal distributions of right whales (and other large whale species, to the extent possible) as well as migratory patterns in the MassCEC study area, which includes the entire WEA. The results of the first year of MassCEC surveys have been incorporated into this EA and the first year report can be accessed at: http://www.masscec.com/content/field-studies-whales-and-sea-turtles-offshore-alternative-energy-planning.

In addition, BOEM's current research efforts to fill data gaps include the following studies:

- Underwater Hearing Sensitivity in the Leatherback Sea Turtle by Assessing the Potential Effect of Anthropogenic Noise
- Pilot Study of Aerial High-Definition Video Surveys for Seabirds, Marine Mammals, and Sea Turtles on the Atlantic OCS
- Determining Offshore Use by Diving Marine Birds Using Satellite Telemetry
- Building a Database to Assess the Relative Vulnerability of Migratory Bird Species to Offshore Renewable Energy Projects on the Atlantic OCS
- Effects of Pile Driving Sounds on Auditory and Non-Auditory Tissues of Fish

BOEM is also working with NOAA and USFWS on the Atlantic Marine Assessment Program for Protected Species to develop models and associated tools to provide seasonal, spatially explicit density estimates incorporating habitat characteristics of marine mammals, turtles, and seabirds in the western North Atlantic Ocean. Additionally, BOEM will continue to incorporate research findings from the BOEM Environmental Studies Program into its planning process for commercial wind lease issuance on the Atlantic OCS.

Several BOEM studies are multi-year collaborations with other Federal or university partners. For more detail on ongoing studies, please refer to the BOEM Studies Web site (http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Renewable-Energy/Renewable-Energy-Research-Ongoing-Studies.aspx).

As new studies and research become available, BOEM may modify requirements for SAPs and COPs as needed. BOEM will also use relevant new information to inform the content of each lessee's lease terms and conditions, as well as future NEPA documentation. BOEM will evaluate the need for additional studies and/or surveys using the best available data when lessees submit a SAP.

Also, please see BOEM's response to comments about "Data sharing" for additional information on how to obtain the results of some of these new studies and surveys.

Survey Guidelines

Commenters noted that BOEM is in the process of developing standardized guidelines for the survey and characterization of biological resources and asked when the guidelines would be available for review and whether stakeholders would be included in the development/review process. Commenters also requested that agencies continue to be included in the process to develop these guidelines and stated that consistency in the approach to the SAP process, specifically consistency of site characterization methodologies, is important.

BOEM's Response to Comments about Survey Guidelines

BOEM has published guidelines for biological surveying on commercial wind leases on the OCS (see http://www.boem.gov/Regulatory-Development-Policy-and-Guidelines/). The guidelines cover standards for avian, benthic, fish, turtles, marine mammals and spatial data surveying. The results of these biological surveys will inform the monitoring efforts and requirements during the lease, including post construction of a meteorological tower(s).

Data Sharing

Generally, commenters requested that BOEM share various types of data as the commercial leasing process moves forward. The most common theme was that BOEM should make the information generated by lessees during site characterization (e.g., survey data) available to the public in an easily accessible format such as a data portal Web site. One commenter requested that site assessment data (e.g., site-specific meteorological data) be made available to agencies.

BOEM's Response to Comments about Data Sharing

BOEM's information sharing with stakeholders includes academic, NGOs, and research institutions, as well as the general public. BOEM is currently considering how best to share results of ongoing and new studies such as results from site characterization and site assessment activities on commercial wind energy leases in and around WEAs, and results from studies funded by or conducted through partnerships with BOEM.

BOEM is committed to sharing data in a manner that does not compromise proprietary or competitive interests of lessees. Data sharing may be by specific request, and data may be made available to the public via online Web sites and data portals.

BOEM is partnering with multiple Federal and independent agencies in the Federal Geographic Data Committee's Marine Boundary Working Group (see http://www.csc.noaa.gov/mbwg/members.html) to provide the public with a portal to access marine data through the Multipurpose Marine Cadastre, which is an online integrated marine information system. BOEM will continue to provide information to stakeholders through the Massachusetts Renewable Energy Task Force and through NEPA documentation at the SAP and COP stages. BOEM will work with agencies to provide agency-specific information, such as meteorological data, to NOAA under its existing Memorandum of Understanding for data sharing. BOEM, in collaboration with State and Federal partners, participates in regional data and information sharing as the Federal co-chair of the Northeast Regional Ocean Council and through the Northeast Ocean Data Portal.

New Technologies

Comments on new technologies focused on the potential use of sound dampening technologies to minimize impacts on marine resources. Commenters noted that lessees should be required to use the best commercially available technology to reduce noise levels during construction and, in particular, during pile driving. Suggestions for new technologies that should be considered included bubble curtains, coffer dams, cushion blocks, temporary noise attenuation pile design, vibratory pile drivers, press-in pile drivers, acoustic auto-detect buoys, and sub-surface gliders with acoustic detection hardware. Commenters also requested that BOEM require lessees to use Passive Acoustic Monitors to aid in real-time exclusion of marine mammals from a designated exclusion area. One commenter requested that BOEM convene a workshop or expert panel to discuss new technologies, especially to benefit right whales.

BOEM's Response to Comments about New Technologies

BOEM evaluates new technologies on an ongoing basis. As new information becomes available (i.e., results of new research/studies and site characterization activities), BOEM's Smart from the Start process provides opportunities for further development and modification of SOCs, which can be applied to the terms and conditions of a specific lease agreement. BOEM will coordinate with agencies and stakeholders about the use of new technologies. Lessees also have the opportunity to propose new technologies when they submit a SAP and COP.

The current SOCs (see Appendix B) were designed to provide protection to birds, marine mammals, and sea turtles based on current scientific data. Selection of the best option for the type of pile driving mechanism and noise minimization technology depends on a number of factors such as type and size of the pile, the type of substrate, water depth, the type and size of the impact hammer, and availability of equipment. The current SOCs incentivize the use of best-available technologies by allowing field verification methods to determine the extent of noise propagation for marine mammals. These SOCs allow finer resolution of noise propagation fields and ultimately result in more precise data on which to base resource protection measures, which benefit both the developer and the marine resource.

New technologies for passive acoustic monitoring systems would be considered by BOEM. Passive acoustic monitoring is useful to detect vocalizing whales, it does not detect whales that are not vocalizing, and since BOEM is not aware of any passive acoustic monitoring systems currently available that can consistently and accurately determine distances to a whale from the sound source(s), other survey methods are also important. At this time, there are various opportunities for acoustic monitoring to be used before and during site assessment and site characterization activities. Marine fauna surveys are required as part of the biological surveys that a lessee must complete for a SAP (30 CFR Part 585 Subpart F); these may include deployment of passive acoustic monitoring systems within the survey area. See Section 3.1.3.3 of the EA, Biological Surveys (page 35). BOEM has published guidelines, available on their website, for marine mammal surveys (BOEM, 2013d).

5.2 COOPERATING AGENCIES

Section 1500.5(b) of the CEQ implementing regulations (40 CFR 1500.5(b)) encourages agency cooperation early in the NEPA process. A Federal agency can be a lead, joint lead, or cooperating agency. A lead agency manages the NEPA process and is responsible for the preparation of an EA or EIS, a joint lead agency shares these responsibilities, and a cooperating agency is one that has jurisdiction by law or special expertise with respect to any environmental issue and that participates in the NEPA process upon the request of the lead agency. The NOI included an invitation to other Federal agencies and State, tribal, and local governments to consider becoming cooperating agencies in the preparation of this EA. Nine cooperating agencies were invited and five participated in the development and review of this EA. The agencies jurisdiction and/or expertise are described below.

Section 4(e) of the OCS Lands Act extends the USACE's authority to prevent obstruction of navigation in the navigable waters of the U.S. to OCS facilities. Such obstruction could include the construction/installation of meteorological towers and installation of buoys proposed by lessees. BOEM invited the USACE in a latter dated May 16, 2012, to participate as a cooperating agency on this EA. That invitation was accepted on October 5, 2012. The USACE is also a co-consulting agency on the Section 106, EFH, and ESA consultations described in Section 5.3 below.

On May 16, 2012, BOEM sent a letter inviting the USCG to participate as a cooperating agency, and the USCG accepted on July 27, 2012. BOEM requested the USCG's assistance because of its jurisdiction and expertise with port usage, vessel traffic, lighting requirements/mitigation measure for meteorological towers and buoys and spill risk and response.

Also on May 16, 2012, BOEM sent a letter inviting the NMFS to participate as a cooperating agency. BOEM requested NMFS's assistance in the preparation of the EA due to its data-rich resources concerning habitat, benthos, protected resource species, fishery and impact metrics, and expertise concerning fishing activity and associated fishery resources and protected species and habitat. In a letter to BOEM dated May 18, 2012, NMFS respectfully declined as the MOU in place between BOEM and NMFS already governs and encourages an exchange of information between the agencies.

On May 31, 2012, BOEM sent letters inviting the Mashpee Wampanoag Tribe, the Narragansett Indian Tribe, the Shinnecock Indian Nation, and the Wampanoag Tribe of Gay Head (Aquinnah) to participate as cooperating agencies. BOEM requested the Tribes' assistance in the preparation of the EA due to their special expertise with respect to environmental impacts and effects on historic properties, including traditional cultural properties. On June 19, 2012, the Mashpee Wampanoag Tribe and BOEM entered into an MOU establishing a cooperating agency relationship for the preparation of this EA. BOEM continues to discuss the EA in government-to-government consultation with the Narragansett Indian Tribe, the Shinnecock Indian Nation, and the Wampanoag Tribe of Gay Head (Aquinnah).

Also on May 31, 2012, BOEM sent letters inviting the MA EOEEA and the RICRMC to participate as cooperating agencies. BOEM requested their assistance in the preparation of the EA due to their special expertise in the local environmental and socioeconomic issues considered in the EA. On May 31, 2012 BOEM and RICRMC entered into an MOU establishing a cooperating agency relationship for the preparation of the EA. On June 6, 2012 BOEM and MA EOEEA entered into an MOU establishing a cooperating agency relationship for the preparation of the EA.

5.3 CONSULTATIONS

5.3.1 Endangered Species Act

As required by Section 7 of the ESA, BOEM consulted with the NMFS and USFWS on assessing the impacts of the proposed action on endangered/threatened species and designated critical habitat under their jurisdiction. BOEM sent letters initiating consultations with the NMFS and the USFWS on July 2, 2012 (Appendix I). The Biological Assessments, prepared by BOEM for the consultations (Appendix I), conclude that the proposed lease issuance, associated site characterization, and subsequent site assessment activities are expected to be discountable[6] and insignificant[7] and, thus, not likely to adversely affect ESA-listed bats, birds, and fish. BOEM anticipates that temporary adverse impacts equivalent to Level B harassment from noise will affect ESA-listed marine mammals and sea turtles during HRG survey and pile driving activity. Potential adverse impacts are greatly reduced when activities are implemented according to the SOCs outlined in this assessment (see Appendix B). These requirements will be included as a condition on any leases and/or SAPs issued or approved under this decision.

BOEM received the USFWS response to its request for an informal ESA consultation for the RI and MA WEAs on November 2, 2012. The letter stated concurrence with BOEM's determination that the proposed actions of commercial wind energy lease issuance, associated site characterization activities and site assessment are not likely to adversely affect the species considered.

In a letter dated October 19, 2012, BOEM initiated formal consultation with NMFS on the effects to ESA-listed marine mammals, sea turtles and fish from proposed activities in several WEAs including offshore Rhode Island, Massachusetts, New York and New Jersey. This formal request terminated BOEM's July 2012 request for informal consultation for activities in the WEAs offshore Rhode Island and Massachusetts.

BOEM received the NMFS Biological Opinion on April 10, 2013. NMFS determined that, with implementation of the SOCs and reasonable and prudent measures, the proposed action may adversely affect but is not likely to jeopardize the continued existence of Kemp's ridley, green, or leatherback sea turtles; the northwest Atlantic DPS of loggerhead sea turtles; North Atlantic right, humpback, fin, sei, or sperm whales, or the GOM, New York Bight, Chesapeake Bay or south Atlantic DPSs of Atlantic sturgeon. Because no critical habitat is designated in the action area, none will be affected by the action.

Those entities applying to BOEM for leases will be responsible for applying for other applicable permits, such as an incidental harassment authorization under the MMPA. Information regarding NMFS permitting can be found at http://www.nmfs.noaa.gov/pr/permits/.

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[6] USFWS and NMFS define "discountable" as those effects that are extremely unlikely to occur (USFWS and NMFS, 1998).

[7] USFWS and NMFS define "insignificant" as effects related to the size of the impact and should never reach the scale where take occurs (USFWS and NMFS, 1998).

5.3.2 Magnuson-Stevens Fishery Conservation and Management Act

Pursuant to Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act, Federal agencies are required to consult with the NMFS on any action that may result in adverse effects on EFH. NMFS regulations implementing the EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act can be found at 50 CFR 600. Certain OCS activities authorized by BOEM may result in adverse effects on EFH and, therefore, require consultation with the NMFS.

As required by the Magnuson-Stevens Fishery Conservation and Management Act, BOEM initiated consultation with the NMFS concurrent with the version of this EA that was available for public and agency review in October 2012. BOEM has determined that the proposed action will not significantly affect the quality and quantity of EFH in the action area. There are no EFH HAPCs in the proposed action area. In a letter dated November 29, 2012, NMFS concurred with several of BOEM's SOCs in regards to protections they will confer to marine fish and EFH. NMFS did not raise any objections to lease issuance. However, since the exact placement of meteorological towers and buoys within the WEA is currently unknown, NMFS has requested to participate in the review of individual SAPs in order to make final conclusions regarding the impacts to EFH from site assessment activities. BOEM is committed to work with NMFS in the review of plans and other recommendations to meet NMFS information needs regarding EFH under the Magnuson-Stevens Fishery Conservation and Management Act.

5.3.3 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) requires that Federal actions that are reasonably likely to affect any land or water use or natural resource of the coastal zone be "consistent to the maximum extent practicable" with relevant enforceable policies of the State's federally approved coastal management program (15 CFR 930 Subpart C). If an activity will have direct, indirect, or cumulative effects, the activity is subject to a Federal consistency determination

BOEM has determined that Rhode Island and Massachusetts share common coastal management issues and have similar enforceable policies as identified by their respective coastal zone management plans (CMPs). Given the proximity of the WEA to each State, the similarity of the reasonably foreseeable activities for the WEA, and the similarity of impacts on environmental and socioeconomic resources and uses within each State, BOEM will prepare a single CD under 15 CFR 930.36(a) to determine whether issuing leases and approving site assessment activities (including the installation, operation, and decommissioning of meteorological towers and buoys) in the WEA offshore of Rhode Island and Massachusetts is consistent to the maximum extent practicable with the provisions identified as enforceable by the Coastal Management Programs of the State of Rhode Island and the Commonwealth of Massachusetts.

This CD will be sent to both the State of Rhode Island and the Commonwealth of Massachusetts for their review. The EA provides the comprehensive data and information required under 30 CFR 939.39 to support BOEM's CD. BOEM will determine if the activities described in this EA are consistent to the maximum extent practicable with the enforceable policies of the CMPs of Rhode Island and Massachusetts. When the affected States receive the CD, they will have 60 days to review it (which provides the supporting information required under 30 CFR 930.39(a)); the State agency has 14 days after receiving this information to identify missing information required by 930.39(a).

5.3.4 National Historic Preservation Act

Section 106 of the NHPA (16 U.S.C. 470f), and implementing regulations (36 CFR Part 800) require Federal agencies to consider the effects of their actions on historic properties and afford the ACHP a reasonable opportunity to comment. BOEM has determined that lease issuance and approval of SAPs constitute undertakings subject to Section 106 of NHPA. Therefore, the reasonably foreseeable consequences of BOEM's actions include:

1. Shallow hazards, geological, geotechnical, and archaeological resource surveys (associated with lease issuance); and

2. Installation and operation of meteorological tower(s), meteorological buoy(s), or a combination of the two (associated with SAP approval).

On February 9, 2011, BOEM formally notified the public through the *Federal Register* (pages 7226–7228), that it was initiating the "Smart from the Start" wind energy initiative and that it would involve Federal agencies, States, Tribes, local governments, wind power developers and the public as BOEM conducted the NEPA process and engaged in consultation. In August 2011, BOEM identified and initiated a request for NHPA Section 106 consultation through correspondence with the appropriate SHPOs and potentially affected federally recognized Tribes, local governments, and other individuals and organizations with a potential interest in the undertaking to obtain further information and to learn their concerns regarding the proposed undertakings' potential effects on historic properties. The entities contacted by BOEM are listed in Table 5-2. In June and July 2011, September 2011, and April and May 2012, BOEM consulted with the Mashpee Wampanoag Tribe, the Narragansett Indian Tribe, and the Wampanoag Tribe of Gay Head (Aquinnah). BOEM will continue to consult with these federally recognized Tribes on a government-to-government basis, in accordance with EO 13175.

On October 27, 2011, BOEM requested public input on the impacts on historic properties from commercial wind lease issuance and site characterization and site assessment activities on the Atlantic OCS. The comment period on the proposed undertaking as it pertained to historic properties closed on November 10, 2011. BOEM received three comments in response to this solicitation. These comments from the Alliance to Protect Nantucket Sound, Mainstream Renewable Power, and Offshore Wind Development Coalition can be viewed at regulations.gov by searching for Docket ID BOEM-2011-0115.

BOEM has prepared a PA to guide its Section 106 activities for these undertakings pursuant to 36 CFR 800.14(b) (see Appendix G). Consulting parties invited to be signatories to the PA included the SHPOs of Rhode Island and Massachusetts, the Mashpee Wampanoag Tribe, the Narragansett Indian Tribe, the Wampanoag Tribe of Gay Head (Aquinnah), and the ACHP. The PA provides for Section 106 consultation to continue through both the leasing process and BOEM's decision making process regarding the approval, approval with modification, or disapproval of lessees' SAPs and allows a phased identification and evaluation of historic properties. The PA also establishes a process for determining and documenting the areas of potential effect for each undertaking to further identify historic properties located within these areas. If a historic property is found to be listed in, or is eligible for listing in, the National Register of Historic Places this established process assesses potential adverse effects and helps to avoid, reduce, or resolve any potential adverse effects.

On December 14, 2011, and February 21, 2012, BOEM held Section 106 consultation webinars to discuss the proposed undertakings and BOEM's intention to prepare a PA. BOEM provided a draft of the PA to the consulting parties on March 26, 2012, and on May 8, 2012, BOEM held another webinar to review comments on the draft Agreement, discuss changes, and prepare a revised draft in preparation for signing. The final PA includes changes and edits resulting from comments BOEM received from all signatories. Although not all parties invited to participate in the development of the PA chose to sign the agreement, the PA has been executed and is in effect.

Table 5-2

Entities Solicited for Information and Concerns Regarding Historic Properties and the Proposed Undertakings

Consulting Party Type	Organization
Advisory Council on Historic Preservation	Advisory Council on Historic Preservation
Federally Recognized Tribal Government	Catawba Indian Nation
	Mashpee Wampanoag Tribe
	Narragansett Indian Tribe
	Saint Regis Mohawk Tribe
	Shinnecock Indian Nation
	Wampanoag Tribe of Gay Head (Aquinnah)
Local Government	Barnstable County
	Cape Cod Commission
	City of Cranston
	City of East Providence
	City of New Bedford
	City of Pawtucket
	City of Providence
	City of Warwick
	Dukes County Commission
	Martha's Vineyard Commission
	Nantucket Planning and Economic Development Commission
	Nantucket Planning Board
	Town of Aquinnah
	Town of Barrington
	Town of Bristol
	Town of Charlestown
	Town of Chilmark
	Town of Dartmouth
	Town of East Greenwich
	Town of Edgartown
	Town of Gosnold
	Town of Jamestown
	Town of Little Compton
	Town of Middleton

Consulting Party Type	Organization
Local Government	Town of Nantucket
	Town of Narragansett
	Town of New Shoreham
	Town of North Kingstown
	Town of Oak Bluffs
	Town of Portsmouth
	Town of South Kingstown
	Town of Tisbury
	Town of Tiverton
	Town of Warren
	Town of West Tisbury
	Town of Westerly
	Town of Westport
Other Tribal Government	Mashantucket Pequot Tribal Nation
	Mohegan Indian Tribe of Connecticut
	Oneida Indian Nation
State Historic Preservation Office(r) (SHPO)	Connecticut SHPO
	Massachusetts SHPO
	New York SHPO
	Rhode Island SHPO

5.3.5 Federal Aviation Administration

BOEM consulted with the FAA regarding the activities in the WEA. Typically, any structure higher than 200 ft (70 m) above ground level at its site and within 12 nm (22 km) of shore would require an evaluation by the FAA under 14 CFR 77. The FAA will determine whether a notice is required and the applicant would need to file “Notice of Proposed Construction or Alteration” with the FAA in accordance with 14 CFR 77.9 for an appropriate aeronautical study. The FAA would determine any impacts on aviation operations, including military and civilian radar systems, and potential mitigation measures would be evaluated and discussed on a case-by-case basis. An aeronautical study, if required, would conclude with a final agency determination of No Hazard to Air Navigation or a Determination of Hazard to Air Navigation. Any Determinations of No Hazard to Air Navigation will include marking and lighting recommendations, if appropriate.

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Appendix A
Announcement of Area Identification for Commercial Wind Energy Leasing on the Outer Continental Shelf Offshore Massachusetts

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ANNOUNCEMENT OF AREA IDENTIFICATION

Commercial Wind Energy Leasing on the Outer Continental Shelf Offshore Massachusetts

May 30, 2012

The Bureau of Ocean Energy Management (BOEM) is proceeding with competitive commercial wind energy leasing on the Outer Continental Shelf (OCS) offshore Massachusetts, as set forth by 30 CFR 585.211 through 585.225. The next step in the competitive leasing process, and the purpose of this announcement, is Area Identification. BOEM defined a Wind Energy Area (WEA) offshore Massachusetts pursuant to the Secretary of the Interior's *Smart from the Start* Atlantic Offshore Wind Initiative. This entire area will be considered for leasing and approval of site assessment plans as the proposed action under the National Environmental Policy Act (NEPA) (42 U.S.C. §§ 4321-4370f). BOEM also has identified alternatives to the proposed action that consider the exclusion of certain portions of the WEA and the issuance of leases and approval of site assessment in the remainder of the WEA. This announcement also identifies mitigation measures and other issues to be considered further in the NEPA document.

On February 6, 2012, BOEM published in the *Federal Register* the *Commercial Leasing for Wind Power on the Outer Continental Shelf Offshore Massachusetts—Call for Information and Nominations* (Call) (77 FR 5820-5830) and *Notice of Intent to Prepare an Environmental Assessment* (NOI) (77 FR 5830-5832).

Figure 1 depicts the "Excluded Area" that will not be considered for leasing or approval of site assessment plans in the NEPA document. The Call included certain areas that overlapped with an area of high sea duck occurrence. BOEM has excluded this "high value" habitat from the WEA, to avoid impacts to this valuable habitat. In addition, the Call included an area that, if ultimately developed with commercial wind energy facilities, would likely cause substantial conflict with "high value" fisheries. This area is a continuation of an area excluded from leasing consideration in the Rhode Island/Massachusetts WEA announced on February 24, 2012. The remainder of the Call Area will be considered for leasing and approval of site assessment plans in an environmental assessment (EA) (see Figure 1, Alternative A).

Alternatives to the proposed action (Alternative A) were defined by excluding certain areas of the WEA because of the following considerations:

- Areas identified as having occurrences of North Atlantic right whales, which are of concern due to potential impacts to this species (see Figure 2, Alternative B);
- All areas within 15 nautical miles of the inhabited coastline of Massachusetts, which are of concern due to potential visual impacts (see Figure 3, Alternative C); and
- All areas within 21 nautical miles of the inhabited coastline of Massachusetts, which are of concern due to potential visual impacts (see Figure 4, Alternative D).

The agency is currently only considering the issuance of leases and approval of site assessment plans in this area. BOEM is not considering, and the EA does not support, any decision(s) regarding the construction and operation of wind energy facilities on leases which will potentially be issued in this WEA. If, after leases are issued, a lessee proposes to construct a commercial wind energy facility, it would submit a construction and operations plan. If and when BOEM receives such a plan, it would prepare a site-specific NEPA document for the project proposed, which would include the lessee's proposed transmission line(s) to shore. These cable routes would underlie areas outside of the WEA, and may include areas beneath the "high value" sea duck habitat and fishing grounds.

BOEM has also identified mitigation measures that may reduce the potential for adverse impacts to North Atlantic right whales. Such measures include seasonal vessel restrictions, vessel speed restrictions, and enhanced monitoring. These measures, and possibly others, will be analyzed in the EA, and if adopted, could be imposed as binding requirements in the form of stipulations in the lease instrument and/or conditions of approval of a site assessment plan. Based upon staff recommendations; consultations with Federal agencies, states, local governments, and affected Indian tribes; and public comments received, BOEM will continue to consider additional measures that may reduce the potential for adverse environmental consequences, and may identify other issues to be considered in the EA.

Figure 1. Wind Energy Area identified offshore Massachusetts for analysis as the Proposed Action (Alternative A) in the EA.

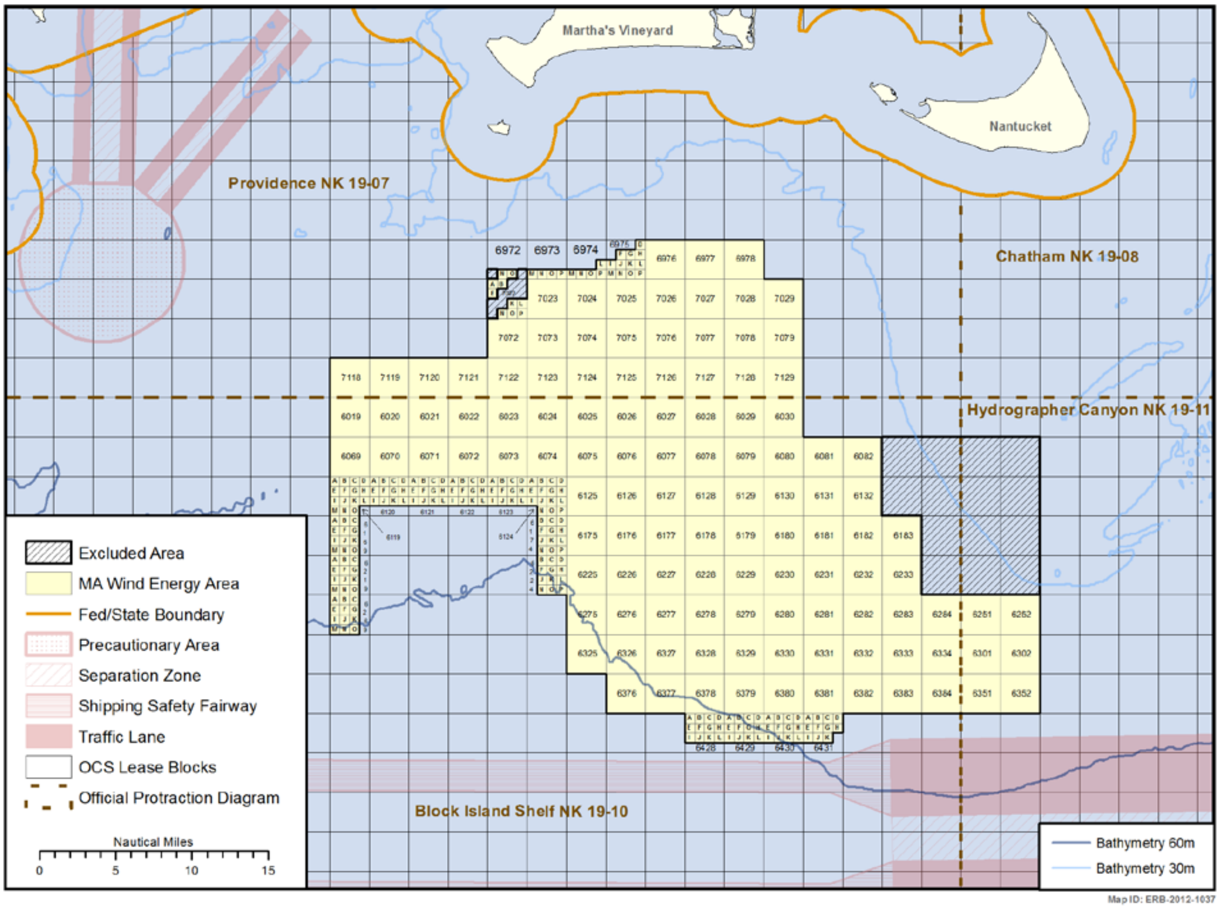


Figure 2. Areas identified as having occurrences of North Atlantic right whales for analysis as Alternative B in the EA.

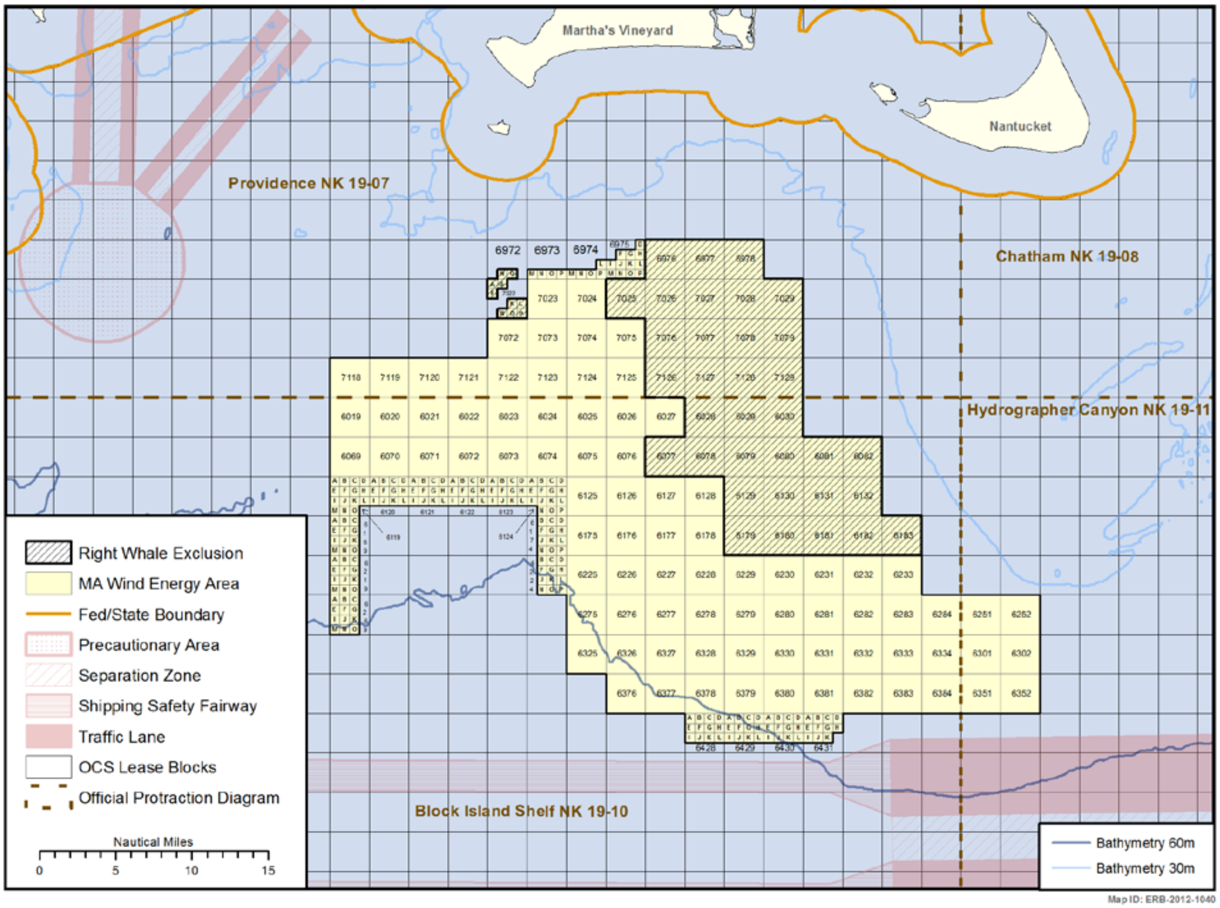


Figure 3. Areas within 15 nautical miles of the inhabited coastline of Massachusetts identified for analysis as Alternative C in the EA.

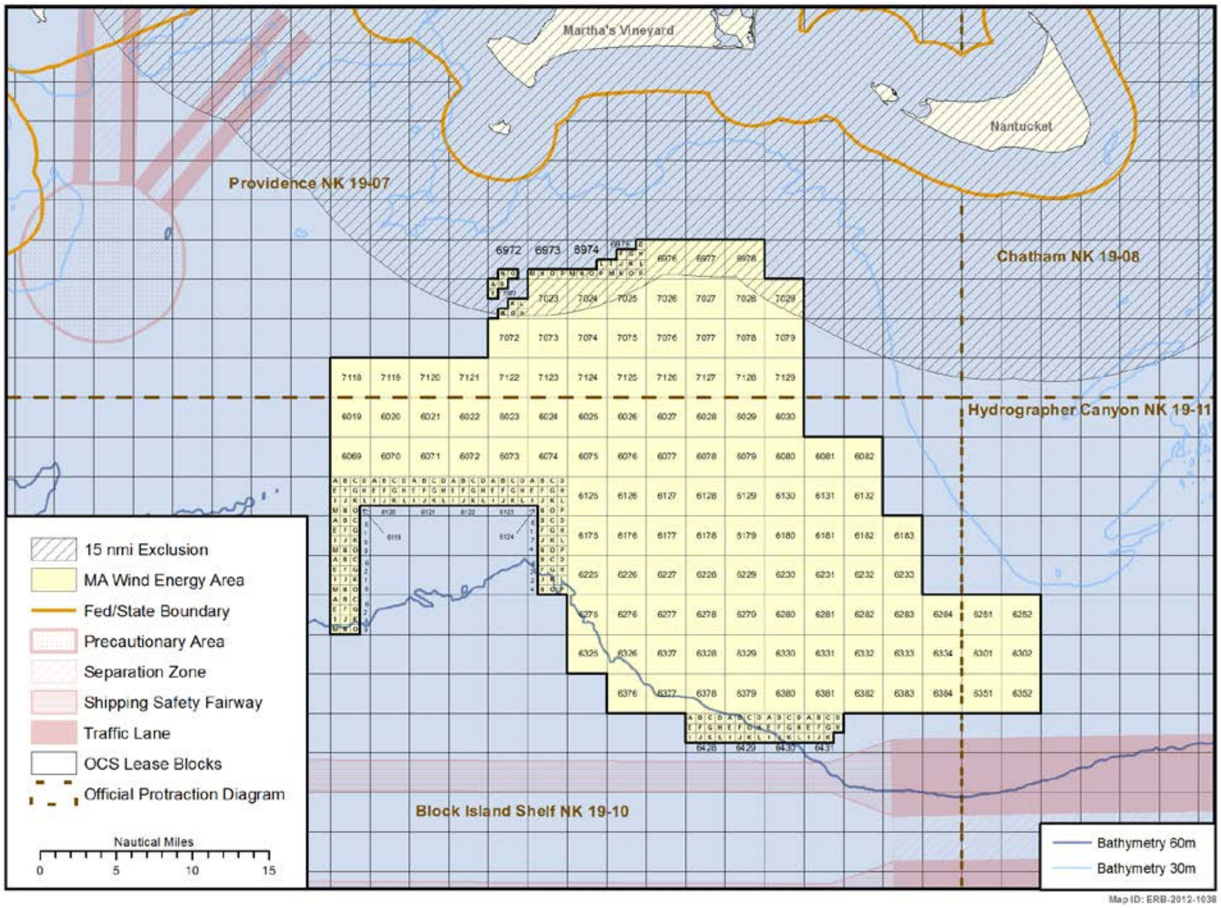
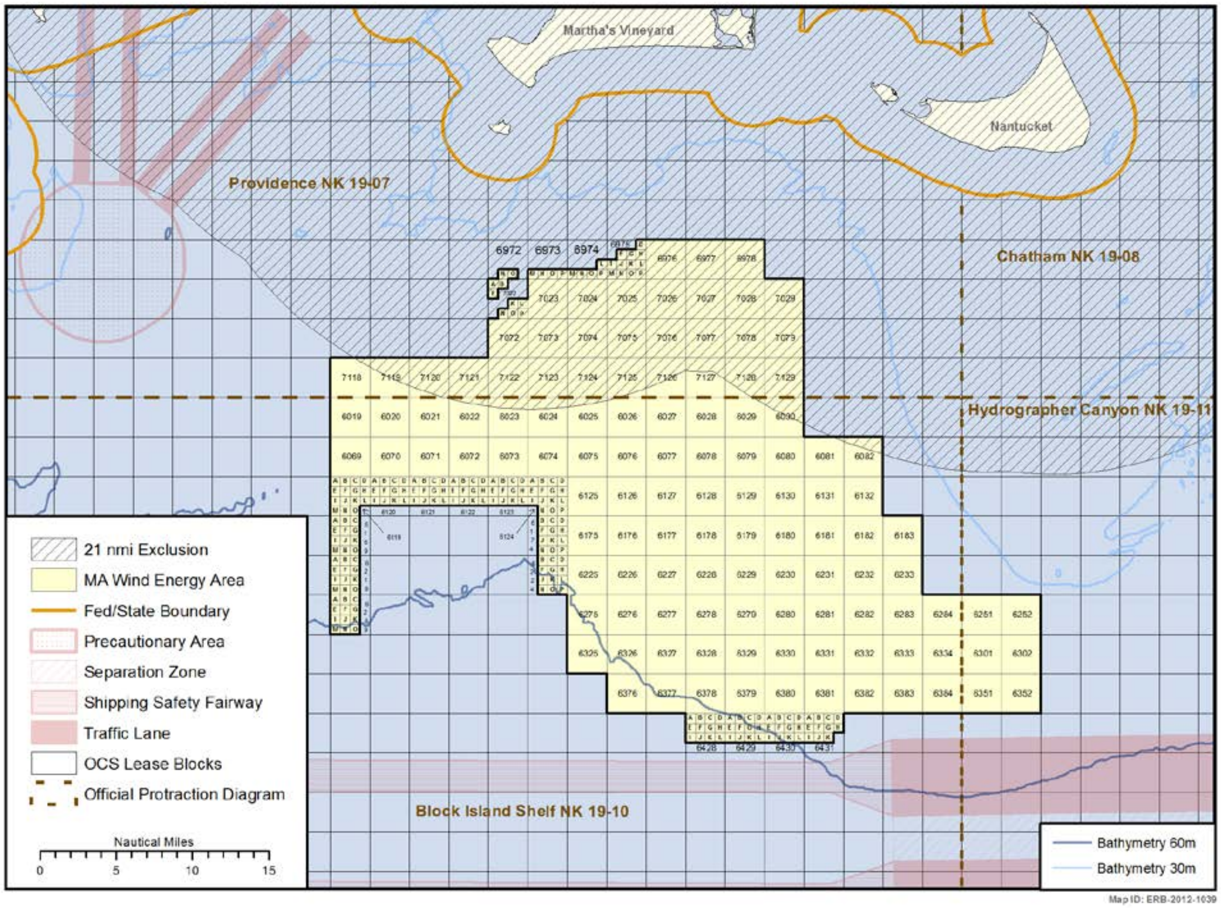


Figure 4. Areas within 21 nautical miles of the inhabited coastline of Massachusetts identified for analysis as Alternative D in the EA.



Appendix B
Standard Operating Conditions

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B. STANDARD OPERATING CONDITIONS FOR PROTECTED SPECIES

This section outlines and provides the substance of the standard operating conditions (SOCs) that are part of the proposed action and which minimize or eliminate potential impacts to protected species including Endangered Species Act (ESA)-listed species of whales, sea turtles, fish and birds.

Additional conditions, including mitigation, monitoring or reporting measures, may be included in any BOEM issued lease or other authorization, including those that may be developed during Federal ESA Section 7 consultations. These conditions are divided into five sections: (1) those required during all project activity associated with Site Assessment Plan (SAP) and/or Construction and Operation Plan (COP) submittal or activity under a SAP; (2) those required during geological and geophysical (G&G) survey activity in support of plan (i.e., SAP and/or COP) submittal; (3) those required during pile driving of a meteorological tower foundation; (4) reporting requirements; and (5) other requirements.

B.1. GENERAL REQUIREMENTS

B.1.1. Vessel Strike Avoidance Measures

The lessee must ensure that all vessels conducting activity in support of a plan (i.e., SAP and/or COP) comply with the vessel strike avoidance measures specified below except under extraordinary circumstances when complying with these requirements would put the safety of the vessel or crew at risk:

1. The lessee must ensure that vessel operators and crews maintain a vigilant watch for cetaceans, pinnipeds, and sea turtles and slow down or stop their vessel to avoid striking protected species.
2. The lessee must ensure that all vessels 65 ft (20 m) in length or greater, operating from November 1 through July 31, operate at speeds of 10 knots (<18.5 km/h) or less. In addition, all vessel operators must comply with 10 knot (<18.5 km/h) speed restrictions in any Dynamic Management Area (DMA). Vessel operators may send a blank email to ne.rw.sightings@noaa.gov for an automatic response listing all current seasonal management areas (SMAs) and DMAs.
3. North Atlantic right whales.
    a. The lessee must ensure all vessels maintain a separation distance of 1,640 ft (500 m) or greater from any sighted North Atlantic right whale.
    b. The lessee must ensure that the following avoidance measures are taken if a vessel comes within 1,640 ft (500 m) of a right whale:

(i) The lessee must ensure that while underway, any vessel must steer a course away from the right whale at 10 knots (< 18.5 km/h) or less until the 1,640 ft (500 m) minimum separation distance has been established (unless (ii) below applies).

(ii) The lessee must ensure that when a North Atlantic right whale is sighted in a vessel's path, or within 328 ft (100 m) to an underway vessel, the underway vessel must reduce speed and shift the engine to neutral. The lessee must not engage the engines until the right whale has moved outside of the vessel's path and beyond 328 ft (100 m).

(iii)The lessee must ensure that when a North Atlantic right whale is sighted within 328 ft (100m) to a stationary vessel, the vessel must not engage engines until the North Atlantic right whale has moved beyond 328 ft (100 m), at which time refer to point 3(b)(i).

4. Non-delphinoid cetaceans other than the North Atlantic right whale.

   a. The lessee must ensure all vessels maintain a separation distance of 328 ft (100 m) or greater from any sighted non-delphinoid cetacean.

   b. The lessee must ensure that the following avoidance measures are taken if a vessel comes within 328 ft (100 m) of a non-delphinoid cetacean:

      (i) The lessee must ensure that when a non-delphinoid cetacean (other than a North Atlantic right whale) is sighted, the vessel underway must reduce speed and shift the engine to neutral, and must not engage the engines until the non-delphinoid cetacean has moved outside of the vessel's path and beyond 328 ft (100 m).

      (ii) The lessee must ensure that if a vessel is stationary, the vessel must not engage engines until the non-delphinoid cetacean has moved out of the vessel's path and beyond 328 ft (100 m).

5. Delphinoid cetaceans.

   a. The lessee must ensure that all vessels maintain a separation distance of 164 ft (50 m) or greater from any sighted delphinoid cetacean.

   b. The lessee must ensure that the following avoidance measures are taken if the vessel comes within 164 ft (50 m) of a delphinoid cetacean:

      (i) The lessee must ensure that any vessel underway remain parallel to a sighted delphinoid cetacean's course whenever possible, and avoid excessive speed or abrupt changes in direction. Course and speed may be adjusted once the delphinoid cetacean has moved beyond 164 ft (50 m) /or the delphinoid cetacean has moved abeam of the underway vessel.

(ii) In addition the lessee must ensure that any vessel underway reduce vessel speed to 10 knots (<18.5 km/h) or less when pods (including mother/calf pairs) or large assemblages of delphinoid cetaceans are observed. Course and speed may be adjusted once the delphinoid cetaceans have moved beyond 164 ft (50 m) /or abeam of the underway vessel.

6. Sea Turtles and Pinnipeds. The lessee must ensure all vessels maintain a separation distance of 164 ft (50 m) or greater from any sighted sea turtle or pinniped.

7. The lessee must ensure that vessel operators are briefed to ensure they are familiar with the above requirements.

B.2. MARINE DEBRIS AWARENESS

Marine debris awareness measures are intended to reduce the risk marine debris poses to protected species from ingestion and entanglement. These simple measures will reduce the potential for debris ending up in the marine environment.

The lessee must ensure that vessel operators, employees and contractors engaged in activity in support of a plan (i.e., SAP and/or COP) are briefed on marine trash and debris awareness elimination as described in the BSEE NTL No. 2012-G01 ("Marine Trash and Debris Awareness and Elimination"). BOEM (the Lessor) will not require the lessee to undergo formal training or post placards, as described under this NTL. Instead, the lessee must ensure that its employees and contractors are made aware of the environmental and socioeconomic impacts associated with marine trash and debris and their responsibilities for ensuring that trash and debris are not intentionally or accidentally discharged into the marine environment. The above referenced NTL provides information the lessee may use for this awareness training.

B.3. GEOLOGICAL AND GEOPHYSICAL (G&G) SURVEY REQUIREMENTS

The lessee must ensure that all vessels conducting activity in support of a plan (i.e., SAP and COP) comply with the geological and geophysical survey requirements specified below except under extraordinary circumstances when the safety of the vessel or crew are in doubt or the safety of life at sea is in question.

Visibility. The lessee must not conduct G&G surveys in support of plan (i.e., SAP and/or COP) submittal at any time when lighting or weather conditions (e.g., darkness, rain, fog, sea state) prevents visual monitoring of the exclusion zones for HRG surveys and geotechnical surveys as specified below. This requirement may be modified as specified below.

Modification of Visibility Requirement. If the lessee intends to conduct G&G survey operations in support of a plan at night or when visual observation is otherwise impaired, an alternative monitoring plan detailing the alternative monitoring methodology (e.g., active or passive acoustic monitoring technologies) must be submitted to the Lessor for consideration. The Lessor may, after consultation with NMFS, decide to allow the lessee to conduct G&G surveys in support of a plan at night or when visual observation is otherwise impaired using the proposed alternative monitoring methodology.

Protected-Species Observer (PSO). The lessee must ensure that the exclusion zone for all G&G surveys performed in support of plan (i.e., SAP and/or COP) submittal is monitored by a NMFS approved PSO. The lessee must provide to the Lessor a list of observers and their résumés no later than forty-five (45) calendar days prior to the scheduled start of surveys performed in support of plan submittal. The résumés of any additional observers must be provided fifteen (15) calendar days prior to each observer's start date. The Lessor will send the observer information to NMFS for approval.

Optical Device Availability. The lessee must ensure that reticle binoculars and other suitable equipment are available to each observer to adequately perceive and monitor distant objects within the exclusion zone during surveys conducted in support of plan (i.e., SAP and/or COP) submittal.

B.3.1. High Resolution Geophysical Survey Requirements

The following requirements will apply to all HRG survey work actively using electromechanical survey equipment where one or more acoustic sound source is operating at frequencies below 200 kHz.

1. Establishment of Default Exclusion Zone. The lessee must ensure that a 656 ft (200 m) default exclusion zone for cetaceans, pinnipeds, and sea turtles will be monitored by a PSO around a survey vessel actively using electromechanical survey equipment where one or more acoustic sound sources is operating at frequencies below 200 kHz. In the case of the right whale, the minimum separation distance of 1,640 ft (500 m) is in effect when the vessel is underway as described in the vessel-strike avoidance measures.
    a. If the Lessor determines that the exclusion zone does not encompass the 180-dB Level A harassment radius calculated for the acoustic source having the highest source level, the Lessor will consult with NMFS about additional requirements.
    b. The Lessor may authorize surveys having an exclusion zone larger than 656 ft (200 m) to encompass the 160-dB Level B harassment radius if the lessee can demonstrate the zone can be effectively monitored.

2. Field Verification of Exclusion Zone. The lessee must conduct field verification of the exclusion zone for specific HRG survey equipment operating below 200 kHz. The lessee must take acoustic measurements at a minimum of two reference locations and be

sufficient to establish the following: source level (peak at 1 meter) and distance to the 180, 160, and 150 dB_{rms} re 1µPa sound pressure level (SPL) isopleths as well as the 187 dB re 1µPa cumulative sound exposure level (cSEL). Sound measurements must be taken at the reference locations at two depths (i.e., a depth at mid-water and a depth at approximately 1 meter above the seafloor). An infrared range finder may be used to determine distance from the sound source to the reference location.

3. Modification of Exclusion Zone. The lessee may use the field-verification method described above to modify the HRG survey exclusion zone for specific HRG survey equipment operating below 200 kHz. This modified exclusion zone may be greater than or less than the 656 ft (200 m) default exclusion zone depending on the results of the field tests. Any new exclusion zone radius must be based on the most conservative measurement (i.e., the largest safety zone configuration) of the target (160 dB or 180 dB) zone. This modified zone must be used for all subsequent use of field-verified equipment and may be periodically reevaluated based on the regular sound monitoring. The lessee must obtain Lessor approval of any new exclusion zone before it may be implemented.

4. Clearance of Exclusion Zone. The lessee must ensure that active acoustic sound sources must not be activated until the PSO has reported the exclusion zone clear of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

5. Seasonal Management Areas (SMAs) and Dynamic Management Areas (DMAs) Right Whale Monitoring. The Lessee must ensure that vessel operators monitor National Marine Fisheries Service's (NMFS) North Atlantic Right Whale reporting systems (e.g., the Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System) for the presence of North Atlantic right whales during HRG survey operations within or adjacent to SMAs and/or DMAs.

6. Electromechanical Survey Equipment Ramp-Up. The lessee must ensure that when technically feasible a "ramp-up" of the electromechanical survey equipment occurs at the start or re-start of HRG survey activities. A ramp-up would begin with the power of the smallest acoustic equipment for the HRG survey at its lowest power output. The power output would be gradually turned up and other acoustic sources added in a way such that the source level would increase in steps not exceeding 6 dB per 5-minute period.

7. Shut Down for Non-Delphinoid Cetaceans and Sea Turtles. If a non-delphinoid cetacean or sea turtle is sighted at or within the exclusion zone, an immediate shutdown of the electromechanical survey equipment is required. The vessel operator must comply immediately with such a call by the observer. Any disagreement or discussion should occur only after shut-down. Subsequent restart of the electromechanical survey

equipment must use the ramp-up provisions described above and may only occur following clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes. If, however, a pinniped or delphinoid cetacean enters the exclusion zone after shutdown, and prior to the completion of ramp up, then subsequent restart of the electromechanical survey equipment must use the power down provisions described below.

8. Power Down for Delphinoid Cetaceans and Pinnipeds. If a delphinoid cetacean or pinniped is sighted at or within the exclusion zone, the electromechanical survey equipment must be powered down to the lowest power output that is technically feasible. The vessel operator must comply immediately with such a call by the observer. Any disagreement or discussion should occur only after power-down. Subsequent power up of the electromechanical survey equipment must use the ramp-up provisions described above and may occur after (1) the exclusion zone is clear of a delphinoid cetacean and/or pinniped or (2) a determination by the PSO after a minimum of 10 minutes of observation that the delphinoid cetacean and/or pinniped is approaching the vessel or towed equipment at a speed and vector that indicates voluntary approach to bow-ride or chase towed equipment. An incursion into the exclusion zone by a non-delphinoid cetacean or sea turtle during a power-down requires implementation of the shut-down procedures described above.

9. Pauses in Electromechanical Survey Sound Source. The lessee must ensure that if the electromechanical sound source shuts down for reasons other than encroachment into the exclusion zone by a non-delphinoid cetacean or sea turtle, including, but not limited to, mechanical or electronic failure, resulting in the cessation of the sound source for a period greater than 20 minutes, the lessee must restart the electromechanical survey equipment using the full ramp-up procedures and clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes. If the pause is less than 20 minutes the equipment may be re-started as soon as practicable at its operational level as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of cetaceans, pinnipeds, and sea turtles. If visual surveys were not continued diligently during the pause of 20-minutes or less, the lessee must restart the electromechanical survey equipment using the full ramp-up procedures and clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

B.3.2. Geotechnical Exploration Requirements

The following requirements will apply to all geotechnical exploration work.

1. Establishment of Default Exclusion Zone. The lessee must ensure that a 656 ft (200 m) radius exclusion zone for all cetaceans, pinnipeds, and sea turtles will be monitored by a PSO around any vessel conducting geotechnical surveys (i.e., drilling, cone penetrometer tests, etc.).

2. Modification of Exclusion Zone. The lessee may use the field-verification method as described below to modify the geotechnical survey exclusion zone for specific geotechnical exploration equipment being utilized. Any new exclusion zone radius must be based on the most conservative measurement (i.e., the largest safety zone configuration) of the 160 dB zone. This modified zone must be used for all subsequent use of field-verified equipment and may be periodically reevaluated based on the regular sound monitoring described below. The lessee must obtain Lessor approval of any new exclusion zone before it may be implemented.

3. Field Verification of Exclusion Zone. If the lessee wishes to modify the exclusion zone as described above, the lessee must conduct field verification of the exclusion zone for specific geotechnical exploration equipment. The results of the measurements from the equipment must be used to establish a new exclusion zone, which may be greater than or less than the 656-ft (200-m) default exclusion zone depending on the results of the field tests. The lessee must take acoustic measurements at a minimum of two reference locations and be sufficient to establish the following: source level (peak at 1 meter) and distance to the 180, 160, and 150 dB_{rms} re 1µPa sound pressure level (SPL) isopleths as well as the 187 dB re 1µPa cumulative sound exposure level (cSEL). Sound measurements must be taken at the reference locations at two depths (i.e., a depth at mid-water and a depth at approximately 1 meter above the seafloor). An infrared range finder may be used to determine distance from the sound source to the reference location.

4. Clearance of Exclusion Zone. The lessee must ensure that geotechnical sound source must not be activated until the PSO has reported the exclusion zone clear of all cetaceans, pinnipeds, and sea turtles for 60 minutes

5. Shut Down for Non-Delphinoid Cetaceans and Sea Turtles. If any non-delphinoid cetaceans or sea turtles are sighted at or within the exclusion zone, an immediate shutdown of the geotechnical exploration equipment is required. The vessel operator must comply immediately with such a call by the observer. Any disagreement or discussion should occur only after shut-down. Subsequent restart of the geotechnical exploration equipment may only occur following clearance of the exclusion zone for 60 minutes.

6. Pauses in Geotechnical Exploration Sound Source. The lessee must ensure that if the geotechnical sound source shuts down for reasons other than encroachment into the exclusion zone by a non-delphinoid cetacean or sea turtle, including, but not limited to, mechanical or electronic failure, resulting in the cessation of the sound source for a period greater than 20 minutes, the lessee must ensure clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes. If the pause is less than 20 minutes the equipment may be re-started as soon as practicable as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of cetaceans, pinnipeds, and sea turtles. If visual surveys were not continued diligently during the pause of 20-minutes or less, the lessee must restart the geotechnical exploration equipment only after the clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

B.4. CONSTRUCTION OF METEOROLOGICAL TOWERS AND INSTALLATION OF METEOROLOGICAL BUOYS

The lessee must ensure that all vessels conducting activity in support of a plan (i.e., SAP and/or COP) comply with the construction of meteorological tower and installation of meteorological buoy requirements specified below except under extraordinary circumstances when the safety of the vessel or crew are in doubt or the safety of life at sea is in question:

Visibility. The lessee must not conduct pile driving for a meteorological tower foundation at any time when lighting or weather conditions (e.g., darkness, rain, fog, sea state) prevents visual monitoring of the exclusion zones for meteorological tower foundation pile driving as specified below. This requirement may be modified as specified below.

Modification of Visibility Requirement. If the lessee intends to conduct pile driving for a meteorological tower foundation at night or when visual observation is otherwise impaired, an alternative monitoring plan detailing the alternative monitoring technologies (e.g., active or passive acoustic monitoring technologies) must be submitted to the Lessor for consideration. The Lessor may, after consultation with NMFS, decide to allow the lessee to conduct pile driving for a meteorological tower foundation at night or when visual observation is otherwise impaired.

Protected-Species Observer (PSO). The lessee must ensure that the exclusion zone for all pile driving for a meteorological tower foundation is monitored by a NMFS-approved PSO. The lessee must provide to the Lessor a list of observers and their résumés no later than forty-five (45) calendar days prior to the scheduled start of meteorological tower construction activity. The résumés of any additional observers must be provided fifteen (15) calendar days prior to each observer's start date. The Lessor will send the observer information to NMFS for approval.

Optical Device Availability. The lessee must ensure that reticle binoculars and other suitable equipment are available to each observer to adequately perceive and monitor distant objects within the exclusion zone during meteorological tower construction activities.

Pre-Construction Briefing. Prior to the start of construction, the lessee must hold a briefing to establish responsibilities of each involved party, define the chains of command, discuss communication procedures, provide an overview of monitoring purposes, and review operational procedures. This briefing must include construction supervisors and crews, and the PSO(s) (see further below). The Resident Engineer (or other authorized individual) will have the authority to stop or delay any construction activity, if deemed necessary by the Resident Engineer. New personnel must be briefed as they join the work in progress.

B.4.1. Requirements for Pile Driving

Prohibition on Pile Driving. The lessee must ensure that no pile-driving activities (e.g., pneumatic, hydraulic, or vibratory installation of foundation piles) occur from November 1 – April 30 nor during an active DMA if the pile driving location is within the boundaries of the DMA as established by the National Marine Fisheries Service or within 3,281 ft (1,000 m) of the boundaries of the DMA.

Establishment of Default Exclusion Zone. The lessee must ensure the establishment of a default 3281-ft (1,000-m) radius exclusion zone for cetaceans, sea turtles, and pinnipeds around each pile driving site. The 3,281 ft (1,000 m) exclusion zone must be monitored from two locations. One observer must be based at or near the sound source and will be responsible for monitoring out to 1,640 ft (500 m) from the sound source. An additional observer must be located on a separate vessel navigating approximately 3,281 ft (1,000 m) around the pile hammer and will be responsible for monitoring the area between 1,640 ft (500 m) to 3,281 ft (1,000 m) from the sound source.

Field Verification of Exclusion Zone. The lessee must conduct acoustic monitoring of pile driving activities during the installation of each meteorological tower requiring pile driving. The lessee must take acoustic measurements at a minimum of two reference locations and be sufficient to establish the following: source level (peak at 1 meter) and distance to the 180, 160, and 150 dB_{rms} re 1µPa sound pressure level (SPL) isopleths as well as the 187 dB re 1µPa cumulative sound exposure level (cSEL). Sound measurements must be taken at the reference locations at two depths (i.e., a depth at mid-water and a depth at approximately 1 meter above the seafloor). An infrared range finder may be used to determine distance from the sound source to the reference location. If the lessee wishes to modify the exclusion zone the lessee must conduct a field verification of the exclusion zone during pile driving of the first pile if the meteorological tower foundation design includes multiple piles. The results of the measurements from the first pile must be used to establish a new exclusion zone which may be greater than or less than the 3281-ft (1,000-m) default exclusion zone, depending on the results of the field tests. Acoustic measurements must take place during the driving of the last half (deepest pile segment) for any given openwater pile. A minimum of two reference locations must be established at a distance of 1,640 ft (500 m) and 3281 ft (1,000 m) from the pile driving. Sound measurements must be taken at the reference locations at two depths (a depth at midwater and a depth at approximately 1m above the seafloor). Sound pressure levels must be measured and reported in the field in dB re 1 μPa rms (impulse). An infrared range finder may be used to determine distance from the pile to the reference location.

Modification of Exclusion Zone. The lessee may use the field verification method described above to modify the default exclusion zone provided above for pile driving activities. Results of the field verification must be submitted to the Lessor after the pile driving of the first pile and before the pile driving of subsequent piles for a multiple pile foundation. The results of the measurements must be used to establish a new exclusion zone which may be greater than or less than the 3,281 ft (1,000 m) default exclusion zone, depending on the results of the field tests. Any new exclusion zone radius must be based on the most conservative measurement (i.e., the largest safety zone configuration) of the target (Level A or Level B) zone.

If multiple piles are being driven, the lessee may use the field verification method described above to modify the default exclusion zone provided above for pile driving activities. Any new exclusion zone radius must be based on the most conservative measurement (i.e., the largest safety zone configuration) of the Level A zone.

Clearance of Exclusion Zone. The lessee must ensure that visual monitoring of the exclusion zone must begin no less than 60 minutes prior to the beginning of soft start and continue until pile driving operations cease or sighting conditions do not allow observation of the sea surface (e.g., fog, rain, darkness). If a cetacean, pinniped, or sea turtle is observed, the observer must note and monitor the position, relative bearing and estimated distance to the animal until the animal dives or moves out of visual range of the observer. The observer must continue to observe for additional animals that may surface in the area, as often there are numerous animals that may surface at varying time intervals.

Implementation of Soft Start. The lessee must ensure that a “soft start” be implemented at the beginning of each pile installation in order to provide additional protection to cetaceans, pinnipeds, and sea turtles near the project area by allowing them to vacate the area prior to the commencement of pile driving activities. The soft start requires an initial set of 3 strikes from the impact hammer at 40 percent energy. The remaining strikes can be at 100 percent energy, but the lessee must ensure that there is a one minute waiting period between all subsequent 3 strike sets.

Shut Down for Cetaceans, Pinnipeds, and Sea Turtles. The lessee must ensure that any time a cetacean, pinniped, and/or sea turtle is observed within the exclusion zone, the observer must notify the Resident Engineer (or other authorized individual) and call for a shutdown of pile driving activity. The pile driving activity must cease as soon as it is safe to do so. Any disagreement or discussion should occur only after shut-down, unless such discussion relates to the safety of the timing of the cessation of the pile driving activity. Subsequent restart of the pile driving equipment may only occur following clearance of the exclusion zone of any cetacean, pinniped, and/or sea turtle for 60 minutes.

Pauses in Pile Driving Activity. The lessee must ensure that if pile driving ceases for 30 minutes or more and a cetacean, pinniped, and/or sea turtle is sighted within the exclusion zone prior to re-start of pile driving, the observer(s) must notify the Resident Engineer (or other authorized individual) that an additional 60 minute visual monitoring period must be completed before restarting pile driving activities. A pause in pile driving for less than 30 minutes must still begin with soft start but will not require the 60 minute clearance period as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of cetaceans, pinnipeds, and sea turtles. If visual surveys were not continued diligently during the pause of 30-minutes or less, the lessee must clear the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

B.5. PROTECTED SPECIES REPORTING REQUIREMENTS

The lessee must ensure compliance with the following reporting requirements for site characterization activities performed in support of plan (i.e., SAP and/or COP) submittal and must use contact information provided by the Lessor, to fulfill these requirements:

1. Reporting Injured or Dead Protected Species. The lessee must ensure that sightings of any injured or dead protected species (e.g., marine mammals, sea turtles, or sturgeon) are reported to the NMFS Northeast Region’s Stranding Hotline (866-755-6622 or current) within 24 hours of sighting, regardless of whether the injury or death is caused by a vessel. In addition, if the injury or death was caused by a collision with a project-related vessel, the lessee must ensure that the Lessor is notified of the strike within 24 hours. The notification of such strike must include the date and location (latitude/longitude) of the strike, the name of the vessel involved, and the species identification or a description of the animal, if possible. If the lessee’s activity is responsible for the injury or death, the lessee must ensure that the vessel assist in any salvage effort as requested by NMFS.

2. Reporting Observed Impacts to Protected Species. The observer must report any observations concerning impacts on Endangered Species Act listed marine mammals, sea turtles, or sturgeon to the Lessor and NMFS within 48 hours. Any injuries or mortalities must be documented on the NMFS Incident Report (see Attachment 1 of this appendix). Any observed Takes of listed marine mammals or sea turtles resulting in injury or mortality must be reported within 24 hours to the Lessor and NMFS.

3. Report Information. Data on all protected-species observations must be recorded based on standard marine mammal observer data collection protocols by the PSO. This information must include: dates, times, and locations of survey operations; time of observation, location and weather; details of marine mammal sightings (e.g., species, numbers, and behavior); and details of any observed Taking (e.g., behavioral disturbances or injury/mortality).

4. HRG Plan for Field Verification of the Exclusion Zone. The lessee must submit a plan for verifying the sound source levels of any electromechanical survey equipment operating at frequencies below 200 kHz to the Lessor no later than 45 days prior to the commencement of the field verification activities. The Lessor may require that the Lessee modify the plan to address any comments the Lessor submits to the Lessee on the contents of the plan in a manner deemed satisfactory to the Lessor prior to the commencement of the field verification activities.

5. Report of Activities and Observations. The lessee must provide the Lessor and NMFS with a report within ninety (90) calendar days following the commencement of HRG and/or geotechnical exploration activities that includes a summary of the survey activities and an estimate of the number of listed marine mammals and sea turtles observed or Taken during these survey activities.

6. Final Technical Report for Meteorological Tower Construction and Meteorological Buoy Installation Observations. The lessee must provide the Lessor and NMFS a report within 120 days after completion of the pile driving and construction activities. The report must include full documentation of methods and monitoring protocols, summarizes the data recorded during monitoring, estimates the number of listed marine mammals and sea turtles that may have been taken during construction activities, and provides an interpretation of the results and effectiveness of all monitoring tasks. The report must also include acoustic monitoring results collected during sound source verification of pile driving activity.

7. Marine Mammal Protection Act Authorization(s). If the Lessee is required to obtain an authorization pursuant to section 101(a)(5) of the Marine Mammal Proteciton Act prior to conducting survey activities, then the Lessee must provide to the Lessor a copy of the authorization prior to commencing these activities.

Reports must be sent to:

Bureau of Ocean Energy Management
Environment Branch for Renewable Energy
Phone: 703-787-1340

Email: renewable_reporting@boem.gov

National Marine Fisheries Service
Northeast Regional Office, Protected Resources Division
Section 7 Incidental Take Coordinator
Phone: 978-281-9328
Email: incidental.take@noaa.gov

B.6. MEASURES FOR ESA-LISTED BIRDS AND BATS

Based on the following assumptions regarding the proposed action (see Section 3 of the EA) within the WEA (Figure 2-1), no additional mitigations for ESA-listed and ESA candidate species are necessary.

Assumptions:

- It is anticipated that meteorological towers constructed for site assessment activities would be self-supported structures and would not require guy wires for support or stability.
- It is anticipated that only red flashing strobe-like lights will be used for meteorological towers to meet FAA requirements. In addition, it also anticipated that navigation lights for towers and buoys will be in compliance with USCG requirements. Finally, it is anticipated that any additional lights (e.g., work lights) on towers and support vessels will be used only when necessary and be hooded downward and directed when possible to reduce upward illumination and illumination of adjacent waters.

In addition, meteorological towers will be required to have visibility sensors to collect data on climatic conditions above and beyond wind speed, direction and other associated metrics generally collected at meteorological towers. This information will assist BOEM and USFWS with evaluating the impacts of future offshore wind facilities on threatened and endangered birds, migratory birds, and bats.

B.7. REQUIREMENTS DURING DECOMMISSIONING

Essentially, the decommissioning process is the reverse of the construction process (absent pile driving), and the impacts from decommissioning would likely mirror those of construction. In addition, vessel activity during decommissioning would be essentially the same as that required during construction. Therefore, the vessel mitigation measures will be required.

Foundation structures must be removed by cutting at least 15 ft (4.6 m) below mudline (see 30 CFR 585.910(a). BOEM assumes the meteorological towers to be constructed in southern New England can be removed using non-explosive severing methods. As detailed in 30 CFR Part 585.902, before the lessee decommissions the facilities under their SAP, the lessee must submit a decommissioning application and receive approval from the BOEM. Furthermore, the approval of the decommissioning concept/methodology in the SAP is not an approval of a decommissioning application.

B.8. OTHER NON-ESA RELATED STANDARD OPERATING CONDITIONS

The regulations for site assessment plans found at 30 CFR Part 585.610 specify the requirements of a site assessment plan. These include a description of the measures the lessee will use to avoid or minimize adverse effects and any potential incidental take of endangered species before conducting activities on the lease, and how the lessee will mitigate environmental impacts from proposed activities. 30 CFR 585.801 also specify requirements of the lessee to reduce impacts on protected species.

B.9. SITE CHARACTERIZATION DATA COLLECTION

In addition to the collection of meteorological and oceanographic data, the purpose of these meteorological towers/buoys and site characterization surveys are to also collect biological and archaeological data. This data will assist in future analysis of proposed wind facilities. In addition to required reports, all site characterization data submitted to BOEM in support of a plan (SAP, COP or GAP) will be shared with NMFS, USFWS, and appropriate State agencies upon request.

Attachment 1 to Appendix B
Endangered Species Act Incident Report Form

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Incident Report: Protected Species Injury or Mortality

Photographs should be taken of all injured or dead animals.

Observer's full name:____
Reporter's full name:____

Species Identification:__________________________________

Name of platform and activity ongoing at time of observation (e.g., transit, survey, pile driving, etc:

____
____

Date animal observed:______________ Time animal observed: ____________________
Date animal collected:______________ Time animal collected:____________________

Environmental conditions at time of observation (i.e., tidal stage, sea state, weather):

____
____

Water temperature (°C) at site and time of observation:_____________________
Describe location of animal and events leading up to, including and after, the incident:

____

Sturgeon Information:
Species ______________________________

Fork length (or total length) ___________________ Weight ____________________

Condition of specimen/description of animal

____
____
____
____

Fish Decomposed: NO SLIGHTLY MODERATELY SEVERELY
Fish tagged: YES / NO *Please record all tag numbers.* Tag # ______________

Photograph taken: YES / NO
(please label *species, date, geographic site* and *vessel name* when transmitting photo)

Genetics Sample taken: YES / NO
Genetics sample transmitted to: __________________ on ____/_____/2012

Sea Turtle Species Information: *(please designate cm/m or inches.)*

Species ______________________________ Weight (kg or lbs)________________________

Sex (circle): Male Female Unknown How was sex determined? ____________________

Straight carapace length ________________ Straight carapace width ____________________

Curved carapace length ________________ Curved carapace width ______________________

Plastron length ________________________ Plastron width ______________________________

Tail length ____________________________ Head width __________________________________

Condition of specimen/description of animal____

____

Existing Flipper Tag Information

Left _______________________________ Right ___________________________________

PIT Tag # _________________________________

Miscellaneous:

Genetic biopsy taken: YES NO

Photos Taken: YES NO

Turtle Release Information:

Date ____________________________ Time _______________________________

Lat _____________________________ Long _______________________________

State ___________________________ County ______________________________

Remarks: (note if turtle was involved with tar or oil, gear or debris entanglement, wounds or mutilations, propeller damage, papillomas, old tag locations, etc.)

____

____

Marine Mammal information:

Species ____

Injuries Observed ____

Condition/Description of Animal ____

____

Other Remarks ____

Date and Time Reported to NMFS Stranding Hotline: ______________________________

Appendix C
Vessel Trip Calculations

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HRG surveys of OCS blocks			
Alternative	# leases	297 survey days/lease	# round trips
A	5	297	1485
B	3	297	891
C	5	297	1485
D	3	297	891

HRG surveying of cable routes					
Alternative	# cable routes	miles/ route	1 hr survey per mile cable	# hrs surveyed per day	total days (round trips)
A	5	150	150	10	15
B	3	90	90	10	9
C	5	150	150	10	15
D	3	90	90	10	9

Avian Surveys - high			
Alternative	baseline - Alt A max surveys	ratio to Alt A	total round trips
A	540	1	540
B	540	0.6	324
C	540	1	540
D	540	0.6	324

Avian Surveys - low			
Alternative	baseline - Alt A max surveys	ratio to Alt A	total round trips
A	360	1	360
B	360	0.6	216
C	360	1	360
D	360	0.6	216

Fish Surveys			
Alternative	baseline - Alt A max surveys	ratio to Alt A	total round trips
A	60	1	60
B	60	0.6	36
C	60	1	60
D	60	0.6	36

Geotech sampling - high								
Alternative	# whole blocks	# partial blocks	turbines per whole block	turbines per partial block	WEA surveying total	# samples @ buoy foundations	# samples per nm of cable route	**TOTAL GEOTECH**
A	117	20	20	10	2540	10	150	**2700**
B	83	18	20	10	1840	6	90	**1936**
C	108	20	20	10	2360	8	120	**2488**
D	81	28	20	10	1900	6	90	**1996**

Geotech sampling - low								
Alternative	# whole blocks	# partial blocks	turbines per whole block	turbines per partial block	WEA surveying total	# samples @ buoy foundations	# samples per nm of cable route	**TOTAL GEOTECH**
A	117	20	4	2	508	10	150	**668**
B	83	18	4	2	368	6	90	**464**
C	108	20	4	2	472	8	120	**600**
D	81	28	4	2	380	6	90	**476**

Total Vessel Trips	**Low Range**	**High Range**
Alternative A	2588	4800
Alternative B	1616	3196
Alternative C	2520	4588
Alternative D	1628	3256

Construction			
	# towers	round trips for construction per tower	total round trips
Alt A	5	40	200
Alt B	3	40	120
Alt C	5	40	200
Alt D	3	40	120

Maintenance - quarterly and weekly				
	# towers	quarterly visits	years	total trips
Alt A	5	4	5	100
Alt B	3	4	5	60
Alt C	5	4	5	100
Alt D	3	4	5	60
	# towers	weekly visits	years	total trips
Alt A	5	52	5	1300
Alt B	3	52	5	780
Alt C	5	52	5	1300
Alt D	3	52	5	780

Decommission			
	# towers	round trips for construction per tower	total round trips
Alt A	5	40	200
Alt B	3	40	120
Alt C	5	40	200
Alt D	3	40	120

Total	Low Range	High Range
Alternative A	500	1700
Alternative B	300	1020
Alternative C	500	1700
Alternative D	300	1020

Construction			
	#buoys	round trips for construction per buoy - low	total round trips
Alt A	10	1	10
Alt B	6	1	6
Alt C	10	1	10
Alt D	6	1	6

Maintenance - quarterly and monthly				
	#buoys	quarterly visits	years	total trips
Alt A	10	4	5	200
Alt B	6	4	5	120
Alt C	10	4	5	200
Alt D	6	4	5	120
	#towers	monthly	years	total trips
Alt A	10	12	5	600
Alt B	6	12	5	360
Alt C	10	12	5	600
Alt D	6	12	5	360

Decommission			
	#buoys	round trips for construction per buoy - low	total round trips
Alt A	10	1	10
Alt B	6	1	6
Alt C	10	1	10
Alt D	6	1	6

Total	Low Range
Alternative A	220
Alternative B	132
Alternative C	220
Alternative D	132

Total Vessel Trip Calculations for Site Characterization and Site Assessment Activites

	Site Characterization		**Site Assessment**		**TOTAL**	
	Low Range	High Range	Low Range	High Range	Low Range	High Range
Alternative A	2588	4800	220	1700	2808	6500
Alternative B	1616	3196	132	1020	1748	4216
Alternative C	2520	4588	220	1700	2740	6288
Alternative D	1624	3236	132	1020	1756	4256

Appendix D
Air Quality Emissions Calculations

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Emissions Summary for Average Year

Phase/Source Description	Emissions (tons/year, metric tons/year for GHG pollutants)								
	CO	NO_x	VOC	$PM_{2.5}$	PM_{10}	SO_x	CO_2	N_2O	CH_4
Site Characterization - Staff Commuting for Surveys									
- POVs	0.88	4.00E-02	5.33E-02	3.11E-03	5.33E-03	2.22E-03	74.19	7.26E-04	3.49E-03
Site Characterization - Off-Shore Surveys									
- Vessel Travel	9.67	116.0	4.39	6.33	6.33	11.43	5,501.8	0.16	0.72
- Fuel Spills	-	-	0.31	-	-	-	-	-	-
SUBTOTAL One year from Years 1-5	**10.55**	**116.1**	**4.45**	**6.33**	**6.33**	**11.43**	**5,576.0**	**0.16**	**0.72**
Site Assessment - On-Shore Tower Construction									
- POVs	9.10E-02	1.43E-02	1.36E-02	1.84E-03	2.81E-03	9.68E-04	49.88	1.60E-04	3.21E-04
- Construction Equipment	0.16	0.37	3.84E-02	4.87E-02	4.87E-02	3.19E-02	20.35	5.96E-04	3.69E-02
Site Assessment - Off-Shore Tower Construction									
- Vessel Travel	0.36	4.28	0.16	0.23	0.23	0.42	202.8	5.88E-03	2.65E-02
- Construction Equipment	0.11	0.20	2.53E-02	2.73E-02	2.73E-02	1.76E-02	9.54	2.79E-04	1.73E-02
- Fuel Spills	-	-	0.31	-	-	-	-	-	-
Site Assessment - On-Shore O&M									
- POVs	6.83E-02	3.10E-03	4.13E-03	2.41E-04	4.13E-04	1.72E-04	5.74	5.62E-05	2.70E-04
Site Assessment - Off-Shore O&M									
- Vessel Travel	1.16	13.96	0.53	0.76	0.76	1.38	662.2	1.92E-02	8.64E-02
- Generators	10.53	48.88	3.96	3.47	3.47	3.23	1,544.9	-	-
- Fuel Spills	-	-	0.31	-	-	-	-	-	-
Site Assessment - On-Shore Decommission									
- POVs	9.10E-02	1.43E-02	1.36E-02	1.84E-03	2.81E-03	9.68E-04	49.88	1.60E-04	3.21E-04
Site Assessment - Off-Shore Decommission									
- Vessel Travel	0.36	4.28	0.16	0.23	0.23	0.42	202.8	5.88E-03	2.65E-02
- Construction Equipment	0.16	0.29	3.68E-02	3.95E-02	3.95E-02	2.55E-02	21.19	6.21E-04	3.84E-02
- Fuel Spills	-	-	0.31	-	-	-	-	-	-
SUBTOTAL One year from Years 1-5	**13.09**	**72.29**	**5.89**	**4.82**	**4.82**	**5.53**	**2,769.3**	**3.28E-02**	**0.23**
TOTAL Emissions from Average Year*	**23.64**	**188.3**	**10.33**	**11.15**	**11.15**	**16.96**	**-**	**-**	**-**
					TOTAL GHG		**8,345.2**	**0.19**	**0.95**

Site Characterization Activities

On-Shore Activities - Staff Commuting to Job Site

Personal Vehicle Round Trips for Vessel Trips Associated with Site Characterization Activities

Survey Task	Total No. of Vessel Round Trips	Duration of Survey Task (years)	No. of Vessel Round Trips (per year)[1]	No. of POV Round Trips (per year)[2]
HRG Survey of OCS blocks within WEA under Alternative A	1,485	5	297	891
HRG surveys of 5 cable routes	15	5	3	9
Geotechnical Sampling	2,900	5	580	1,740
Avian surveys	540	3	180	540
Fish surveys	60	1	60	180
TOTAL	**5,000**	**19**	**1,120**	**3,360**

1. Round trips per year estimated by dividing total round trips per task by the number of years over which the surveys will be conducted.
2. Assume an average of three staff per vessel. Therefore, personal vehicle (POV) round trips assumed to equal three times the number of vessel round trips per year.

Personal Vehicle Emission Factors [1]

Personal Vehicle Type	Model Year[2]	Calendar Year[2]	Emission Factors (grams/mile)								
			CO	NOx	VOC	$PM_{2.5}$[3]	PM_{10}[3]	SOx	CO_2	N_2O	CH_4
Light Duty Gasoline Vehicles	2009	2015	3.97	0.18	0.24	0.014	0.024	0.01	368.00	3.60E-03	1.73E-02

Personal Vehicle Emissions

Personal Vehicle Type	Total No. of Round Trips	Total Miles (per trip)[4]	Emission (tons/year, metric tons/year for GHG pollutants)								
			CO	NOx	VOC	$PM_{2.5}$	PM_{10}	SOx	CO_2	N_2O	CH_4
Light Duty Gasoline Vehicles	3,360	60	**0.88**	**4.00E-02**	**5.33E-02**	**3.11E-03**	**5.33E-03**	**2.22E-03**	**74.19**	**7.26E-04**	**3.49E-03**

1. Emission factors and methodology from Air Emissions Factor Guide to Air Force Mobile Sources, December 2009, Section 4. Emission Factors for N_2O and CH_4 obtained from the Federal Greenhouse Gas Accounting and Reporting Guidance Technical Support Document (2010), Table D-1, for Tier 2 gasoline passenger cars.
2. Assume staff drive Light Duty Gasoline Vehicles, with average of Model Year 2009 in Calendar Year 2015. CY2015 is the latest year provided in the guidance, and provides an approximate median year for the project.
3. Emission factors for $PM_{2.5}$ an PM_{10} include fugitive sources of PM from brake and tire.
4. Assume each employee drives 60 miles round trip.

Site Characterization Activities

Off-Shore Activities - Surveys

Survey Vessel Details

Survey Task	Vessel Type	Total No. of Vessel Round Trips	Duration of Survey Task (years)	No. of Vessel Round Trips (per year)[2]	Avg. Miles Per Round Trip (nautical miles)	Total (nautical miles/yr)[3]	Activity (hrs/yr)[4]
HRG Survey of OCS blocks within WEA under Alternative A	Crew Boat	1,485	5	297	-	12,700	2,822
HRG Surveys of 5 cable routes	Crew Boat	15	5	3	-	150	33
Geotechnical Sampling[1]	Small Tug Boat	2,900	5	580	180	104,400	8,700
Geotechnical Sampling[1]	Cargo Barge	2,900	5	580	180	104,400	8,700
Avian Surveys	Crew Boat	540	3	180	180	32,400	1,800
Fish Surveys	Crew Boat	60	1	60	180	10,800	600

1. Assume all of the 2,900 total round trips over the 5 year period were performed using Small Tug Boat in conjunction with small Cargo Barge, which does not have an engine. Assume all Avian surveys completed by boat to obtain worst case scenario.
2. Round trips per year estimated by dividing total round trips per task by the number of years over which the surveys will be conducted.
3. Assume HRG Survey of 63,500 nautical miles (i.e., 14,100 hours of vessel time) over 5 years equals 12,700 nm per year. Similarly, 750 nm of HRG Survey Cable Routes over 5 years equals 150 nm per year. Total nm for other surveys based on calculated round trips multipled by average round trip nm.
4. Assume an average speed of 4.5 knots/hour for HRG surveys, 12 knots/hour for the tug boats/barges, and 18 knots/hour for crew boats to estimate Activity hours based upon Total nautical miles traveled. No time for the vessels spent at idle at the towers was captured in this calculation.
http://www.scrutonmarine.com/Crew%20Boats.htm and http://www.chacha.com/question/what-is-the-average-top-speed-of-a-tug-boat

Emission Factors for Vessels

Vessel Type	Engine Size (hp)	Engine Power (kW)[1]	Load Factor (%)[2]	Emission Factors (g/kW-hr)[3]								
				CO	NOx	VOC	$PM_{2.5}$[4]	PM_{10}	SOx[5]	CO_2	N_2O	CH_4
Crew Boat	1,000	746	45%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09
Small Tug Boat	2,000	1,491	31%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09

1. Engine power (kW) estimated by dividing horsepower by a factor of 1.341.
2. Load factor based upon Table 3.4 of *Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories* , U.S. EPA, April 2009. Table 3-1 describes both crew boats and tug boats as Harbor Vessels; therefore, load factors (Table 3.8) are for Harbor Vessels.
3. Emission factors were provided in the *Current Methodologies* document, Table 3-8. Category 2 (typically between 1,000 and 3,000 kW) factors were used for both types of boats since the crew boat is almost within that category, and it provides a conservative assumption for pollutants for which the areas are in non-attainment.
4. Assume $PM_{2.5} = PM_{10}$
5. SOx emission factor overestimates emissions since it assumes a higher sulfur content fuel than will likely be used.

Emissions from Vessels

Vessel Type	Emission (tons/year, metric tons/year for GHG pollutants)[1,2]								
	CO	NOx	VOC	$PM_{2.5}$	PM_{10}	SOx	CO_2	N_2O	CH_4
Crew Boat	2.35	28.2	1.07	1.54	1.54	2.78	1,338.6	3.88E-02	0.17
Small Tug Boat	7.32	87.8	3.33	4.79	4.79	8.65	4,163.2	0.12	0.54
TOTAL	**9.67**	**116.0**	**4.39**	**6.33**	**6.33**	**11.43**	**5,501.8**	**0.16**	**0.72**

1. Emissions quantified using the following equation: Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kW-hr) x Power Adjustment ÷ 453.59 ÷ 2000. For GHG pollutants CO_2, N_2O, and CH_4, emissions are in metric tons.
2. Power adjustment of 1.1 was assumed for a crew boat to account for auxiliary engines, and 1.5 for a harbor tug, based upon Table 3.5 of the *Current Methodologies* document.

Off-Shore Activities - Fuel Spill

Spill Volume (gal)[1]	Fuel Type	Density (lb/gal)[2]	Percent Recovered[3] (%)	Amount Not Recovered[3] (gal)	VOC Emissions (lb/yr)	VOC Emissions (tpy)
88	Diesel	7.1	0%	88	624.8	**0.31**

1. Assume a spill of 88 gallons of diesel occurs each year.
2. Liquid fuel density values obtained from Air Emissions Factor Guide to Air Force Stationary Sources, December 2009, Table 14-2.
3. Assume none of the spill could be recovered, and that 100% of the fuel evaporates.

Site Assessment Activities

On-Shore Activities - Staff Commuting to Job Site and Material/Equipment Delivery

Vehicle Emission Factors [1]

Personal Vehicle Type	Model Year[2]	Calendar Year[2]	Emission Factors (grams/mile)								
			CO	NOx	VOC	$PM_{2.5}$[3]	PM_{10}[3]	SOx	CO_2	N_2O	CH_4
Heavy Duty Diesel Vehicles	2009	2015	0.15	1.68	0.18	0.02	0.03	0.01	1,029.9	4.80E-03	5.10E-03
Light Duty Gasoline Vehicles	2009	2015	3.97	0.18	0.24	0.014	0.024	0.01	368.0	3.60E-03	1.73E-02
Light Duty Diesel Trucks	2009	2015	0.35	0.11	0.12	0.02	0.03	0.01	598.6	1.40E-03	9.00E-04

Personal Vehicle Emissions

Personal Vehicle Type	Total No. of Round Trips[4]	Total Miles (per trip)[5]	Emission (tons/year, metric tons/year for GHG pollutants)								
			CO	NOx	VOC	$PM_{2.5}$	PM_{10}	SOx	CO_2	N_2O	CH_4
Heavy Duty Diesel Vehicles	12	60	2.38E-04	2.67E-03	2.86E-04	3.17E-05	4.76E-05	1.59E-05	1.48	6.91E-06	7.34E-06
Light Duty Gasoline Vehicles	48	60	6.30E-02	2.86E-03	3.81E-03	2.22E-04	3.81E-04	1.59E-04	5.30	5.18E-05	2.49E-04
Light Duty Diesel Trucks	48	60	2.78E-02	8.73E-03	9.52E-03	1.59E-03	2.38E-03	7.94E-04	43.10	1.01E-04	6.48E-05
TOTAL	-	-	**9.10E-02**	**1.43E-02**	**1.36E-02**	**1.84E-03**	**2.81E-03**	**9.68E-04**	**49.88**	**1.60E-04**	**3.21E-04**

1. Emission factors and methodology from Air Emissions Factor Guide to Air Force Mobile Sources, December 2009, Section 4. Emission factors for N_2O and CH_4 obtained from the Federal Greenhouse Gas Accounting and Reporting Guidance Technical Support Document (2010), Table D-1 for Tier 2 gasoline passenger cars, moderate diesel light trucks, and moderate diesel heavy-duty trucks.
2. Assume contractors drive Light Duty Diesel Trucks (Type 3/4), staff drive Light Duty Gasoline Vehicles, and material/equipment deliveries are made using Heavy Duty Diesel Trucks (Type 5), with average of Model Year 2009 in Calendar Year 2015. CY2015 is the latest year provided in the guidance, and provides an approximate median year for the project.
3. Emission factors for $PM_{2.5}$ an PM_{10} include fugitive sources of PM from brake and tire.
4. Assume construction, transportation, and erection of all five towers will take place over the course of five years. Assume an average of 25 contractors travel to the site over 240 days total. In addition, assume an average of five staff travel to the site over 240 days total. Lastly, assume two heavy duty trucks travel to the site over 60 days total. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**
5. Assume each employee drives 60 miles round trip.

On-Shore Activities - Heavy Equipment Use

Construction Equipment	Usage (hrs)	Emission (tons/year, metric tons/year for GHG pollutants)								
		CO	NOx	VOC	$PM_{2.5}$	PM_{10}	SOx	CO_2	N_2O	CH_4
Cranes	192	7.42E-02	0.18	2.28E-02	2.54E-02	2.54E-02	1.64E-02	10.17	2.98E-04	1.84E-02
Rubber Tired Loaders	192	8.67E-02	0.19	1.56E-02	2.33E-02	2.33E-02	1.55E-02	10.17	2.98E-04	1.84E-02
TOTAL	**-**	**0.16**	**0.37**	**3.84E-02**	**4.87E-02**	**4.87E-02**	**3.19E-02**	**20.35**	**5.96E-04**	**3.69E-02**

1. Only cranes and loaders were assumed to be used on-shore during assembly of the towers to move and lift the pieces into place.
2. Assume crane and rubber tire loader operate half of the 240 days estimated to complete the construction of the towers, for 8 hours per day (i.e., 960 hours) over the course of five years. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**
3. Assume $PM_{10} = PM_{2.5}$. See EF Construction Equip tab for emission factors.

Site Assessment Activities

Off-Shore Activities - Transport of Towers to Sites from Ports

Vessel Details for Construction of Towers

Vessel Type	Total No. of Vessel Round Trips[1]	Avg. Miles Per Round Trip (nautical miles)	Total (nautical miles/yr)	Activity (hrs/yr)[2]
Crane Barge	2	180	360	30
Deck Cargo	2	180	360	30
Small Cargo Barge	2	180	360	30
Crew Boat	21	180	3,780	210
Small Tug Boat	4	180	720	60
Large Tug Boat	8	180	1,440	120

1. Based upon projected vessel usage for the construction of one met tower (Table 3.5), total round trips multipled by five for a total of five met towers. It was assumed that these trips would be conducted over the course of five years. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**

2. Assume an average speed of 12 knots/hour for the tug boats/barges and 18 knots/hour for the crew boat to estimate Activity hours based upon Total nautical miles traveled. No time for the vessels spent at idle at the towers was captured in this calculation.
http://www.scrutonmarine.com/Crew%20Boats.htm and http://www.chacha.com/question/what-is-the-average-top-speed-of-a-tug-boat

Emission Factors for Vessels

Vessel Type[1]	Engine Size (hp)	Engine Power (kW)[2]	Load Factor (%)[3]	Emission Factors (g/kW-hr)[4]								
				CO	NOx	VOC	$PM_{2.5}$[5]	PM_{10}	SOx[6]	CO_2	N_2O	CH_4
Crew Boat	1,000	746	45%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09
Small Tug Boat	2,000	1,491	31%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09
Large Tug Boat	4,200	3,132	31%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09

1. The Small and Large Tug Boats are used in conjunction with the Crane Barge, Deck Cargo, and Small Cargo Barge, which do not have an engine. Therefore, only the Crew Boat, Small Tug Boat, and Large Tug Boat have emission factors. Assume construction of towers instead of buoys for a worst case scenario.
2. Engine power (kW) estimated by dividing horsepower by a factor of 1.341.
3. Load factor based upon Table 3.4 of *Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories* , U.S. EPA, April 2009. Table 3-1 describes both crew boats and tug boats as Harbor Vessels; therefore, load factors (Table 3.8) are for Harbor Vessels.
4. Emission factors were provided in the *Current Methodologies* document, Table 3-8. Category 2 (typically between 1,000 and 3,000 kW) factors were used for the crew boat, small tug boat, and large tug boat since the crew boat and large tug boat are approximately within that category.
5. Assume $PM_{2.5} = PM_{10}$
6. SOx emission factor overestimates emissions since it assumes a higher sulfur content fuel than will likely be used.

Emissions from Vessels

Vessel Type	Emission (tons/year, metric tons/year for GHG pollutants)[1,2]								
	CO	NOx	VOC	$PM_{2.5}$	PM_{10}	SOx	CO_2	N_2O	CH_4
Crew Boat	9.40E-02	1.13	4.27E-02	6.15E-02	6.15E-02	0.11	53.49	1.55E-03	6.98E-03
Small Tug Boat	5.05E-02	0.61	2.29E-02	3.30E-02	3.30E-02	5.96E-02	28.71	8.32E-04	3.74E-03
Large Tug Boat	0.21	2.54	0.10	0.14	0.14	0.25	120.6	3.50E-03	1.57E-02
TOTAL	**0.36**	**4.28**	**0.16**	**0.23**	**0.23**	**0.42**	**202.8**	**5.88E-03**	**2.65E-02**

1. Emissions quantified using the following equation: Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kW-hr) x Power Adjustment ÷ 453.59 ÷ 2000. For GHG pollutants CO_2, N_2O, and CH_4, emissions are in metric tons.
2. Power adjustment of 1.1 was assumed for a crew boat to account for auxiliary engines, and 1.5 for a harbor tug, based upon Table 3.5 of the *Current Methodologies* document.

Site Assessment Activities

Off-Shore Activities - Construction of Pilings

Construction Equipment	Usage (hrs)	Emission (tons/year, metric tons/year for GHG pollutants)								
		CO	NOx	VOC	$PM_{2.5}$	PM_{10}	SOx	CO_2	N_2O	CH_4
Bore/Drill Rigs	30	4.77E-02	5.71E-02	7.48E-03	7.46E-03	7.46E-03	4.82E-03	1.59	4.66E-05	2.88E-03
Cranes	150	5.79E-02	0.14	1.78E-02	1.99E-02	1.99E-02	1.28E-02	7.95	2.33E-04	1.44E-02
TOTAL	**-**	**0.11**	**0.20**	**2.53E-02**	**2.73E-02**	**2.73E-02**	**1.76E-02**	**9.54**	**2.79E-04**	**1.73E-02**

1. Only bore/drill rigs and cranes were assumed to be used off-shore during the construction of the pilings.
2. Assume bore/drill rigs operate for three days, 10 hours per day (i.e., 30 hours) and cranes operate for three weeks total, 10 hours per day (i.e., 150 hours) for each of the five towers. It was assumed that these activities would be conducted over the course of five years. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**
3. Assume $PM_{10} = PM_{2.5.}$ See EF Construction Equip tab for emission factors.
4. Assume construction of towers instead of buoys for a worst case scenario.

Off-Shore Activities - Fuel Spill

Spill Volume (gal)[1]	Fuel Type	Density (lb/gal)[2]	Percent Recovered[3] (%)	Amount Not Recovered[3] (gal)	VOC Emissions (lb/yr)	VOC Emissions (tpy)
88	Diesel	7.1	0%	88	624.8	**0.31**

1. Assume a spill of 88 gallons of diesel occurs each year.
2. Liquid fuel density values obtained from Air Emissions Factor Guide to Air Force Stationary Sources, December 2009, Table 14-2.
3. Assume none of the spill could be recovered, and that 100% of the fuel evaporates.

Personal Vehicle Emission Factors [1]

Personal Vehicle Type	Model Year[2]	Calendar Year[2]	Emission Factors (grams/mile)								
			CO	NOx	VOC	$PM_{2.5}$ [3]	PM_{10} [3]	SOx	CO_2	N_2O	CH_4
Light Duty Gasoline Vehicles	2009	2015	3.97	0.18	0.24	0.014	0.024	0.01	368.00	3.60E-03	1.73E-02

Personal Vehicle Emissions

Personal Vehicle Type	Total No. of Round Trips[4]	Total Miles (per trip)[5]	Emission (tons/year, metric tons/year for GHG pollutants)								
			CO	NOx	VOC	$PM_{2.5}$	PM_{10}	SOx	CO_2	N_2O	CH_4
Light Duty Gasoline Vehicles	260	60	**6.83E-02**	**3.10E-03**	**4.13E-03**	**2.41E-04**	**4.13E-04**	**1.72E-04**	**5.74**	**5.62E-05**	**2.70E-04**

1. Emission factors and methodology from Air Emissions Factor Guide to Air Force Mobile Sources, December 2009, Section 4. Emission Factors for N_2O and CH_4 obtained from the Federal Greenhouse Gas Accounting and Reporting Guidance Technical Support Document (2010), Table D-1, for Tier 2 gasoline passenger cars.
2. Assume staff drive Light Duty Gasoline Vehicles, with average of Model Year 2009 in Calendar Year 2015. CY2015 is the latest year provided in the guidance, and provides an approximate median year for the project.
3. Emission factors for $PM_{2.5}$ an PM_{10} include fugitive sources of PM from brake and tire.
4. Assume five weekly trips by one person to observe/service each of the five towers, and to refuel/perform maintenance of the assumed three generators. Only one year was modeled but it captures all five towers.
5. Assume 60 miles round trip.

Site Assessment- Operation and Maintenance

Off-Shore Activities - Routine Maintenance and Evaluation

Maintenance Vessel Details

Task	Vessel Type	Total No. of Vessel Round Trips	Duration of Task (years)	No. of Vessel Round Trips (per year)[2]	Avg. Miles Per Round Trip (nautical miles)	Total (nautical miles/yr)	Activity (hrs/yr)[3]
Routine Maintenance	Crew Boat	260	1	260	180	46,800	2,600

1. Assume five round trips each week using a crew boat to observe/service each of the five towers, including fueling/performing maintenance on the assumed three generators. Only one year was modeled but it captures all five towers.
2. Round trips per year estimated by dividing total round trips per task by the number of years (only one year was modeled) needed to complete task.
3. Assume an average speed of 18 knots/hour to estimate Activity hours based upon Total nautical miles traveled. No time for the vessels spent at idle at the towers was captured in this calculation.

Emission Factors for Vessels

Vessel Type	Engine Size (hp)	Engine Power (kW)[1]	Load Factor (%)[2]	Emission Factors (g/kW-hr)[3]								
				CO	NOx	VOC	$PM_{2.5}$[4]	PM_{10}	SOx[5]	CO_2	N_2O	CH_4
Crew Boat	1,000	746	45%	1.10	13.20	0.50	0.72	0.72	1.30	690.00	0.02	0.09

1. Engine power (kW) estimated by dividing horsepower by a factor of 1.341.
2. Load factor based upon Table 3.4 of *Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories* , U.S. EPA, April 2009. Table 3-1 describes crew boats as Harbor Vessels; therefore, the load factor (Table 3.8) is for Harbor Vessels.
3. Emission factors were provided in the *Current Methodologies* document, Table 3-8. Category 2 (typically between 1,000 and 3,000 kW) factors were used for the crew boat since it is almost within that category, and it provides a conservative assumption for pollutants for which the areas are in non-attainment.
4. Assume $PM_{2.5} = PM_{10}$
5. SOx emission factor overestimates emissions since it assumes a higher sulfur content fuel than will likely be used.

Emissions from Vessels

Vessel Type	Emission (tons/year, metric tons/year for GHG pollutants))[1,2]								
	CO	NOx	VOC	$PM_{2.5}$	PM_{10}	SOx	CO_2	N_2O	CH_4
Crew Boat	1.16	13.96	0.53	0.76	0.76	1.38	662.2	1.92E-02	8.64E-02
TOTAL	**1.16**	**13.96**	**0.53**	**0.76**	**0.76**	**1.38**	**662.2**	**1.92E-02**	**8.64E-02**

1. Emissions quantified using the following equation: Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kW-hr) x Power Adjustment ÷ 453.59 ÷ 2000.
2. Power adjustment of 1.1 was assumed for a crew boat to account for auxiliary engines, and 1.5 for a harbor tug, based upon Table 3.5 of the *Current Methodologies* document.

Site Assessment- Operation and Maintenance

Off-Shore Activities - Operation of Three Prime Generators

Unit Information

Source	Estimated Rated Capacity (hp)	Hours (hours/year)	Fuel
Three 75 kW diesel-fired generators to serve as primary source of electricity for three of the five towers	120	8,760	Diesel

Emission Factors [1,2]

Pollutant	Diesel (lb/hp-hr)
NO_x	0.031
CO	6.68E-03
PM	2.20E-03
SO_2	2.05E-03
VOC	2.51E-03
CO_2	1.08

Potential Criteria Pollutant Emissions [3]

Source	NO_x (tpy)	CO (tpy)	$PM/PM_{10}/PM_{2.5}$ (tpy)	SO_2 (tpy)	VOC (tpy)	CO_2 (metric tpy)
Three 75 kW diesel-fired generators to serve as primary source of electricity for three of the five towers	48.88	10.53	3.47	3.23	3.96	1,544.9
TOTAL	**48.88**	**10.53**	**3.47**	**3.23**	**3.96**	**1,544.9**

1. Emission factors were obtained from AP-42, Section 3.3.
2. Conservatively assumed PM = PM_{10} = $PM_{2.5}$.
3. Emissions were calculated for one year, capturing all three generators.

Off-Shore Activities - Fuel Spill

Spill Volume (gal)[1]	Fuel Type	Density (lb/gal)[2]	Percent Recovered[3] (%)	Amount Not Recovered[3] (gal)	VOC Emissions (lb/yr)	VOC Emissions (tpy)
88	Diesel	7.1	0%	88	624.8	**0.31**

1. Assume a spill of 88 gallons of diesel occurs each year.
2. Liquid fuel density values obtained from Air Emissions Factor Guide to Air Force Stationary Sources, December 2009, Table 14-2.
3. Assume none of the spill could be recovered, and that 100% of the fuel evaporates.

Site Assessment - Decommission

On-Shore Activities - Contractors Commuting to Job Site for Decommission

Vehicle Emission Factors [1]

Personal Vehicle Type	Model Year[2]	Calendar Year[2]	Emission Factors (grams/mile)								
			CO	NOx	VOC	$PM_{2.5}$[3]	PM_{10}[3]	SOx	CO_2	N_2O	CH_4
Heavy Duty Diesel Vehicles	2009	2015	0.15	1.68	0.18	0.02	0.03	0.01	1,029.90	4.80E-03	5.10E-03
Light Duty Gasoline Vehicles	2009	2015	3.97	0.18	0.24	0.014	0.024	0.01	368.00	3.60E-03	1.73E-02
Light Duty Diesel Trucks	2009	2015	0.35	0.11	0.12	0.02	0.03	0.01	598.60	1.40E-03	9.00E-04

Personal Vehicle Emissions

Personal Vehicle Type	Total No. of Round Trips[4]	Total Miles (per trip)[5]	Emission (tons/year, metric tons/year for GHG pollutants)								
			CO	NOx	VOC	$PM_{2.5}$	PM_{10}	SOx	CO_2	N_2O	CH_4
Heavy Duty Diesel Vehicles	12	60	2.38E-04	2.67E-03	2.86E-04	3.17E-05	4.76E-05	1.59E-05	1.48	6.91E-06	7.34E-06
Light Duty Gasoline Vehicles	48	60	6.30E-02	2.86E-03	3.81E-03	2.22E-04	3.81E-04	1.59E-04	5.30	5.18E-05	2.49E-04
Light Duty Diesel Trucks	48	60	2.78E-02	8.73E-03	9.52E-03	1.59E-03	2.38E-03	7.94E-04	43.10	1.01E-04	6.48E-05
TOTAL	-	-	**9.10E-02**	**1.43E-02**	**1.36E-02**	**1.84E-03**	**2.81E-03**	**9.68E-04**	**49.88**	**1.60E-04**	**3.21E-04**

1. Emission factors and methodology from Air Emissions Factor Guide to Air Force Mobile Sources, December 2009, Section 4. Emission factors for N_2O and CH_4 obtained from the Federal Greenhouse Gas Accounting and Reporting Guidance Technical Support Document (2010), Table D-1 for Tier 2 gasoline passenger cars, moderate diesel light trucks, and moderate diesel heavy-duty trucks.

2. Assume contractors drive Light Duty Diesel Trucks (Type 3/4), staff drive Light Duty Gasoline Vehicles, and material/equipment deliveries are made using Heavy Duty Diesel Trucks (Type 5), with average of Model Year 2009 in Calendar Year 2015. CY2015 is the latest year provided in the guidance, and provides an approximate median year for the project.

3. Emission factors for PM2.5 an PM10 include fugitive sources of PM from brake and tire.

4. Assume decommissioning of all five towers will take place over the course of five years. Assume an average of 25 contractors travel to the site over 240 days total. In addition, assume an average of five staff travel to the site over 240 days total. Lastly, assume two heavy duty trucks travel to the site over 60 days total. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**

5. Assume each employee drives 60 miles round trip.

Site Assessment - Decommission

Off-Shore Activities - Tower Decommissioning

Vessel Details for Decommissioning of Towers

Vessel Type	Total No. of Vessel Round Trips	Avg. Miles Per Round Trip (nautical miles)	Total (nautical miles/yr)	Activity (hrs/yr)[1]
Crane Barge	2	180	360	30
Deck Cargo	2	180	360	30
Small Cargo Barge	2	180	360	30
Crew Boat	21	180	3,780	210
Small Tug Boat	4	180	720	60
Large Tug Boat	8	180	1,440	120

1. Round trips for the decommissioning of five towers assumed to be equivalent to the construction of five towers, using Table 3-5 round trips per tower. It was assumed that these trips would be conducted over the course of five years. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**

2. Assume an average speed of 12 knots/hour for the tug boats/barges and 18 knots/hour for the crew boat to estimate Activity hours based upon Total nautical miles traveled. No time for the vessels spent at idle at the towers was captured in this calculation.
http://www.scrutonmarine.com/Crew%20Boats.htm and http://www.chacha.com/question/what-is-the-average-top-speed-of-a-tug-boat

Emission Factors for Vessels

Vessel Type[1]	Engine Size (hp)	Engine Power (kW)[2]	Load Factor (%)[3]	Emission Factors (g/kW-hr)[4]								
				CO	NOx	VOC	$PM_{2.5}$[5]	PM_{10}	SOx[6]	CO_2	N_2O	CH_4
Crew Boat	1,000	746	45%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09
Small Tug Boat	2,000	1,491	31%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09
Large Tug Boat	4,200	3,132	31%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09

1. The Small and Large Tug Boats are used in conjunction with the Crane Barge, Deck Cargo, and Small Cargo Barge, which do not have an engine. Therefore, only the Crew Boat, Small Tug Boat, and Large Tug Boat have emission factors. Assume decommissioning of towers instead of buoys for a worst case scenario.
2. Engine power (kW) estimated by dividing horsepower by a factor of 1.341.
3. Load factor based upon Table 3.4 of *Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories* , U.S. EPA, April 2009. Table 3-1 describes both crew boats and tug boats as Harbor Vessels; therefore, load factors (Table 3.8) are for Harbor Vessels.
4. Emission factors were provided in the *Current Methodologies* document, Table 3-8. Category 2 (typically between 1,000 and 3,000 kW) factors were used for the crew boat, small tug boat, and large tug boat since the crew boat and large tug boat are approximately within that category.
5. Assume $PM_{2.5} = PM_{10}$
6. SOx emission factor overestimates emissions since it assumes a higher sulfur content fuel than will likely be used.

Emissions from Vessels

Vessel Type	Emission (tons/year, metric tons/year for GHG pollutants)[1,2]								
	CO	NOx	VOC	$PM_{2.5}$	PM_{10}	SOx	CO_2	N_2O	CH_4
Crew Boat	9.40E-02	1.13	4.27E-02	6.15E-02	6.15E-02	0.11	53.49	1.55E-03	6.98E-03
Small Tug Boat	5.05E-02	0.61	2.29E-02	3.30E-02	3.30E-02	5.96E-02	28.71	8.32E-04	3.74E-03
Large Tug Boat	0.21	2.54	0.10	0.14	0.14	0.25	120.6	3.50E-03	1.57E-02
TOTAL	**0.36**	**4.28**	**0.16**	**0.23**	**0.23**	**0.42**	**202.8**	**5.88E-03**	**2.65E-02**

1. Emissions quantified using the following equation: Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kW-hr) x Power Adjustment ÷ 453.59 ÷ 2000. For GHG pollutants CO_2, N_2O, and CH_4, emissions are in metric tons.
2. Power adjustment of 1.1 was assumed for a crew boat to account for auxiliary engines, and 1.5 for a harbor tug, based upon Table 3.5 of the *Current Methodologies* document.

Site Assessment - Decommission

Site Assessment - Decommission

Off-Shore Activities - Deconstruction of Pilings

Construction Equipment	Usage (hrs)	Emission (tons/year, metric tons/year for GHG pollutants)								
		CO	NOx	VOC	$PM_{2.5}$	PM_{10}	SOx	CO_2	N_2O	CH_4
Concrete/Indust. Saw	200	8.29E-02	0.10	1.30E-02	1.30E-02	1.30E-02	8.38E-03	10.60	3.11E-04	1.92E-02
Cranes	200	7.72E-02	0.19	2.38E-02	2.65E-02	2.65E-02	1.71E-02	10.60	3.11E-04	1.92E-02
TOTAL	**-**	**0.16**	**0.29**	**3.68E-02**	**3.95E-02**	**3.95E-02**	**2.55E-02**	**21.19**	**6.21E-04**	**3.84E-02**

1. Only concrete/industrial saws and cranes were assumed to be used off-shore during the deconstruction of the pilings.
2. Assume that the equipment operates for four weeks, 10 hours per day (i.e., 200 hours) for each of the five towers. It was assumed that these activities would be conducted over the course of five years. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**
3. Assume PM_{10} = $PM_{2.5.}$ See EF Construction Equip tab for emission factors.
4. Assume decommissioning of towers instead of buoys for a worst case scenario.

Off-Shore Activities - Fuel Spill

Spill Volume (gal)[1]	Fuel Type	Density (lb/gal)[2]	Percent Recovered[3] (%)	Amount Not Recovered[3] (gal)	VOC Emissions (lb/yr)	VOC Emissions (tpy)
88	Diesel	7.1	0%	88	624.8	**0.31**

1. Assume a spill of 88 gallons of diesel occurs each year.
2. Liquid fuel density values obtained from Air Emissions Factor Guide to Air Force Stationary Sources, December 2009, Table 14-2.
3. Assume none of the spill could be recovered, and that 100% of the fuel evaporates.

Construction Equipment Air Quality Emission Factors

Diesel Equipment	Average Rated HP[1]	Consumption (mpg)[2]	Loading Factors[3]	Emission Factors (grams/HP-hr)[4]						Emission Factors (lbs/hr)[5]						Emission Factors (grams/mile)[6]		
				CO	NOx	VOC	PM	Aldehydes	SOx	CO	NOx	VOC	PM	Aldehydes	SOx	CO_2	N_2O	CH_4
Bore/Drill Rigs	209	6.17	75%	9.20	11.01	1.443	1.44	0.20	0.93	3.18	3.80	0.50	0.50	0.07	0.32	116.81	3.42E-03	0.21
Concrete/Indust. Saw	56	6.17	73%	9.20	11.01	1.443	1.44	0.20	0.93	0.83	0.99	0.13	0.13	0.02	0.08	116.81	3.42E-03	0.21
Cranes	194	6.17	43%	4.20	10.30	1.293	1.44	0.20	0.93	0.77	1.89	0.24	0.26	0.04	0.17	116.81	3.42E-03	0.21
Rubber Tired Loaders	158	6.17	54%	4.80	10.30	0.863	1.29	0.20	0.86	0.90	1.94	0.16	0.24	0.04	0.16	116.81	3.42E-03	0.21

Note: The above information was selected from the following tables provided in the *Nonroad Engine and Vehicle Emission Study--Report* , US EPA Doc 21A-2001, 1991.

1. Table 2-04 for Inventory A (Inventory A generally gives higher results and is, therefore, more conservative than Inventory B)
2. Vehicle fuel consumption from USAF IERA Air Emissions Inventory Guidance Document For Mobile Sources at Air Force Installations, May 1999, Revised January 2002, Section 4.
3. Table 2-05 for Inventory A
4. Table 2-07a for Diesel Equipment
5. **Emission Factors** (lbs/hr) = **Average Rated HP** X **Loading Factors** X **Emission Factors** (grams/HP-hr) X **Conversion Factor** (grams to lbs)
6. GHG Emission factors obtained from Environment Canada National Inventory Report Greenhouse Gas Sources Section A13.1.4 Moderately Controlled Diesel Mobile Combustion; factors were changed from grams/liter to grams/mile using conversion factor 1 liter=0.264 gallons and average fuel consumption.

Appendix E
Sightings per Unit Effort Figures for Non-ESA-Listed Marine Mammals

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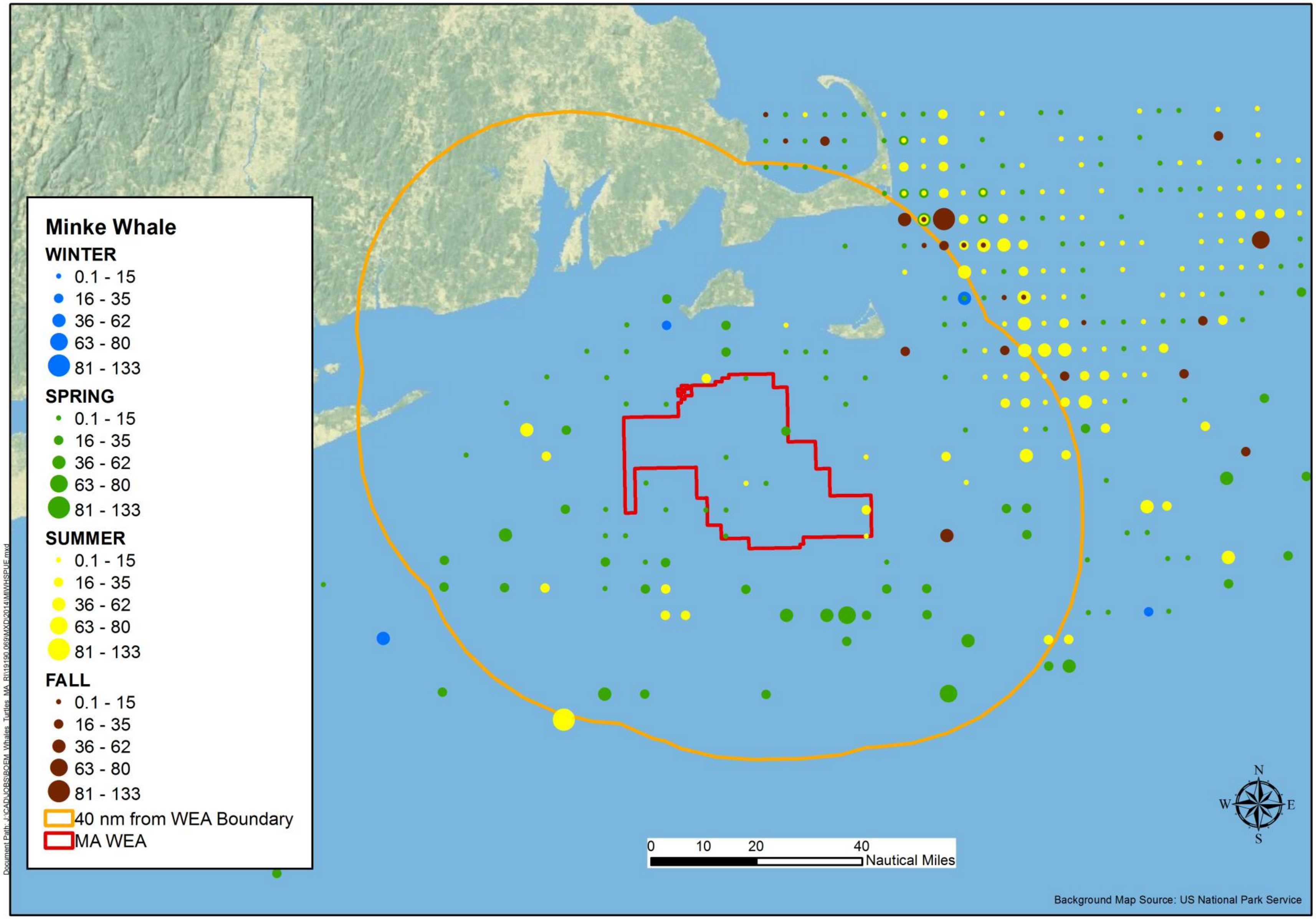

Figure 1. SPUE for minke whales in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2014). Map prepared by Normandeau Associates, Inc.

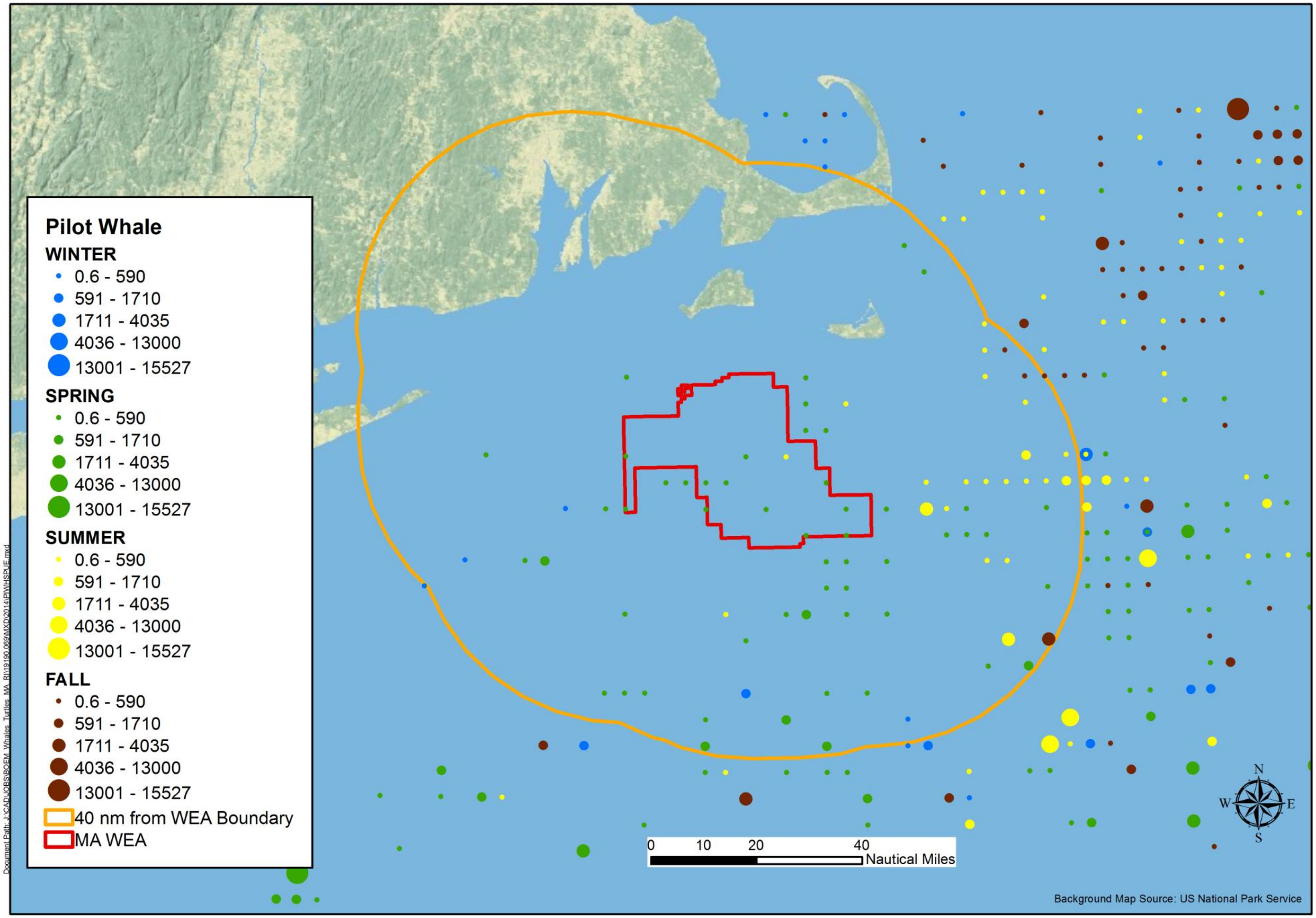

Figure 2. SPUE for pilot whales in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2014). Map prepared by Normandeau Associates, Inc.

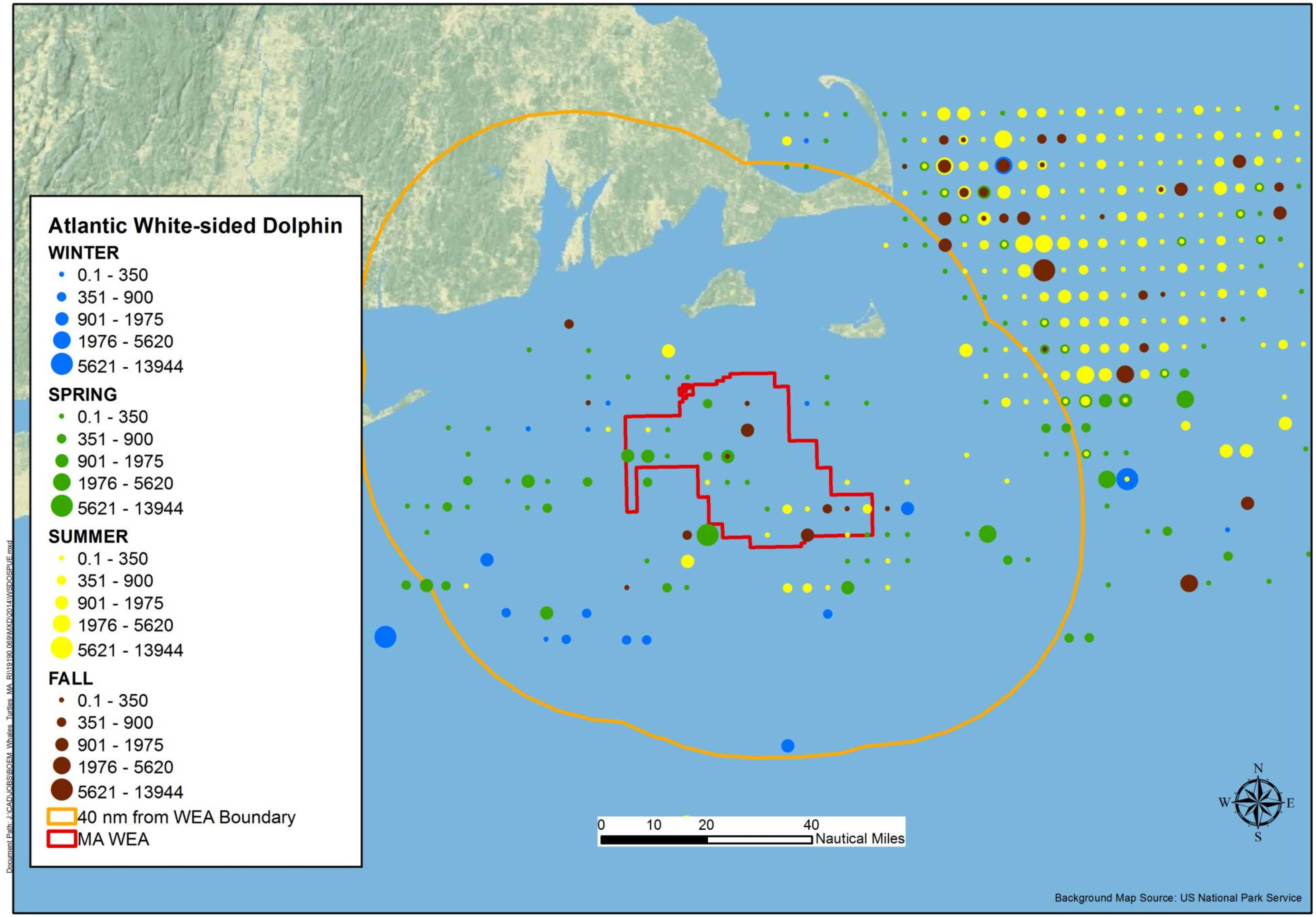

Figure 3. SPUE for Atlantic white-sided dolphins in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2014). Map prepared by Normandeau Associates, Inc.

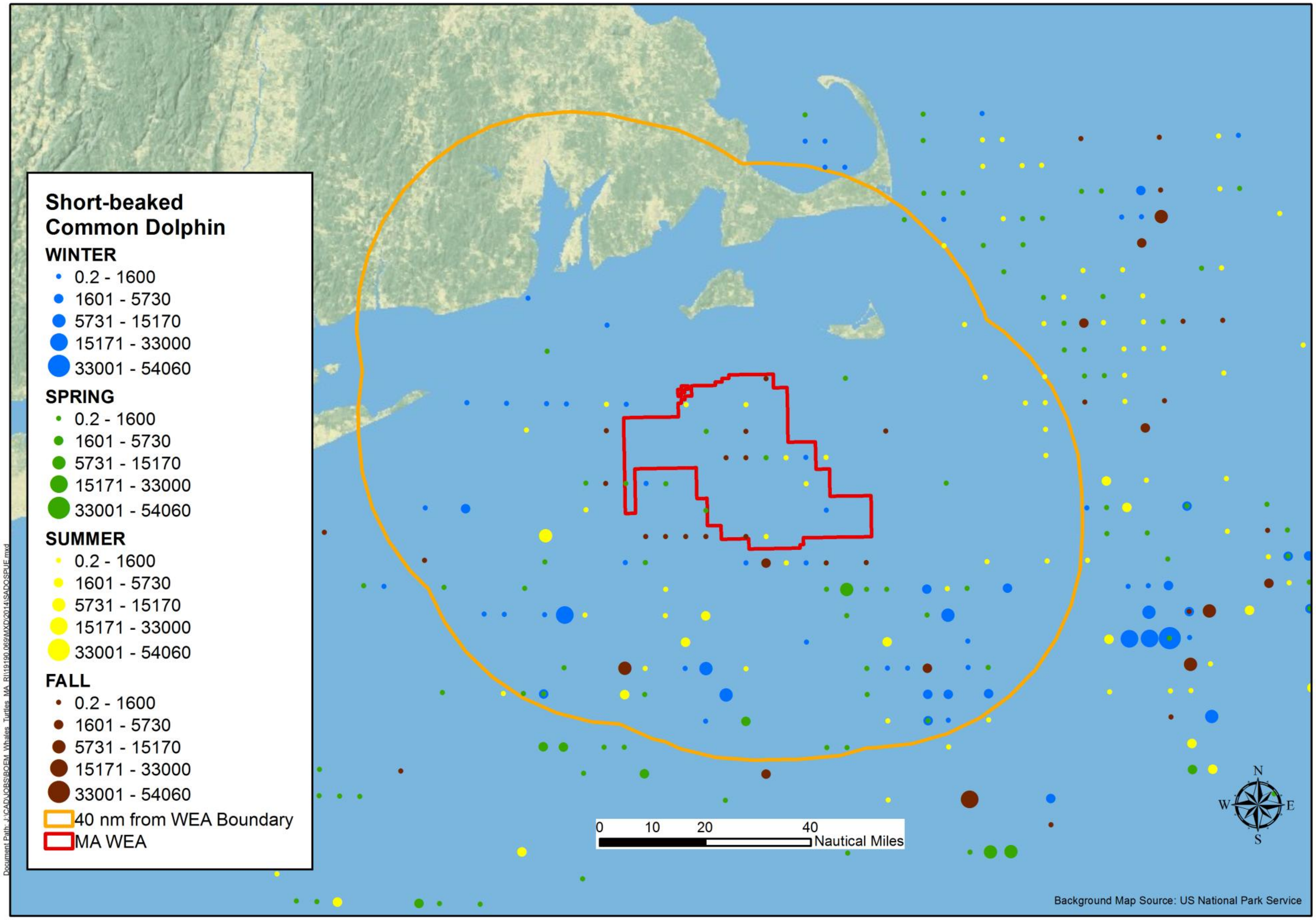

Figure 4. SPUE for short-beaked common dolphins in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2014). Map prepared by Normandeau Associates, Inc.

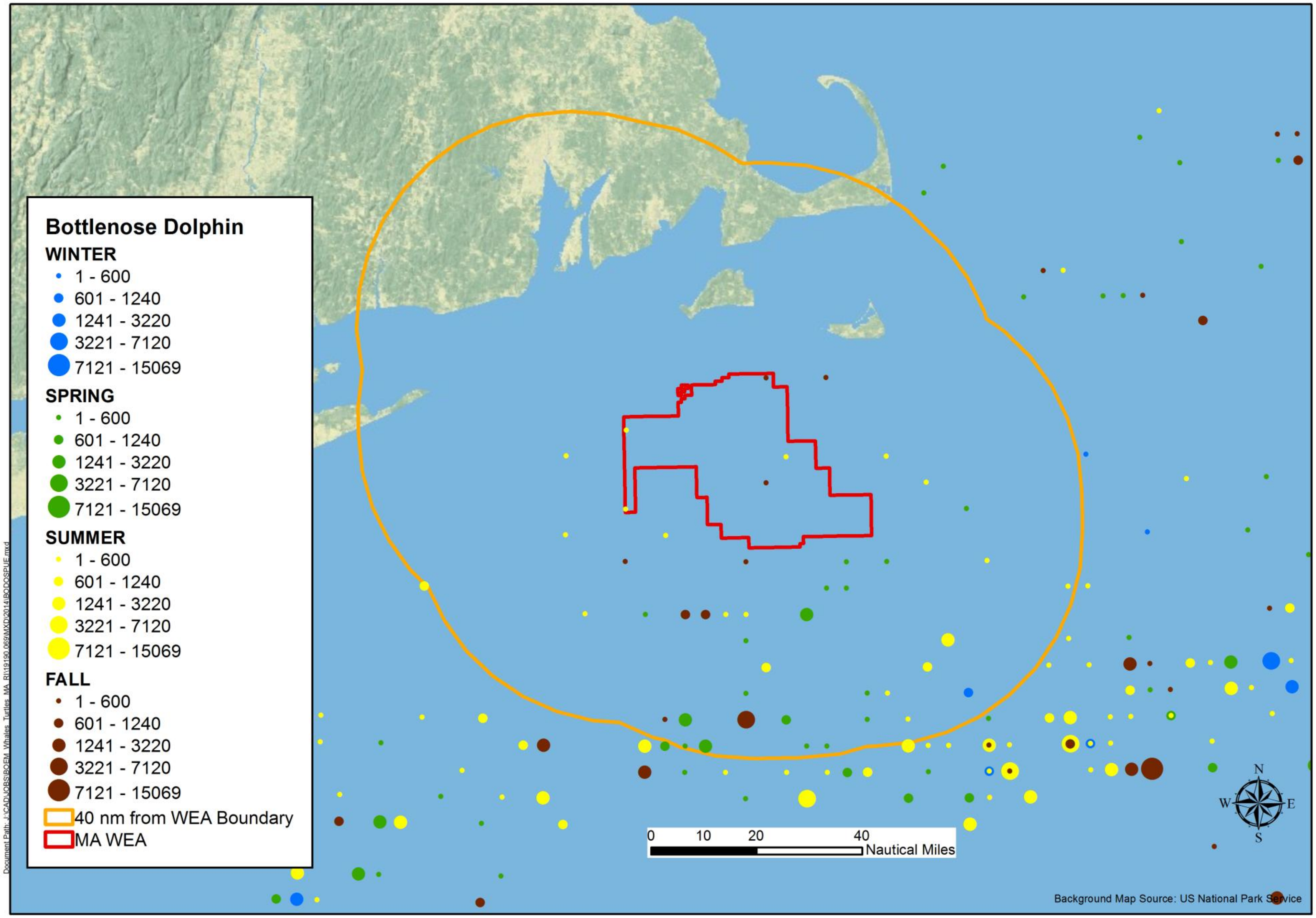

Figure 5. SPUE for Western North Atlantic offshore stock of bottlenose dolphins in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2014). Map prepared by Normandeau Associates, Inc.

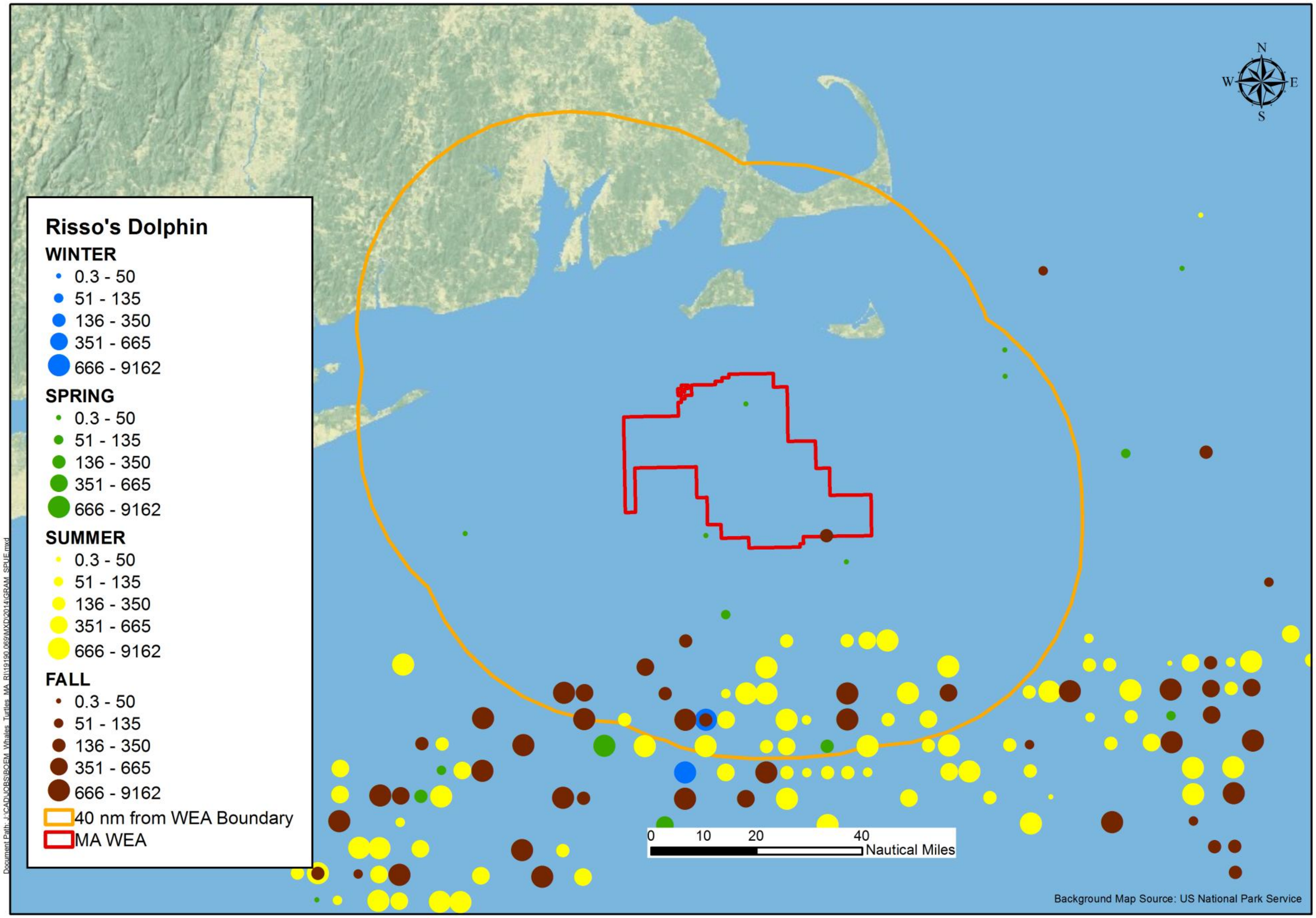

Figure 6. SPUE for Risso's dolphins in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2014). Map prepared by Normandeau Associates, Inc.

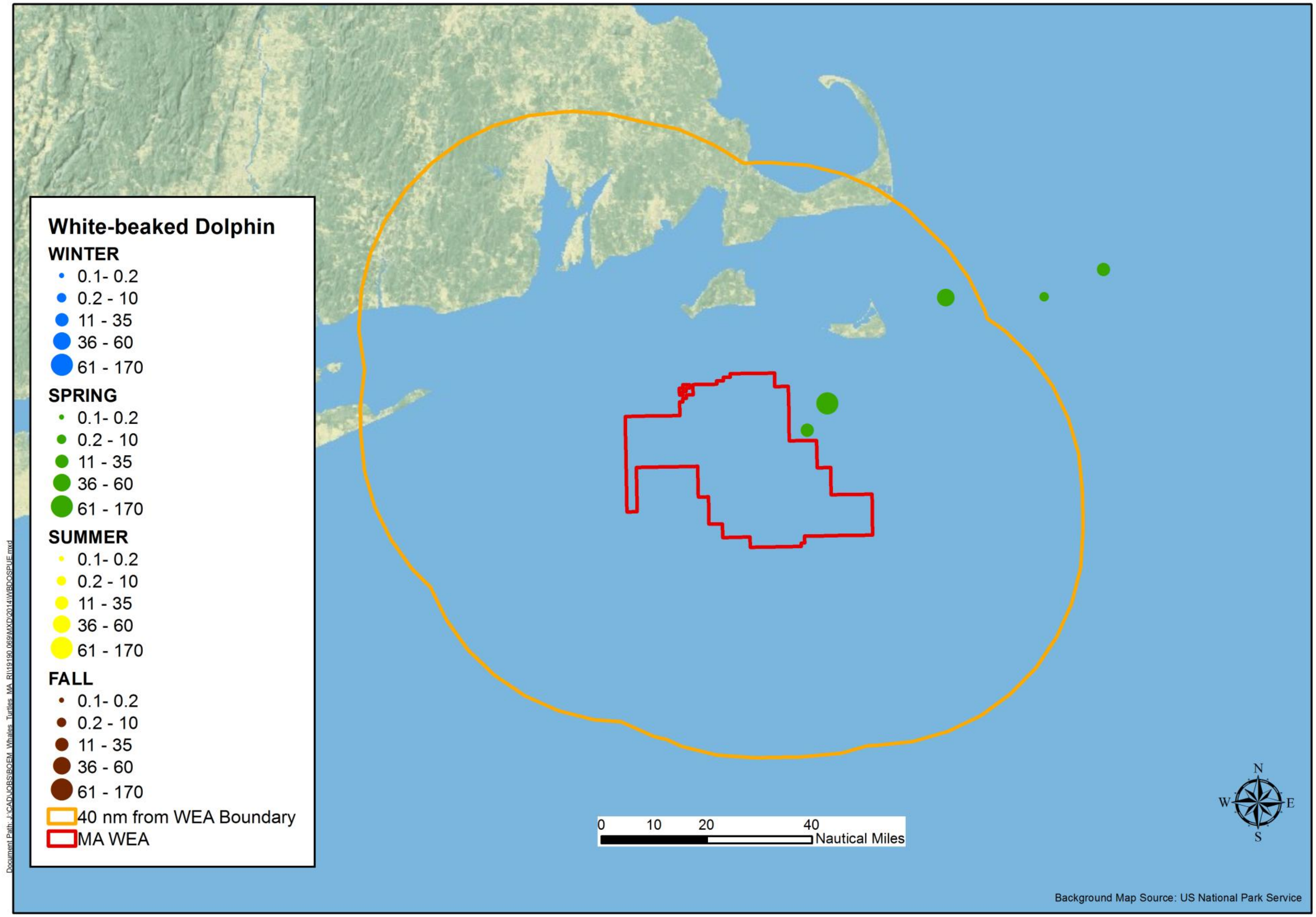

Figure 7. SPUE for white-beaked dolphins in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2014). Map prepared by Normandeau Associates, Inc.

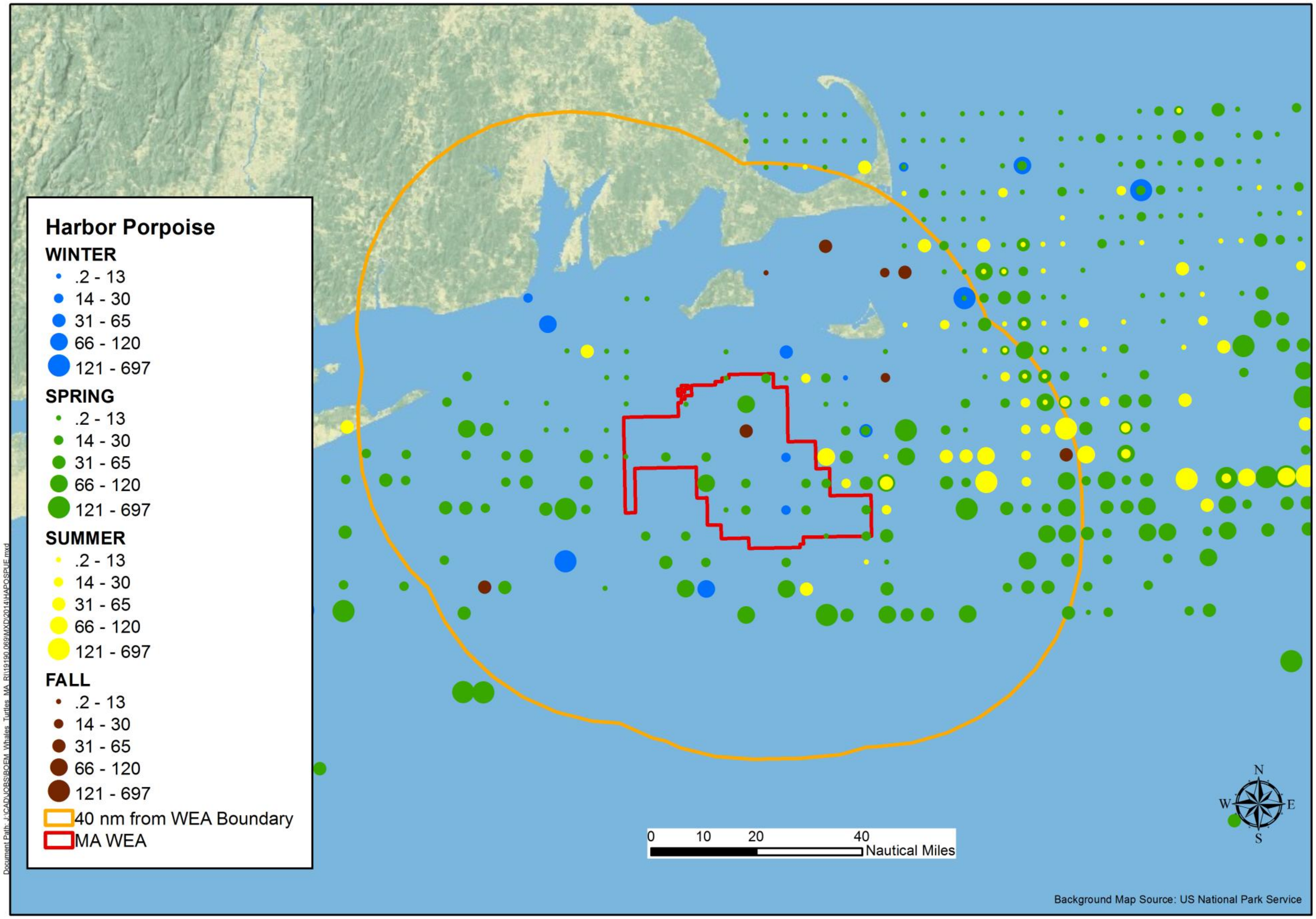

Figure 8. SPUE for harbor porpoise in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2014). Map prepared by Normandeau Associates, Inc.

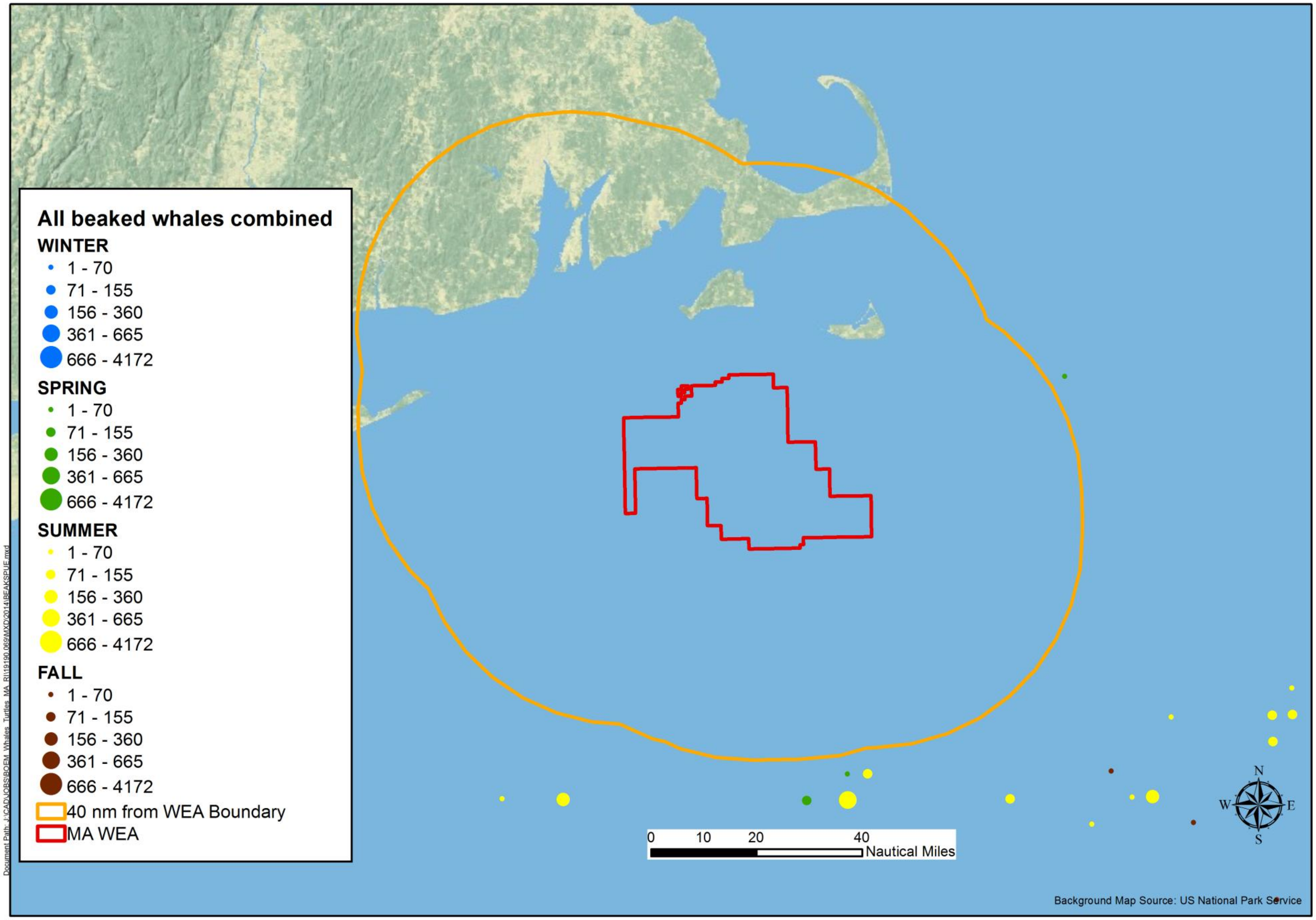

Figure 9. SPUE for beaked whales in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2014). Map prepared by Normandeau Associates, Inc.

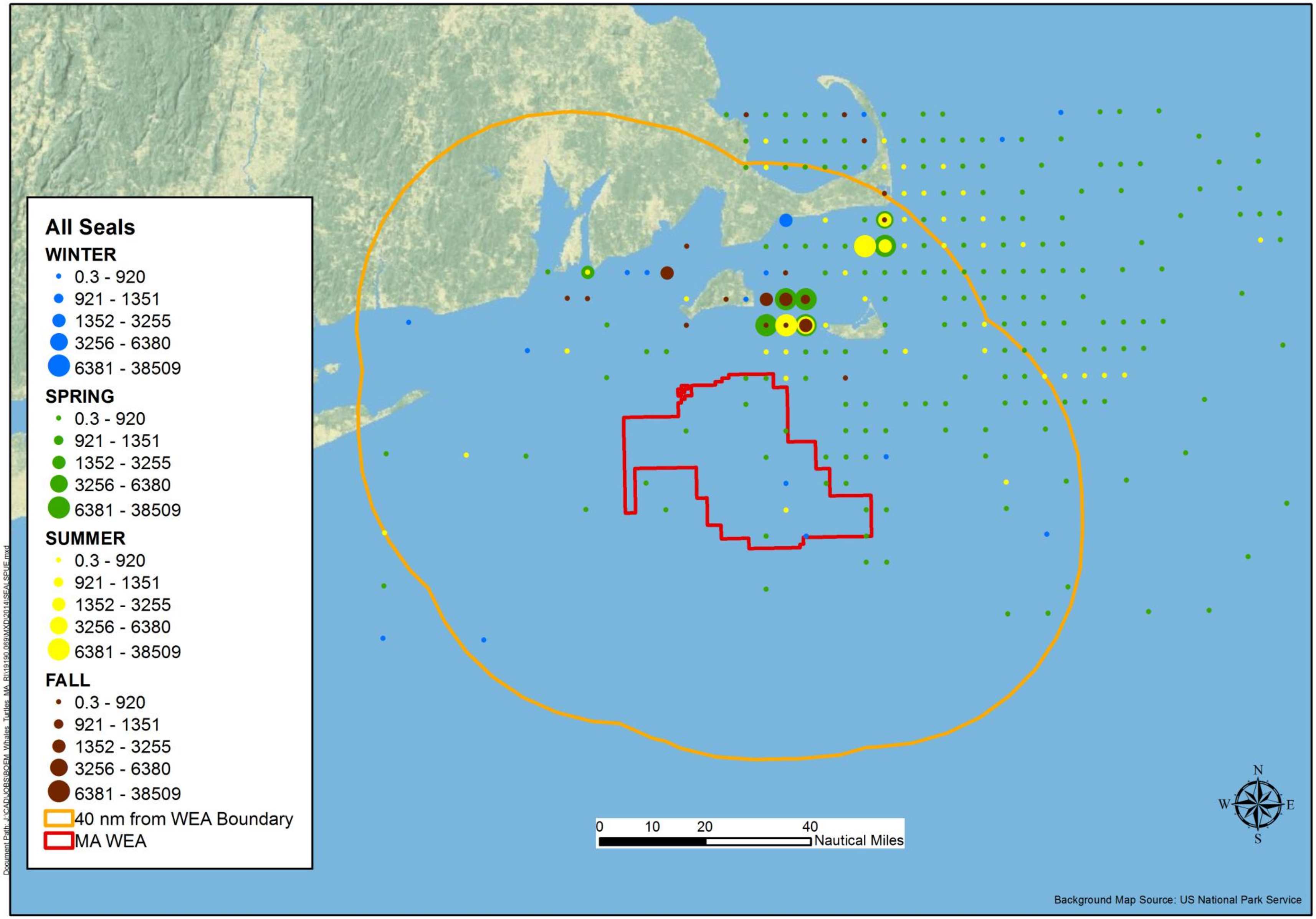

Figure 10. SPUE for seals (harbor, gray, hooded, and harp seals) in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2014). Map prepared by Normandeau Associates, Inc.

Appendix F
Sightings per Unit Effort Figures for Threatened and Endangered Whales and Sea Turtles

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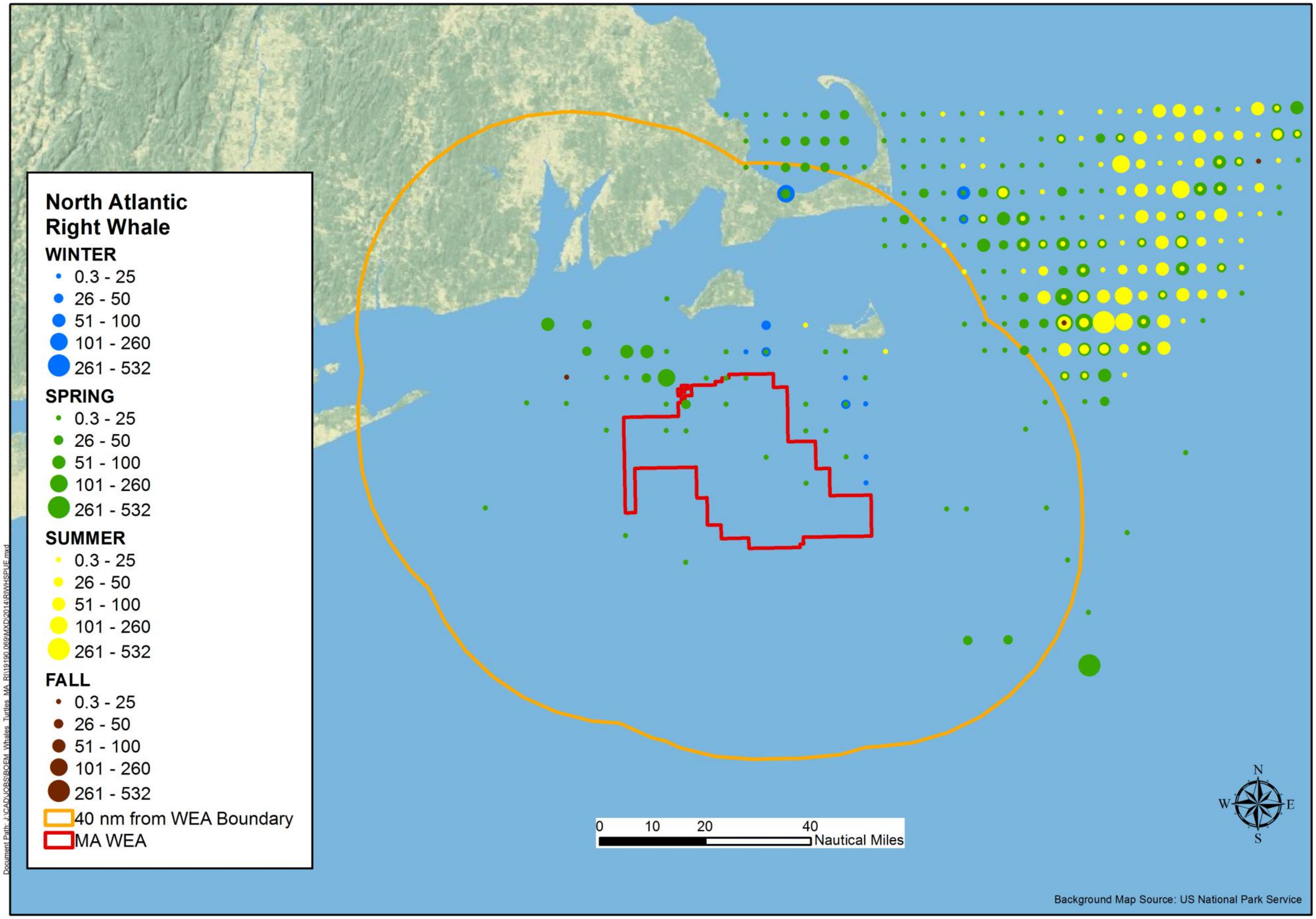

Figure 1. SPUE for North Atlantic right whales in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2014. Map prepared by Normandeau Associates, Inc.

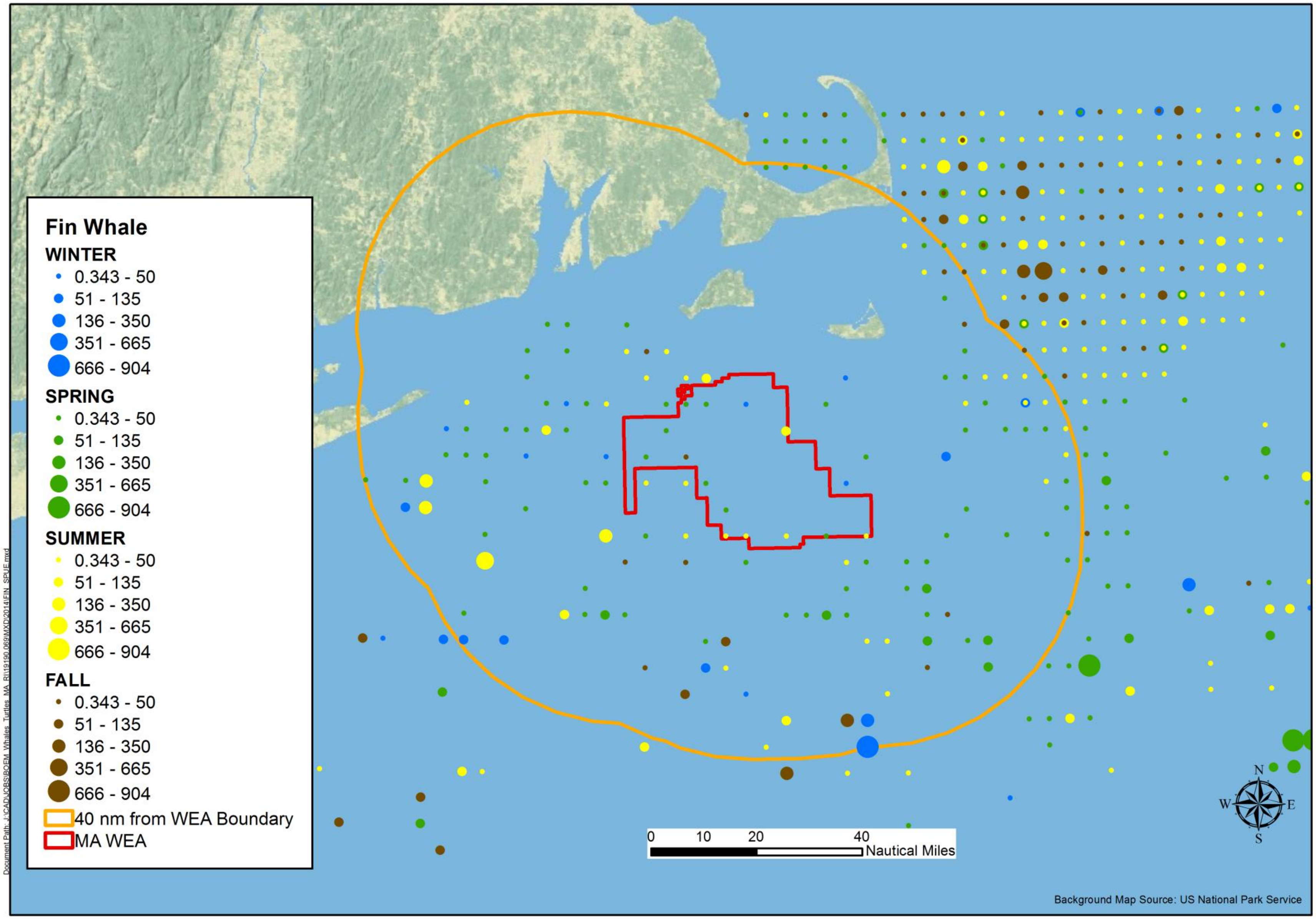

Figure 2. SPUE for fin whales in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2014. Map prepared by Normandeau Associates, Inc.

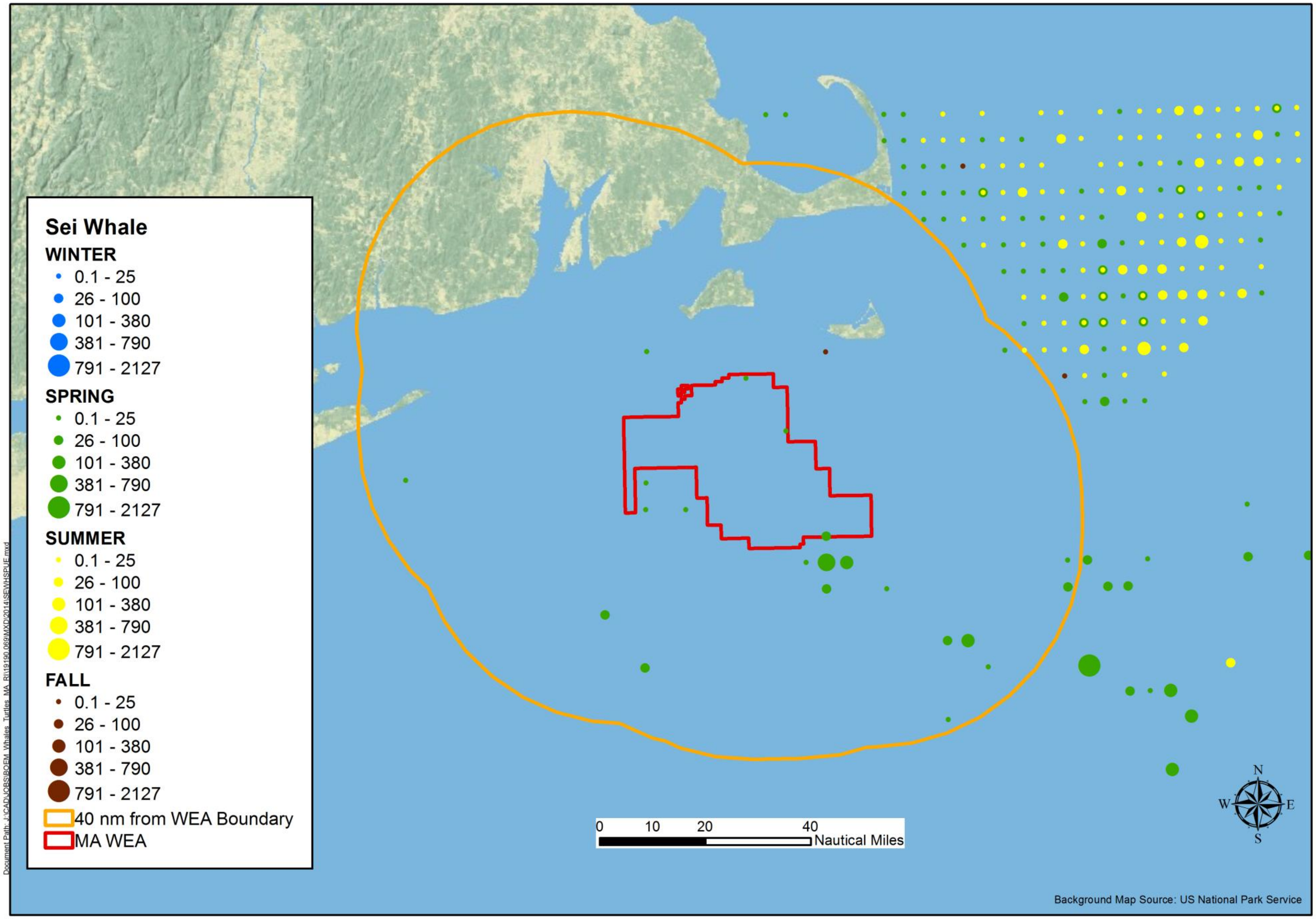

Figure 3. SPUE for sei whales in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2014. Map prepared by Normandeau Associates, Inc.

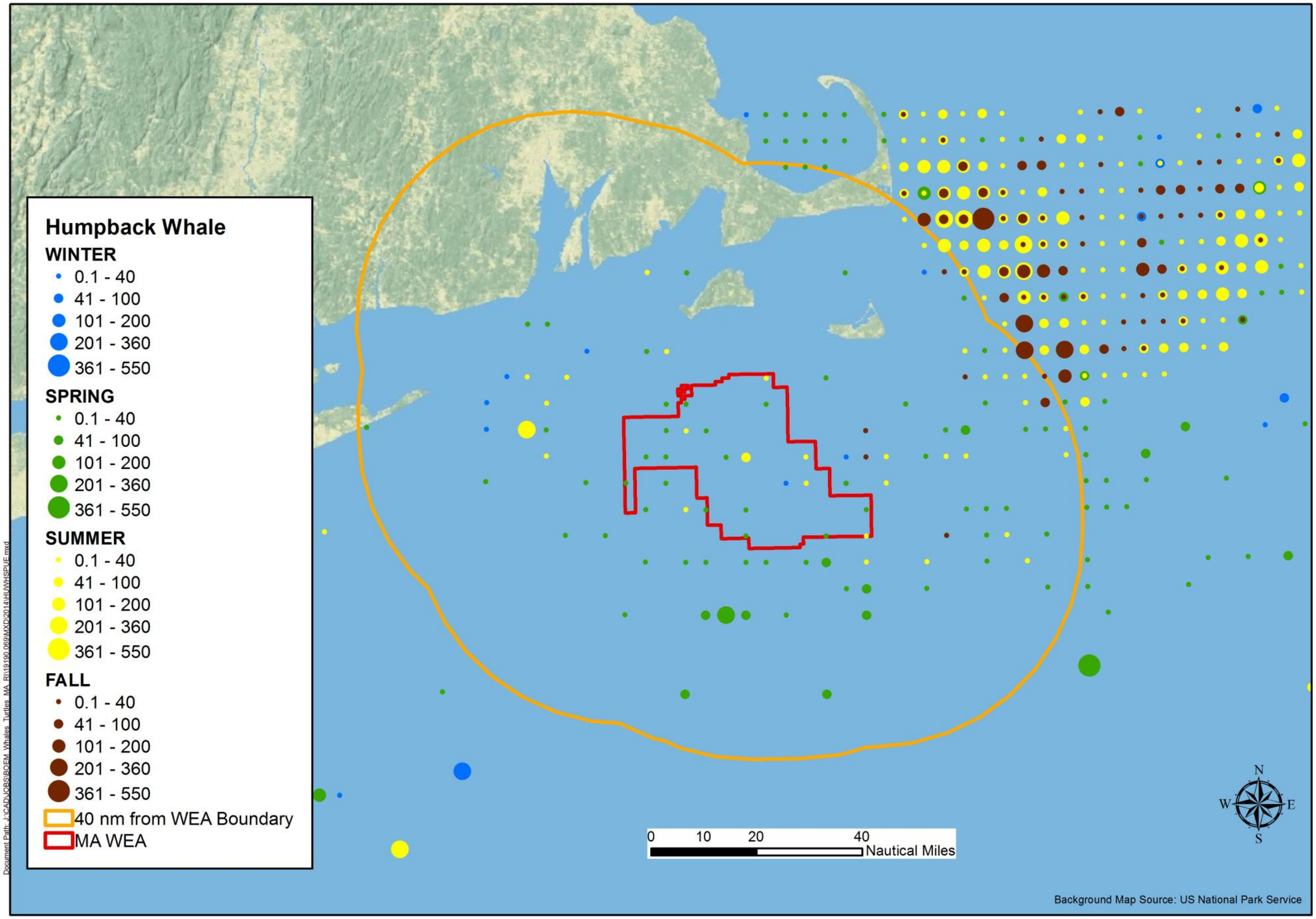

Figure 4. SPUE for humpback whales in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2014. Map prepared by Normandeau Associates, Inc.

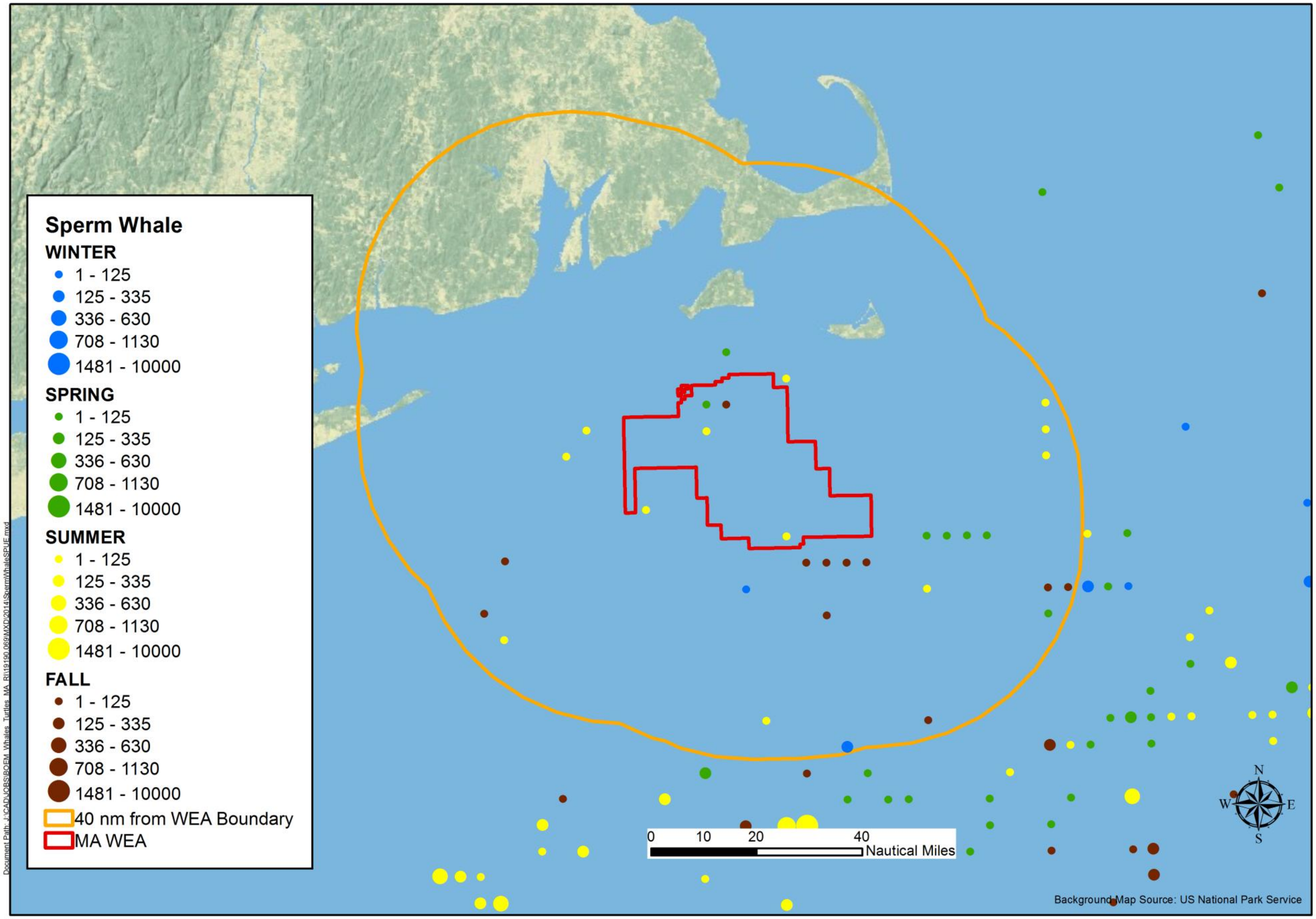

Figure 5. SPUE for sperm whales in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2014. Map prepared by Normandeau Associates, Inc.

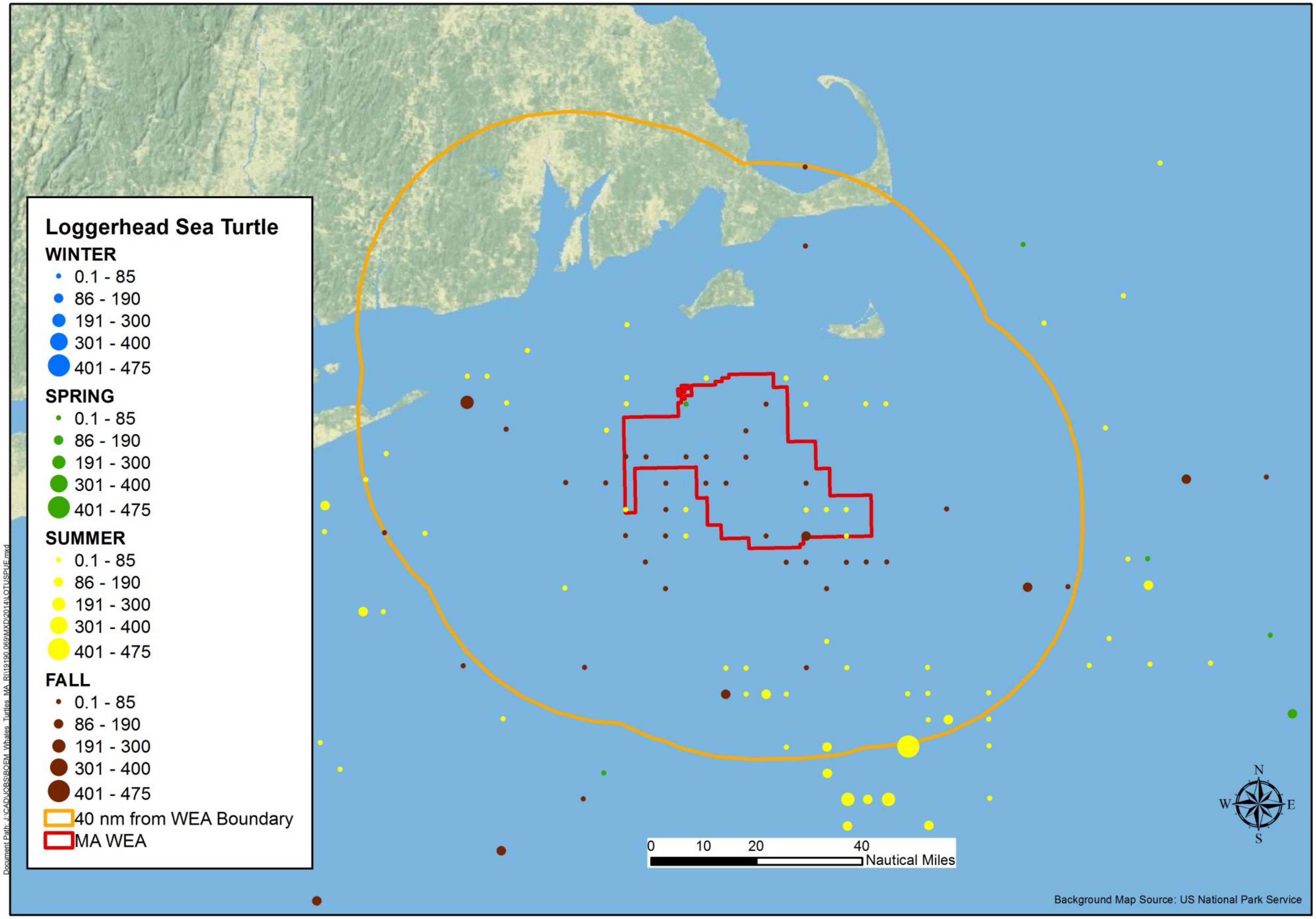

Figure 6. SPUE for loggerhead sea turtle in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2014. Map prepared by Normandeau Associates, Inc.

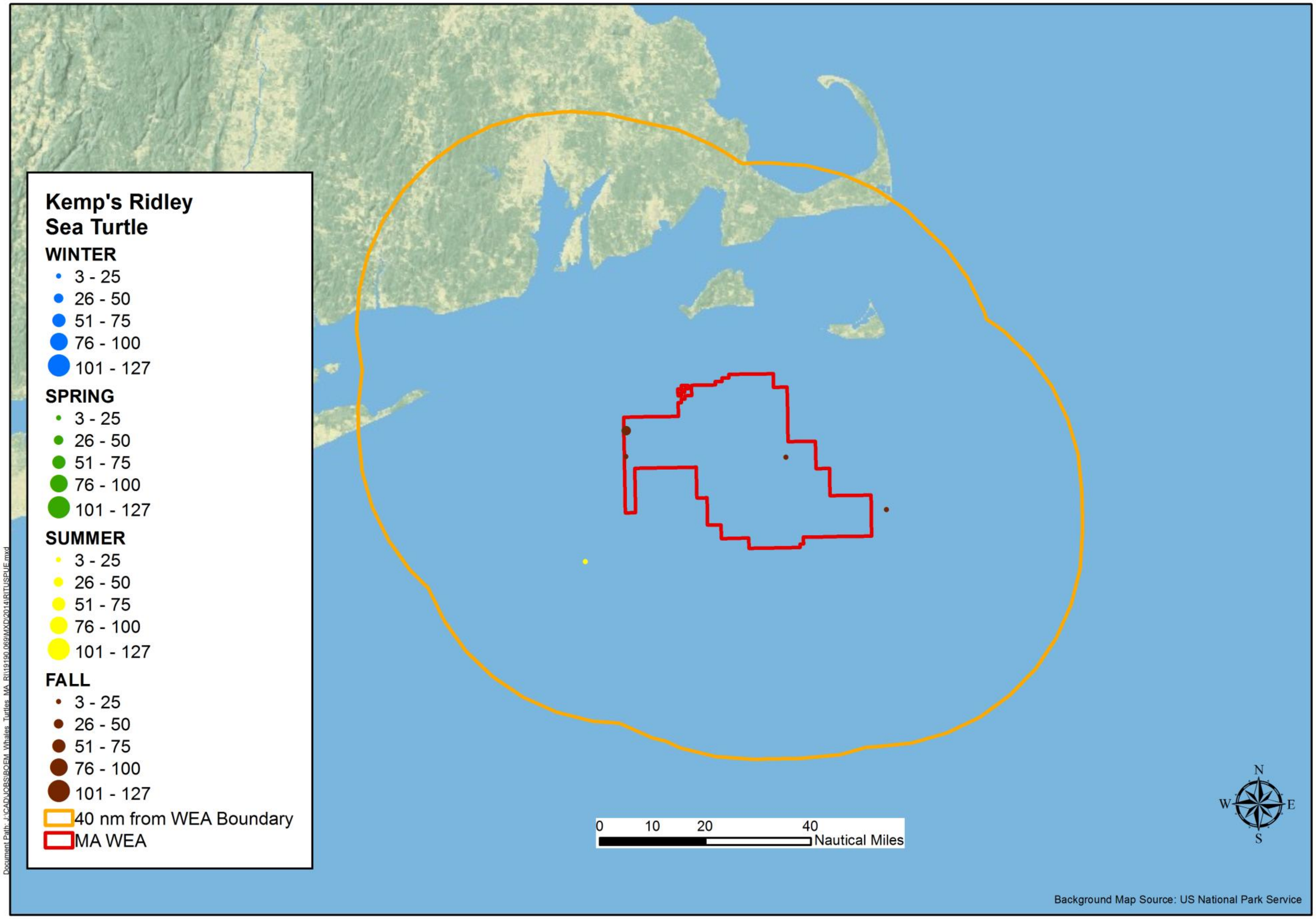

Figure 7. SPUE for Kemp's ridley sea turtles in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2014. Map prepared by Normandeau Associates, Inc.

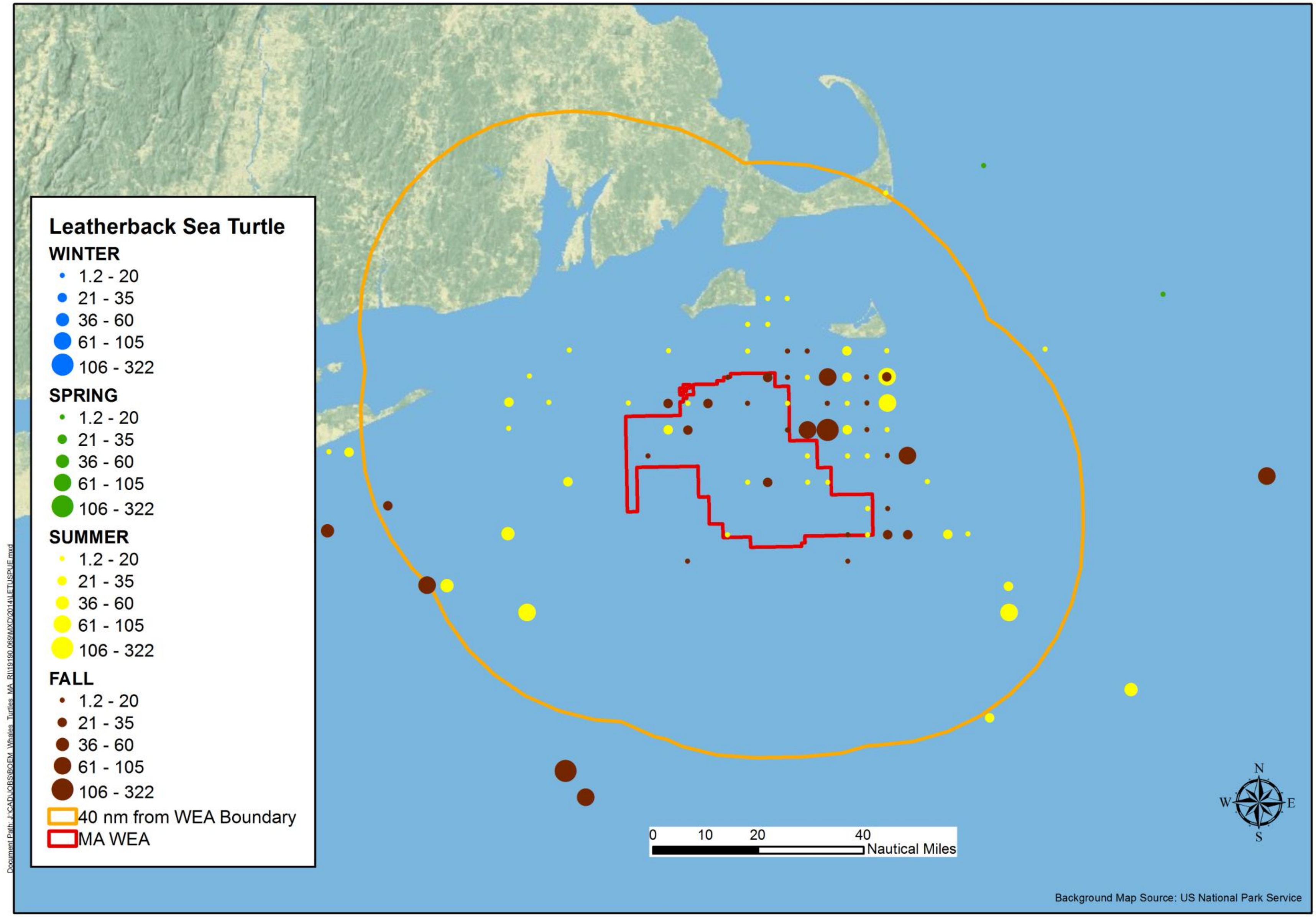

Figure 8. SPUE for leatherback sea turtles in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2014. Map prepared by Normandeau Associates, Inc.

Appendix G
Programmatic Agreement

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MAY 23 2012

PROGRAMMATIC AGREEMENT
Among
The U.S. Department of the Interior, Bureau of Ocean Energy Management;
the State Historic Preservation Officers of Massachusetts and Rhode Island;
The Mashpee Wampanoag Tribe;
The Narragansett Indian Tribe;
The Wampanoag Tribe of Gay Head (Aquinnah); and
The Advisory Council on Historic Preservation;
Regarding
the "Smart from the Start" Atlantic Wind Energy Initiative:
Leasing and Site Assessment Activities offshore Massachusetts and Rhode Islands

WHEREAS, the Energy Policy Act of 2005, Pub. L. No. 109-58, added Section 8(p)(1)(C) to the Outer Continental Shelf Lands Act (OCSLA), which grants the Secretary of the Interior the authority to issue leases, easements, or rights-of-way on the Outer Continental Shelf (OCS) for the purpose of renewable energy development, including wind energy development. *See* 43 U.S.C. § 1337(p)(1)(C); and

WHEREAS, the Secretary delegated this authority to the former Minerals Management Service (MMS), now the Bureau of Ocean Energy Management (BOEM), and promulgated final regulations implementing this authority at 30 CFR Part 585; and

WHEREAS, under the renewable energy regulations, the issuance of leases and subsequent approval of wind energy development on the OCS is a staged decision-making process that occurs in distinct phases: lease issuance; approval of a site assessment plan (SAP); and approval of a construction and operation plan (COP); and

WHEREAS, BOEM is currently identifying areas that may be suitable for wind energy leasing through collaborative, consultative, and analytical processes; and

WHEREAS, the issuance of a commercial wind energy lease gives the lessee the exclusive right to subsequently seek BOEM approval of plans (SAPs and COPs) for the development of the leasehold; and

WHEREAS, the lease does not grant the lessee the right to construct any facilities; rather, the lease grants the lessee the right to use the leased area to develop its plans, which must be approved by BOEM before the lessee implements them. *See* 30 CFR 585.600 and 585.601; and

WHEREAS, the SAP contains the lessee's detailed proposal for the construction of a meteorological tower and/or the installation of meteorological buoys ("site assessment activities") on the leasehold. *See* 30 CFR 585.605 - 585.618; and

WHEREAS, the lessee's SAP must be approved by BOEM before it conducts these "site assessment" activities on the leasehold; and

WHEREAS, BOEM may approve, approve with modification, or disapprove a lessee's SAP. *See* 30 CFR 585.613; and

WHEREAS, the COP is a detailed plan for the construction and operation of a wind energy project on the lease. *See* 30 CFR 585.620-585.638; and

WHEREAS, BOEM approval of a COP is a precondition to the construction of any wind energy facility on the OCS. *See* 30 CFR 585.600; and

WHEREAS, the regulations require that a lessee provide the results of surveys with its SAP and COP for the areas affected by the activities proposed in each plan, including an archaeological resource survey. *See* 30 CFR 585.610(b)(3) and 30 CFR 585.626(a)(5). BOEM refers to surveys undertaken to acquire this information as "site characterization" activities. *See Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information Pursuant to 30 CFR Part 585* at: http://www.boem.gov/Renewable-Energy-Program/Regulatory-Information/GGARCH4-11-2011-pdf.aspx; and

WHEREAS, BOEM has embarked upon the "Smart from the Start" Atlantic Wind Energy Initiative for the responsible development of wind energy resources on the Atlantic OCS; and

WHEREAS, under the "Smart from the Start" Initiative, BOEM has identified areas on the OCS that appear most suitable for future wind energy activities offshore the Commonwealth of Massachusetts (MA) and the State of Rhode Island (RI); and

WHEREAS these areas are located: (1) within the Rhode Island-Massachusetts Wind Energy Area (WEA); and (2) within the MA Call area east of the Rhode Island-Massachusetts WEA (hereafter known as "Areas"); and

WHEREAS BOEM may issue multiple renewable energy leases and approve multiple SAPs on leases issued within these Areas; and

WHEREAS, BOEM has determined that issuing leases and approving SAPs within these Areas constitute multiple undertakings subject to Section 106 of the National Historic Preservation Act (NHPA; 16 U.S.C. § 470f), and its implementing regulations (36 CFR 800); and

WHEREAS, BOEM has determined that the implementation of the program is complex as the decisions on these multiple undertakings are staged, pursuant to 36 CFR § 800.14(b); and

WHEREAS, the implementing regulations for Section 106 (36 CFR § 800) prescribe a process that seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among parties with an interest in the effects of the undertakings, commencing at the early stages of the process; and

WHEREAS, the Section 106 consultations have been initiated and coordinated with other reviews, including the National Environmental Policy Act (NEPA), in accordance with 36 CFR § 800.3(b); and

WHEREAS, 36 CFR § 800.14(b)(3) provides for developing programmatic agreements (Agreements) for complex or multiple undertakings and § 800.14(b)(1)(ii) and (v) provide for developing Agreements when effects on historic properties cannot be fully determined prior to approval of an undertaking and for other circumstances warranting a departure from the normal section 106 process; and

WHEREAS, 36 CFR § 800.4(b)(2) provides for phased identification and evaluation of historic properties where alternatives consist of large land areas, and for the deferral of final identification and evaluation of historic properties when provided for in a Agreement executed pursuant to 36 CFR §800.14(b); and

WHEREAS, BOEM has determined that the identification and evaluation of historic properties shall be conducted through a phased approach, pursuant to 36 CFR § 800.4(b)(2), where the final identification of historic properties will occur after the issuance of a lease or leases and before the approval of a SAP; and

WHEREAS, the Section 106 consultations described in this Agreement will be used to establish a process for identifying historic properties located within the undertakings' Areas of Potential Effects (APE) that are listed in or eligible for listing in the National Register of Historic Places (National Register), and assess the potential adverse effects and avoid, reduce, or resolve any such effects through the process set forth in this Agreement; and

WHEREAS, according to 36 CFR § 800.16(l)(1) "historic property" means

> *any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria*; and

WHEREAS, the APEs, as defined in 36 CFR § 800.16(d) of the Advisory Council on Historic Preservation's (ACHP's) regulations implementing Section 106 of the NHPA, for the undertakings that are the subject of this Agreement, are: (1) the depth and breadth of the seabed that could potentially be impacted by seafloor/bottom-disturbing activities associated with the undertakings (e.g., core samples, anchorages and installation of meteorological towers and buoys); and (2) the viewshed from which lighted meteorological structures would be visible; and

WHEREAS, BOEM has identified and consulted with the State Historic Preservation Offices (SHPOs) for MA and RI, (collectively, "the SHPOs"); and

WHEREAS, BOEM initiated consultation in 2011 and 2012 through letters of invitation, telephone calls, emails, meetings, webinars, and the circulation and discussion of this Agreement in draft; and this outreach and notification included contacting over 66 individuals and entities, including federally-recognized Indian Tribes (Tribes), local governments, SHPOs, and the public; and

WHEREAS, BOEM has initiated formal government-to-government consultation with the following Tribes: the Mashpee Wampanoag Tribe, the Narragansett Indian Tribe, the Shinnecock Indian Nation, and the Wampanoag Tribe of Gay Head (Aquinnah); and

WHEREAS, these Tribes have chosen to consult with BOEM and participate in development of this Agreement, in which the term Tribe refers to them, within the meaning of 36 CFR § 800.16(m); and

WHEREAS, BOEM shall continue to consult with these Tribes to identify properties of religious and cultural significance that may be eligible for listing in the National Register of Historic Places (Traditional Cultural Properties or TCPs) and that may be affected by these undertakings; and

WHEREAS, BOEM involves the public and identifies other consulting parties through notifications, requests for comments, existing renewable energy task forces, contact with SHPOs, NEPA scoping meetings and communications for these proposed actions; and

WHEREAS, BOEM, the SHPOs, the Mashpee Wampanoag Tribe, the Narragansett Indian Tribe, and the Wampanoag Tribe of Gay Head (Aquinnah) and the ACHP are Signatories to this Agreement, and

WHEREAS, future submission of a COP and commercial-scale development that may or may not occur within the Areas would be separate undertakings and considered under future, separate Section 106 consultation(s) not under this Agreement; and

WHEREAS, BOEM requires a SAP to include the results of site characterization surveys that will identify potential archaeological resources that could be affected by the installation and operation of meteorological facilities. *See* (30 CFR § 585.611 (b)(6); and

WHEREAS, consultations conducted prior to the execution of this Agreement included all steps in the Section 106 process up to and including consulting on the scope of identification efforts that would be used to conduct site characterization surveys that would identify historic properties that may be impacted by activities described in the SAP pursuant to 36 CFR § 800.4(a); and

WHEREAS, these consultations resulted in recommendations to BOEM that the following items should be added to leases issued within the Areas, both to ensure that historic properties that may be impacted by activities described in the SAP are identified through a reasonable and good faith effort (§ 800.4(b)(1)), and also to ensure that properties identified through the geophysical surveys are not impacted by geotechnical sampling:

> *The lessee may only conduct geotechnical (sub-bottom) sampling activities in areas of the leasehold in which an analysis of the results of geophysical surveys has been completed for that area. The geophysical surveys must meet BOEM's minimum standards (see Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information Pursuant to 30 CFR Part 285 at* http://www.boem.gov/Renewable-Energy-Program/Regulatory-Information/GGARCH4-11-2011-pdf.aspx*), and the analysis must be completed by a qualified marine archaeologist who both meets the Secretary of the Interior's Professional Qualifications Standards (48 FR 44738- 44739) and has experience analyzing marine geophysical data. This analysis must include a determination whether any potential archaeological resources are present in the area and the geotechnical (sub-bottom) sampling activities must avoid potential archaeological resources by a minimum of 50.0 meters (m; 164.0 feet). The avoidance distance must be calculated from the maximum discernible extent of the archaeological resource. In no case may the lessee's actions impact a potential archaeological resource without BOEM's prior approval*;

NOW, THEREFORE, BOEM, the ACHP, the SHPOs, Tribes, and the other concurring parties (the Parties), agree that Section 106 consultation shall be conducted in accordance with the following stipulations in order to defer final identification and evaluation of historic properties.

STIPULATIONS

I. SAP Decisions. Before making a decision on a SAP from a lessee, BOEM will treat all potential historic properties identified as a result of site characterization studies and consultations as historic properties potentially eligible for inclusion on the National Register and avoid them by requiring the lessee to relocate the proposed project, resulting in a finding of *No historic properties affected* (36 CFR § 800.4(d)(1)). If a potential historic property is identified, and the lessee chooses to conduct additional investigations, and:

   A. If additional investigations demonstrate that a historic property does not exist, then BOEM will make a determination of *No historic properties affected* and follow 36 CFR § 800.4(d)(1).

B. If additional investigations demonstrate that a historic property does exist and may be affected, BOEM will evaluate the historic significance of the property, in accordance with 800.4(c); make a determination of *Historic properties affected* and follow 36 CFR § 800.4(d)(2); and resolve any adverse effects by following 800.5.

II. Tribal Consultation. BOEM shall continue to consult with the Tribes throughout the implementation of this Agreement in a government-to-government manner consistent with Executive Order 13175, Presidential memoranda, and any Department of the Interior policies, on subjects related to the undertakings.

III. Public Participation

A. Because BOEM and the Parties recognize the importance of public participation in the Section 106 process, BOEM shall continue to provide opportunities for public participation in Section 106-related activities, and shall consult with the Parties on possible approaches for keeping the public involved and informed throughout the term of the Agreement.

B. BOEM shall keep the public informed and may produce reports on historic properties and on the Section 106 process that may be made available to the public at BOEM's headquarters, on the BOEM website, and through other reasonable means insofar as the information shared conforms to the confidentiality clause of this Agreement (Stipulation IV).

IV. Confidentiality. Because BOEM and the Parties agree that it is important to withhold from disclosure sensitive information such as that which is protected by NHPA Section 304 (16 U.S.C. § 470w-3) (*e.g.*, the location, character and ownership of an historic resource, if disclosure would cause a significant invasion of privacy, risk harm to the historic resources, or impede the use of a traditional religious site by practitioners), BOEM shall:

A. Request that each Party inform the other Parties if, by law or policy, it is unable to withhold sensitive data from public release.

B. Arrange for the Parties to consult as needed on how to protect such information collected or generated under this Agreement.

C. Follow, as appropriate, 36 CFR 800.11(c) for authorization to withhold information pursuant to NHPA Section 304, and otherwise withhold sensitive information to the extent allowable by laws including the Freedom of Information Act, 5 U.S.C. § 552, through the Department of the Interior regulations at 43 CFR Part 2.

D. Request that the Parties agree that materials generated during consultation be treated by the Parties as internal and pre-decisional until they are formally released, although the Parties understand that they may need to be released by one of the Parties if required by law.

V. Administrative Stipulations

A. In coordinating reviews, BOEM shall follow this process:

1. Standard Review: The Parties shall have a standard review period of thirty (30) calendar days for commenting on all documents which are developed under the terms of this Agreement, from the date they are sent by BOEM.

2. Expedited Request for Review: The Parties recognize the time-sensitive nature of this work and shall attempt to expedite comments or concurrence when BOEM so requests. The expedited comment period shall not be less than fifteen (15) calendar days from the date BOEM sends such a request.

3. If a Party cannot meet BOEM's expedited review period request, it shall notify BOEM in writing within the fifteen (15) calendar day period. If a Party fails to provide comments or respond within the time frame requested by BOEM (either standard or expedited), then BOEM may proceed as though it has received concurrence from that Party. BOEM shall consider all comments received within the review period.

4. All Parties will send correspondence and materials for review via electronic media unless a Party requests, in writing, that BOEM transmit the materials by an alternate method specified by that Party. Should BOEM transmit the review materials by the alternate method, the review period will begin on the date the materials were received by the Party, as confirmed by delivery receipt.

5. MA and RI SHPO Review Specifications: All submittals to the MA and RI SHPOs shall be in paper format and shall be delivered to the MA and RI SHPOs' offices by US Mail, by a delivery service, or by hand. Plans and specifications submitted to the MA and RI SHPOs shall measure no larger than 11" x 17" paper format (unless another format is specified in consultation). The MA and RI SHPOs shall review and comment on all adequately documented project submittals within 30 calendar days of receipt unless a response has been requested within the expedited review period specified in Stipulation V.A.2.

6. Each Signatory shall designate a point of contact for carrying out this Agreement and provide this contact's information to the other Parties, updating it as necessary while this Agreement is in force. Updating a point of contact alone shall not necessitate an amendment to this Agreement.

B. Dispute Resolution. Should any Signatory object in writing to BOEM regarding an action carried out in accordance with this Agreement, or lack of compliance with the terms of this Agreement, the Signatories shall consult to resolve the objection. Should the Signatories be unable to resolve the disagreement, BOEM shall forward its background information on the dispute as well as its proposed resolution of the dispute to the ACHP. Within 45 calendar days after receipt of all pertinent documentation, the ACHP shall either: (1) provide BOEM with written recommendations, which BOEM shall take into account in reaching a final decision regarding the dispute; or (2) notify BOEM that it shall comment pursuant to 36 CFR 800.7(c), and proceed to comment. BOEM shall take this ACHP comment into account, in accordance with 36 CFR 800.7(c)(4). Any ACHP recommendation or comment shall be understood to pertain only to the subject matter of the dispute; BOEM's responsibility to carry out all actions under this Agreement that are not subjects of dispute shall remain unchanged.

C. Amendments. Any Signatory may propose to BOEM in writing that the Agreement be amended, whereupon BOEM shall consult with the Parties to consider such amendment. This Agreement may then be amended when agreed to in writing by all Signatories, becoming effective on the date that the amendment is executed by the ACHP as the last Signatory.

D. Adding Federal Agencies. In the event that another Federal agency believes it has Section 106 responsibilities related to the undertakings which are the subject of this Agreement, that agency may attempt to satisfy its Section 106 responsibilities by agreeing in writing to the terms of this Agreement and notifying and consulting with the SHPOs and the ACHP. Any modifications to this agreement that may be necessary for meeting that agency's Section 106 obligations shall be considered in accordance with this Agreement.

E. Adding Concurring Parties. In the event that another party wishes to assert its support of this Agreement, that party may prepare a letter indicating its concurrence, which BOEM will attach to the Agreement and circulate among the Signatories.

F. Term of Agreement. The Agreement shall remain in full force until BOEM makes a final decision on the last SAP submitted under a lease issued under this portion of the "Smart from the Start" initiative, or for ten (10) years from the date the Agreement is executed, defined as the date the last signatory signs, whichever is earlier, unless otherwise extended by amendment in accordance with this Agreement.

G. Termination.

1. If any Signatory determines that the terms of the Agreement cannot or are not being carried out, that Party shall notify the other Signatories in writing and consult with them to seek amendment of the Agreement. If within sixty (60) calendar days, an amendment cannot be made, any Signatory may terminate the Agreement upon written notice to the other Signatories.

2. If termination is occasioned by BOEM's final decision on the last SAP contemplated under this portion of the "Smart from the Start" Initiative, BOEM shall notify the Parties and the public, in writing.

H. Anti-Deficiency Act. Pursuant to 31 U.S.C. § 1341(a)(1), nothing in this Agreement shall be construed as binding the United States to expend in any one fiscal year any sum in excess of appropriations made by Congress for this purpose, or to involve the United States in any contract or obligation for the further expenditure of money in excess of such appropriations.

I. Existing Law and Rights. Nothing in this Agreement shall abrogate existing laws or the rights of any consulting party or agency party to this Agreement.

J. Compliance with Section 106. Execution and implementation of this Agreement evidences that BOEM has satisfied its Section 106 responsibilities for all aspects of these proposed undertakings by taking into account the effects of these undertakings on historic properties and affording the ACHP a reasonable opportunity to comment with regard to the undertakings.

Programmatic Agreement concerning the "Smart from the Start" Atlantic Wind Energy Initiative: Leasing and Site Assessment Activities offshore Massachusetts and Rhode Island

By:

[signature] Date: 5-23-12

Maureen A. Bornholdt
Program Manager, Office of Renewable Energy Programs
Bureau of Ocean Energy Management

Programmatic Agreement concerning the "Smart from the Start" Atlantic Wind Energy Initiative: Leasing and Site Assessment Activities offshore Massachusetts and Rhode Island

Brona Simon _______________ Date: 5/31/12

Brona Simon
Massachusetts Historical Commission
Massachusetts State Historic Preservation Officer

Programmatic Agreement concerning the "Smart from the Start" Atlantic Wind Energy Initiative: Leasing and Site Assessment Activities offshore Massachusetts and Rhode Island

Edward F. Sanderson ______________________ Date: 6/4/2012 ______________________

[NAME] Edward F. Sanderson
[TITLE] Executive Director, Rhode Island Historical Preservation & Heritage Commission
Rhode Island State Historic Preservation Officer

Programmatic Agreement concerning the "Smart from the Start" Atlantic Wind Energy Initiative: Leasing and Site Assessment Activities offshore Massachusetts and Rhode Island

______________________________ Date: 05 June 2012

John Brown
Tribal Historic Preservation Officer
Narragansett Indian Tribe

Programmatic Agreement concerning the "Smart from the Start" Atlantic Wind Energy Initiative: Leasing and Site Assessment Activities offshore Massachusetts and Rhode Island

[signature] Date: 5/29/12

Cedric Cromwell
Tribal Chairman
Mashpee Wampanoag Tribe

Programmatic Agreement concerning the "Smart from the Start" Atlantic Wind Energy Initiative: Leasing and Site Assessment Activities offshore Massachusetts and Rhode Island

John M. Fowler ____________________ Date: 6/8/12

John M. Fowler
Executive Director
Advisory Council on Historic Preservation

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Appendix H
Visual Simulations for Meteorological Tower

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Static Simulation Viewing Instructions

The static simulations are developed to be viewed 33.6” from the display when printed full size. The panorama is intended to be printed so that the height of the panorama is 18”. The panorama displays approximately a 30° vertical field of view and a 117° horizontal field of view. Using the formula tan(30°/2)=(18”/2)/(viewing distance), the approximate calculated true scale viewing distance is 33.6”.

Video Simulations Viewing Instructions

The video simulations were developed with a still photography base of existing conditions at the two requested locations. They were developed to display the same approximate 30° vertical field of view (FOV) as the print simulations with the horizontal viewing angle cropped to the limits of the video. Video simulations should be viewed approximately 38.1” from a 42” diagonal sized monitor screen when viewed full screen.

Because of the numerous sizes and aspect ratios of monitors, no single viewing distance recommendation can be given. The video simulations were prepared and checked on a Panasonic TH-42PH9 42” HD wide screen video monitor. This monitor has a vertical screen size of 20.4” and a horizontal screen size of 36.2”. The recommended viewing distance given above used this screen size as a reference. To calculate the viewing distance from different monitor sizes, the following equation can be used: tan(30/2°)=(video height/2)/(viewing distance) where the video height is the vertical size of the image as displayed on the screen. If a monitor adds areas of black on the top or bottom or the viewer has a banner on the application window this must be accounted for in the calculations.

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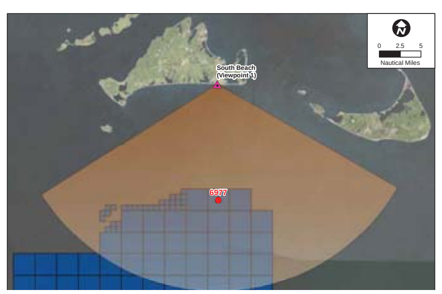
South Beach – 8:17 AM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

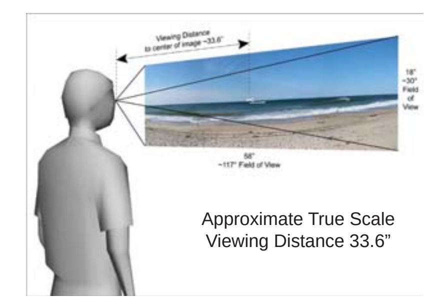


Legend

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

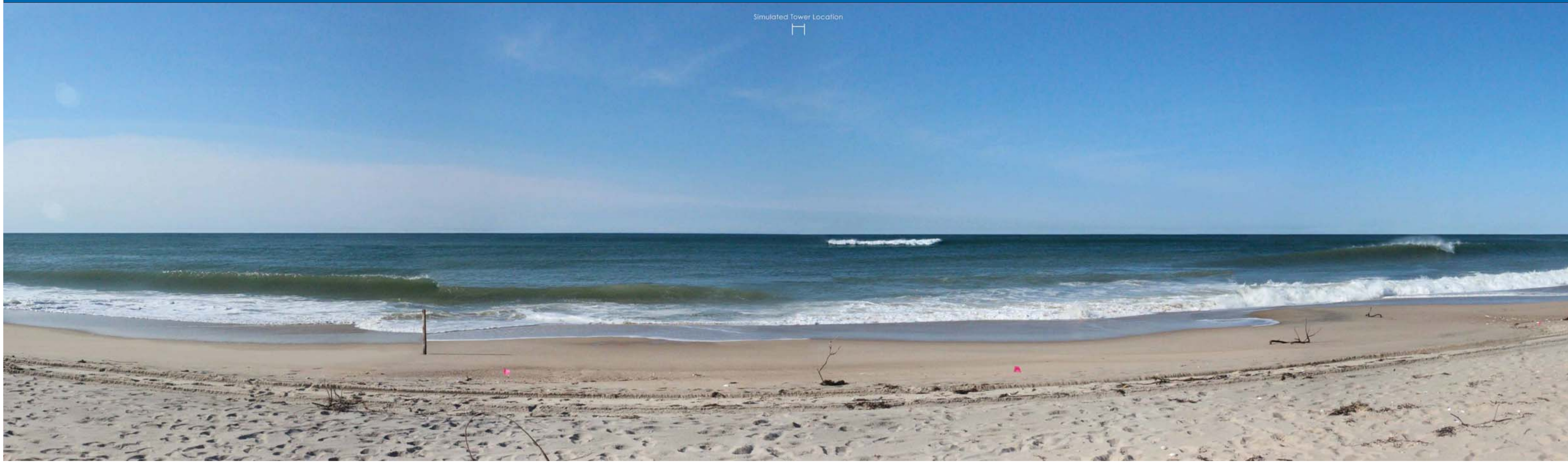
Photographic Information

Time of photograph:	8:17 AM
Date of photograph:	5-19-12
Weather condition:	Partly Cloudy
Viewing direction:	South
Latitude:	41°19'19.431"N
Longitude:	70°28'39.259"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Sidelight
Distance to tower:	NA
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	183°

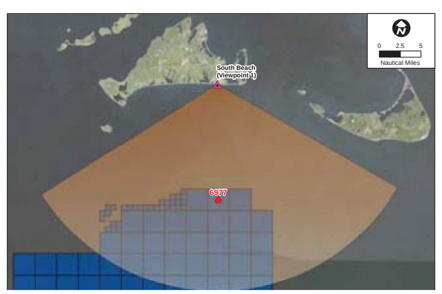


South Beach – 8:17 AM

Simulation of Meteorological Tower Placed in OCS Block 6977



Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

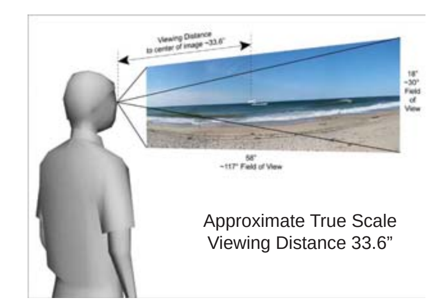


Legend

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

Photographic Information

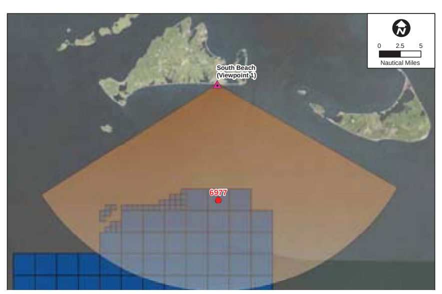
Time of photograph:	8:17 AM
Date of photograph:	5-19-12
Weather condition:	Partly Cloudy
Viewing direction:	South
Latitude:	41°19'19.431"N
Longitude:	70°28'39.259"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Sidelight
Distance to tower:	14 nautical miles
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	183°



South Beach – 12:29 PM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

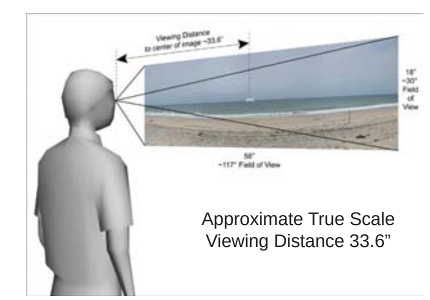


Legend

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

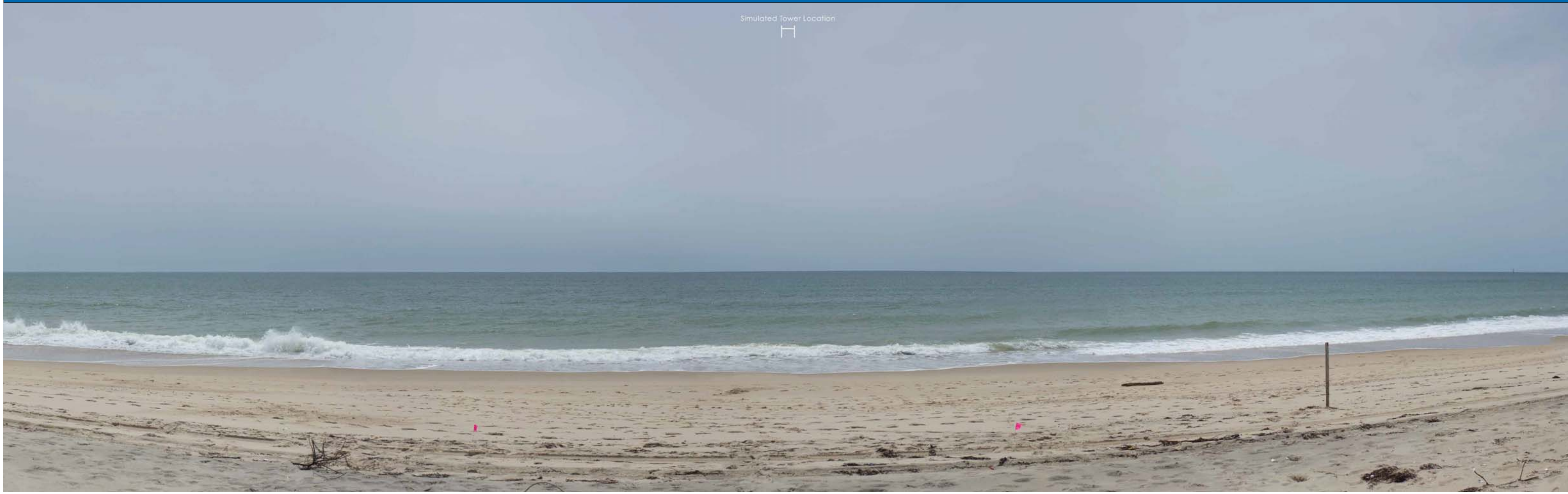
Photographic Information

Time of photograph:	12:29 PM
Date of photograph:	5-18-12
Weather condition:	Cloudy
Viewing direction:	South
Latitude:	41°19'19.431"N
Longitude:	70°28'39.259"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Backlight
Distance to tower:	NA
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	183°

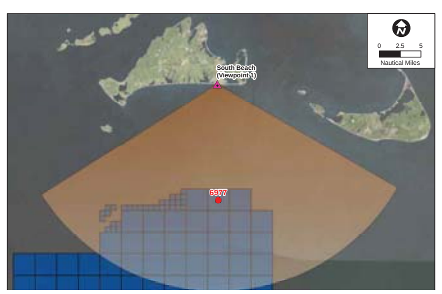


South Beach – 12:29 PM

Simulation of Meteorological Tower Placed in OCS Block 6977



Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

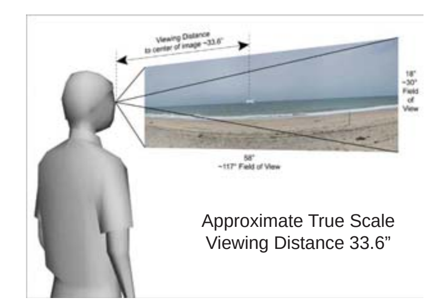


Legend

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

Photographic Information

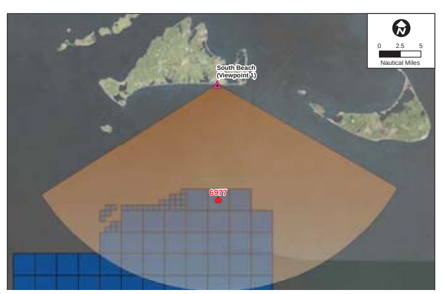
Time of photograph:	12:29 PM
Date of photograph:	5-18-12
Weather condition:	Cloudy
Viewing direction:	South
Latitude:	41°19'19.431"N
Longitude:	70°28'39.259"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Backlight
Distance to tower:	14 nautical miles
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	183°



South Beach – 1:03 PM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

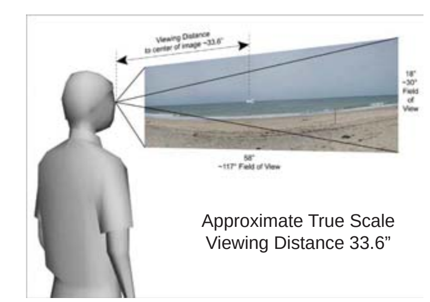


Legend

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

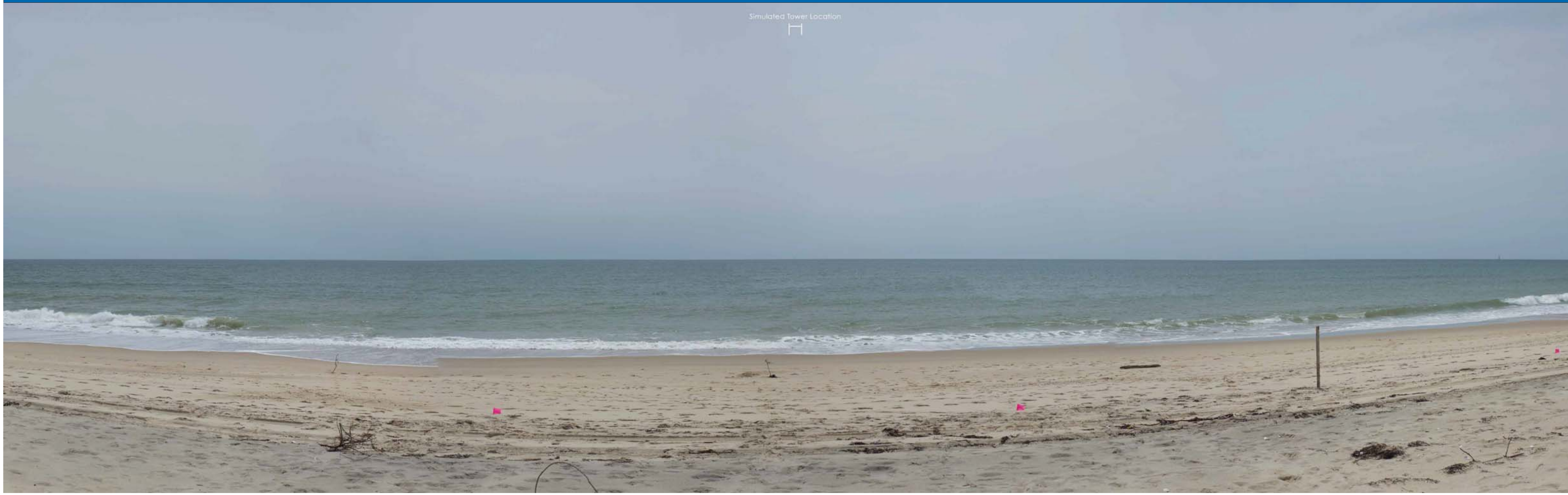
Photographic Information

Time of photograph:	1:03 PM
Date of photograph:	5-18-12
Weather condition:	Cloudy
Viewing direction:	South
Latitude:	41°19'19.431"N
Longitude:	70°28'39.259"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Backlight
Distance to tower:	NA
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	183°

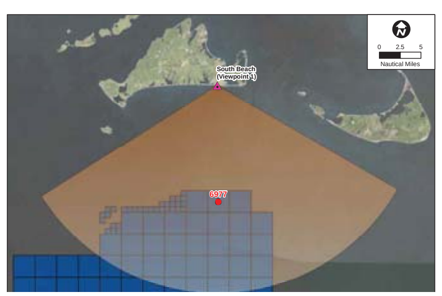


South Beach – 1:03 PM

Simulation of Meteorological Tower Placed in OCS Block 6977



Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

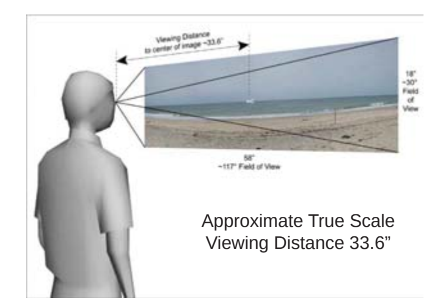


Legend

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

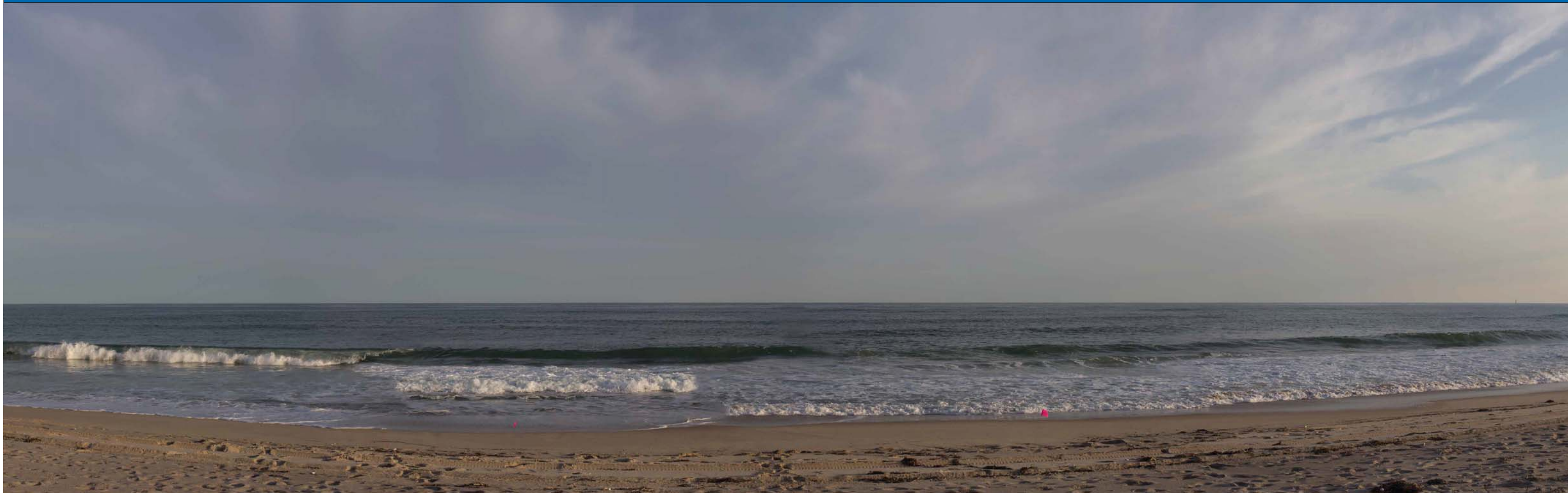
Photographic Information

Time of photograph:	1:03 PM
Date of photograph:	5-18-12
Weather condition:	Cloudy
Viewing direction:	South
Latitude:	41°19'19.431"N
Longitude:	70°28'39.259"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Backlight
Distance to tower:	14 nautical miles
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	183°

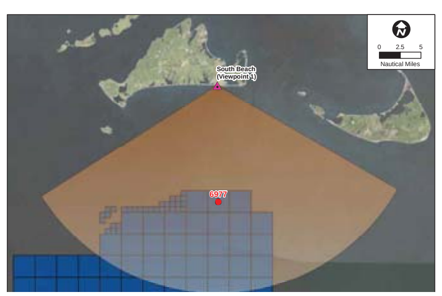


South Beach – 7:03 PM

Existing Conditions



Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

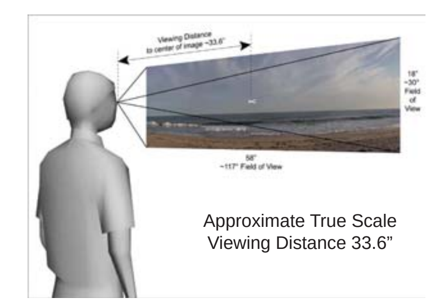


Legend

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

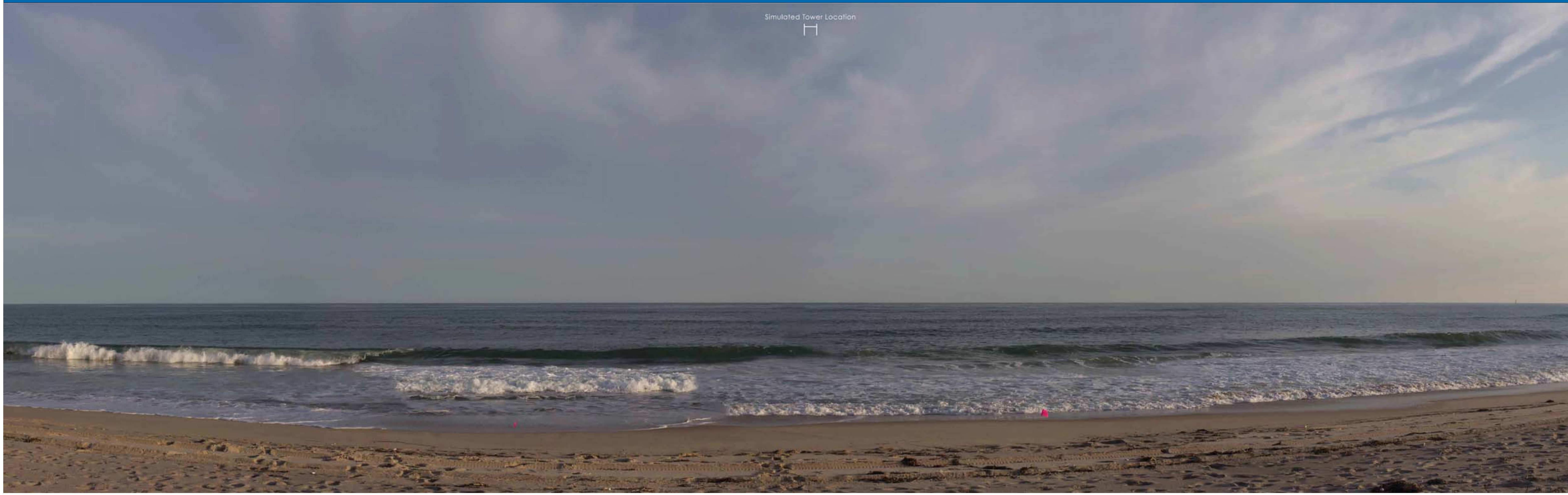
Photographic Information

Time of photograph:	7:03 PM
Date of photograph:	5-17-12
Weather condition:	Cloudy
Viewing direction:	South
Latitude:	41°19'19.431"N
Longitude:	70°28'39.259"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Sidelight
Distance to tower:	NA
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	183°

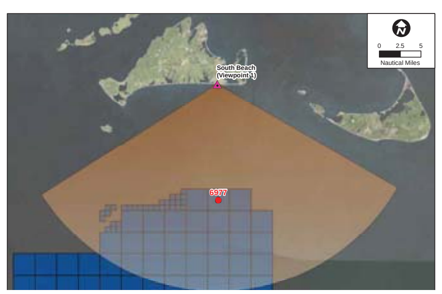


South Beach – 7:03 PM

Simulation of Meteorological Tower Placed in OCS Block 6977



Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

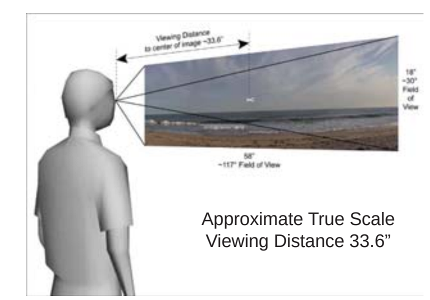


Legend

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

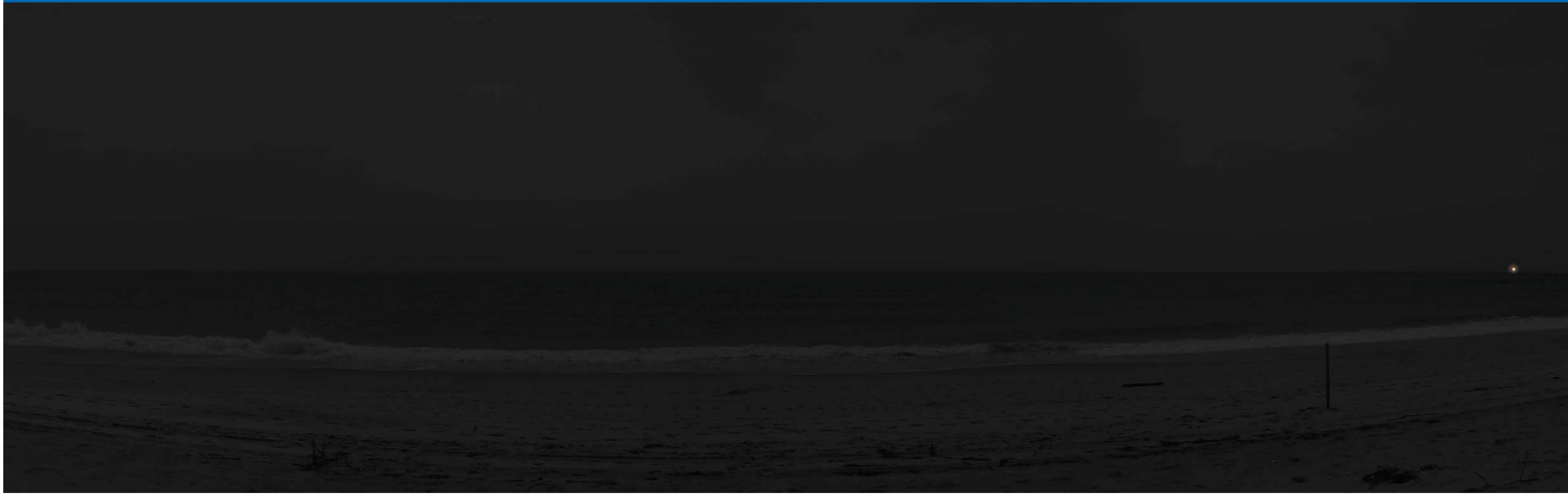
Photographic Information

Time of photograph:	7:03 PM
Date of photograph:	5-17-12
Weather condition:	Cloudy
Viewing direction:	South
Latitude:	41°19'19.431"N
Longitude:	70°28'39.259"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Sidelight
Distance to tower:	14 nautical miles
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	183°

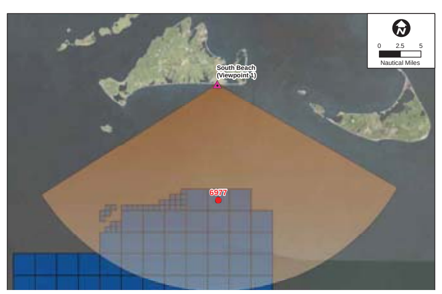


South Beach – 10:08 PM

Existing Conditions



Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

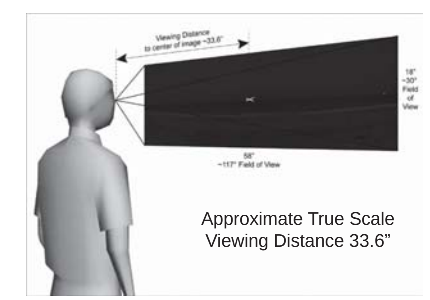


Legend

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

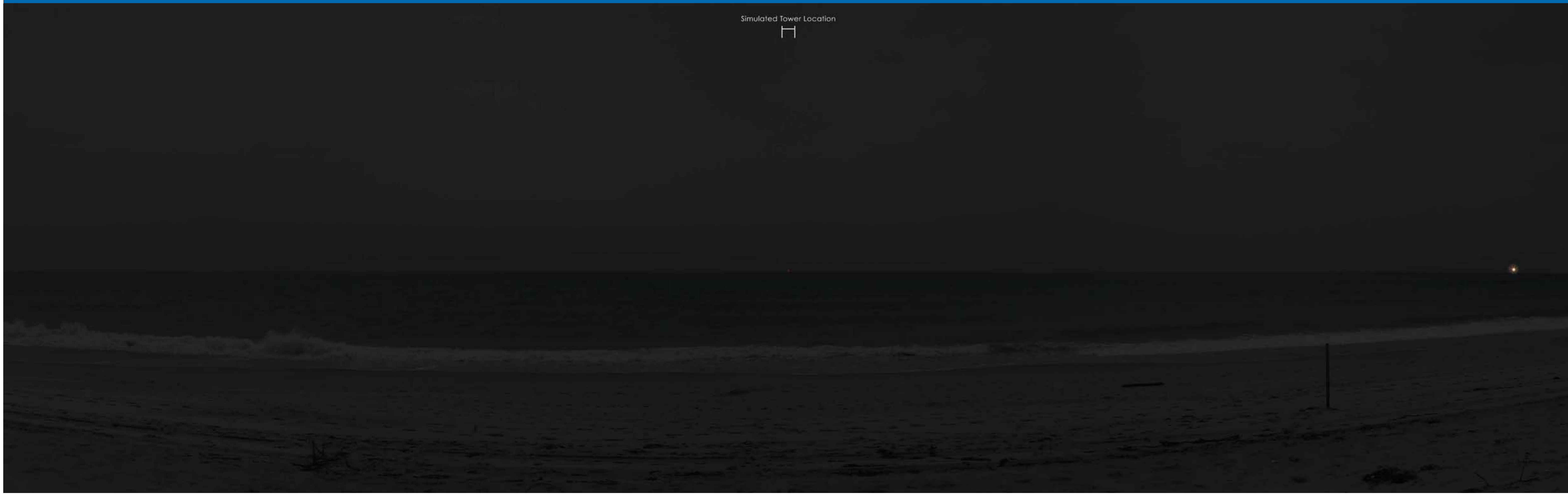
Photographic Information

Time of photograph:	10:08 PM
Date of photograph:	5-18-12
Weather condition:	Cloudy
Viewing direction:	South
Latitude:	41°19'19.431"N
Longitude:	70°28'39.259"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	None
Distance to tower:	NA
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	183°

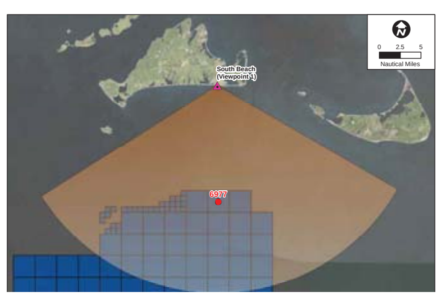


South Beach – 10:08 PM

Simulation of Meteorological Tower Placed in OCS Block 6977



Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

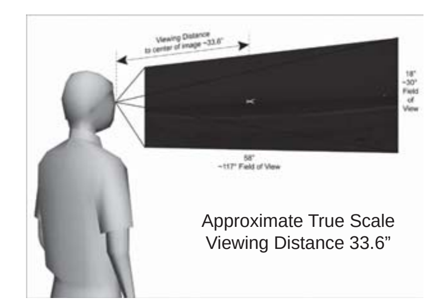


Legend

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

Photographic Information

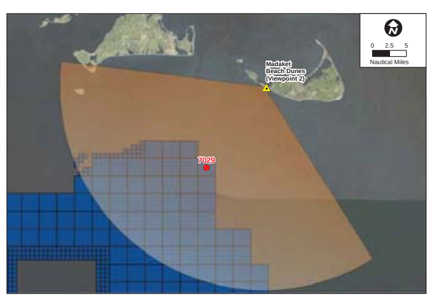
Time of photograph:	10:08 PM
Date of photograph:	5-18-12
Weather condition:	Cloudy
Viewing direction:	South
Latitude:	41°19'19.431"N
Longitude:	70°28'39.259"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	None
Distance to tower:	14 nautical miles
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	183°



Madaket Beach Dunes – 8:02 AM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

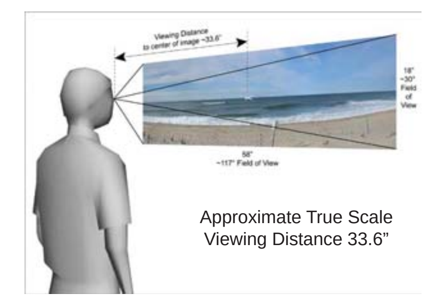


Legend

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

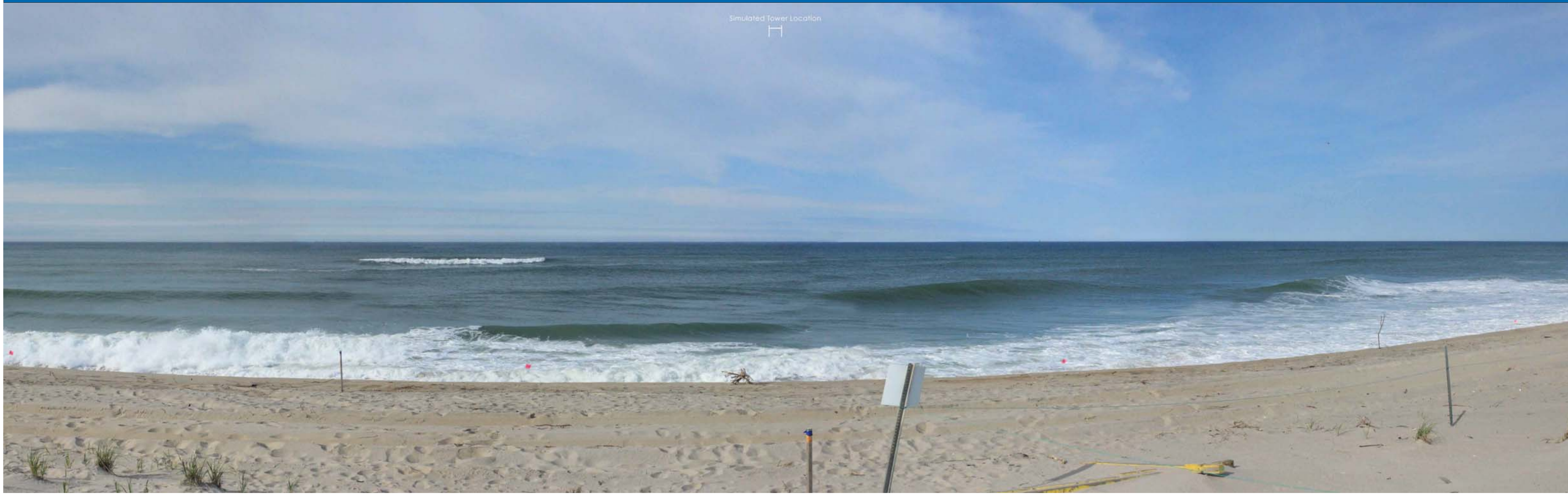
Photographic Information

Time of photograph:	8:02 AM
Date of photograph:	5-19-12
Weather condition:	Cloudy
Viewing direction:	Southwest
Latitude:	41°15'44.922"N
Longitude:	70°11'12.26"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Frontlight
Distance to tower:	NA
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	217°

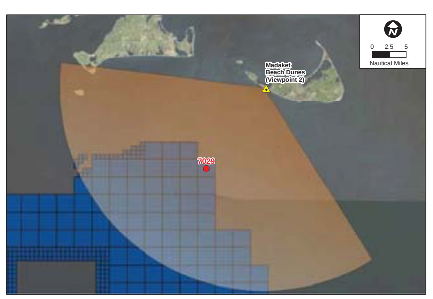


Madaket Beach Dunes – 8:02 AM

Simulation of Meteorological Tower Placed in OCS Block 7029



Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

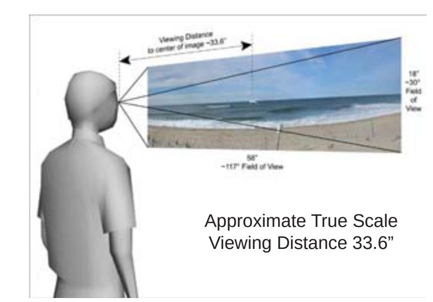


Legend

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

Photographic Information

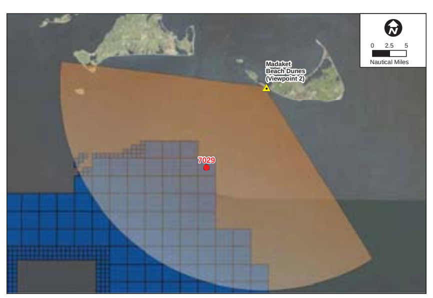
Time of photograph:	8:02 AM
Date of photograph:	5-19-12
Weather condition:	Cloudy
Viewing direction:	Southwest
Latitude:	41°15'44.922"N
Longitude:	70°11'12.26"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Frontlight
Distance to tower:	16.7 nautical miles
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	217°



Madaket Beach Dunes – 12:25 PM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

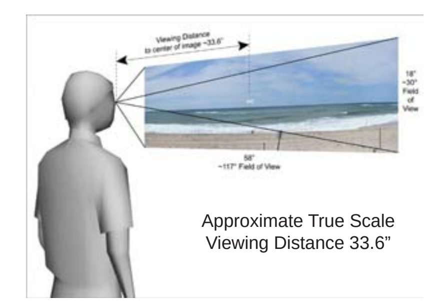


Legend

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

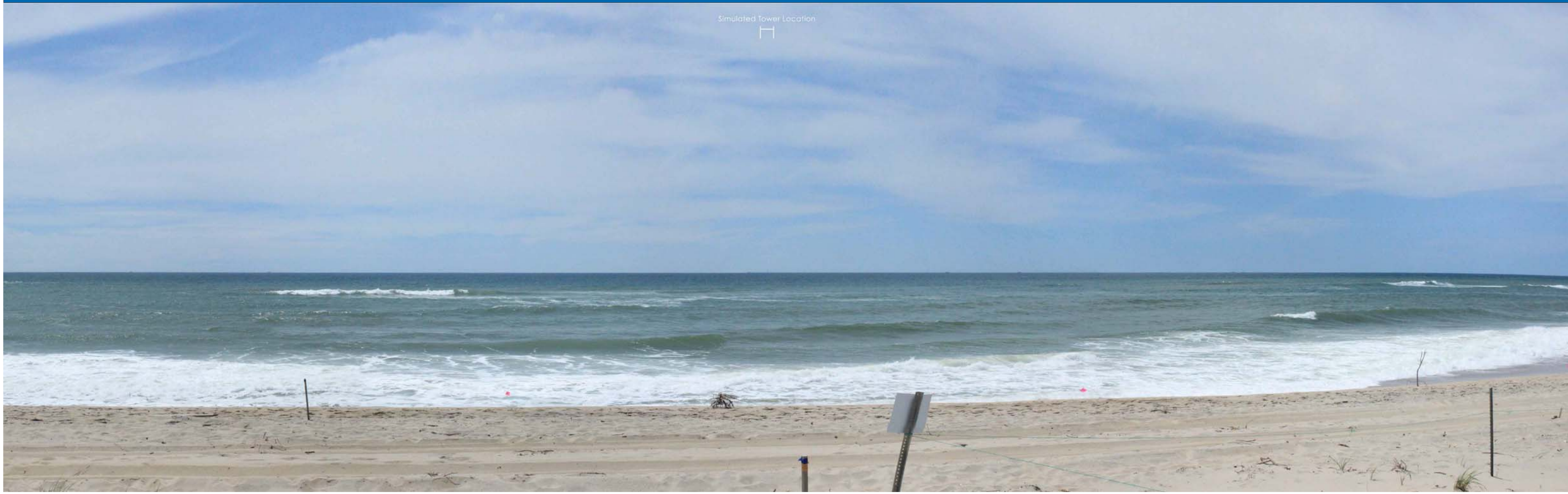
Photographic Information

Time of photograph:	12:25 PM
Date of photograph:	5-20-12
Weather condition:	Cloudy
Viewing direction:	Southwest
Latitude:	41°15'44.922"N
Longitude:	70°11'12.26"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Backlight
Distance to tower:	NA
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	217°

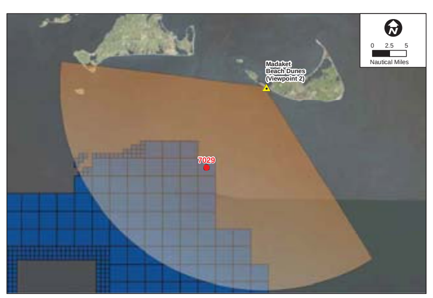


Madaket Beach Dunes – 12:25 PM

Simulation of Meteorological Tower Placed in OCS Block 7029



Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

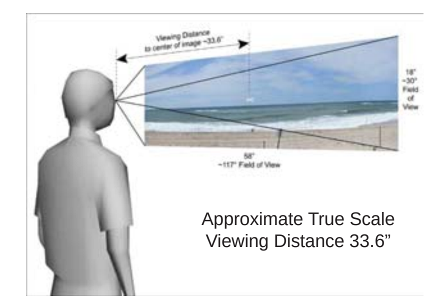


Legend

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

Photographic Information

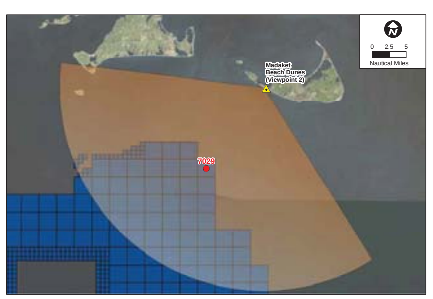
Time of photograph:	12:25 PM
Date of photograph:	5-20-12
Weather condition:	Cloudy
Viewing direction:	Southwest
Latitude:	41°15'44.922"N
Longitude:	70°11'12.26"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Backlight
Distance to tower:	16.7 nautical miles
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	217°



Madaket Beach Dunes – 4:34 PM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

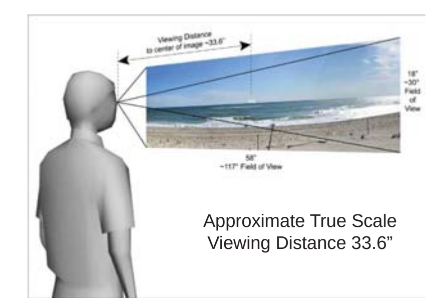


Legend

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

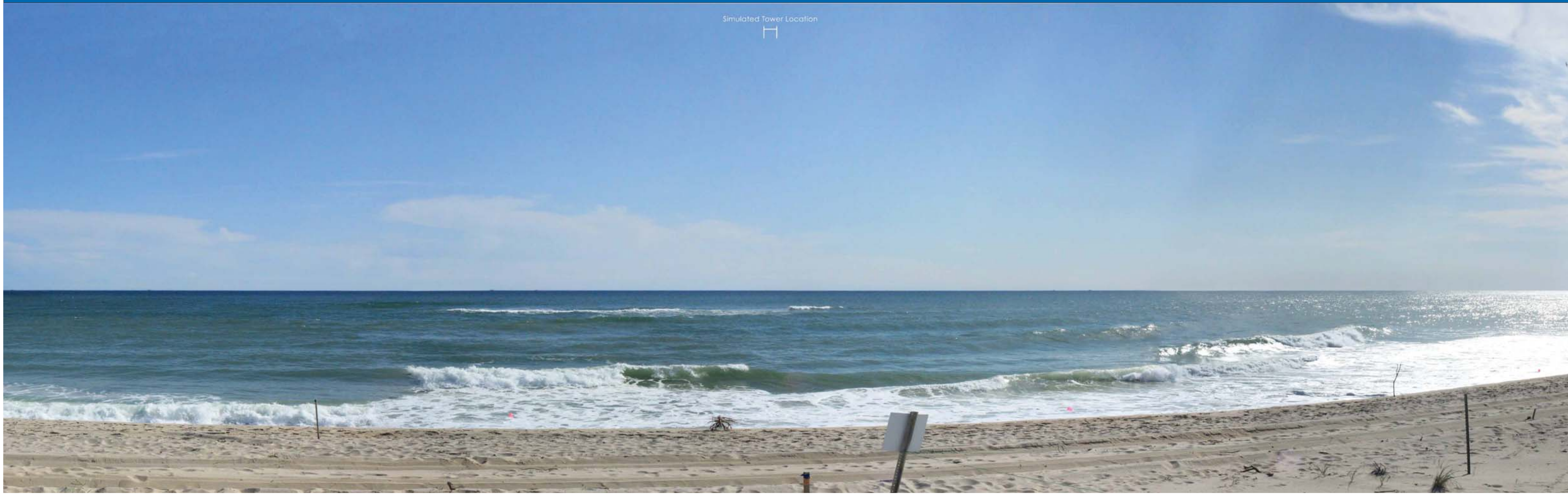
Photographic Information

Time of photograph:	4:34 PM
Date of photograph:	5-20-12
Weather condition:	Cloudy
Viewing direction:	Southwest
Latitude:	41°15'44.922"N
Longitude:	70°11'12.26"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Sidelight
Distance to tower:	NA
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	217°

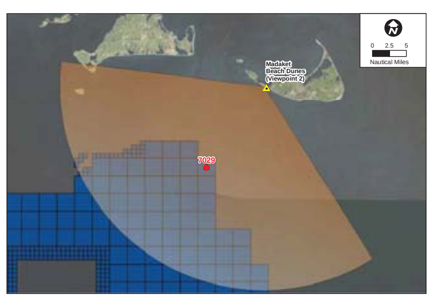


Madaket Beach Dunes – 4:34 PM

Simulation of Meteorological Tower Placed in OCS Block 7029



Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

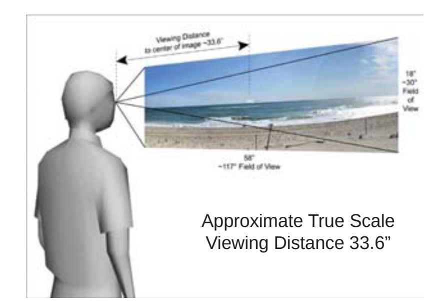


Legend

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

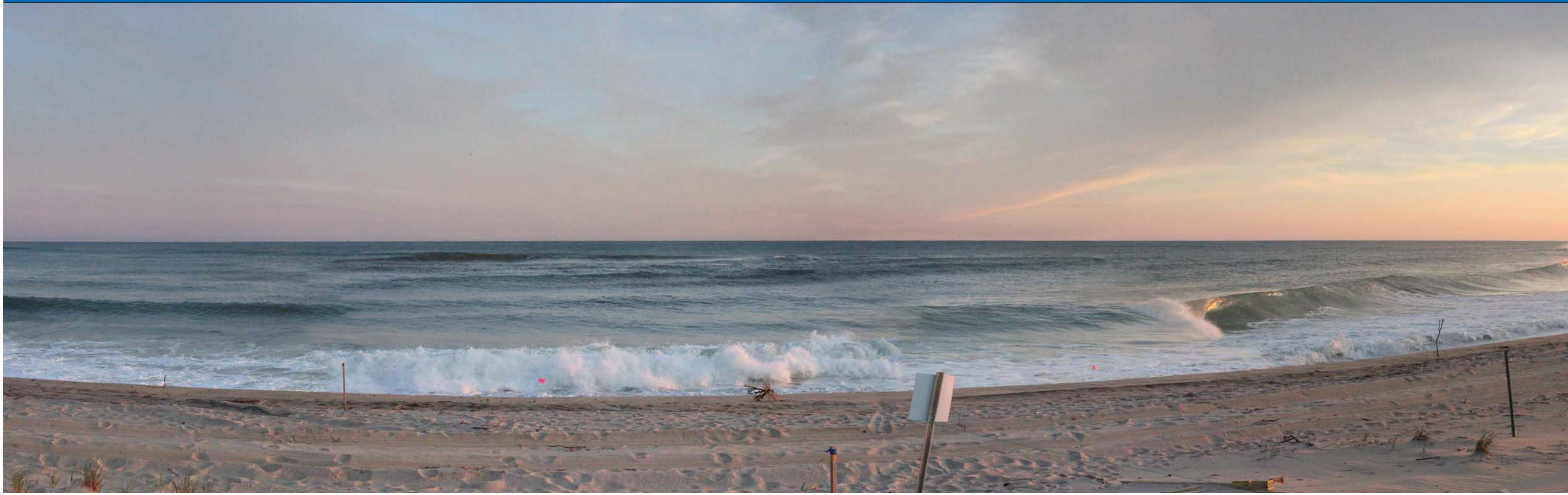
Photographic Information

Time of photograph:	4:34 PM
Date of photograph:	5-20-12
Weather condition:	Cloudy
Viewing direction:	Southwest
Latitude:	41°15'44.922"N
Longitude:	70°11'12.26"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56
Lighting condition:	Sidelight
Distance to tower:	16.7 nautical miles
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	217°



Madaket Beach Dunes – 7:45 PM

Existing Conditions



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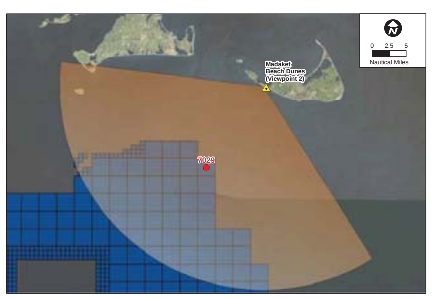

Legend

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

Photographic Information

Time of photograph:	7:45 PM
Date of photograph:	5-19-12
Weather condition:	Cloudy
Viewing direction:	Southwest
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Longitude:	70°11'12.26"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
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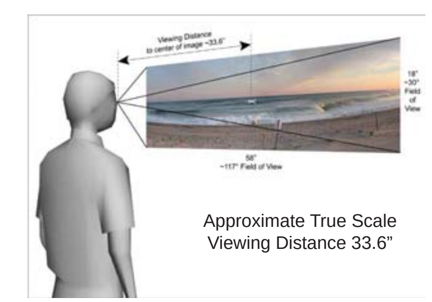
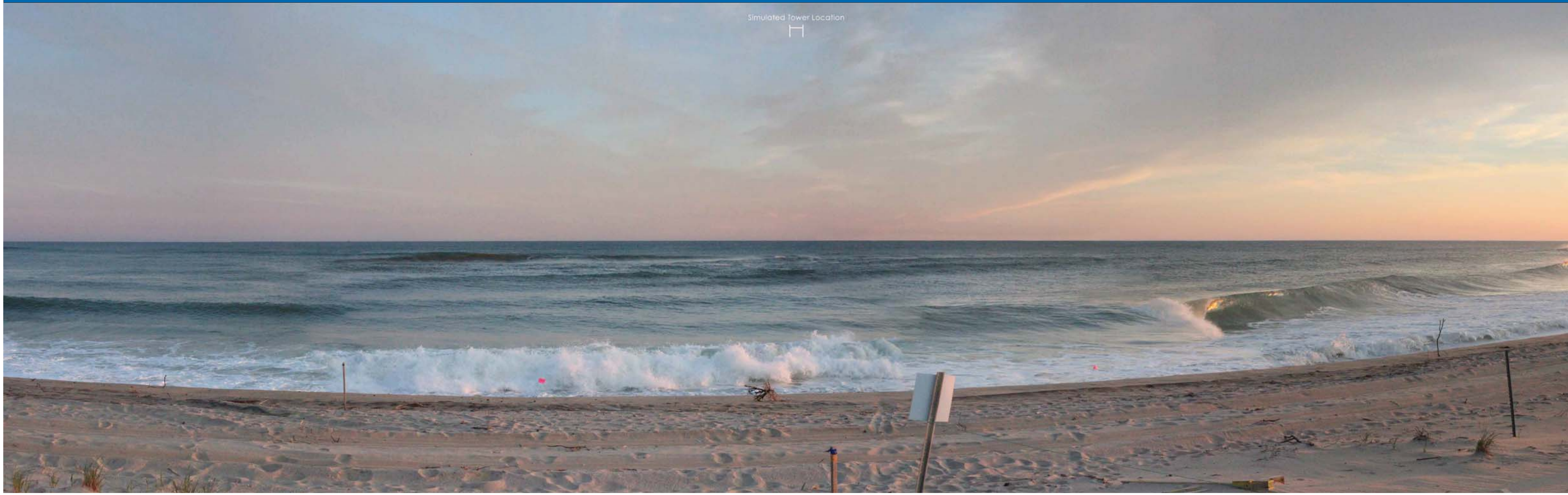
Vertical field of view:	30°
Camera bearing:	217°

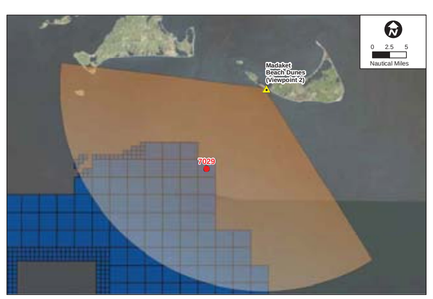


Madaket Beach Dunes – 7:45 PM

Simulation of Meteorological Tower Placed in OCS Block 7029



Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.



Legend

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

Photographic Information

Time of photograph:	7:45 PM
Date of photograph:	5-19-12
Weather condition:	Cloudy
Viewing direction:	Southwest
Latitude:	41°15'44.922"N
Longitude:	70°11'12.26"W
Camera model:	Canon EOS Rebel T3i
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	Sidelight
Distance to tower:	16.7 nautical miles
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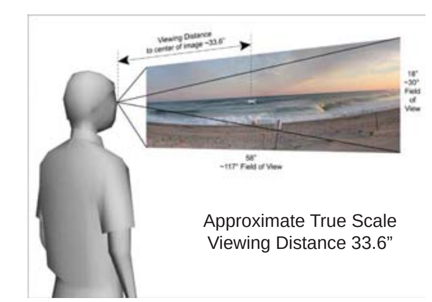
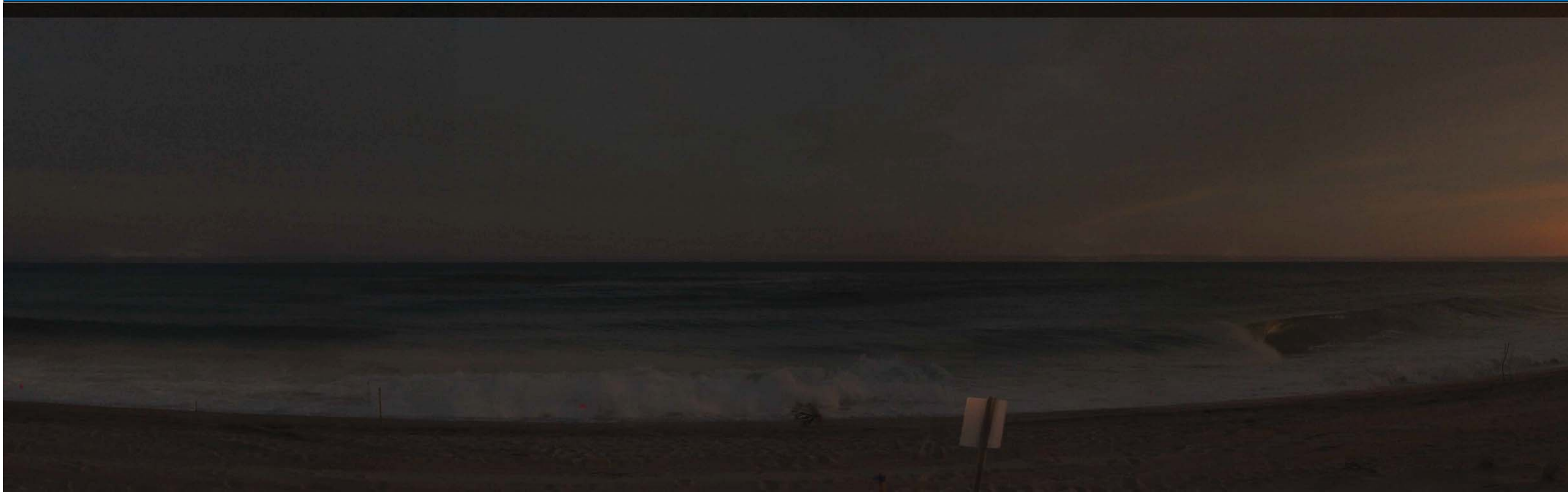
Vertical field of view:	30°
Camera bearing:	217°

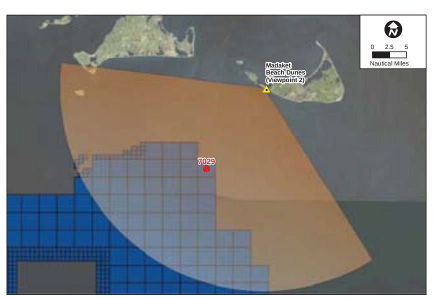


Madaket Beach Dunes – 10:12 PM

Existing Conditions



Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.



Legend

- Meteorological Tower
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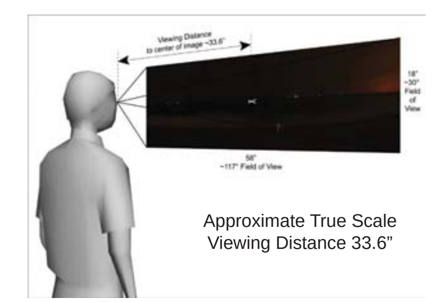
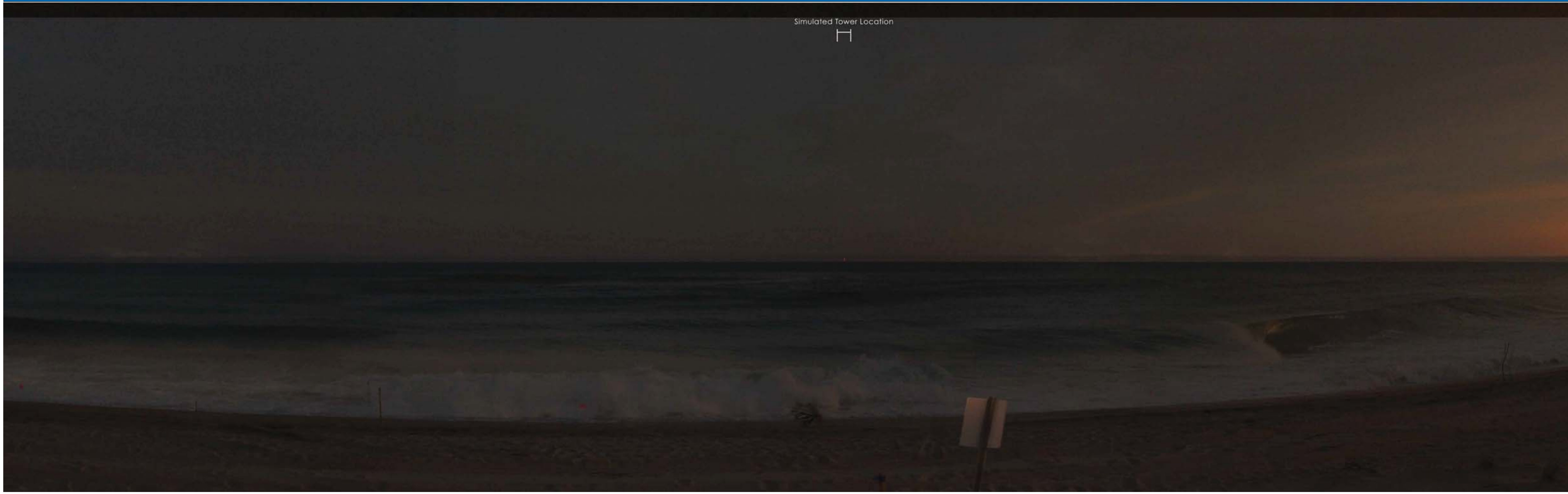
Digital focal length:	35mm
35mm equivalent:	56mm
Lighting condition:	None
Distance to tower:	NA
Horizontal field of view:	117°
Vertical field of view:	30°
Camera bearing:	217°

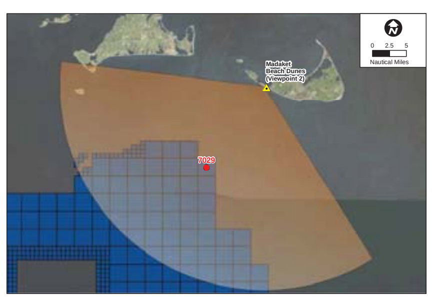


Madaket Beach Dunes – 10:12 PM

Simulation of Meteorological Tower Placed in OCS Block 7029



Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.



Legend

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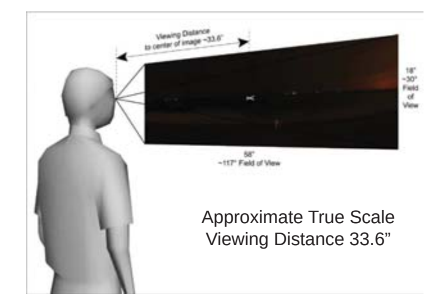

Appendix I
Government Consultation Letters

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United States Department of the Interior

BUREAU OF OCEAN ENERGY MANAGEMENT
WASHINGTON, DC 20240-0001

JUL 02 2012

Mr. Daniel Morris
Acting Regional Administrator, Northeast Region
National Marine Fisheries Service
55 Great Republic Drive
Gloucester, Massachusetts 01930-9333

Under Section 7 of the Endangered Species Act (ESA) of 1973, the Bureau of Ocean Energy Management (BOEM), as the lead Agency in cooperation with the U.S. Army Corps of Engineers (USACE), requests informal consultation with the National Marine Fisheries Service (NMFS) on the effects on ESA-listed species from proposed activities in wind energy areas (WEAs) off Rhode Island and Massachusetts. The activities being considered include: (1) issuing leases; (2) associated site characterization activities that lessees may undertake on those leases (e.g., geophysical, geotechnical, archaeological and biological surveys); and (3) the subsequent approval of site assessment activities on the leaseholds (e.g., installation and operation of meteorological towers and buoys).

An informal Section 7 consultation for similar activities off New Jersey, Delaware, Maryland, and Virginia was concluded on September 20, 2011. Although the total area of the Rhode Island and Massachusetts WEAs is 34% larger than the total area of the Mid-Atlantic WEAs, 25% fewer meteorological towers and buoys are considered under this consultation (9 towers and 18 buoys vs. 12 towers and 25 buoys, respectively).

In the enclosed biological assessment (BA), BOEM concludes that the impacts of the proposed activities, in consideration of standard operating conditions, are expected to be discountable and insignificant and thus not likely to adversely affect ESA-listed sea turtles, marine mammals, and fish. The inclusion of standard operating conditions, based on the Mid-Atlantic and other previous consultations, greatly reduce the likelihood of any adverse impacts to ESA-listed species. BOEM has also determined that no critical habitat would be impacted by the proposed activities.

BOEM requests your concurrence and/or advice regarding the conclusions in the BA within 90 days. We are also initiating informal consultation regarding impacts to ESA-listed birds and bats with the U.S. Fish and Wildlife Service, under separate cover. If you have any questions or require additional information, please contact Mr. Brian Hooker at (703) 787-1634 or Brian.Hooker@boem.gov.

Correspondence should be sent to the following address:

Bureau of Ocean Energy Management
Environment Branch for Renewable Energy
381 Elden Street, HM 1328
Herndon, Virginia 20170-4817

Sincerely,

Michelle Morin
Chief, Environment Branch for Renewable Energy

Enclosure

cc: USACE

United States Department of the Interior

BUREAU OF OCEAN ENERGY MANAGEMENT
WASHINGTON, DC 20240-0001

JUL 02 2012

Mr. Thomas R. Chapman
Supervisor
U.S. Fish and Wildlife Service
New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087

Under Section 7 of the Endangered Species Act (ESA) of 1973, the Bureau of Ocean Energy Management (BOEM), as the lead Agency in cooperation with the U.S. Army Corps of Engineers (USACE), requests informal consultation with the with the U. S. Fish and Wildlife Service (USFWS) on the effects on ESA-listed species from proposed activities in wind energy areas (WEAs) off Rhode Island and Massachusetts. The activities being considered include: (1) issuing leases; (2) associated site characterization activities that lessees may undertake on those leases (e.g., geophysical, geotechnical, archaeological and biological surveys); and (3) the subsequent approval of site assessment activities on the leaseholds (e.g., installation and operation of meteorological towers and buoys).

An informal Section 7 consultation for similar activities off New Jersey, Delaware, Maryland, and Virginia was concluded on June 20, 2011. Although the total area of the Rhode Island and Massachusetts WEAs is 34% larger than the total area of the Mid-Atlantic WEAs, 25% fewer meteorological towers and buoys are considered under this consultation (9 towers and 18 buoys vs. 12 towers and 25 buoys, respectively).

In the enclosed biological assessment (BA), BOEM concludes that the impacts of the proposed activities are expected to be discountable and insignificant and thus not likely to adversely affect ESA-listed bird and ESA candidate bird species. BOEM has also determined that no critical habitat would be impacted by the proposed activities.

BOEM requests your concurrence and/or advice regarding the conclusions in the BA within 90 days. We are also initiating informal consultation with the National Marine Fisheries Service, under separate cover. If you have any questions or require additional information, please contact Dr. David Bigger at (703) 787-1802 or David.Bigger@boem.gov.

Correspondence should be sent to the following address:

Bureau of Ocean Energy Management
Environment Branch for Renewable Energy
381 Elden Street, HM 1328
Herndon, Virginia 20170-4817

Sincerely,

Michelle Morin
Chief, Environment Branch for Renewable Energy

Enclosure

cc: USACE

Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Rhode Island, Massachusetts, New York, and New Jersey

For the National Marine Fisheries Service

Biological Assessment (October 2012)

U.S. Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs

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Table of Contents

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List of Tables

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List of Figures

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Acronyms and Abbreviations

ADCP	Acoustic Doppler Current Profiler
AMAPPS	Atlantic Marine Assessment Program for Protected Species
ATCA	Atlantic Tuna Convention Act
BOEM	Bureau of Ocean Energy Management
C	Celsius
CETAP	Cetacean and Turtle Assessment Program
CODAR	Coastal Ocean Dynamic Application Radar
COP	Construction and Operations Plan
CPT	Cone Penetrometer Test
DMA	Dynamic Management Area
DPS	Distinct Population Segment
EA	Environmental Assessment
EPACT	Energy Policy Act of 2005
ESA	Endangered Species Act
F	Fahrenheit
GGARCH	Geological, Geophysical, and Archeological
GIS	Geographic Information System
HRG	High Resolution Geophysical
ICCAT	International Convention for the Conservation of Atlantic Tunas
IP	Interim Policy
LIDAR	Light Detecting and Ranging
MMPA	Marine Mammal Protection Act
NARWSS	North Atlantic Right Whale Sighting Survey
NEFSC	Northeast Fisheries Science Center
NM	Nautical Mile
NMFS	National Marine Fisheries Service
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
ROV	Remotely Operated Vehicle
SAMP	Special Area Management Plan
SAP	Site Assessment Plan
SAS	Sighting Advisory System
SEFSC	Southeast Fisheries Science Center
SMA	Special Management Area
SODAR	Sonic Detection And Ranging
SPUE	Sightings Per Unit of Effort
USACE	United States Army Corps of Engineers
USDOC	United States Department of Commerce
USDOI	United States Department of Interior
USFWS	United States Fish and Wildlife Service
WEA	Wind Energy Area

1 Introduction

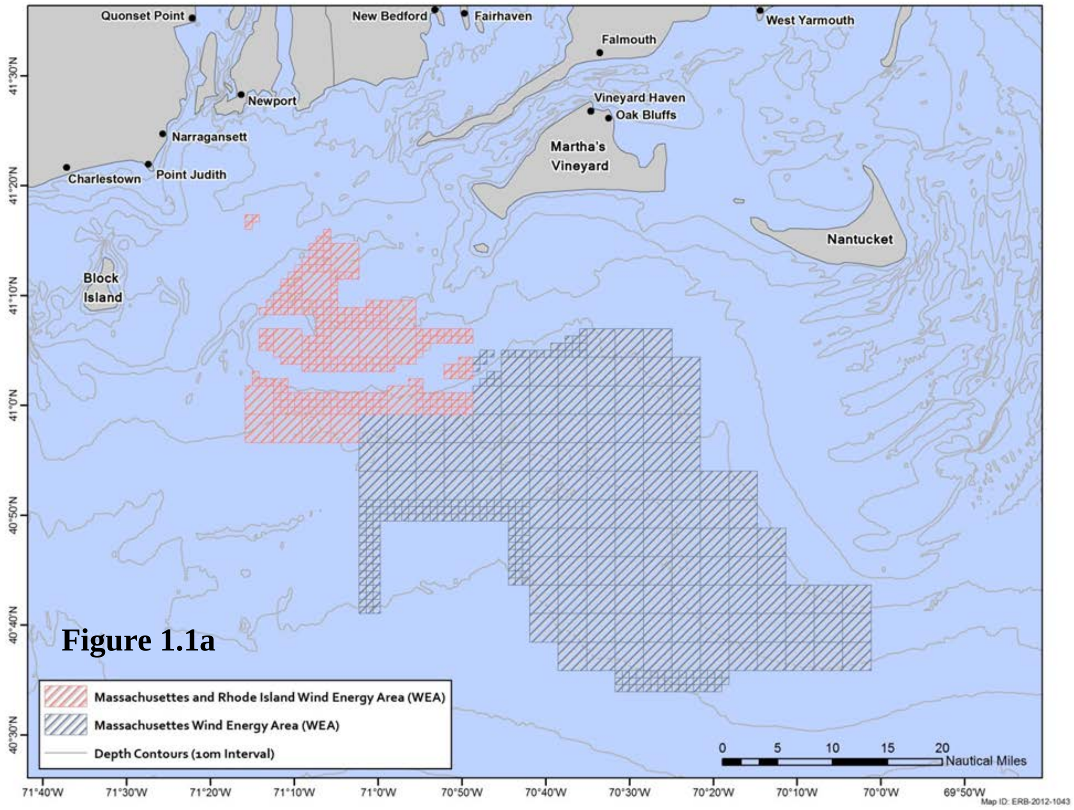
The Energy Policy Act (EPACT) of 2005, Public Law No. 109-58, added Section 8(p)(1)(C) to the Outer Continental Shelf Lands Act (OCSLA), which grants the Secretary of the Interior the authority to issue leases, easements, or rights-of-way on the Outer Continental Shelf (OCS) for the purpose of renewable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

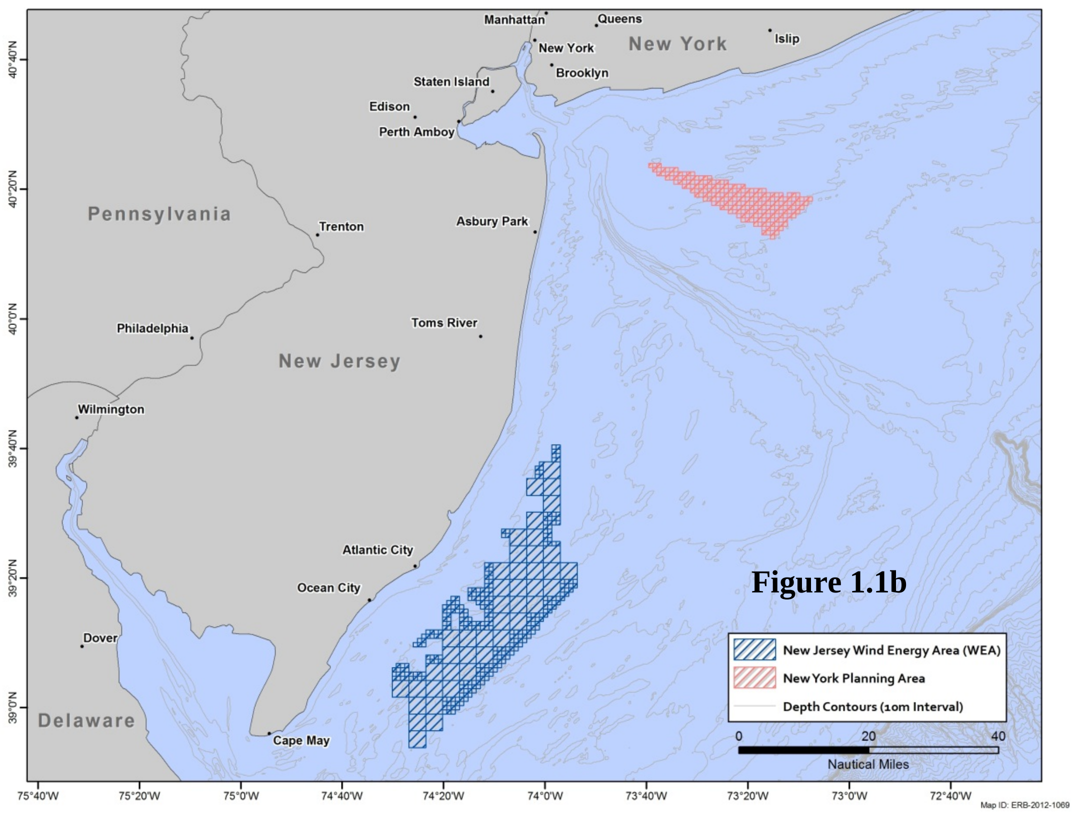
This document is a biological assessment (BA) of impacts to endangered and threatened species listed under the Endangered Species Act (ESA) that are under the oversight of the National Marine Fisheries Service (NMFS) from proposed commercial wind energy lease issuance, associated site characterization activities, and subsequent site assessment activities in BOEM's North Atlantic Planning Area. This BA initiates formal consultation under Section 7 of the ESA. A separate assessment document was prepared for the informal consultation with the U.S. Fish and Wildlife Service for ESA-listed species under their oversight.

1.1 Project Area

The Project Area comprises three areas offshore Massachusetts, Rhode Island and New Jersey where BOEM has solicited interest in offshore wind energy development, and one area offshore New York for which BOEM has received an unsolicited application. Generally, under the Department of Interior's "Smart from the Start" initiative, only offshore wind energy areas that BOEM has identified through its intergovernmental task force process are referred to as "Wind Energy Areas" (WEAs). However, in this document the area offshore New York may be referred to as a WEA for simplicity, even though it does not meet the Department's definition. This document will assess the impacts from site characterization (e.g. geological and geophysical (G&G) and biological surveys) in all four WEAs. However, this document will only assess the site assessment activities (e.g., meteorological tower and/or meteorological buoy installation) in the "Massachusetts" WEA (MA WEA) and the "Rhode Island and Massachusetts" WEA (RI/MA WEA) (see Figure 1-1a). Discussion of the RI/MA and MA ESA species is often commensurate with the impacts expected from those activities. The New York and New Jersey WEAs are depicted in Figure 1-1b. These WEAs, with the exception of New York, were developed through collaboration and consultation with state intergovernmental task forces, Federal agencies, Native American Tribes, the general public, and other stakeholders. The WEAs are located in relatively shallow waters of the Atlantic continental shelf of the Northeast Continental Shelf Large Marine Ecosystem (NCSLME) (Cook and Auster, 2007; Sherman, 1991).

Figures 1.1a and 1.1b. Project Area for RI/MA, MA, NY, and NJ WEAs.





1.2 Proposed Action

The proposed action, that is the subject of this BA, is the issuance of commercial wind energy leases for the four WEAs. For the RI/MA and MA WEAs the action also includes the approval of site assessment plans to provide for the responsible development of wind energy resources within all or some of the RI/MA WEA and the MA WEA. This BA will consider the environmental consequences associated with reasonably foreseeable site characterization scenarios associated with leasing (including geophysical, geotechnical, archeological and biological surveys), and for the RI/MA and MA WEAs site assessment activities (including the installation, operation and decommissioning of meteorological towers and buoys).

1.3 Renewable Energy Process

Under the renewable energy regulations, the issuance of leases and subsequent approval of wind energy development on the OCS is a staged decision-making process. BOEM's wind energy program occurs in four distinct phases:

1) **Planning and Analysis.** The first phase is to identify suitable areas to be considered for wind energy project leases through collaborative, consultative, and analytical processes using the state's task forces, public information meetings, input from the states, Native American Tribes, and other stakeholders.
2) **Lease Issuance.** The second phase is the issuance of a commercial wind energy lease. The competitive lease process is set forth at 30 CFR 585.210 to 585.225, and the noncompetitive process is set forth at 30 CFR 585.230 to 585.232. A commercial lease gives the lessee the exclusive right to subsequently seek BOEM approval for the development of the leasehold. The lease does not grant the lessee the right to construct any facilities; rather, the lease grants the right to use the leased area to develop its plans, which must be approved by BOEM before the lessee can move on to the next stage of the process (30 CFR 585.600 and 585.601).
3) **Approval of a Site Assessment Plan (SAP).** The third stage of the process is the submission of a SAP, which contains the lessee's detailed proposal for the construction of a meteorological tower and/or the installation of meteorological buoys on the leasehold (30 CFR 585.605 to 585.618). The lessee's SAP must be approved by BOEM before it conducts these "site assessment" activities on the leasehold. BOEM may approve, approve with modification, or disapprove a lessee's SAP (30 CFR 585.613).
4) **Approval of a Construction and Operation Plan (COP).** The fourth and final stage of the process is the submission of a COP, a detailed plan for the construction and operation of a wind energy project on the lease (30 CFR 585.620 to 585.638). BOEM approval of a COP is a precondition to the construction of any wind energy facility on the OCS (30 CFR 585.628). As with a SAP, BOEM may approve, approve with modification, or disapprove a lessee's COP (30 CFR 585.628).

The regulations also require that a lessee provide the results of surveys with its SAP or COP, including a shallow hazards survey (30 CFR 585.626 (a)(1)), geological survey (30 CFR

585.616(a)(2)), geotechnical survey (30 CFR 585.626(a)(4)), and an archaeological resource survey (30 CFR 585.626(a)(5)). BOEM refers to these surveys as "site characterization" activities. Although BOEM does not issue permits or approvals for these site characterization activities, it will not consider approving a lessee's SAP or COP if the required survey information is not included. *See* "Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information Pursuant to 30 CFR Part 585,"[1] referred to herein as the 'GGARCH guidelines' (USDOI, BOEMRE, OAEP, 2011a).

[1] *see* http://www.boem.gov/Renewable-Energy-Program/Regulatory-Information/Index.aspx#Notices_to_Lessees,_Operators_and_Applicants

2 Endangered Species Act (ESA) Section 7 Consultation History

The proposed action is similar in many respects to the consultation for *Issuance of Leases for Wind Resource Data Collection on the Outer Continental Shelf Offshore Delaware and New Jersey Environmental Assessment* (IP EA) that was concluded in the Spring of 2009 (USDOI MMS 2009) and the action described in the *Environmental Assessment (EA) for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia* (NJ-VA EA) and its associated biological assessment which were finalized in January 2012 (USDOI BOEM 2012). Each of these assessments considered the issuance of leases for wind resource data collection, including geological and geophysical, hazards, and archaeological (GGARCH) site characterization surveys. The IP EA considered issuing leases for seven lease blocks and the NJ-VA EA considered issuing leases within all or part of four WEAs while the project area in the NJ-VA EA was comprised of approximately 117 OCS lease blocks across four states.

However, this consultation incorporates some new sound modeling information that BOEM developed in support of the ongoing consultation for the Biological Assessment of G&G Survey Activities in the Mid and South Atlantic Planning Areas. Since NJ is not included in that assessment it is important to assess site characterization impacts in that WEA with the best available information. The New York area was only recently defined through and unsolicited application to BOEM. The new sound models are more conservative in many respects than previous models and have resulted in an expansion of the area of ensonification during site characterization surveys and lead BOEM to request formal consultation under Section 7 of the ESA. The following is a summary of the consultation history for previous and ongoing NMFS consultations for lease issuance and site assessment activities on the Atlantic OCS.

Previous National Marine Fisheries Service Consultations on Similar Actions

On January 9, 2009, BOEM (formerly BOEMRE) initiated consultation with NMFS for the actions described in the IP EA. This consultation evaluated the issuance of several IP leases for wind resource data collection, including geological and geophysical, hazards, and archaeological (GGARCH) site characterization surveys. These IP leases were concentrated off of Delaware and New Jersey. The consultation was concluded in a May 14, 2009, letter from NMFS concurring with the determination that the issuance of seven IP leases by BOEM to allow the construction of up to seven meteorological facilities and associated GGARCH surveys would not be likely to adversely affect any listed species under NMFS jurisdiction. BOEM reinitiated consultation with NMFS when the Garden State Offshore Energy/Deepwater Wind Project Plan proposed the use of a unique light detecting and ranging (LIDAR) equipped meteorological spar buoy rather that a meteorological tower for one of the IP leases. In a letter dated December 6, 2010, NMFS concluded that all the effects of the proposed action would be insignificant or discountable, and not likely to adversely affect any ESA-listed species under their jurisdiction.

In March 2011, BOEM initiated informal consultation with NMFS for the issuance of leases, site assessment, and site characterization activities for NJ-VA. The consultation was concluded in a September 20, 2011, letter from NMFS concurring with the determination that the issuance of leases associated with site characterization and subsequent site assessment activities for siting of wind energy facilities in the identified WEAs may affect but is not likely to adversely affect any listed species under NMFS jurisdiction.

On May 24, 2012, BOEM initiated formal consultation for site characterization activities for all of BOEM's program areas (oil and gas, marine minerals and renewable energy) in the Mid and South Atlantic Planning Areas. The assessment of the renewable energy program's G&G survey activity produced some new modeling scenarios the areas ensonified at Level A and Level B harassment levels during operation of the equipment. Applicable information from that assessment is incorporated throughout this document.

3 Threatened and Endangered Species in the Proposed Action Area

The proposed action area is defined as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action” (50 CFR §402.02). For this activity, the proposed action area includes the Project Area (the four WEAs) (*see* Figure 1-1a and 1-1b) as well as waters between the Project Area and shore. This area is expected to encompass all effects of the proposed action. Several ESA-listed species under NMFS oversight occur both seasonally and year round in the action area. Since the proposed activities could occur year-round it can be assumed that these species could be present for all or some of the proposed activity. The Programmatic EIS for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf (USDOI, MMS 2007) gives greater detail of the life histories of the species outlined in this Section and is thus incorporated by reference and not repeated herein.

3.1 Marine Mammals

There are six whale species in the North Atlantic that are federally listed as endangered (Table 3.1-1). The six whale species are the North Atlantic right whale (*Eubaleana glacialis)*, fin whale (*Balaenoptera physalus)*, humpback whale (*Megaptera novaengliae)*, blue whale (*Baleanoptera musculus*), sei whale (*Balaeonoptera borelais*), and sperm whale (*Physeter macrocephalus*). Of these six species, there are five –North Atlantic right, fin, humpback, sei, and sperm whales – that are likely to occur in and around the Project Area. These 5 species are expected to occur in the region during all times of the year; however, they are more prevalent in some seasons than others. The right, humpback, and sei whales are most likely to occur in the Project Area spring; sperm whales are most likely to occur in the summer; and fin whales are most likely to occur in the Project Area in the winter. Although blue whales occur in the North Atlantic, sightings data indicate that they are more likely to be found offshore the Grand Banks and Newfoundland and only occasionally in the U.S. exclusive economic zone (EEZ) (Waring *et al.*, 2011) and therefore, not likely to be found in the Project Area or its surrounding waters.

Manatees are federally-listed as endangered (USDOI, USFWS 2008). Occasional sightings of individual manatees have occurred in the New England region during the summer months. However, since sightings are rare and there is no regular occurrence of this species within the region during any season, they will not be discussed further in this document.

Table 3.1-1
Marine Mammals in the North Atlantic

Species	Status	General Occurrence North Atlantic
Order Cetacea		
Suborder Mysticeti (Baleen Whales)		
Family Baleanidae		
North Atlantic Right Whale (*Eubaleana glacialis*)	E	Year-round
Family Balaenopteridae		
Blue Whale (*Balaenoptera musculus*)	E	Summer
Fin Whale (*Balaenoptera physalus*)	E	Year-round
Humpback Whale (*Megaptera novaeangliae*)	E	Year-round
Minke Whale (*Balaenoptera acutorostrata*)		Spring/Summer
Sei Whale (*Balaenoptera borealis*)	E	Spring/Summer
Suborder Odontoceti (toothed whales and dolphins)		
Dwarf Sperm Whales (*Balaenoptera borealis*)		Late Spring/ Summer1
Pygmy Sperm Whale (*Kogia breviceps*)		Late Spring/ Summer1
Sperm Whale *(Physeter macrocephalus*)	E	Spring/Summer/Fall
Family Ziphiidae		
Blainville's Beaked Whale (*Mesoplodon densirostris*)		Later Spring/Summer1
Cuvier's Beaked Whale (*Ziphius cavirostris*)		Later Spring/Summer1
Gervais' Beaked Whale (*Mesoplodon europaeus*)		Later Spring/Summer1
True's Beaked Whale (*Mesoplodon mirus*)		Later Spring/Summer1
Sowerby's Beaked Whale (*Mesoplodon bidens)*		Later Spring/Summer1
Family Delphinidae		
Short-Beaked Common Dolphin (*Delphinus delphis*)		Year-round
Pantropical-Spotted Dolphin (*Stenella attenuata*)		Later Spring/Summer1
Bottlenose Dolphin (*Tursiops truncatus*)		Year-round
Atlantic White-Sided Dolphin (*Lagenorhynchus acutus*)		Year-round
White-Beaked Dolphin (*Lagenorhynchus albirostri)*		Later Spring/Summer1
Killer Whale (*Orcinus orca*)		Later Spring/Summer1
Atlantic Spotted Dolphin *(Stenella frontalis*)		Year-round
Short-Finned Pilot Whale (*Globicephala macrorhynchus*)		Later Spring/Summer1
Long-Finned Pilot Whale *(Globicephala melas*)		Year-round
Risso's (*Grampus griseus*)		Year-round
Striped Dolphin (*Stenella coeruleoalba*)		Year-round
Harbor Porpoise *(Phocoena phocoena*)		Year-round
Order Carinovora		
Suborder Fissipedia		
Family Phocidae		
Harbor Seal (*Phoca vitulina*)		Year-round
Grey Seal (*Halichoerus grypus*)		Year-round
Harp Seal (*Pagophilus groenlandicus)*		Winter/Spring
Hooded Seal (*Cystophora cristata)*		Winter/Spring

Note:
[1] Due to insufficient sighting data and information on these species, the best available information for the season of general occurrence in the North Atlantic corresponds with survey effort

Key:
E = Endangered under the Endangered Species Act.

Source: Waring *et al*, 2011.

Information on the occurrence of ESA listed species and their existing environment within the North Atlantic has been developed based on recent studies and a literature synthesis that specifically aims at areas encompassing the waters of the BOEM North Atlantic Planning Area. These studies include the NMFS marine mammal stock assessment reports, New Jersey's *Ocean/Wind Power Ecological Baseline Studies Final Report: January 2008-December 2009* (NJDEP 2010), the Rhode Island SAMP (and its accompanying appropriate technical reports), preliminary data from the *2010 Atlantic Marine Assessment Program for Protected Species* (AMAPPS) (Palka 2010), and the 1982 Final Report *from A Characterization of Marine Mammals and Sea Turtles in the Mid- and North Atlantic Areas of the U.S. Outer Continental Shelf* (Cetacean and Sea Turtle Assessment Program [CETAP] 1982). Sightings per unit of effort data for the areas offshore New York and New Jersey are from the Nature Conservancy's comprehensive Northwest Atlantic Marine Ecoregional Assessment (NAM ERA) report (TNC, 2011).

The New Jersey survey was conducted over a 24-month period between January 2008 and December 2009 using three sampling techniques, aerial line transect surveys, shipboard line transect surveys, and passive acoustic monitoring (PAM). The Rhode Island SAMP technical report, *Marine Mammals and Sea Turtles of Narragansett Bay, Block Island Sound, Rhode Island Sound, and Nearby Waters: An Analysis of Existing Data for the Rhode Island Ocean Special Area Management Plan (SAMP)* (Kenney and Vigness-Raposa 2010), used available sources of information on the occurrence of marine mammals and sea turtles within the Rhode Island study area, which encompasses the RI/MA WEA. The Rhode Island SAMP was then able to map the spatial and temporal distributions and relative abundances of all marine mammals known to occur within the Rhode Island study area (Kenney and Vigness-Raposa 2010). The AMAPPS surveys are the result of an inter-agency agreement between BOEM and NMFS in an effort to assess the abundance and spatial distribution of marine mammals and sea turtles along the U.S. east coast. Surveys were conducted by the Northeast Fisheries Science Center (NEFSC) and the Southeast Fisheries Science Center (SEFSC). Preliminary data for this program was collected by NEFSC during 5,723 miles (9,210 kilometers) of on-effort aerial line-transect abundance surveys over the Atlantic continental shelf between Cape May, NJ and Gulf of St. Lawrence, Canada. These surveys were conducted between August 17 and September 26, 2010 (Palka 2010). The preliminary data from this survey effort was used to support the summer distribution of marine mammal species within the North Atlantic Planning Area. Information from the NOAA Northeast Fisheries Science Center's North Atlantic Right Whale Sightings Advisory System (SAS) and data reported in Duke University's Ocean Biogeographic Information System (OBIS)-SEAMAP were also used for recent sightings of North Atlantic right whales within the region. Sightings per unit of effort data for New York and New Jersey was compiled by the Nature Conservancy for their comprehensive NAM ERA report. The underlying data sources for these maps are the U.S. Navy's Marine Resource Assessment, which in turn, utilized NMFS survey data from 1979 - 2003.

3.1.1 North Atlantic Right Whale

3.1.1.1 Status

The North Atlantic right whale was listed as federally endangered under the ESA in 1970 (NMFS 2012a). Currently, the minimum population is estimated between 350 and 400 individuals and is globally considered one of the most critically endangered large whale populations, although recent data suggests a slight positive trend in population size (Waring *et al.,et al.,* 2011).

3.1.1.2 Description

The North Atlantic right whale is a species of baleen whale that feeds primarily on zooplankton such as large copepods (*Calanus finmarchicus*), smaller copepods, krill and barnacle larvae (NMFS 2004; Kenney and Vigness-Raposa 2010). Feeding is accomplished by skimming along the surface and filtering out the preferred prey through their baleen plates (NMFS 2004).

Adult North Atlantic right whales measure between 45 and 55 feet (14 and 17 meters) in length and can weigh up to 70 tons (63,503 kilograms) (NMFS 2004). The species is sexually dimorphic, with females being generally larger than males (NMFS 2004). The North Atlantic right whale has several distinguishing features including a stocky body, large head, a highly arched margin of the lower lip, and callosities in the head region (NMFS 2004).

3.1.1.3 Distribution

The North Atlantic right whale can be found in U.S. waters spanning the entire east coast from the Gulf of Maine to the waters off northeast Florida (Waring *et al.*, 2011; Kenney and Vigness-Raposa 2010). It is primarily a coastal and continental shelf species, likely due to the availability and distribution of their preferred prey item, late-stage juvenile and adult copepods in these waters (NMFS 2004; Kenny and Vigness-Raposa 2010).

Annually, the species migrates from winter calving grounds in the southern latitudes of its range to spring and summer feeding grounds in higher latitudes. During the winter right whales can be found in the nearshore waters of northeast Florida and Georgia where it is expected that reproductive females return annually to calve (NMFS 2004; Kenney and Vigness-Raposa 2010). During spring and summer months, right whales migrate north to the productive waters of the northeast region to feed and nurse their young. Within the northeast region feeding habitats have been observed off the coast of Massachusetts, at Georges Bank, the Great South Channel, in the Gulf of Maine and over the Scotian Shelf (Waring *et al.*, 2011). These feeding and calving habitats are considered high-use areas for the species.

While high-use areas have been established for the right whale, frequent travel along the east coast of the U.S. is common. Satellite tags have shown North Atlantic right whales making round-trip migrations to an area off the southeastern U.S. and back to Cape Cod Bay at least twice during the winter (Waring *et al.*, 2011).

3.1.1.4 Threats

Vessel collisions and entanglement in fishing gear cause approximately 40 percent of the North Atlantic right whale deaths (Waring *et al.*, 2011). Other threats include habitat degradation, contaminants and pollutants, climate and ecosystem change, anthropogenic disturbance and low frequency sound, predators such as large sharks or killer whales (NMFS 2004; Parks *et al.*, 2011).

3.1.1.5 Occurrence in the Project Area

New Jersey and New York WEAs

New Jersey study (NJDEP, 2010a) that found the following for North Atlantic right whales. Similar occurrences could be expected for the NY WEA which lies just north of the study area. The sighting data for both areas is in Figure 3.1.1-1b. The report stated:

> *Observed*
>
> Right whales were seen as single animals or in pairs (mean group size=1.5). Sightings occurred in water depths ranging from 17 to 26 m (56 to 85 ft) with a mean value of 22.5 m (73.8 ft). Distances from shore ranged from 19.9 to 31.9 km (10.7 to 17.2 nm) with a mean of 23.7 km (12.8 nm). Right whales were seen in winter, spring, and fall in waters with SST ranging from 5.5 to 12.2 degrees Celsius (°C); 41.9 to 54.0 degrees Fahrenheit (°F); mean 10.0°C (50.0°F)). Three sightings were recorded during November, December, and January when right whales are known to be on the breeding/calving grounds farther south (Winn et al., 1986) or in the Gulf of Maine (Cole et al., 2009). The November 2008 sighting just south of the Study Area boundary was of an adult female who must have been migrating through the Study Area on her way to the calving grounds because she was sighted in mid-December 2008 off the coast of Florida (Zani, M., New England Aquarium, pers.comm., 14 January 2009). The sighting recorded in December 2009 near the southern boundary of the Study Area (water depth of 25 m/82 ft) was also of a female that was later sighted off the coast of Georgia in early January 2010 (Zani, M., New England Aquarium, pers. comm., 11 January 2010). Initially, two sightings of right whales were recorded close together in both time and space. Subsequent photo-identification analyses indicate that these sightings were of the same individual North Atlantic right whale. Therefore, the first sighting of this individual is considered the original sighting, and the second sighting is considered a re-sight of the individual. The January 2009 sighting was of two adult males; these whales were sighted offshore of Barnegat Light in the northernmost portion of the Study Area. The whales exhibited feeding behavior (i.e., surface skimming with mouths open) in 26 m (85 ft) of water; however, actual feeding could not be confirmed. During May 2008, a cow-calf pair was recorded in waters near the 17 m (56 ft) isobath southeast of Atlantic City. The pair was sighted in the southeast U.S. in January and February prior to the May sighting, and they were sighted in the Bay of Fundy in August (Zani, M., New England Aquarium, pers. comm., 6 January 2010).
>
> *Passive Acoustic Monitoring*
>
> Analysis of recordings captured in the Study Area during the baseline study period demonstrated North Atlantic right whale occurrence throughout the year, with a peak number of detection days in March through June (46 days in 2008, 10 in 2009 although June was not represented in 2009). North Atlantic right whales were also detected sporadically in the eastern and northern areas of the Study Area during the summer through the fall in 2008 (two days detected during July, five in August, five in September, one in October, six in November, and one in December) and in 2009 (three in August, six in September, four in October, and one in November). Nine days of detection (mid-January to mid-March 2009) resulted from the December 2008 PAM deployment even though only two of the five deployed pop-ups were recovered. During these winter

months, the North Atlantic right whale calls were detected on the pop-up located 21.4 km (12 nm) from shore at a depth of 24 m (79 ft). Winter represents the time of year when North Atlantic right whale mothers and calves are found off the southeast U.S. coast (mainly off northern Florida and southern Georgia; Hamilton and Mayo, 1990; Hain et al., 1992; Knowlton et al., 1992), but it is unknown where the majority of North Atlantic right whale males and females without calves spend their time during this season. Very little data are represented from the migratory corridor (i.e., the eastern U.S. coast from New Jersey to Virginia) between the southern calving grounds and the northern feeding grounds for comparison (Mead, 1986; Knowlton et al., 1992; McLellan et al., 2002); however, these winter detection days are inconsistent with current distribution data.

Rhode Island and Massachusetts WEAs

The MA WEA and the RI/MA WEA are 15 miles (13 nm) from the south coast of Martha's Vineyard, Massachusetts. Although outside all of the major high use habitat areas, the RI/MA and MA WEAs may be used to transit between habitats.

Sightings per unit effort (SPUE)

All SPUE data for right whales in the RI/MA and MA WEAs are from 1828 to 2009, provided by the Right Whale Consortium, (2012) and plotted in Figure 3.1.2-1a. The vast majority of sightings were from the 1970's to 2009; however, the historic data was included to capture all areas of potential use by this species. Since whales may be sensitive to anthropogenic noise at long distances from the source (Madsen *et al.,* 2006; Nieukirk *et al.,* 2004), the occurrence of this species (and the other large whale species in this section of the report) will be reported for the RI/MA and MA WEAs (within the delineated WEAs) as well as in an expanded area within 40 nm from the WEA boundaries.

Within 40 nm of the RI/MA and MA WEAs boundary, SPUE for right whales were highest in the spring with several locations ranging from 0.5 to 100 whales per 1,000 km (Figure 3.1.1-1a). SPUE were lower in the summer with two locations near Nantucket ranging from 0.5 to 25 whales per 1,000 km, followed by one location in the fall and one location in the winter (Figure 3.1.1-1a). Figure 3.1.1-1a does not include 2010 or 2011, both years in which high numbers of right whales were observed both in the RI/MA and MA WEAs and within 40 nm to the west of the RI/MA and MA WEAs (Khan *et al.,* 2011; NMFS NEFSC, 2010). 2010 and 2011 sightings data are included in Figures 3.1.1-4, 3.1.1-5, and 3.1.1-6.

According to Kenney and Vigness-Raposa (2010), the highest occurrence of right whales within the Rhode Island Ocean SAMP study area (from the middle of Long Island to outer Cape Cod and south to 39°15') was in the spring (58% of all sightings), with less in the winter (19%) and summer (16%), and relatively low occurrence in the fall (4.5%). Kenney and Vigness-Raposa, (2010) also indicated that this pattern likely reflects migration from winter grounds to feeding grounds. According to Kenney and Vigness-Raposa (2010), migratory whales are likely to be less detectable and therefore this species may be occurring with greater frequency than determined from surveys.

Mate *et al.,* (1997) radio-tagged right whales in the Bay of Fundy and tracked their movements in the western North Atlantic in 1990 and 1991. Satellite-acquired positions of the nine whales tagged (six females, one pregnant and three with calves, two males, and one juvenile) are shown on Figure 3.1.1-2, showing that right whales occurred in the RI/MA and MA WEAs (Mate *et al.,* 1997). Figure 3.1.1-3 shows the movements of the three females with calves and the pregnant female, tracked for 7 to 42 days (Mate *et al.,* 1997). Although these monitoring data occurred over a relatively short period of time, they show the relatively high mobility in the western North Atlantic region and the use of the RI/MA and MA WEAs.

Supplemental to the above maps, are summaries of right whale sightings from two separate but overlapping sources, New England Aquarium and NMFS North Atlantic Right Whale Sightings Surveys (NARWSS). Right whale survey sightings were mapped for each year from 1978 to 2003 by the GIS group at the New England Aquarium. A summary of these sightings within 40nm of the RI/MA and MA WEAs is presented in Table 3.1-2. The first year that the survey included the RI/MA and MA WEAs was 1991. From 1991 to 2003, right whale sightings have been recorded for most years even with the relatively low survey effort (i.e. a single track line in the early 1990's) specifically in the RI/MA and MA WEAs, or the Nantucket Shoals.

Table 3.1-2
Summary of Right Whale Aerial Surveys. Surveys in months which at least one right whale aerial survey was conducted within 40 nm of the RI/MA and MA WEAs.

*Year Surveyed	Months Surveyed	Number of Tracklines	Right Whale Sighted within 40 nm of the RI/MA & MA WEAs (Month)
1991	May – July	1	June
1992	April – August	1	
1993	June – August	1	
1995	June – September	Multiple	
1998	April – August	Multiple	April
1999	February – June	Multiple	February, March
2000	February – May; August – September	Multiple	January, February, March
2001	February – July	Multiple	
2002	February – November	Multiple	May, June
2003	March – December	Multiple	

Source: NEAQ GIS Group, 2012.
*This study included right whale surveys in various locations within the Northwest Atlantic from 1978 -2003

NMFS NARWSS reports document right whale survey sightings from 2002 to present and are summarized in Table 3.1-3. These reports showed very high numbers in 2010 and 2011 in the nearby waters to the west of the RI/MA and MA WEAs (Table 3.1-3). In 2010, the whales were observed in the RI/MA and MA WEAs and within 40nm northwest of the RI/MA and MA WEAs, and in 2011 the whales were also observed in the RI/MA and MA WEAs and in the adjacent waters to the west of the RI/MA and MA WEAs (Figures 3.1.1-4, 3.1.1-5, and 3.1.1-6). The 2010 event, with a total of 98 whales, triggered implementation of a dynamic management area (DMA), which encompassed the RI/MA and MA WEAs. DMAs were also implemented off Nantucket in February, March, and April, 2010 (Khan *et al.*, 2011). DMAs are triggered when three or more right whales are sighted outside of a special management area (SMA). "DMAs are put in place for two weeks and encompass an area commensurate to the number of whales present. Mariners are notified of DMAs via email, the internet, Broadcast Notice to Mariners (BNM), NOAA Weather Radio, and the Mandatory Ship Reporting system (MSR), and are requested to reduce their speed when transiting through DMAs. Unlike SMAs, compliance is voluntary for DMAs" (Khan *et al.,* 2011). NMFS NARWSS data indicate that the waters within the RI/MA and MA WEAs and out to 40 nm from the RI/MA and MA WEAs are at a minimum an occasional area of use, and possibly a regularly utilized area. However, due to the relatively low survey effort prior to these most recent reports, more data are needed for a more definitive summary of right whale abundance in this area.

Table 3.1-3
Summary of confirmed right whale sightings. Data compiled from National Marine Fisheries Service, North Atlantic Right Whale Sightings Survey (NMFS NARWSS) Reports from 2002 to 2011.

NARWSS Report Year	Months Project Area surveyed	[1]SPUE (per nm surveyed) or Number of sightings within 40 nm of the in Project Area	Reference[2]
2002	March – July; September-November	SPUE = low (<0.25)	Cole *et al.*, 2007
2003	April - December	1-4 Sightings	Rone *et al.*, 2007a
2004	February – July; September – December	1-4 Sightings	Rone *et al.*, 2007b
2005	April - December	1-2 Sightings	Niemeyer *et al.*, 2007a
2006	January - December	1-2 Sightings	Niemeyer *et al.*, 2007b
2007	January – March (only 1 transect line)	2-4 Sightings	Niemeyer *et al.*, 2008
2008	0	1 Sighting (source = whale watch)	Khan *et al.*, 2009
2009	0	0	Khan *et al.*, 2010
2010	April – June	21 Sightings (98 whales)[3,4]	Khan *et al.*, 2011
2011	NA	1-25 whales at 10 sightings locations	NMFS NEFSC 2012[5]

[1]Sightings reported as SPUE in 2002 and by count from 2003-2011; depending on presentation in report.
[2]Sightings sources include aerial and shipboard surveys, whale watches, and opportunistic (i.e. the general public, Coast Guard, commercial ships, and fishing vessels). Unconfirmed reports were not included in the report.
[3]DMA (triggered by ≥3 right whales outside a SMA) in Rhode Island Sound, April – May.
[4] Source: Kenney and Vigness-Raposa, 2010
[5]Sightings map (October 2010- June 2011) only, report not available yet.

Right whale sightings in the RI/MA and MA WEAs during 1998, 2010, and 2011

Kenney and Vigness-Raposa (2010) described what they called an "aggregation of feeding right whales just east of Block Island in April 1998" that lasted for at least three weeks. Eighteen whales were identified either against the right whale catalog or as uncataloged individuals that were seen on multiple days. Most individuals were males. The rate of resightings was low, however, and it is suspected that there were substantially more than 18 individuals feeding in Rhode Island Sound during this period. Observers were not able to determine the spatial extent of this high-use area. Knowlton *et al.*, (2005) noted that six individuals observed in Block Island Sound in 1998 had actually been recorded earlier in the year in the traditional winter/spring feeding grounds of Cape Cod Bay. No further sightings of these particular individuals were made until they reached the Bay of Fundy in the summer.

During the week of April 23, 2010, 98 right whales were reported feeding in the waters between Martha's Vineyard and Block Island (Figure 3.1-4; Khan *et al.*, 2011). From October 2010 through September 2011, a relatively high number of right whales were observed at ten sightings locations ranging from one to 25 right whales at each location within the RI/MA and MA WEAs (Figures 3.1.1-4, 3.1.1-5, and 3.1.1-6; NMFS NEFSC, 2012).

Right whale strandings in Massachusetts and Rhode Island

Although the stranding location of a whale is not necessarily indicative of the location or area inhabited by the whale, strandings data for the south coast of Massachusetts and Rhode Island are included for two reasons: 1) as potentially showing a whale's presence in the area, and 2) as a baseline for serious injuries and mortalities to this species to be used when assessing potential impacts. Five right whale strandings have been recorded in the vicinity of the RI/MA and MA WEAs from south of Block Island to Monomoy Island, Massachusetts from 2000 to 2009 (Table 3.1-4).

Table 3.1-4
Records of right whales strandings from 2000 to 2009.

Date	Location	Cause of Mortality
19 January 2000	15 km southeast of Block Island, RI	Not determined
12 October 2002	Nantucket, MA	Entangled in fishery gear
28 April 2005	Monomoy Island, MA	Ship strike
13 May 2005	39 km south of Martha's Vineyard, MA	Not determined
21 May 2006	56 km south of Block Island, RI	Not determined

Source: Kenney and Vigness-Raposa, 2010; Henry *et al.*, 2011

In summary, North Atlantic right whales were rare (SPUE 0.1 to 25 whales per 1,000 km) within 40 nm of the RI/MA and MA WEAs through 2010 during the winter, summer, and fall, and were most abundant (SPUE as high as 50 to100 whales per 1,000 km) in the spring (Right Whale Consortium, 2012). Periods of high right whale activity in or near the RI/MA and MA WEAs during 1998, 2010, and 2011 demonstrate that the current knowledge of migratory and feeding activities is incomplete, and that there is interannual variability in the timing and location of these activities.

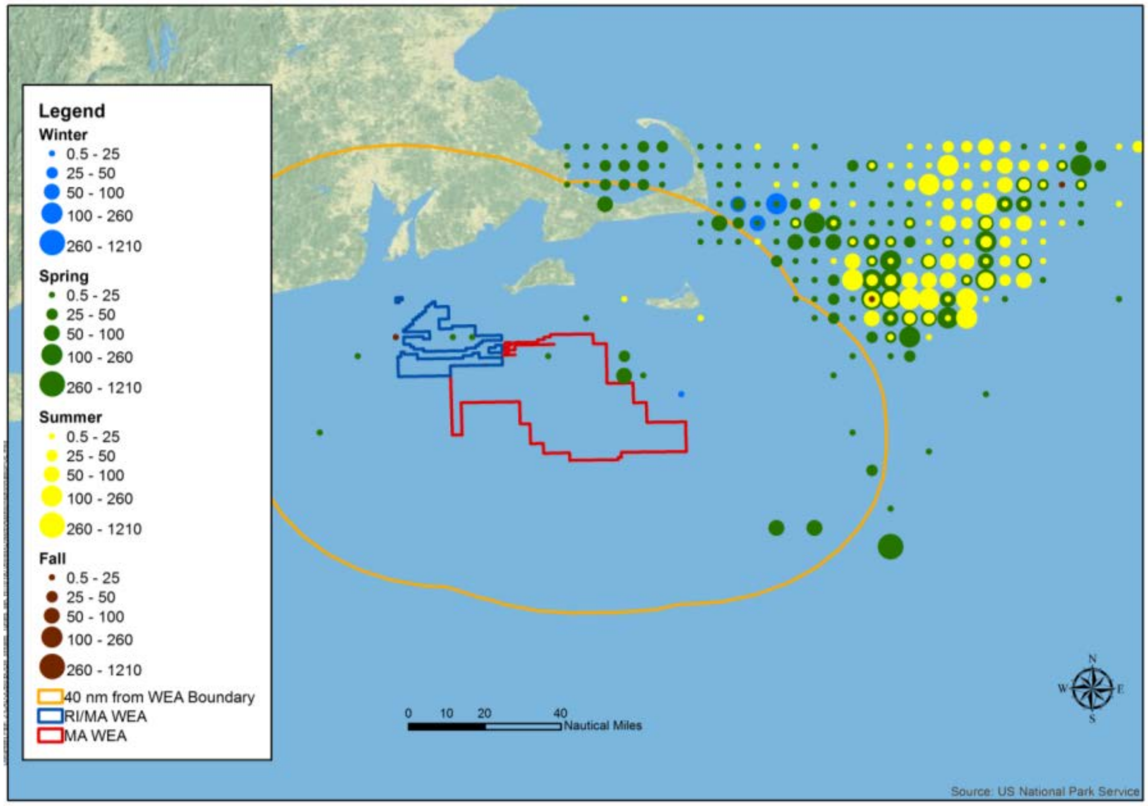


Figure 3.1.1-1a: SPUE for North Atlantic right whales. Map depicts RI/MA and MA WEAs and surrounding waters (40 nm from the action area outlined in orange for reference).

Note: Data Source Right Whale Consortium, 2012. Map provided by Normandeau Associates, Inc.

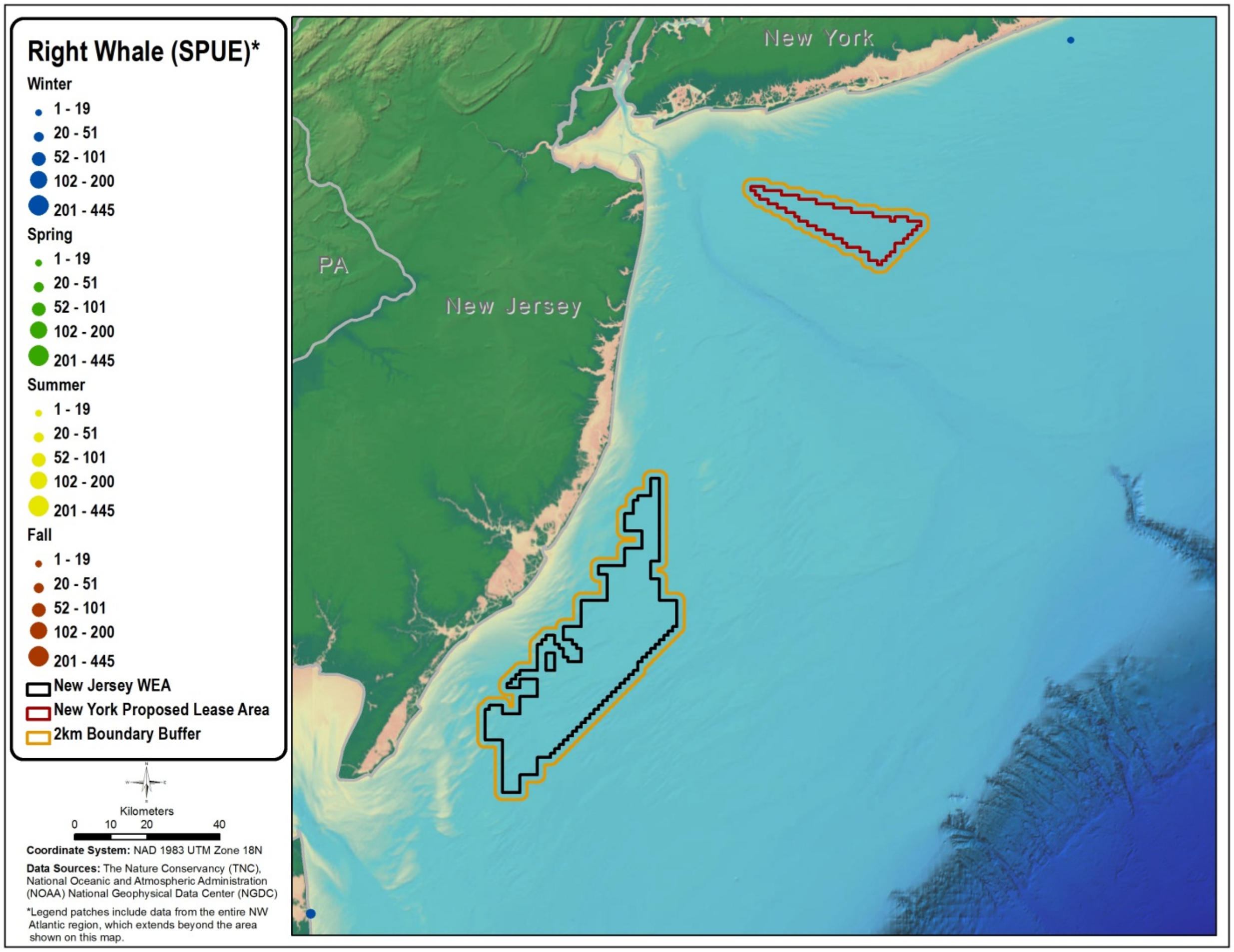


Figure 3.1.1-1b: SPUE for North Atlantic right whales. Map depicts New York and New Jersey areas and surrounding waters (2 km from the action area outlined in orange for reference).

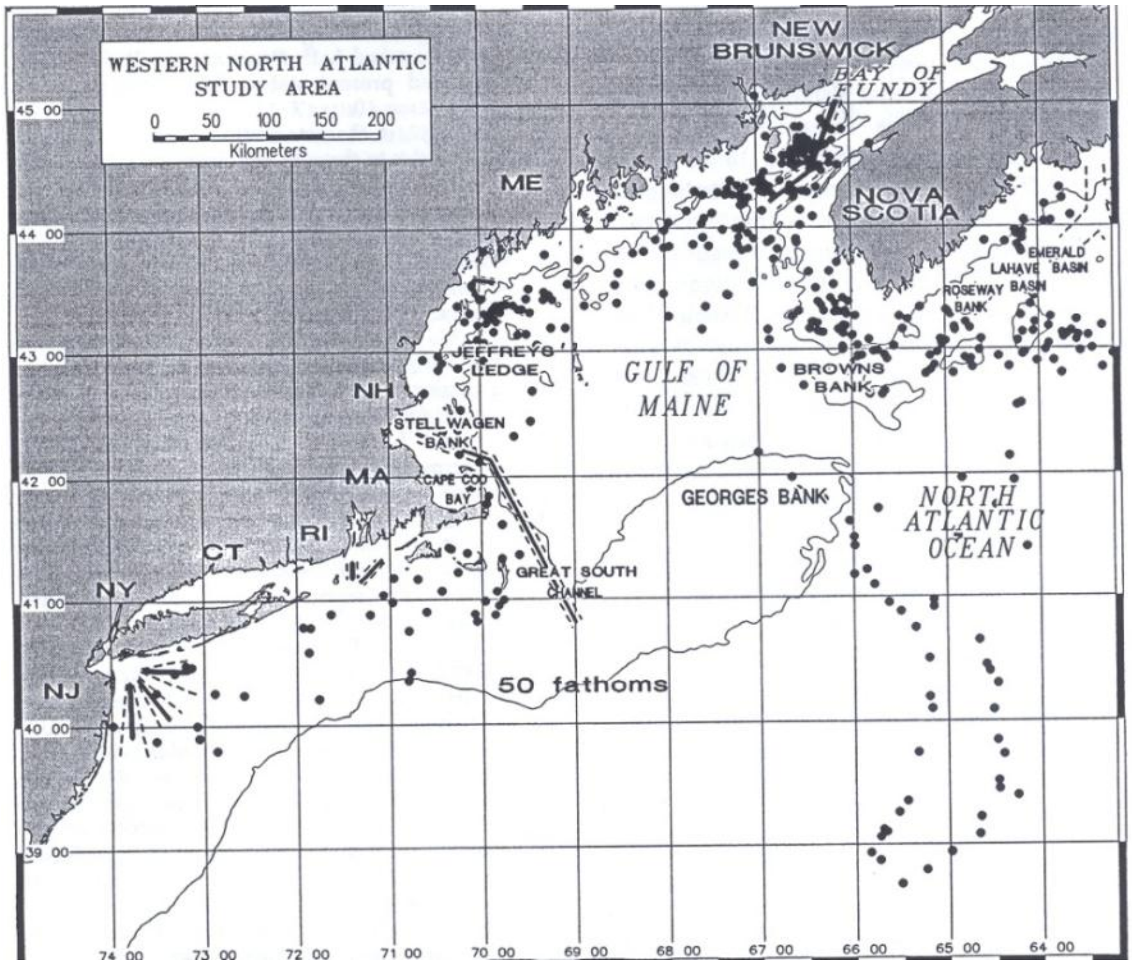


Figure 3.1.1-2: Satellite-acquired locations for 9 right whales. Whales tagged in the Bay of Fundy from 1989-1991, tagging data ranged from 7 to 42 days (Mate *et al.,* 1997).

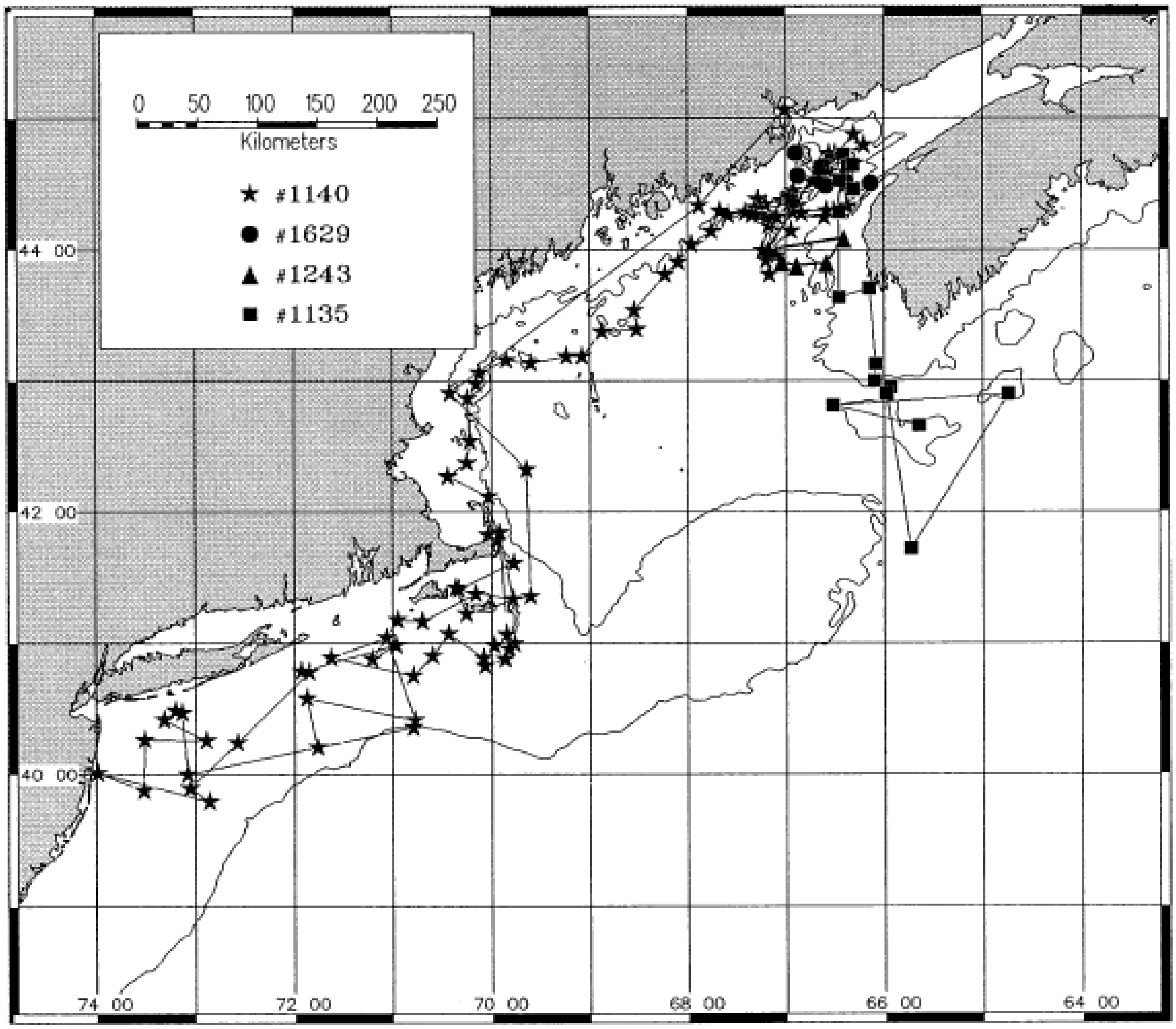


Figure 3.1.1-3: Satellite-monitored movements of 4 female right whales radiotagged.

Note: In the Bay of Fundy in 1990 and 1991, including a pregnant female (#1135 tagged for 7 days) and 3 female with calves (#1140 tagged for 42 days, #1629 tagged for 10 days, and #1243 tagged for 10 days, Mate *et al.*, 1997).

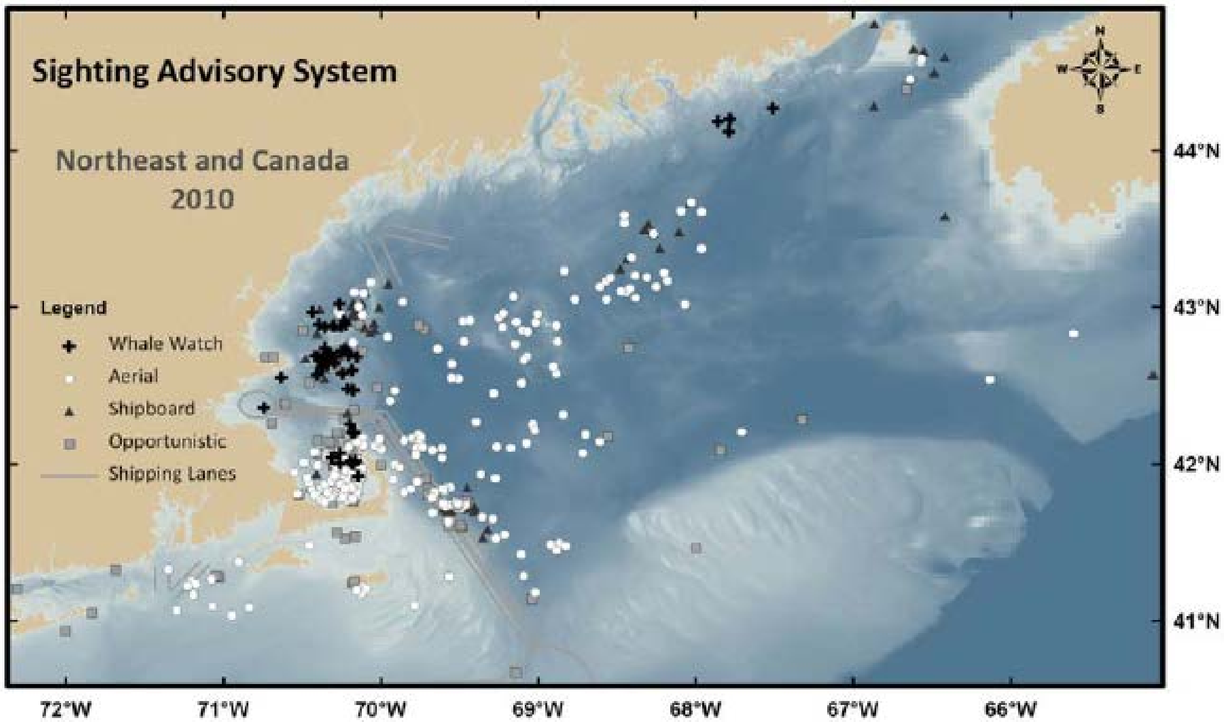


Figure 3.1.1-4: Locations of all right whale sightings reported to the Right Whale Sightings Advisory System.

Note: (RWSAS) within Northeast US and Canadian waters in 2010, shown by reporting source. The category 'Opportunistic' includes reports made by the general public, the Coast Guard, commercial ships, and fishing vessels. Unconfirmed reports were excluded from this figure (Khan *et al.*, 2011).

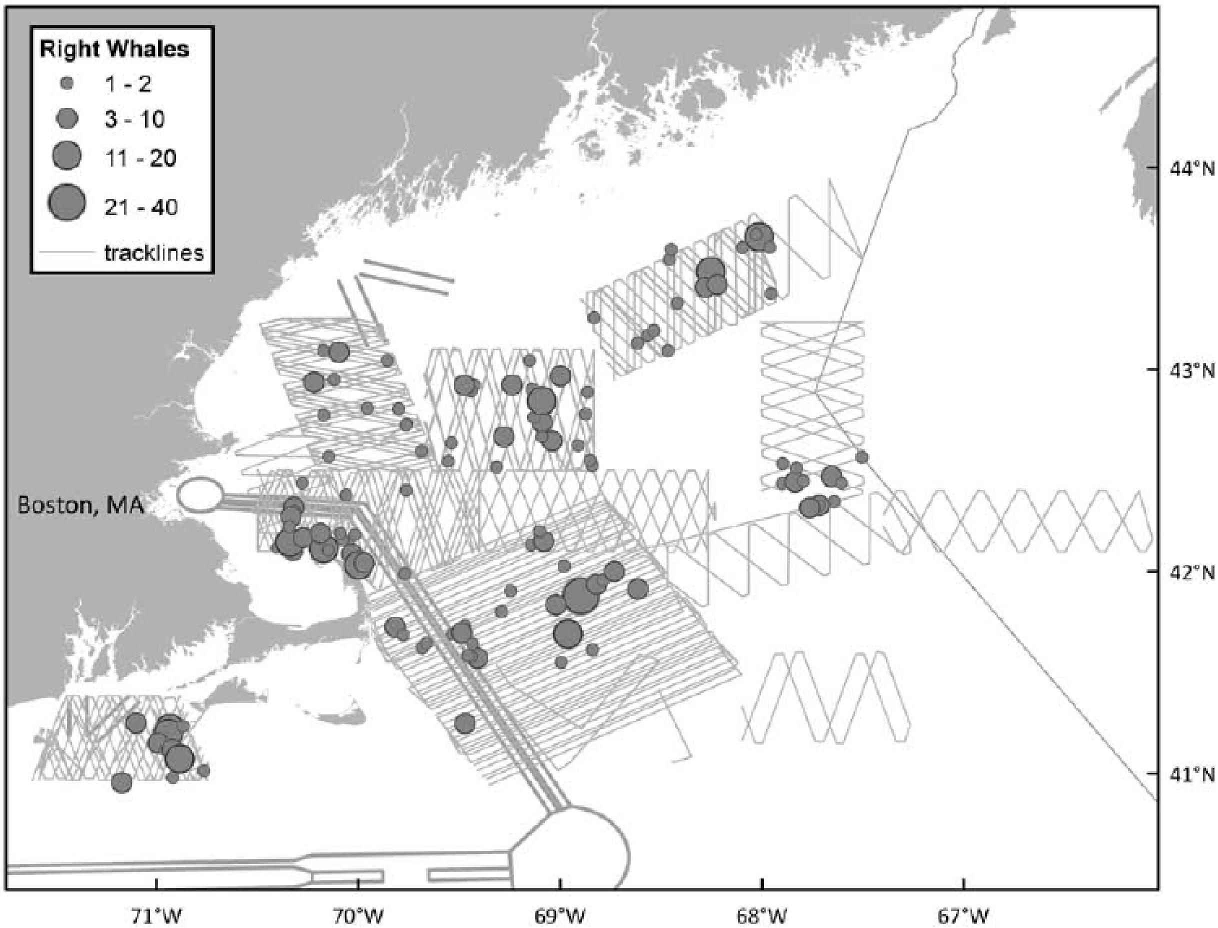


Figure 3.1.1-5. North Atlantic right whale aerial survey. Results from October 2010 through September 2011 (NMFS NEFSC, 2012).

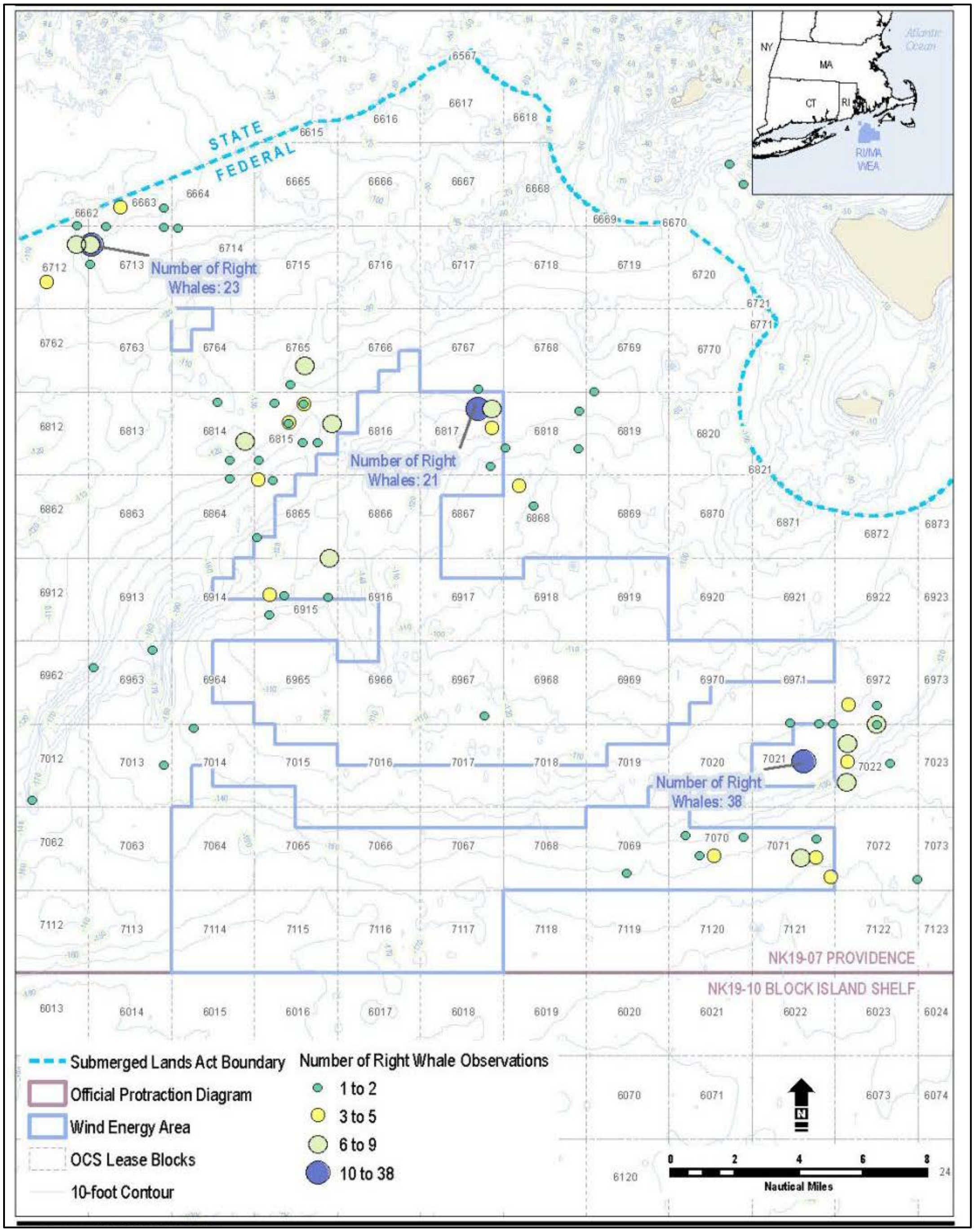


Figure 3.1.1-6. North Atlantic Right Whale Observations within the RI WEA April 2010. Map provided by Ecology and Environment Inc.

3.1.1.6 Critical Habitat

No critical habitat exists for the North Atlantic right whale within the Project Area and its surrounding waters. The closest critical habitat near the Project Area is the Great South Channel east of Cape Cod. Critical habitat is also located in Cape Cod Bay, and in coastal Florida and Georgia from the Sebastian Inlet to the Altamaha River (NMFS 2004; NMFS 2012a).

3.1.2 Humpback Whale

3.1.2.1 Status

The humpback whale was listed as federally endangered under the ESA in 1970 (NMFS 1991). According to tagging data the North Atlantic population of the humpback whale is estimated to be composed of 4,894 males and 2,804 females. However this population estimate is thought to be an underestimate because the sex ratio of the species is known to be even (Waring *et al.,* 2011).

3.1.2.2 Description

The humpback whale is a species of baleen whale that feeds primarily on krill and small fish such as herring (*Clupea harengusy*), sand lance (*Ammodytes americanus*), and capelin (*Mallotus villosus*). Feeding is accomplished by gulping large amounts of water and filtering out their preferred prey thought the baleen plates (Kenny and Vigness-Raposa 2010; NMFS 1991).

Adult male and female humpback whales measure 40 to 48 feet (12.2 and 14.6 meters) and 25 to 50 feet (13.7 to 15. 2 meters) in length, respectively. Both sexes weigh from 25 to 40 tons (22,680 to 36,287 kilograms) (ACS 2004a). The humpback whale has several distinguishing features including particularly long flippers (average about 1/3 total body length), a robust body, and dark coloring on the back, contrasted by white pigmentation on the side and ventral surface of the body, flukes and flippers (NMFS 1991).

3.1.2.3 Distribution

Humpback whales can be found in U.S. waters spanning the entire east coast from the Gulf of Maine to the waters off Florida (Waring *et al.,* 2011). They are also known to occur in waters north of the Gulf of Maine such as the Gulf of St. Lawrence, Newfoundland/Labrador during the spring, summer, and fall to feed (Waring *et al.,* 2011). During winter months, humpback whales from all of the northern feeding locations migrate south to the West Indies to mate and calve (Waring *et al.,* 2011).

The distribution of humpback whales in the northeast is thought to be greatly dependent on the distribution of its Gulf of Maine prey species - herring and sand lance (Kenney and Vigness-Raposa 2010). Shifts in prey abundance have been correlated with shifts in humpback distribution between the Gulf of Maine and Cape Cod Bay/east of Cape Cod (Kenney and Vigness-Raposa 2010).

3.1.2.4 Threats

Threats to humpback whales include vessel collisions, entanglement in fishing gear, disturbance from anthropogenic noise (specifically low frequency sound), pollutants and contaminants, habitat degradation, and overfishing of the animals prey base (NMFS 1991). Vessel collisions and entanglement in fishing gear are likely the main cause of humpback mortality (Waring *et al.,* 2011).

3.1.2.5 Occurrence in the Project Area

New Jersey and New York WEAs

New Jersey study (NJDEP, 2010a) that found the following for humpback whales. Similar occurrences could be expected for the NY WEA which lies just north of the study area.

Figure 3.1.2-1b shows the limited SPUE data for NY and NJ areas. The report included more detailed information including:

Observed

Humpback whales are known to occur regularly throughout the year in the Mid-Atlantic and may occur in the Study Area year-round. Seventeen sightings of humpback whales were recorded during the study period; seven of these were off-effort and 10 were on-effort. Humpback whales were sighted during all seasons; the majority of sightings (nine) were recorded during winter. Humpback whales were sighted as single animals or in pairs (mean group size=1.2). Distance from shore ranged from 4.8 to 33.2 km (2.6 to 18.0 nm; mean=18.4 km/9.9 nm). In mid-September 2008, a mixed species aggregation of a fin and humpback whale was recorded south of Atlantic City. The humpback whale was observed lunge feeding in the vicinity of the fin whale; the water depth of this sighting was 15 m (49 ft). Humpback whale sightings occurred at water depths ranging from 12 to 29 m (39 to 95 ft) with a mean depth of 20.5 m (67.3 ft). This species was sighted in waters with SST ranging from 4.7°C to 19.5°C (40.5 to 67.1°F; mean 10.1°C [50.2°F]).

Rhode Island and Massachusetts WEAs

Within the Gulf of Maine region and south, humpback whales are distributed across the continental shelf, especially during the spring. During the summer, sightings are more common in the eastern half of the Rhode Island Ocean SAMP study area (Figure 3.1-2; Kenney and Vigness-Raposa, 2010). This species occurs in this region throughout the year, with 71% of all sightings (including whale watching records) occurring in the summer, 16% in the spring, 10% in the fall, and 3% in the winter (Kenney and Vigness-Raposa, 2010). Within the Rhode Island Ocean SAMP study area, humpback whales are likely to be relatively rare in most years, but may be locally abundant in other years (Kenney and Vigness-Raposa, 2010).

Regionally, SPUE for humpback whales were highest in the Great South Channel during summer and fall, with levels ranging from 0.2 to 1,090 whales per 1,000 km (Right Whale Consortium, 2012; Figure 3.1.2-1a). Within the RI/MA and MA WEAs, SPUE were more scattered, and ranged from 0.2 to 40 whales per 1,000 km in the spring, 40 to 100 whales per 1,000 km in the winter, and 100 to 200 whales per 1,000 km in the summer (Right Whale Consortium, 2012). Within 40 nm of the RI/MA and MA WEAs, humpback whale sightings were higher in the winter, spring, and fall with SPUE ranging from 40 to 100 whales per 1,000 km, and lower in the summer (SPUE ranging from 0.2 to 40 whales per 1,000 km; Right Whale Consortium, 2012; Figure 3.1.2-1a).

Humpback whales have stranded relatively frequently in recent years. Over the past decades, there have been 13 humpback whale strandings recorded off Massachusetts and Rhode Island (Table 3.1-4). Four of the strandings were recorded in Rhode Island from 2001 to 2005, and nine were recorded in within Massachusetts waters (Waring *et al.,* 2011; Kenney and Vigness-Raposa, 2010).

Table 3.1-5
Record of humpback whale strandings or serious injury/mortality in Massachusetts and Rhode Island for the past decades.

Date	Location	[1]Cause of serious injury or mortality or [2]Stranding
22 June 2001	Newport, RI	Stranding
10 August 2001	Middletown, RI	Stranding
3 June 2004	Charlestown, RI	Stranding
6 July 2005	Newport, RI	Stranding
October 1987	[3]Massachusetts Islands	Stranding
November 1988	Massachusetts Islands	Stranding
January 1991	Massachusetts Islands	Stranding
June 1992	Massachusetts Islands	Stranding
6 September 2006	East of Cape Cod	Fisheries entanglement
13 May 2007	Rockport, MA	Ship strike
24 June 2007	Stellwagen Bank	Ship strike
8 July 2008	Off Nauset, MA	Ship strike
21 August 2008	Off Chatham, MA	Fisheries entanglement

[1]Waring *et al.*, 2011.
[2] Kenney and Vigness-Raposa, 2010.
[3]More specific information regarding which of the "Massachusetts Islands" on which these strandings took place was not available. There are multiple islands off Massachusetts, and those referred to here are not necessarily Martha's Vineyard or Nantucket.

3.1.2.6 Critical Habitat

Critical habitat has not been designated for the humpback whale (NMFS 1991).

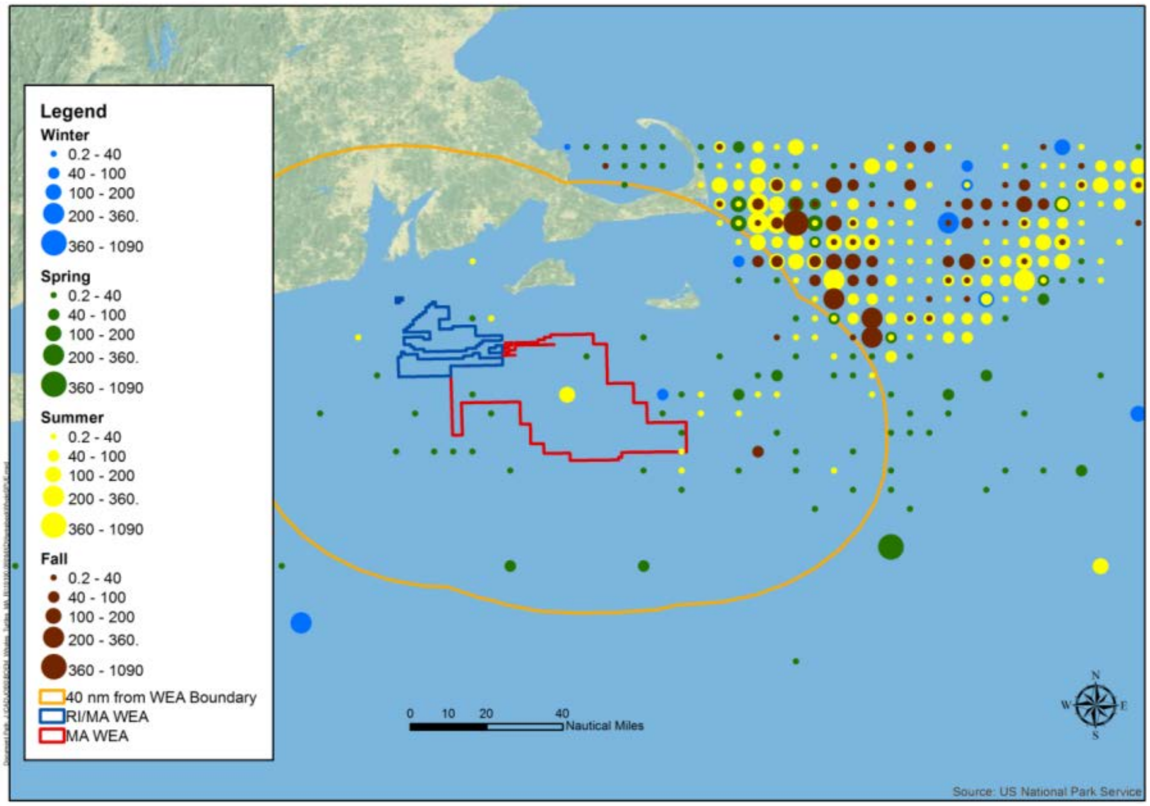


Figure 3.1.2-1a. SPUE for humpback whales. Map depicts the RI/MA and MA WEAs and surrounding waters (40 nm from the action area outlined in orange for reference).

Note: Data Source Right Whale Consortium, 2012. Map provided by Normandeau Associates Inc.

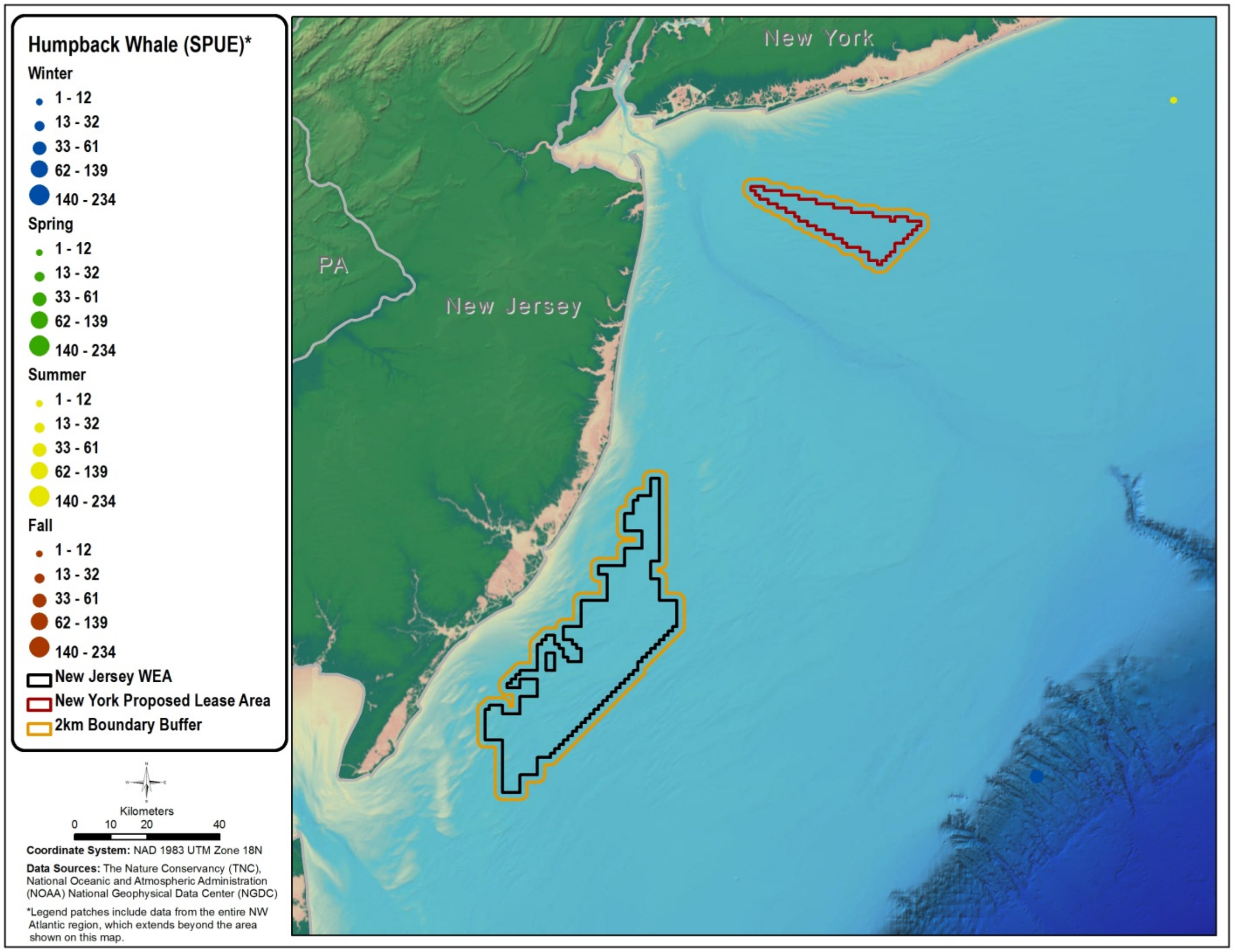


Figure 3.1.2-1b. SPUE for humpback whales. Map depicts the NY and NJ areas and surrounding waters (2 km from the action area outlined in orange for reference).

3.1.3 Fin Whale

3.1.3.1 Status

The fin whale was listed as federally endangered under the ESA in 1970 (NMFS 2011b). Based on surveys conducted in 2006 and 2007, the best abundance estimate for the western North Atlantic stock is 3,985 individuals (Waring *et al.*, 2011).

3.1.3.2 Description

The fin whale is a species of baleen whale that feeds primarily on krill and small schooling fish, such as herring, sand lance and capelin (NMFS 2010b). Feeding is accomplished by gulping large amounts of water and filtering out their preferred prey through the baleen plates (Kenny and Vigness-Raposa 2010).

The fin whale is the second largest whale species in length measuring up to 78 feet (24 meters) in the northern hemisphere and 88 feet (26.8 meters) in the southern hemisphere (NMFS 2010b). The fin whale has several distinguishing features including a sleek, streamlined body form, dorsal fin located between two-thirds and three-quarters of the way back on the body, and a distinct ridge along the back between the dorsal fin and the fluke (Kenney and Vigness-Raposa 2010).

3.1.3.3 Distribution

Fin whales are widely distributed throughout the North Atlantic. Within U.S. waters they can occur from the Gulf of Maine to the Gulf of Mexico (NMFS 2010b). Primarily they are found between the Gulf of Maine and Cape Hatteras (Waring *et al.,* 2011). Fin whales are one of the most commonly observed large whales. During surveys conducted between 1978 and 1982 fin whales accounted for 46 percent of the large whales observed (CETAP 1982, Waring *et al.,* 2011). Mass migratory movements along a defined migratory corridor have not been supported by sightings (NMFS 2010b). However, acoustic data have indicated a “southward flow pattern” occurring in the fall from the Labrador/Newfoundland area, past Bermuda, and to the West Indies (NMFS 2010b).

Off the coast of the eastern United States, fin whales are generally centered over the 328 foot (100 meter) isobath but have been sighted in shallower and deeper water, including submarine canyons off the continental shelf (NMFS 2010b). Within the northeast region, fin whales are primarily found from spring through the fall months as New England is a major feeding habitat for the population (Hain *et al.,* 1992 *as cited in* Kenney and Vigness-Raposa 2010; Waring *et al.,* 2011).

3.1.3.4 Threats

Commercial harvest for fin whales in the North Atlantic has not occurred since 1987, however, hunting (based on a catch limit system), still occur in the waters of Greenland. Other threats to fin whales include vessel collisions, reduced prey as a result of overfishing, entanglement in fishing gear, habitat degradation, and anthropogenic sound. (NMFS 2010b).

3.1.3.5 Occurrence in the Project Area

New Jersey and New York WEAs

New Jersey study (NJDEP, 2010a) that found the following for fin whales. Similar occurrences could be expected for the NY WEA which lies just north of the study area. Figure 3.1.3-1b shows fin whales sightings per unit of effort for the period 1979-2003. The NJ report echoes the greater occurrence of this species over other large whales in the area including:

> *Observed*
>
> Fin whales were the most frequently sighted large whale species during the survey period. There were a total of 37 fin whale sightings; the majority of these (27) were recorded on effort. Fin whale group size ranged from one to four animals (mean group size=1.5). Water depth for fin whale sightings ranged from 12 to 29 m (39 to 95 ft) with a mean depth of 21.5 m (70.5 ft). SSTs for these sightings ranged from 4.2 to 19.7°C (39.6 to 67.5°F) with a mean temperature of 9.6°C (49.3°F). Fin whales were sighted between 3.1 and 33.9 km (1.7 and 18.3 nm) from shore with a mean distance of 20.0 km (10.8 nm).
>
> Fin whales were sighted during all seasons. Twenty-six sightings were recorded throughout the Study Area during the 2008 surveys. Most of these sightings were recorded during the winter and summer. One mixed-species aggregation of a fin and

humpback whale was observed in September. While the humpback whale was lunge feeding, the fin whale surfaced multi-directionally but did not appear to be feeding. One calf was observed with an adult fin whale in August 2008. During the 2009 surveys, fin whales were again the most frequently sighted baleen whale species and were seen in every season except summer for a total of 11 sightings.

Passive Acoustic Monitoring

The fin whale was the most common marine mammal species detected acoustically during PAM of the Study Area. Fin whale pulses were primarily documented in the northern and eastern range of the Study Area where the shelf waters were deeper (>25 m [82 ft]) and distance from shore was greater than 25 km (13 nm). The consistent presence of fin whale pulses indicates that this species, or at least members of this species, can be regularly found along the New Jersey outer continental shelf. Fin whale pulses and downsweeps were documented in every month of acoustic monitoring. The 20-hertz (Hz) infrasonic pulses have duration of ~1 s (Thomson and Richardson, 1995; Charif et al., 2002). Automatic detection software facilitated an examination of all hard drives of data. Fin whales were detected on 47 days from March to May 2008, 62 days from June to September 2008, 31 days from October to December 2008, 57 days from January to March 2009, 16 days in April and May 2009, and 68 days from August to October 2009.

Rhode Island and Massachusetts WEAs

According to Kenney and Vigness-Raposa (2010), this species occurs throughout the continental shelf in the Rhode Island Ocean SAMP study area in all seasons, with the highest sightings in the summer (81% of all sightings), and 12% in spring. These sightings include whale watch data in addition to Right Whale Consortium survey data. Within the Rhode Island Ocean SAMP study area, the highest occurrence of fin whales is in the outer half of the area from south of Montauk Point to south of Nantucket, “in precisely the same area as the dense aggregations of sighting records from the whale watch boats” (Kenney and Vigness-Raposa, 2010). In other words, this area is targeted by whale watch boats because of the high probability of finding whales in the area.

Regionally, SPUE for fin whales were relatively high in all seasons along the 100m isobaths southeast of Cape Cod, and along the continental shelf west, south, and east of the RI/MA and MA WEAs (Right Whale Consortium, 2012; Figure 3.1.3-1). Within the RI/MA and MA WEAs, fin whales were relatively abundant in all seasons with SPUE ranging from 0.3 to 350 whales per 1,000 km in the summer, 0.3 to 135 whales per 1,000 km in the winter, 0.3 to 50 whales per 1,000 km in the spring, and 0.3 to 135 whales per 1,000 km in the fall (Right Whale Consortium, 2012; Figure 3.1.3-1).

Strandings and human caused mortalities in Massachusetts and Rhode Island

Fin whales are the most commonly stranded large whale in the Rhode Island Ocean SAMP study area, with a recorded 28 strandings from 1970 to present, and have also been common in Massachusetts (Kenney and Vigness-Raposa, 2010; Table 3.1-6). However, no fin whale strandings have been reported in Massachusetts from 2004 to 2008 (Waring *et al.*, 2011). Between 2004 and 2008, ten fin whale mortalities resulting from ship strike, were recorded from

Virginia to Canada (Waring *et al.*, 2011). From 2004 to 2008, entanglement in fishing gear caused one mortality in the RI/MA and MA WEAs region, off Martha's Vineyard, on September 26, 2007 (Waring *et al.*, 2011).

Table 3.1-6
Location of fin whale strandings in Rhode Island in the past decades.

Year of Stranding	Location (Rhode Island)
1983	Block Island
1989	Quonset Point
1991	East Matunuck State Beach
1996	Little Compton
2002	Newport
2004	Fort Adams State Park
2004	Brenton Point State Park

Source: Kenney and Vigness-Raposa, 2010

3.1.3.6 Critical Habitat

Critical habitat has not been designated for the fin whale (NMFS 2010b).

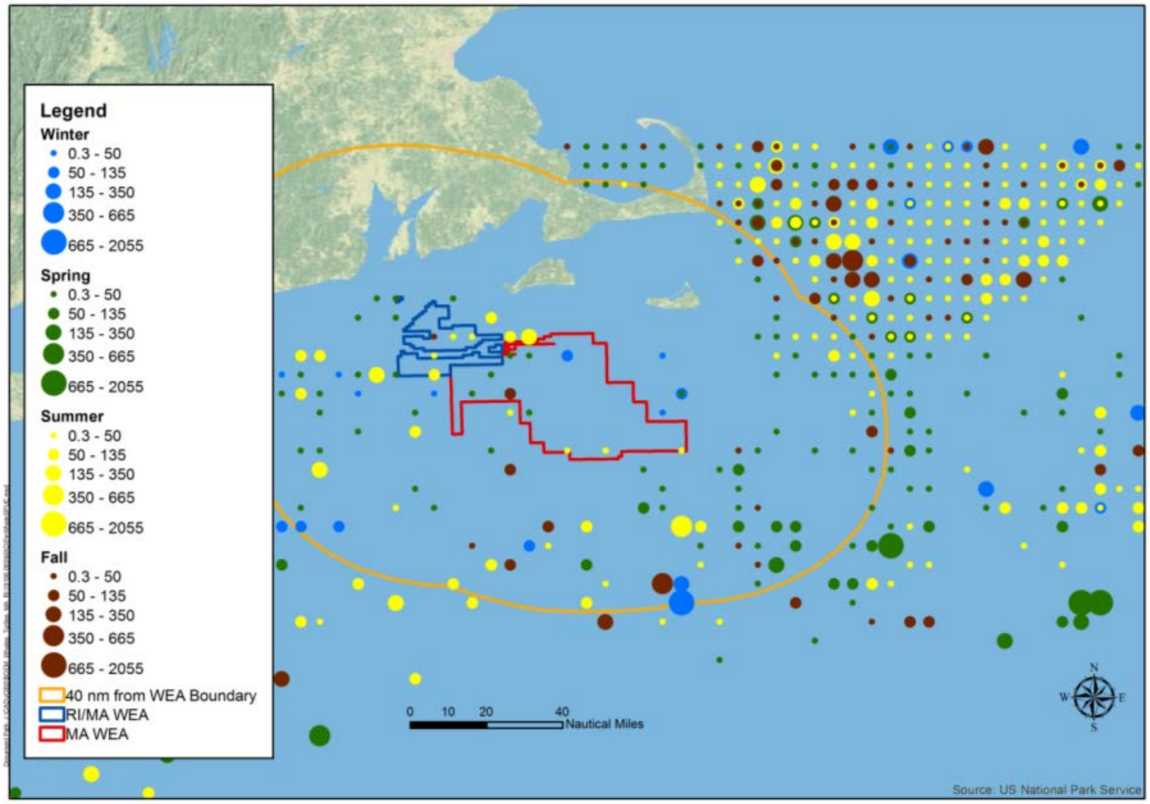


Figure 3.1.3-1a. SPUE for fin whales. Map depicts RI/MA and MA WEAs and surrounding waters (40 nm from the action area outlined in orange for reference).

Note: Data Source Right Whale Consortium, 2012. Map provided by Normandeau Associates Inc.

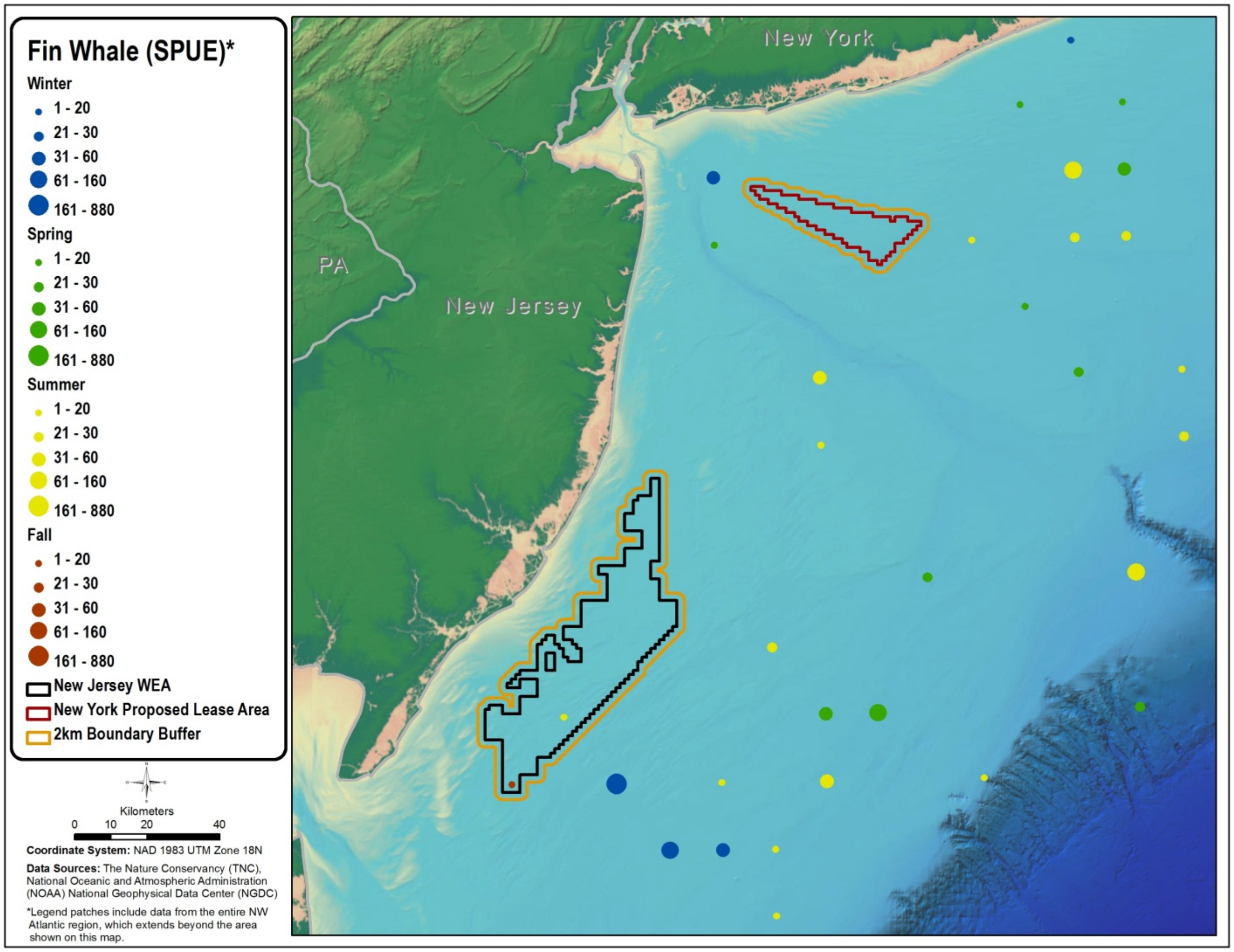


Figure 3.1.3-1b. SPUE for fin whales. Map depicts NY and NJ project areas and surrounding waters (2 km from the action area outlined in orange for reference).

3.1.4 Sei Whale

3.1.4.1 Status

The sei whale was listed as federally endangered under the ESA in 1970 (NMFS 2011a). Abundance estimates for sei whales are only reliably given for the Scotian Shelf population (386) but this does not include the Project Area (Waring *et al.*, 2011).

3.1.4.2 Description

The sei whale is a species of baleen whale that feed on plankton (e.g., copepods and krill), small schooling fish, and cephalopods (e.g., squid) by both gulping and skimming. They prefer to feed at dawn and may exhibit unpredictable behavior while foraging and feeding on prey. Sometimes seabirds are associated with the feeding frenzies of these and other large whales.

Sei whales become sexually mature at 6-12 years of age when they reach about 45 ft (13 m) in length, and generally mate and give birth during the winter in lower latitudes. Females breed every 2-3 years, with a gestation period of 11-13 months. Females give birth to a single calf that is about 15 ft (4.6 m) long and weighs about 1,500 lbs (680 kg). Calves are usually nursed for 6-9 months before being weaned on the preferred feeding grounds. Sei whales have an estimated lifespan of 50-70 years (NMFS, 2011a).

3.1.4.3 Distribution

The Nova Scotia stock of sei whales is distributed across the continental shelf waters from the northeast U.S. coast to south of Nova Scotia (Waring *et al.,* 2011) and is typically sighted on the U.S. Atlantic mid-shelf and the shelf edge and slope. Predominantly a deep water species, most commonly observed over the continental slope, shelf breaks, and deep ocean basins situated between banks (NMFS, 2011a) sei whales are also known to come inshore into more shallow waters episodically (Schilling *et al.,* 1992). According to Olsen *et al.,* (2009), sei whale's movements appear to be associated with oceanic fronts, sea surface temperatures, and specific bathymetric features. Along the U.S. Atlantic seaboard, in spring and early summer sei whales are frequently observed in areas with North Atlantic right whales in the Great South Channel and southern Gulf of Maine (NMFS, 2011a). Major changes have been noted in sei whale distribution and movements over the last few decades in the North Atlantic.

3.1.4.4 Threats

Human caused threats to sei whales include ship strikes and entanglement in fishing gear.

3.1.4.5 Occurrence in the Project Area

New Jersey and New York WEAs

Due to sei whales preference for deep offshore waters they are not anticipated to occur in the NY and NJ action areas. Neither the NJ baseline study nor the TNC NAM ERA sightings data have any record of sei whales in the NY and NJ action area. Thus BOEM considers sei whales are highly unlikely to occur in the NY and NJ action areas.

Rhode Island and Massachusetts WEAs

Past sightings in the continental shelf waters off Cape Cod include a group of at least 40 sei whales, which were part of a larger, multi-species group of whales, recorded in Hydrographer Canyon, in April 1981 (Kenney and Winn, 1987). Groups of up to 10 sei whales were recorded in the inshore waters of the southern Gulf of Maine on 30 of 67 days during the summer of 1986 (NMFS, 2011a). Baumgartner *et al.,* (2011) have observed sei whales in the Great South Channel during spring from 2004 to 2010, indicating that this species is more common in the area than previously thought.

According to Kenney and Vigness-Raposa, (2010) though sightings in southern New England are considered rare, with only 35 records in the Rhode Island Ocean SAMP study area; most sightings occurred in the spring (83%). There are two locations of note in the vicinity of the RI/MA and MA WEAs. South of Montauk and Block Island there was a small cluster of inshore sightings of individual whales during July 1981 on three different days; one in August 1982, and one in May 2003. The second noteworthy sighting was on May 7, 2001 when 23 sightings of a total of 112 whales were observed on the mid-shelf area south of Nantucket (Kenney and Vigness-Raposa, 2010).

Regionally, sei whale SPUE data from the Right Whale Consortium show the highest levels of sightings in the Great South Channel occurring in the spring and summer, and ranging from low to high (0.004 to 4,840 whales per 1,000 km; Right Whale Consortium, 2012; Figure 3.1.4-1). Within the RI/MA and MA WEAs, SPUE were at relatively low levels and scattered in all seasons, ranging from 0.004 to 25 whales per 1,000 km, with a few slightly higher in the spring (25 to 100 whales per 1,000 km; Right Whale Consortium, 2012). Within 40 nm of the RI/MA and MA WEAs, SPUE were lowest (0.004 to 25 whales per 1,000 km) in the winter, summer, and fall, and highest in the spring (ranging from 100 to 380 whales per 1,000 km; Right Whale Consortium, 2012).

There have been three reports of sei whale strandings or mortalities in the northeast U.S. area: (1) on November 17, 1994, a sei whale carcass came in on the bow of a container ship as it docked in Boston, MA; (2) in May 2001, a sei whale slid off the bow of a ship arriving in New York Harbor; and, (3) a sei whale was found off Deer Island, MA, with ship strike known as the primary cause of death (Waring *et al.*, 2011; Kenney and Vigness-Raposa, 2010). There are no known sei whale strandings in Rhode Island in recent years (Kenney and Vigness-Raposa, 2010).

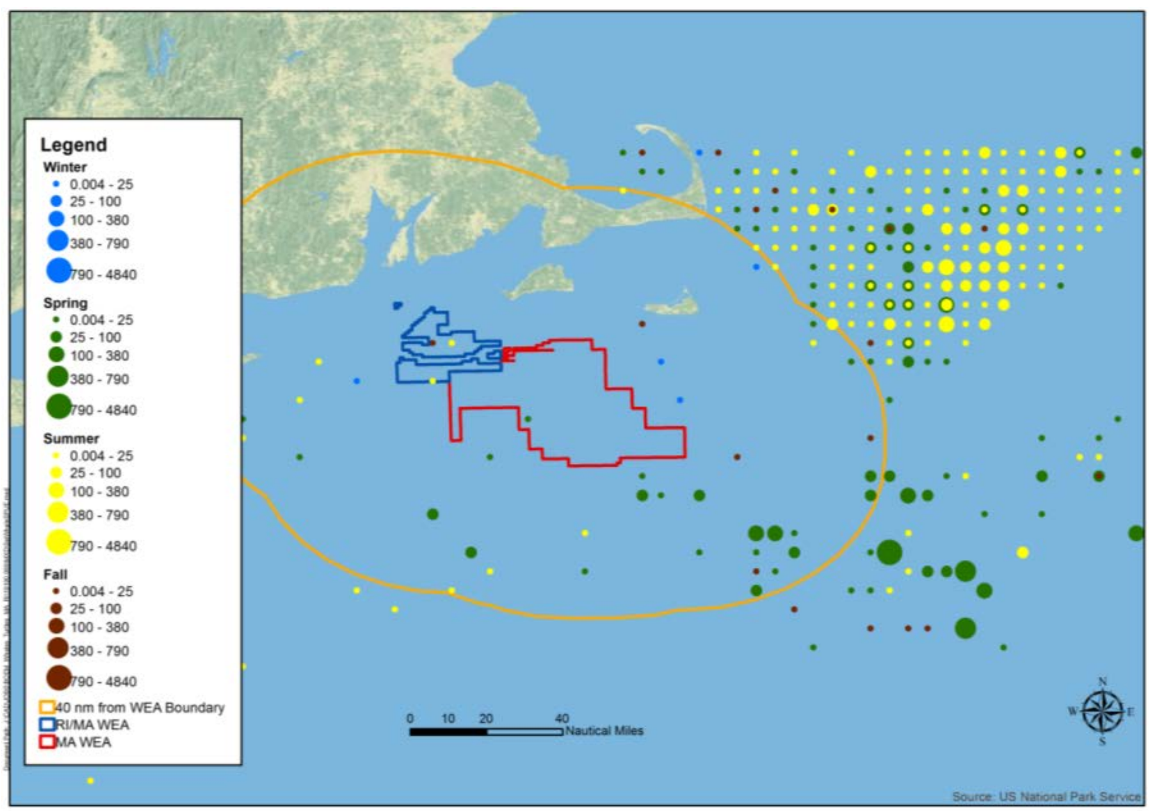


Figure 3.1.4-1a. SPUE for sei whales. Map depicts the RI/MA and MA WEAs and surrounding waters (40 nm from the action area outlined in orange for reference).

Note: Data Source Right Whale Consortium, 2012 Map provided by Normandeau Associates Inc.

3.1.5 Sperm Whale

3.1.5.1 Status

The sperm whale was listed as federally endangered under ESA in 1970 (NMFS, 2012a). The current abundance estimate for the western North Atlantic stock (Bay of Fundy to Florida) of sperm whales is 4,804. Sperm whales occurring in the North Atlantic are considered to be one stock, with those occurring in the eastern U.S. Atlantic EEZ likely representing only a fraction of the total stock (Waring *et al.,* 2011).

3.1.5.2 Description

Sperm whales (*Physeter macrocephalus*) are the largest of the odontocetes (toothed whales) and the most sexually dimorphic cetaceans, with males considerably larger than females. Adult females may grow to lengths of 36 feet (11 m) and weigh 15 tons (13607 kg). Adult males, however, reach about 52 feet (16 m) and may weigh as much as 45 tons (40823 kg). Sperm whales spend most of their time in deep waters (300-600m) and thus their diet consists of many larger organisms that also occupy deep waters of the ocean. Their principle prey are large squid weighing between 3.5 ounces and 22 pounds (0.1 kg and 10 kg), but they will also eat large demersal and mesopelagic sharks, skates, and fishes. The average dive lasts about 35 minutes and is usually down 1,312 feet (400 m), however dives may last over an hour and reach depths over 3280 feet (1000 m).

3.1.5.3 Distribution

The overall distribution of sperm whales along the U.S. east coast is centered along the shelf break and over the slope (NMFS, 2010a). Sperm whales tend to inhabit offshore waters, usually in depths of 600 m, and are uncommon in waters less than 300 m deep (NMFS, 2012a). The exception to this distribution pattern is found with a relatively high number of sightings in the shallow continental shelf waters of southern New England (Scott and Sadove, 1997). Geographic distribution may be linked to their social structure, with females and juveniles generally found in tropical and subtropical waters, and males ranging more widely (Waring *et al.,* 2011).

3.1.5.4 Threats

Although largely discontinued, commercial harvest of sperm whales was the biggest threat to its existence until the early 1980s. Other threats to sperm whales include vessel collisions, fishing gear entanglements, pollution, and exposure to anthropogenic sound (NMFS 2012a).

3.1.5.5 Occurrence in the Project Area

New Jersey and New York WEAs

Due to sperm whales preference for deep offshore waters their occurace in the NY and NJ action areas is considered highly unlikley. Figure 3.1.5-1b clearly shows this species preference for the continental shelf break, far from impacts in the action area. Neither the NJ baseline study nor the TNC NAM ERA data have any record of sperm whales in the NY and NJ action area.

Rhode Island and Massachusetts WEAs

Within the northeast U.S., this species occurs in all seasons, but is found in higher numbers in the spring and summer, with fewer in the fall and winter (Kenney and Vigness-Raposa, 2010). Within the Rhode Island Ocean SAMP study area, "sperm whales are predicted to be present in all four seasons, but in scattered and low abundance" (Kenney and Vigness-Raposa, 2010).

SPUE data supports this information, with the highest SPUE found along the continental shelf edge and slope south of the RI/MA and MA WEAs in all seasons. The highest overall SPUE in the shelf waters occurred in the summer, with up to 3,000 whales per 1,000 km (Right Whale Consortium, 2012; Figure 3.1.5-1a). Within the RI/MA and MA WEAs SPUE were highest in the fall (ranging from 125 to 335 whales per 1,000 km; Right Whale Consortium, 2012) followed by the spring and summer (ranging from 2 to 125 whales per 1,000 km). Within 40 nm of the RI/MA and MA WEAs sperm whales occurred in all seasons (SPUE ranging from 125 to 335 whales per 1,000 km in the winter, spring, and fall, and slightly lower in the summer ranging from 2 to 125 whales per 1,000 km; Right Whale Consortium, 2012).

There have been occasional sperm whale strandings in Massachusetts; two whales from 2001 to 2005 (Waring *et al.*, 2011), and none in Rhode Island in the past decades (Kenney and Vigness-Raposa, 2010).

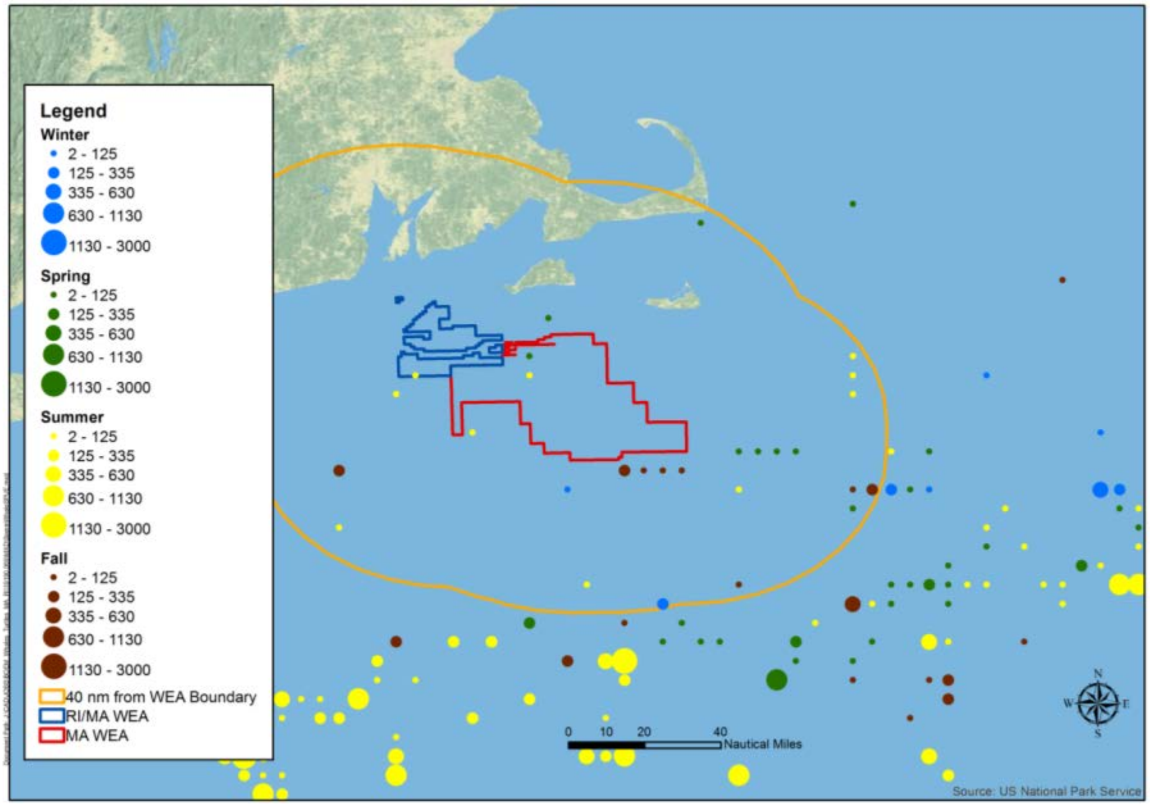


Figure 3.1.5-1a. SPUE for sperm whales. Map depicts the RI/MA and MA WEAs and surrounding (40 nm from the RI/MA and MA WEAs outlined in orange for reference).

Note: Data Source Right Whale Consortium, 2012. Map provided by Normandeau Associates Inc.

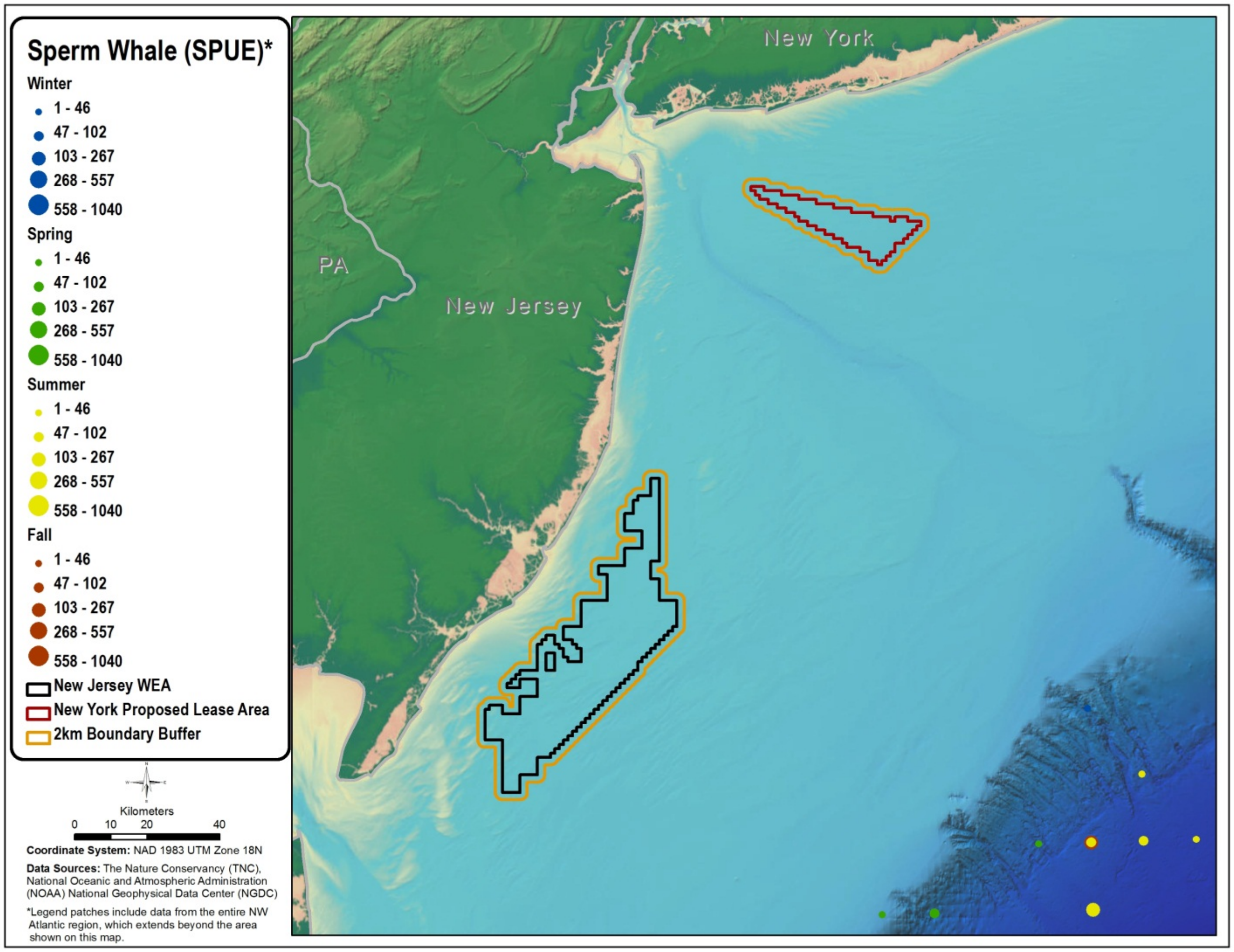


Figure 3.1.5-1b. SPUE for sperm whales. Map depicts NY and NJ project areas and surrounding waters (2 km from the action area outlined in orange for reference).

3.2 Sea Turtles

There are six species of sea turtles that can be found in the offshore waters of the U.S.. Of these six species, there are four that could potentially occur within the Project Area and its surrounding waters. All four species are either threatened or endangered under the ESA (Table 3.2). These sea turtles species include the Northwest Atlantic Distinct Population Segment (DPS) of loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*), green (*Chelonia mydas*), and leatherback (*Dermochelys coriace*). These four species are highly migratory and only found seasonally within the Project Area and its surrounding waters. It is not likely that any individual members of these species are year-round residents of the Project Area or its surrounding waters.

Table 3.2
Sea Turtle Species of the Western North Atlantic

Species	Status	General Occurrence North Atlantic	Occurrence in WEA[1]
Northwest Atlantic DPS Loggerhead Sea turtle (*Caretta caretta*)	T	Summer/Fall	Common
Green Sea Turtle (*Chelonia mydas*)	T	Summer	Possible
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	E	Summer/Fall	Possible
Leatherback Sea Turtle (*Dermochelys coriacea*)	E	Summer/Fall	Common

Note:
[1] The occurrence category is based upon historical sightings data compiled in the Rhode Island Ocean Special Area Management Plan , and Kenney and Vigness-Raposa 2010

Key:
E = Endangered.
T = Threatened.

Density information for sea turtles in the North Atlantic is limited. However useful information is available from the CETAP survey program. This program provided the data synthesized in Shoop and Kenney (1992), was conducted between 1978 and 1982, and provided the first comprehensive look at sea turtle distribution in the North Atlantic from Nova Scotia, Canada to Cape Hatteras, North Carolina. The program consisted of three years of both aerial and shipboard surveys. Overall, they were able to determine seasonal distributions of loggerhead and leatherback seas turtles, the two most commonly sighted turtles during the survey. The sightings data allowed the authors to determine density of the two species per square km. The density for loggerheads was estimated at 0.00164-0.510 per square kilometer, and the density for leatherbacks was estimated at 0.00209-0.0216 per square kilometer. It should be noted that these density estimates were averaged for the entire survey range. Therefore, individual abundance estimates within the Project Area will not necessarily reflect this data. However, the survey was useful in providing information on the seasonal distribution of the species and the general sighting locations, indicating the presence of both loggerhead and leatherback sea turtles within the North Atlantic. This information coupled with New Jersey's Baseline Study, Rhode Island's SAMP (Rhode Island CRMC 2010) and the preliminary AMAPPS data provide a good overview on the potential occurrence of sea turtles in the Project Area and its surrounding waters.

3.2.1 Northwest Atlantic Loggerhead Sea Turtle

3.2.1.1 Status

The Northwest Atlantic DPS of the loggerhead sea turtle was listed as federally threatened under the ESA effective October 24, 2011 (76 FR 58868). This is the DPS of loggerhead sea turtle that is likely to be present in the action area.

3.2.1.2 Description

The loggerhead sea turtle is its relatively large head, which supports powerful jaws used to crush hard shelled prey (NMFS 2012c). Preferred prey consists of crustaceans, mollusks, jellyfish, and small fin fish (NMFS and USFWS 2008). The adult and juvenile carapace, dorsal and lateral head scales, and dorsal flipper scales are reddish-brown in color. The flippers also have light to medium yellow edges (NMFS and USFWS 2008). Adult loggerhead sea turtles weigh 250 pounds (113 kilogram) on average, and can reach up to 3 feet (~1meter) in length (NMFS 2012c).

3.2.1.3 Distribution

Loggerhead sea turtles occur in temperate and tropical waters of the Atlantic, Pacific, and Indian Oceans (NMFS and USFWS, 2008). They are the most common sea turtle species along the U.S east coast. In the eastern U.S. the majority of loggerhead sea turtle nesting occurs 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). Despite its northern nesting limit of Virginia, the loggerhead sea turtle can be found in waters as far north as the Gulf of Maine (Shoop and Kenney 1992). Non-breeding adults and juveniles are commonly observed within the Long Island Sound region and the waters of southern New England (Shoop and Kenney 1992).

Loggerhead presence within the U.S. is potentially influenced by both water temperature and depth. During the CETAP aerial surveys loggerheads were most frequently observed in waters between 72 and 160 feet (22 and 49 meters) deep, and approximately 84 percent of the sightings occurring in waters less than 262 feet (80 meters), suggesting that loggerheads prefer shallower waters (Shoop and Kenney 1992). Loggerhead sightings occurred most frequently in surface water temperatures of between 7 and 30º Celsius (44.6 and 86º Fahrenheit), which tracked the seasonal change in ocean temperature (Shoop and Kenney 1992).

In southern New England loggerhead sea turtles can be found seasonally, primarily during the summer and fall months (Kenney and Vigness-Raposa 2010). Loggerheads are absent from southern New England during winter months (Kenney and Vigness-Raposa 2010; Shoop and Kenney 1992). During the CETAP surveys, one of the greatest aggregations of loggerheads was observed along the continental shelf northeast of Long Island (Shoop and Kenney 1992). According to preliminary data from AMAPPS, the loggerhead was the most frequently observed sea turtle species in the Northeast region between August and September (29 sightings of single animals) (Palka 2010). It is likely that the number of loggerheads in New England waters is greatly underestimated due the high likelihood that large numbers of juveniles occur in embayments and bays within the southern New England region. This life stage of the species would be too small to be detected during surveys (Kenney and Vigness-Raposa 2010).

3.2.1.4 Threats

Threats to loggerhead sea turtles include beach development, beach armoring and shoreline stabilization, and vehicle use of beaches, all of which cause destruction to their nesting habitat. Lighting pollution is also a potential threat as it could deter females from nesting, or disorienting hatchlings attempting to find the ocean (NMFS and USFWS 2008). In water threats include bycatch from fisheries such as pelagic longlining, trawling, dredging, and gill net fisheries, vessel strikes, anthropogenic noise, marine debris, legal and illegal harvest, oil pollution and predation by native and exotic species (NMFS and USFWS 2008).

3.2.1.5 Occurrence in the Project Area

New Jersey and New York WEAs

New Jersey study (NJDEP, 2010a) that found the following for loggerhead sea turtles. Similar occurrences could be expected for the NY WEA which lies just north of the study area.

Figure 3.2.1-1b shows regular occurrence of loggerhead sea turtles in the summer. The NJ report supports this finding including:

> Loggerhead turtles are more common in Mid-Atlantic waters during the summer and fall; however, this species may occur in the Study Area year-round. A total of 69 sightings of loggerhead turtles were recorded during the surveys; the vast majority of these (63) were recorded on effort. The 15 unidentified hard-shell turtle sightings recorded during spring and summer may have been loggerhead turtles; however, species identifications could not be confirmed. All loggerhead turtle sightings were of single individuals; four of the total 69 sightings were recorded as juveniles. Loggerhead sightings occurred in water depths ranging from 9 to 34 m (30 to 112 ft) with a mean depth of 23.5 m (77.1 ft). Distance from shore ranged from 1.5 to 38.4 km (0.8 to 20.7 NM; mean=24.6 km/13.3 NM). SSTs associated with these sightings ranged from 11.0 to 20.3°C (51.8 to 68.5°F) with a mean value of 18.5°C (65.3°F). This was the second highest mean SST of all sightings which is consistent with the strong seasonality of loggerhead occurrence in the Study Area. Loggerhead turtles were sighted from late spring through fall. The earliest a loggerhead was sighted was June and the latest was October. Sightings of loggerhead turtles are fairly evenly distributed although over 50% of the sightings were recorded in the eastern half of the Study Area. During the baseline study period, opportunistic sightings of sea turtles were recorded during monitoring efforts conducted in a potential wind farm site southeast of Atlantic City. Experienced observers recorded two juvenile loggerhead turtles during the geophysical surveys in August 2009 (GMI 2009b).

Rhode Island and Massachusetts WEAs

Loggerhead sea turtles are frequently seen in waters off Rhode Island and southern Massachusetts seasonally. Most recently the AMAPPS aerial survey observed loggerheads within Rhode Island Sound, directly off shore of Point Judith, Rhode Island, and in the waters adjacent to the RI/MA and MA WEAs (Palka 2010). Loggerhead turtles have been observed relatively consistently in low numbers within and south of the RI/MA and MA WEAs in the summer and fall (ranging from 1 to 85 turtles per 1,000 km; Right Whale Consortium, 2012; Figure 3.2.1-1a). SPUE for this species are likely to be underestimated due to the relatively small size, the high submergence time of the turtles, and subsequent difficulty for observation.

Stranding data for Cape Cod Bay indicate that loggerheads are relatively common in southern New England waters. Of 1,381 sea turtles stranded in Cape Cod Bay from 1979 to 2003, 20.3% were loggerheads (Dodge *et al.*, 2003). Among the 279 loggerheads known to strand in Massachusetts from 1986 to 2007, ten were stranded on Martha's Vineyard, and five on Nantucket (NMFS SEFSC, 2012). An additional 31 loggerhead turtles were stranded in Rhode Island during the same time period (NMFS SEFSC, 2012).

Because of their documented occurrence and use of southern New England waters, particularly within the vicinity of the RI/MA and MA WEAs, it is likely that loggerhead sea turtles could occur within the RI/MA and MA WEAs or its surrounding waters during the summer and fall, however it is not likely that concentrations of these animals would be found within the area, as observations indicated that these animals are generally single and relatively dispersed throughout the area (Kenney and Vigness-Raposa 2010; Palka 2010).

3.2.1.6 Critical Habitat

Critical habitat has not been designated for the loggerhead sea turtle (NMFS, 2012c).

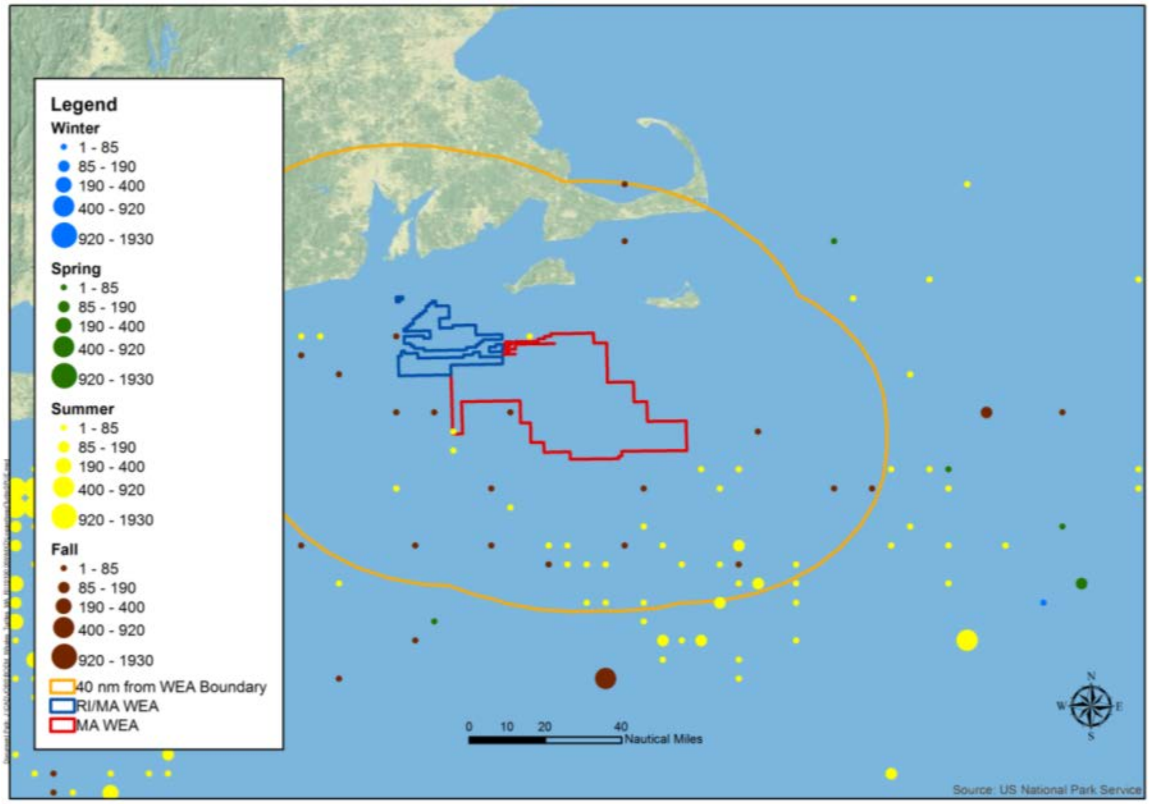


Figure 3.2.1-1a. SPUE for loggerhead sea turtles. Map depicts the RI/MA and MA WEAs and surrounding waters (40 nm from the action area outlined in orange for reference).

Note: Data Source Right Whale Consortium, 2012. Map provided by Normandeau Associates Inc.

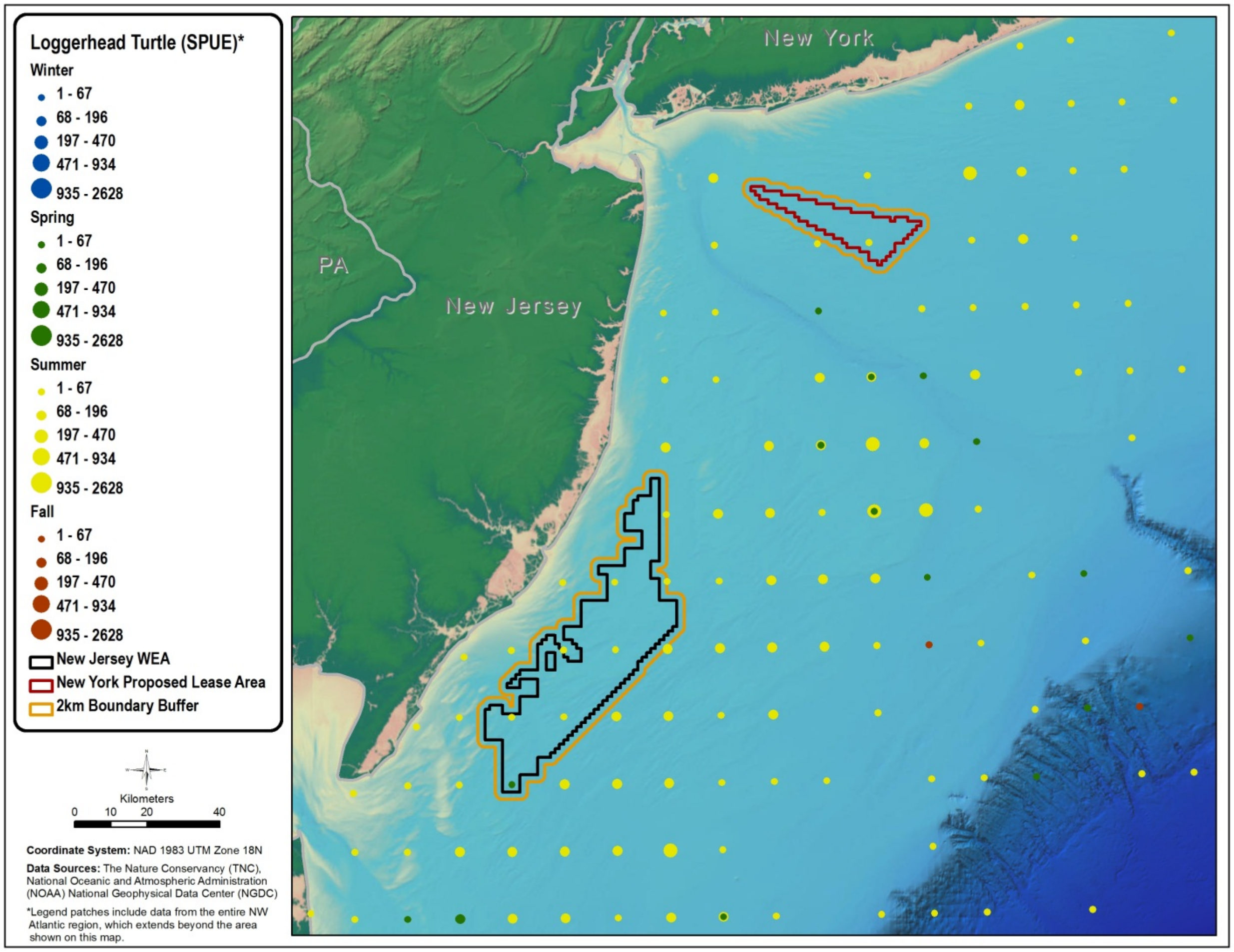


Figure 3.2.1-1b. SPUE for loggerhead sea turtles. Map depicts the NY and NJ areas and surrounding waters (2 km from the action area outlined in orange for reference).

3.2.2 Leatherback Sea Turtle

3.2.2.1 Status

The leatherback sea turtle was listed as federally endangered under the ESA in 1970 (NMFS 2012c).

3.2.2.2 Description

The leatherback sea turtle is the largest sea turtle and the largest living reptile in the world (NMFS 2012c). Adults can reach up to 2,000 pounds (900 kilograms) in weight and 6.5 feet (2 meters) in length (NMFS 2012c; NMFS and USFWS 2007c). The leatherback sea turtle is the only sea turtle that does not have a carapace comprised of bony plates. Instead, the carapace of the leatherback sea turtle consists of a tough, oil-saturated connective tissue with a nearly continuous layer of small dermal bones that lie just below the leather like outer layer of the carapace (NMFS and USFWS 1992). The front flippers of the leatherback sea turtle are proportionally longer than other sea turtles, and can reach up to 106 inches (270 centimeters). The leatherback jaw is not designed for crushing, as other sea turtle species. Instead the jaw is pointed with sharp edges that make it useful for consuming a diet of soft-bodied oceanic prey such as jellyfish and salps (NMFS 2012c).

3.2.2.3 Distribution

The leatherback sea turtle is the most globally distributed sea turtle, occupying habitats in tropical and subtropical waters, as well as cold-temperate waters (NMFS and USFWS 1992). They are also considered the most pelagic sea turtle, however they are often reported in coastal waters off the U.S. continental shelf (NMFS and USFWS 1992). 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 1992). The CETAP aerial survey reported leatherbacks to be present throughout their study area (the outer continental shelf between Cape Hatteras and Nova Scotia) with the greatest concentrations seen between Long Island and the Gulf Maine (Shoop and Kenney 1992).

The leatherback sea turtle is not known to nest as far north as Rhode Island and Massachusetts. Along the eastern continental U. S. nesting occurs in lower latitudes, primarily southeastern Florida where minor nesting colonies are known to exist (NMFS and USFWS 1992, Eckert *et al.*, 2002). Mating often occurs in the waters adjacent to nesting beaches and along the migratory pathway. Following nesting, leatherback turtles that have nested along Florida beaches often head north toward feeding grounds in higher latitude, colder waters (Eckert *et al.*, 2002; James *et al.*, 2005). Adult leatherback sea turtles have thermoregulatory adaptations that allow them to tolerate colder water temperatures than other sea turtles, allowing them to seasonally forage as far north as Newfoundland (NMFS 2012c). The migration north is driven by foraging habitat present in colder waters, allowing the leatherback to feed on its preferred prey of jellyfish and other gelatinous plankton (James *et al.*, 2005; NMFS and USFWS 1992).

3.2.2.4 Threats

The primary threat to the leatherback sea turtle is legal and illegal harvesting of eggs and nesting females. Threats in the nesting habitat also include beach development, beach armoring and shoreline stabilization, and vehicle use of beaches, all of which cause destruction to their nesting habitat. Lighting pollution is also a potential threat as it could deter females from nesting, or disorienting hatchlings attempting to find the ocean (NMFS and USFWS 1992). In water threats include bycatch from fisheries such as pelagic longlining, trawling, dredging, and gill net fisheries, vessel strikes, anthropogenic noise, marine debris, oil pollution and predation by native and exotic species (NMFS and USFWS 1992).

3.2.2.5 Occurrence in the Project Area

New Jersey and New York WEAs

New Jersey study (NJDEP, 2010a) that found the following for leatherback sea turtles. Similar occurrences could be expected for the NY WEA which lies just north of the study area. Leatherback sightings information is presented in Figure 3.2.2-1b. The NJ report stated:

> Leatherback turtles are more common in Mid-Atlantic waters during the summer and fall; however, this species may occur in the Study Area year-round. Twelve sightings of leatherback turtles were recorded during the surveys; nine of these were on-effort and three were off-effort. All leatherback turtle sightings were of single individuals; eight of the total 12 sightings were thought to be juveniles. Water depths of leatherback sightings ranged from 18 to 30 m (59 to 98 ft) with a mean depth of 24 m (79 ft). The SSTs

associated with leatherback turtle sightings ranged from 18.1 to 20.3°C (64.6 to 68.5°F) with a mean of 19.0°C (66.2°F). This mean SST is the highest average value for any species or species group sighted during the survey period and is consistent with the seasonality of leatherback occurrence in the Study Area. Leatherback turtles were sighted only during the summer. The majority of sightings (seven) occurred in the far northern portion of the Study Area. Sightings were recorded from 10.3 to 36.2 km (5.6 to 19.5 NM) from shore with a mean distance of 28.6 km (15.4 NM).

Rhode Island and Massachusetts WEAs

In southern New England, leatherback sea turtles are generally observed during summer and fall (Kenney & Vigness-Raposa 2010). Sightings data indicate that leatherback occurrence within the two WEAs and coastal areas is more dispersed, with no concentration areas noted in the WEAs. However concentrations of leatherbacks have been noted near the WEAs. One area was noted south of central Long Island during the CETAP aerial surveys (Shoop and Kenney 1992). Also, according to Kara Dodge of the Large Pelagics Research Center (pers. comm., 2012), the area of Nantucket Shoals south of Martha's Vineyard and Nantucket and east is considered a "hot spot" for leatherbacks from at least July (and maybe June) through September. It is not known why leatherbacks spend time in southern New England waters, however during the CETAP aerial surveys leatherbacks were observed off the Rhode Island coast in association with aggregations of *Cyanea sp.* (Shoop and Kenney 1992).

Regionally, relatively high SPUE were recorded, ranging from 20 to 105 leatherback turtles per 1,000 km in the fall and 20 to 35 turtles per 1,000 km in the summer and winter (Right Whale Consortium, 2012). In the surrounding continental shelf waters to the southwest, south, and southeast of the RI/MA and MA WEAs, SPUE were as high as 105 to 230 turtles per 1,000 km in the summer and fall (Right Whale Consortium, 2012; Figure 3.2.6.3-2). Recently the AMAPPS aerial survey observed leatherbacks within Block Island Sound, to the west of the RI/MA and MA WEAs during August and September (Palka 2010).

Leatherback sea turtle strandings have been recorded for Rhode Island and Massachusetts. However unlike most other sea turtles, the strandings in this case are not likely due to cold-stunning, due to this species' thermoregulatory abilities. Leatherback sea turtles are the most common species to strand in Rhode Island with 144 records from 1986 to 2007 (NMFS SEFSC, 2012). Among the 159 leatherbacks known to strand in Massachusetts from 1986 to 2007, 29 were stranded on Martha's Vineyard, and four on Nantucket (NMFS SEFSC, 2012).

Because of their documented occurrence and use of southern New England waters, particularly within the vicinity of the RI/MA and MA WEAs, it is likely that leatherback sea turtles could occur within the RI/MA and MA WEAs during the summer and fall. However, it is not likely that concentrations of these animals would be found within the WEAs, as observations indicated that these animals are relatively dispersed throughout the area (Kenney and Vigness-Raposa 2010).

3.2.2.6 Critical Habitat

No critical habitat is designated for the leatherback sea turtle within the Project Area or along the U.S. Atlantic Coast (NMFS 2011c). Critical habitat has been designated since 1979 in the coastal waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands (44 FR 17710). Critical habitat has also been designated on the U.S. Pacific Coast, in California, Washington and

Oregon (77 FR 4170). On May 5, 2011 the petition to revise critical habitat off the coast of Puerto Rico was accepted by the NMFS (76 FR 25660).

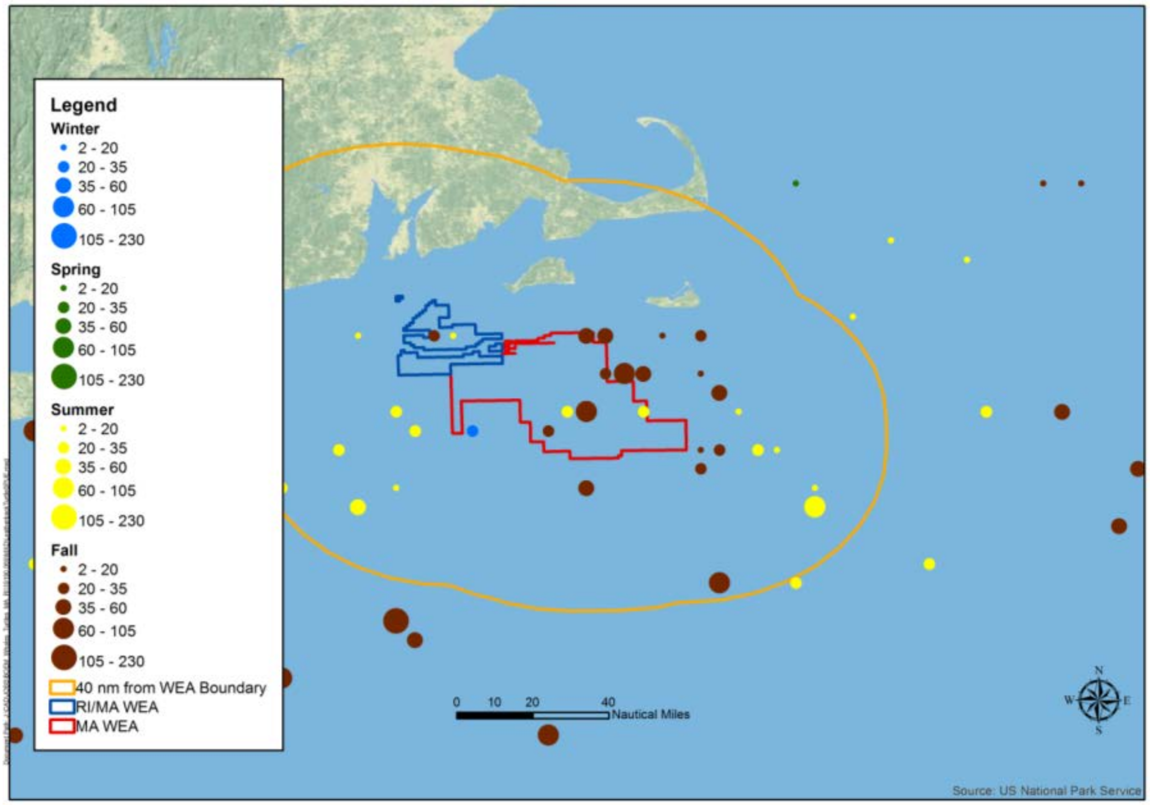


Figure 3.2.2-1a. SPUE for leatherback sea turtles. Map depicts the RI/MA and MA WEAs and surrounding waters (40 nm from the Project Area outlined in orange for reference).

Note: Data Source Right Whale Consortium, 2012. Map provided by Normandeau Associates Inc.

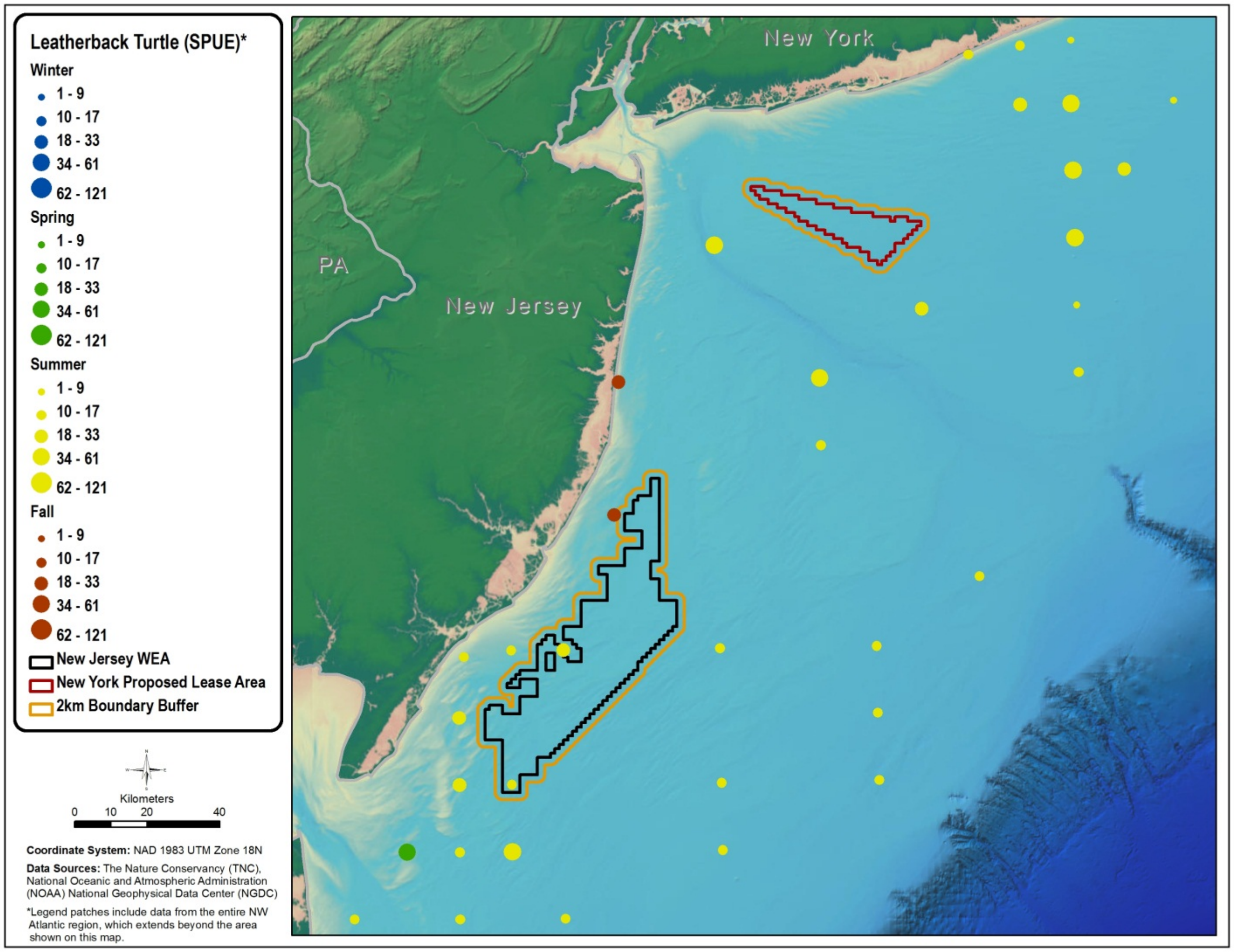


Figure 3.2.2-1b. SPUE for leatherback sea turtles. Map depicts the NY and NJ areas and surrounding waters (2 km from the action area outlined in orange for reference).

3.2.3 Green Sea Turtle

3.2.3.1 Status

The green sea turtle was listed under the ESA in 1978 (NMFS 2011d). The breeding populations in Florida and along the Pacific coast of Mexico are listed as endangered, while it is listed as threatened throughout the rest of its range, including Rhode Island and Massachusetts.

3.2.3.2 Description

The green sea turtle is the largest of the hard-shelled sea turtles, growing to a maximum length of approximately 4 feet (1.2 meters) and weighing up to 440 pounds (200 kilograms) (NMFS and USFWS 1991). Adult green sea turtles are herbivorous, feeding on seagrasses, sea lettuce, and algae. Their carapace color can vary between black, gray, green, brown, or yellow (NMFS and USFWS 1991). The carapace is more oval in shape and less tapered than that of a loggerhead sea turtle (Kenney and Vigness-Raposa 2010). The head is also narrow and lacks the large crushing jaws that are found on loggerhead sea turtles (Kenney and Vigness-Raposa 2010).

3.2.3.3 Distribution

The green sea turtle can be found globally, most often in tropical and subtropical waters. Some individuals are also known to occur in cooler, temperate regions (NMFS and USFWS 1991). They can be found throughout the Caribbean, and in continental U.S. waters from Texas to Massachusetts (NMFS and USFWS 1991).

The green sea turtle is not known to nest as far north as Rhode Island and Massachusetts. Along the eastern continental U.S. nesting occurs in large numbers in the lower latitudes, primarily southeastern Florida, and more specifically Brevard, Indian River, St. Lucie, Martin, Palm Beach and Broward Counties (NMFS and USFWS 1991). They can generally be found feeding in shallow waters of reefs, bays, inlets, lagoons, and shoals that are abundant in algae or marine grass, such as eel grass (NMFS and USFWS 2007b).

3.2.3.4 Threats

Threats to green sea turtles include beach development, beach armoring and shoreline stabilization, and vehicle use of the beaches, all of which cause destruction to their nesting habitat. Light pollution is also a potential threat as it could deter females from nesting, or disorienting hatchlings attempting to find the ocean (NMFS and USFWS 1991). In water threats include bycatch from fisheries such as pelagic longlining, trawling, dredging, and gill net fisheries, sea grass bed degradation, vessel strikes, anthropogenic noise, marine debris, oil pollution and predation by native and exotic species NMFS and USFWS 2007b). The principal cause of the decline in green sea turtle populations globally can be attributed to long-term harvesting of eggs, as well as juveniles and adults. While harvesting of this species is illegal in most parts of the world, it still occurs (NMFS and USFWS 1991).

3.2.3.5 Occurrence in Project Area

New Jersey and New York WEAs

There have been only a relatively few sightings of green sea turtles near the NY and NJ action areas as reported by AMAPPS and the TNC NAM ERA sightings data. However, they are expected to occur in or near the areas in very low numbers in the summer (Palka 2010).

Rhode Island and Massachusetts WEAs

In southern New England, green sea turtles are rare, yet when they are observed it is generally during summer months due to the limiting factor of water temperature (CETAP 1982). Should green sea turtles be present within the area, they will mostly likely be juveniles, as this is the life stage that is most often reported in New England waters. Within southern New England, green sea turtles are known to be found in the waters of Cape Cod Bay and Block Island and Long Island Sounds (CETAP 1982).

Within the RI/MA and MA WEAs, there has been one confirmed green sea turtle sighting in 2005 (Kenney and Vigness-Raposa 2010). Two strandings were reported in Connecticut and Rhode Island between 1987 and 2001, however the exact locations and dates of the strandings are unknown (Kenney and Vigness-Raposa 2010). Most recently the AMAPPS aerial survey observed a single green sea turtle south west of the RI/MA and MA WEAs in August 2010 (Palka 2010). The survey did not indicate whether it was an adult or a juvenile. Due to the infrequent occurrence of green sea turtles within waters of southern New England, and their preference for the shallow waters of Long Island Sound when in southern New England waters, it less likely that green sea turtle may occur within the RI/MA and MA WEAs or its surrounding waters.

3.2.3.6 Critical Habitat

No critical habitat has been designated for the green sea turtle within or surrounding the Project Area (NMFS and USFWS 2007b). Critical habitat has been designated, however, within the coastal waters around Culebra, Puerto Rico (NMFS and USFWS 2007b)

3.2.4 Kemp's Ridley Sea Turtle

3.2.4.1 Status

The Kemp's ridley sea turtle was listed as federally endangered in 1970 (NMFS and USFWS 2007a).

3.2.4.2 Description

The Kemp's ridley sea turtle, along with the olive ridley sea turtle, is the smallest of sea turtle species. Adults can weigh between 70.5 and 108 pounds (32 and 49 kilograms) and reach up to 24 to 28 inches (60 to 70 centimeters) in length (NMFS and USFWS 2007a). An adult Kemp's ridely turtle's carapace can be almost as wide as it is long, and is lighter grey-olive in color. Males and females are very similar in size, however secondary sexual characteristics, such as long tails and re-curved claws are present in males (NMFS, USFWS and SEAMARNAT 2011). The preferred diet of this sea turtle species is crabs, although they may also eat fish, jellyfish and mollusks (NMFS and USFWS 2007a).

3.2.4.3 Distribution

The Kemp's ridley sea turtle is found most commonly in the Gulf of Mexico and along the U.S. Atlantic Coast. However a few records have reported them near the Azores, Morocco and in the Mediterranean Sea. It is a nearshore species and rarely ventures into waters deeper than 160 feet (50 m), primarily occupying the neritic zone which contains muddy or sandy bottoms where their prey can be found (NMFS and USFWS 2007a).

Their nesting is mostly limited to the Western Gulf of Mexico, primarily Tamaulipas and Veracruz, Mexico. Ninety-five percent of Kemp's ridley nesting occurs in Tamaulipas, Mexico where females arrive onshore in large aggregations to nest during what is called the "arribada". Some nesting also occurs in Texas and irregularly in a few other U.S. states and occasional nests along the U.S. Atlantic Coast have been identified as far north as North Carolina. Juvenile Kemp's ridely sea turtles are known to travel north to New England waters seasonally for foraging habitat found in Long Island Sound, New York (NMFS, USFWS and SEAMARNAT 2011).

3.2.4.4 Threats

Threats to Kemp's ridley sea turtles in the nesting habitat include beach development, beach armoring and shoreline stabilization, and vehicle use of beaches, all of which cause destruction to their nesting habitat. Lighting pollution is also a potential issue threat as it could deter females from nesting, or disorienting hatchlings attempting to find the ocean (NMFS, USFWS and SEAMARNAT 2011). In water threats include bycatch from fisheries such as pelagic longlining, trawling, dredging, and gill net fisheries, vessel strikes, anthropogenic noise, marine debris, oil pollution and predation by native and exotic species (NMFS, USFWS and SEAMARNAT 2011).

3.2.4.5 Occurrence in Project Area

New Jersey and New York WEAs

Kemp's ridley sea turtle is the rarest of the four sea turtles assessed in this document in the NY and NJ action areas. As reported by AMAPPS and the TNC NAM ERA sightings data Kemp's ridley is anticipated to be rare to non-existent as they range is generally confined to warmer waters off the U.S southeast coast. However, in the rare chance they occur, they are expected to occur in very low numbers in the summer (Palka 2010).

Rhode Island and Massachusetts WEAs

In southern New England, juvenile Kemp's ridley sea turtles are known to occur both in Long Island Sound and Cape Cod Bay (CETAP 1982). Many of the reports of juvenile Kemp's ridley sea turtles in Long Island Sound are those of cold shock turtles, and the only records in the Rhode Island area are during summer and fall months (Kenney and Vigness-Raposa 2010). Strandings of Kemp's ridley, loggerhead, and green sea turtles in Cape Cod Bay increased dramatically from 1999-2003, with the mean annual number of stranded turtles equal to 144 per year (Dodge *et al.,* 2003). The increase in the number of Kemp's ridley strandings is in proportion to the number of hatchlings released from the head start program from nesting beaches in the southern U.S. two years earlier (Dodge *et al.,* 2003). In the headstart program, hatchlings are caught just as they begin to swim offshore (to enable "imprinting" on the ocean) and brought to a facility to develop, where they can avoid the high predation rate (1% survival for neonates; NMFS, USFWS, and SEMARNAT, 2011). During this time period, they are tagged and subsequently released at variable ages. An additional dataset of sea turtle strandings by state can be found at the NMFS Sea Turtle Stranding and Salvage Network. This dataset includes sea turtle stranding data for Massachusetts and Rhode Island from 1986 through 2007, including species, year, month, and location by county. NMFS, Southeast Fisheries Science Center (SEFSC) has verified all data through 2005, and may make changes as needed for 2006 and 2007 data. Although the numbers of Kemp's ridleys strandings are relatively high (1,156) in Massachusetts (more specifically Cape Cod Bay), the stranding numbers are low near the RI/MA and MA WEAs, with two on Martha's Vineyard, one on Nantucket, and four in Rhode Island from 1986 to 2007 (NMFS SEFSC, 2012).

There is little visual sighting data information for this species, as it is a small species and is difficult to sight during aerials surveys. Also, the majority of ocean based surveys do not take into account bays and estuaries; therefore, they are less likely encounter Kemp's ridleys as they are more commonly found in these protected areas within southern New England. The only sightings of Kemp's ridley turtles were reported from three locations. The first location was within 20 nm south of the RI/MA and MA WEAs (from 21 to 45 turtles per 1,000 km during the summer), the second was a larger group (90 to 170 turtles per 1,000 km southwest of the RI/MA and MA WEAs) also in the summer, and the third was 21 to 45 turtles per 1,000 km during the fall (Right Whale Consortium, 2012; Figure 3.2.4-1). SPUE for this species are likely to be greatly underestimated due to the relatively small size, the high submergence time of the turtles, and subsequent difficulty for observation.

Despite Kemp's ridely turtles commonly occurring in Long Island Sound and Cape Cod Bay, they are not as common in Rhode Island and southern Massachusetts waters. It is expected that this area does not have suitable habitat for the juvenile turtles. Therefore, Kemp's ridely turtles are expected to be rare within the RI/MA and MA WEAs, however there is the potential that they may transit through the area occasionally while traveling between Long Island Sound and Cape Cod Bay during summer months (Kenney and Vigness-Raposa 2010).

3.2.4.6 Critical Habitat

There is no critical habitat is designated for the Kemp's ridley sea turtle within the Project Area or along the U.S. Atlantic Coast (NMFS and USFWS 2007a). On February 17, 2010, NMFS and USFWS were petitioned to designate critical habitat for nesting beaches on the Texas coast and marine habitat in the Gulf of Mexico and Atlantic Ocean. The petition is currently being reviewed (NMFS and USFWS 2007a).

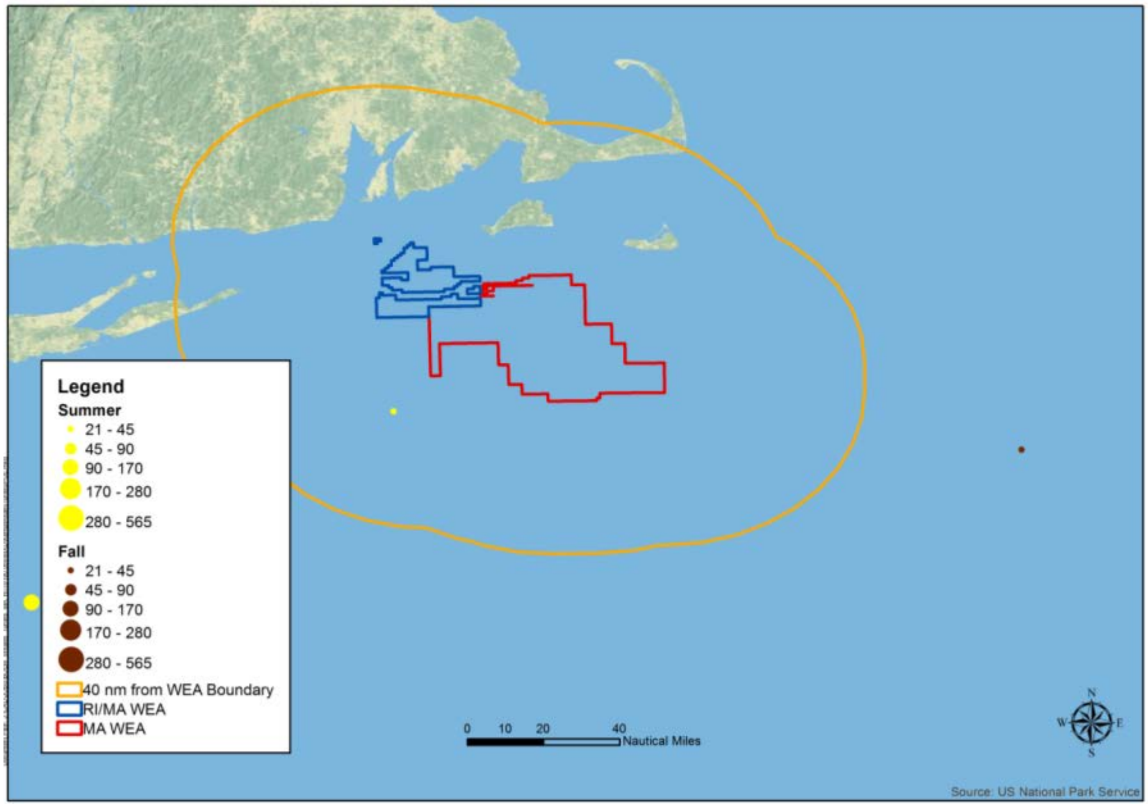


Figure 3.2.4-1. SPUE for Kemp's ridley sea turtles. Map depicts the Project Area and surrounding waters (40 nm from the Project Area outlined in orange for reference).

Note: Data Source Right Whale Consortium, 2012. Map provided by Normandeau Associates Inc.

3.3 Marine Fish

Marine finfish present throughout the Mid Atlantic Bight, and associated with the Project Area include demersals, pelagics and shark finfish assemblages. Within the Project Area there is one endangered species of fish (Atlantic sturgeon) and several species of concern and/or candidate species that may likely occur.

3.3.1 Atlantic Sturgeon

3.3.1.1 Description

The Atlantic sturgeon is a long-lived (up to 60 years), estuarine dependent, anadromous (migrates from the ocean into coastal estuaries and rivers to spawn) species of fish (ASSRT 2007). Adult Atlantic sturgeon can reach sexual maturity between years 5 and 34, have five rows of bony plates (scutes), covering the head and body; a long, hard snout that turns upward at the tip; and a soft, toothless mouth within four sensory barbels on the underside of the snout. They typically have bluish-black to tan dorsal side, brown coloring on the lateral sides, and a grayish-white ventral side. Adults can reach 14 feet (4.3 meters) in length and weight more than 600 pounds (270 kilograms) (ASSRT 2007).

3.3.1.2 Distribution

The Atlantic sturgeon is a subtropical species occurring along the Atlantic coast and in estuaries from Labrador, Canada to Florida (ASSRT 2007). It is currently known to occur in 35 rivers, including 20 in which spawning is known to occur (ASSRT 2007). Atlantic sturgeon occupy coastal waters and estuaries when not spawning, generally in shallow, nearshore areas dominated by sand or gravel substrate at depth between 33 and 164 feet (10 and 50 meters) (ASSRT 2007).

The Atlantic sturgeon population has been divided into five DPSs (Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic). These DPSs were configured to account for the marked difference in physical, genetic, and physiological factors within the species, as well as the unique ecological settings and unique genetic characteristics that would leave a significant gap in the range of the taxon if one of them were to become extinct (ASSRT 2007). As published in the *Federal Register* by NMFS, Atlantic sturgeon DPSs were listed as either threatened or endangered on February 6, 2012 (*see* 77 FR 5880 and 77 FR 5914) (Table 3-3).

Table 3-3
Atlantic Sturgeon Federal Listings

Distinct Population Segment	Status
Gulf of Maine (GOM)	Threatened
New York Bight (NYB)	Endangered
Chesapeake Bay (CB)	Endangered
Carolina	Endangered
South Atlantic	Endangered

Source: 77 FR 5880; 77 FR 5914

Of the five DPS's designated by the NMFS, the DPS most likely to be present within the Project Area and its surrounding waters is the New York Bight DPS, as this encompasses all Atlantic sturgeon that spawn in watersheds that drain into coastal waters from Chatham, MA to the Delaware / Maryland border on Fenwick Island (*see* 77 FR 5880). Within this range, Atlantic sturgeon have been documented from the Hudson and Delaware rivers as well as at the mouth of the Connecticut and Taunton rivers, and throughout Long Island Sound, with evidence to support that spawning occurs in the Hudson and Delaware rivers (ASSRT 2007). NOAA Fisheries determined that the Atlantic sturgeon New York Bight DPS is currently in danger of extinction throughout its range due to precipitous declines in population sizes and the protracted period in which sturgeon populations have been depressed; limited amount of current spawning; and the impacts and threats that have and will continue to prevent population recovery (NMFS 2012d). In fact, Atlantic sturgeon aggregation areas in the New York Bight exhibit the highest abundance along the east coast of the U.S. and have been recommended as essential fish habitat, which could warrant either full time or seasonal closures (Dunton *et al.*, 2010). But, based on NMFS's opinion and current literature (Dunton *et al.*, 2012), since there is the potential for offshore genetic mixing of stocks from other DPSs within areas associated with the Project Area, this BA has considered impacts to all 5 DPSs including: the New York Bight DPS (endangered); the Gulf of Maine DPS (threatened); the Chesapeake Bay DPS (endangered); the South Atlantic DPS (endangered), and the Carolina DPS (endangered).

3.3.1.3 Threats

Primary threats to Atlantic sturgeon include habitat degradation and loss, ship strikes, and general depletion from historical fishing (ASSRT 2007). Sturgeons are particularly vulnerable to anthropogenic stressors given their complex life cycle and low intrinsic rates of population increase (ASSRT 2007). Genetic studies suggest that adult sturgeon return to spawn in their natal river (ASSRT 2007), which means that overfishing or habitat degradation within rivers can cause rapid, localized and lasting stock collapse.

3.3.1.4 Occurrence in the Project Area

The Atlantic sturgeon may occur within the Project Area. According to capture records from various surveys, the species is known to occur throughout the southern New England/mid-Atlantic coastal region during all months of the year. Although predominantly inshore, capture records indicate sturgeon occur in all seasons offshore of New York and New Jersey. However, the results of the surveys indicate that the event of an Atlantic sturgeon capture in the RI/MA and MA WEAs is very rare. Only one Atlantic sturgeon was caught in the Massachusetts Department of Marine Fisheries (MADMF) bottom trawl surveys between 1978 and 2007, with the total number of trawls completed = 5,563, and a depth range of 4 to 86 m (Dunton, *et al.*, 2010). However, a study using observer data collected between 1989 and 2000 found that sturgeon species have been captured in groundfish fisheries that take place in and near the Project Area, with gear including bottom otter trawls, sink gill nets, and drift gill nets (Stein, *et al.*, 2004a; Zollett, 2009). Additionally, interestuarine migrations have been documented (Loesch *et al.*, 1979), indicating that coastal areas may be used to transit between rivers (Eyler *et al.*, 2009). Given that the Hudson River stock is the largest contributor to the NY Bight DPS it is highly likely that Atlantic sturgeon transit the NY action area.

3.3.1.5 Critical Habitat

Currently, no critical habitat has been designated for the Atlantic sturgeon.

3.3.2 Species of Concern and Candidate Species

Four species of concern/candidate species that may occur in the Project Area are the Atlantic bluefin tuna (*Thunnus thynnus*), American eel (*Anguilla rostrata*), alewife (*Alosa psuedoharengus*), and blueback herring (*Alosa aestivalis*). Alewife and blueback herring, collectively called river herring, are generally found throughout the New York-Southern New England Bight in nearshore waters, coastal bays and estuaries up to spawning grounds in upstream riverine habitats. Their decline has generally been attributed to loss of upstream habitat due to man-made impediments (i.e., dams) and fishing pressure. Although they may occur in the offshore marine environment including the wind energy areas, their presence is predominantly nearshore. River herring are currently undergoing a status review by the National Marine Fisheries Service. The American eel is currently undergoing a status review by the U.S. Fish and Wildlife Service (USFWS) and the status review for Atlantic Bluefin tuna was concluded in May 2011 with the determination that listing under the ESA was not currently warranted.

3.3.2.1 Atlantic Bluefin Tuna

Atlantic bluefin tuna (*Thunnus thynnus*) are a highly migratory, epipelagic species that ranges from Newfoundland to Brazil in the Western Atlantic and Norway to central Africa in the Eastern Atlantic. Bluefin tuna in the Northwest Atlantic are managed by the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS) under the authority of the Atlantic Tunas Convention Act (ATCA) and the Magnuson-Stevens Fisheries Conservation and Management Act (Magnuson-Stevens Act). ATCA authorizes and implements conservation and management recommendations adopted by the International Commission for the Conservation of Atlantic Tunas (ICCAT). The harvest of this species is highly regulated due to recent concern over population levels, and the bluefin tuna is listed as a federal species of concern (ABTSRT 2001). Spawning takes place principally in the Gulf of Mexico and in the Florida Straits, and foraging grounds are along the U.S. eastern continental shelf, including the vicinity of the Project Area, where they prey on squid, herring, mackerel, and other pelagic forage species (ABTSRT 2011). The Project Area falls inside the Essential Fish Habitat (EFH) for both adult and juvenile Atlantic bluefin tuna (ABTSRT, 2011).

There is no dedicated fishery-independent survey for Atlantic bluefin tuna in the Northwest Atlantic. Data for stock assessments comes from NOAA’s Marine Recreational Information Program (MRIP), and commercial catch rates and landings (ICCAT, 2010). The most recent stock assessment conducted in 2010 updated and summarized fishery indicators, status of the stock and its outlook. The highest catch level since 1981 was seen in 2002, followed by a steady decline through 2007, largely due to reductions in catch levels. Higher catch levels occurred in 2008-2010 than the previous years, 2002-2007.

3.3.2.2 American Eel

The American eel (*Anguilla rostrata*) is a catadromous species found in fresh, brackish, and coastal waters from Greenland to northeastern South America, and the only freshwater eel in the Western Hemisphere. American eels spawn in the Sargasso Sea, and eggs hatch into transparent, laterally-compressed leptocephali. Leptocephali and glass eel life stages then take years to reach freshwater streams where they mature. Mature American eels eventually return to their Sargasso Sea birth waters to spawn and die. Threats to American eel include habitat loss, riverine impediments to migration such as dams, pollution, nearshore habitat destruction, and fishing pressure (Greene *et al.*, 2009).

The American eel is present in many streams and rivers of Massachusetts, Rhode Island, New York, and New Jersey, but the species is rarely seen in coastal and oceanic surveys (Greene *et al*, 2009), and is therefore unlikely to be encountered in the Project Area in any great numbers.

4 Proposed Action

4.1 Overview

The actions being evaluated as a part of this consultation are the issuance of a renewable energy lease and subsequent site assessment activities to aid in the siting of potential wind turbine generators in the OCS in the BOEM North Atlantic Planning Area. The issuance of the lease does not constitute an irreversible commitment of the resources toward full development of the lease area. Thus this action does not authorize, and the consultation does not evaluate, the construction of any commercial electricity generating facilities or transmission cables with the potential to export electricity.

The type of activities evaluated for this action includes, but is not limited, to the following:

1. GGARCH assessment
   - High resolution geophysical surveys (surface and subsurface seismic profiling, extent/intensity determined by the area being considered for development (primarily high to mid frequency sonar (i.e., side scan sonar, echo sounder, sub-bottom profilers). The use of airguns is NOT being considered as a part of this activity.
   - Geotechnical sub-bottom sampling (includes CPTs, geologic borings, vibracores, etc).
2. Wind resource assessment
   - Construction of meteorological towers
   - Installation of LIDAR buoys
3. Biological resource assessment:
   - Presence/absence of threatened and endangered species
   - Presence/absence of sensitive biological resources/habitats
4. Archaeological resource assessment
5. Assessment of coastal and marine use

4.1.1 Project Area

The four WEAs under consideration in the North Atlantic Planning Area comprise a total area of approximately 2,100 square statute miles (1,344,000 acres) and contain 178 whole OCS lease blocks and 94 partial OCS lease blocks. These areas are collectively referred to as the Project Area. The total area is shown in Figures 1-1a and 1-1b.

The proposed action consists of the issuance of commercial wind energy leases in the Project Area and implementation of BOEM-approved site characterization activities on those leaseholds. The effects of site assessment activities are assessed for the RI/MA and MA WEAs in addition to the effects of site characterization activity. Because of the expressions of commercial wind energy interests, BOEM assumes that the entire Project Area would be leased. The New Jersey and New York areas only include impacts from site characterization activities. The biological assessment of site assessment activities that was included in the consultation for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia (BOEM 2012a) remains valid and unchanged for New Jersey. The assessment of the effects of site characterization activities off New Jersey is being updated to ensure it remains consistent with the Atlantic G&G Draft Programmatic Environmental Impact Statement and associated Biological Assessment. For the New York WEA, BOEM has received and unsolicited lease application but has yet to determine if there is competitive interest in leasing the area. Thus it is premature to assess potential site assessment activities within that area.

4.2 Site Characterization Surveys (RI/MA, MA, NY and NJ Areas)

Site characterization surveys include a number of activities that allow the lessee to locate shallow hazards, physical restrictions and cultural and biological resources in the area where a project may take place. The activities are described below.

4.2.1 High-resolution Geophysical (HRG) Survey

Data obtained from the HRG surveys will provide information on geophysical shallow hazards, the presence or absence of archaeological resources, biological resources and to conduct bathymetric charting. This information is used in the design construction and operations of meteorological towers and future wind turbine placement to mitigate the potential impacts to installations, operations and production activities, and structure integrity. The scope of HRG surveys will be sufficient to reliably cover any portion of the site that may be affected by the renewable energy project's construction, operation, and decommissioning. This includes the project area encompassing all seafloor/bottom-disturbing activities. The maximum project area includes but is not limited to the footprint of all seafloor/bottom-disturbing activities (including the areas in which installation vessels, barge anchorages, and/or appurtenances may be placed) associated with construction, installation, inspection, operation, maintenance, and removal of structures.

The geophysical survey grid(s) for the proposed transmission cable route(s) to shore would be oriented with respect to the bathymetry, shallow geologic structures, and renewable energy structure locations. The grid pattern for each survey would cover the project area for all anticipated physical disturbances from construction and operation of a wind facility. Parameters for line spacing include:

For collection of geophysical data for shallow hazard assessments using side scan-sonar/sub-bottom profilers, spacing would not likely exceed 492 feet (150 meter) throughout the project area.

For collecting geophysical data for archaeological resource assessment using magnetometers, side-scan sonar, and all sub-bottom profilers, lines are to be flown at approximately 98 feet (30 meter) throughout the project area.

For bathymetric charting using a multi-beam echo-sounder or side-scan sonar mosaic, construction may vary based on water depth but will provide full coverage of the seabed plus suitable overlap and resolution of small discrete targets of 1.6 to 3.3 feet (0.5 to 1.0 meters) in diameter. This is also necessary for the identification of potential archaeological resources.

4.2.1.1 HRG Survey Instrumentation

Table 4.1 gives an overview of the types of instrumentation that could be used during HRG survey work in the Project Area.

Bathymetry/Depth Sounder. The depth sounder system would record with a sweep appropriate to the range of depths expected in the survey area. Lessees can use multi-beam and/or single-beam bathymetry systems. The use of a multi-beam bathymetry system may be more appropriate for characterizing those lease areas containing complex topography or fragile habitats.

Magnetometer. Magnetometer surveys would be used to detect the identification of ferrous, ferric, or other objects having a distinct magnetic signature. The magnetometer sensor is typically towed as near as possible to the seafloor, which is anticipated to be approximately 20 feet (6 meters) above the seafloor.

Seafloor Imagery / Side-Scan Sonar. A typical side-scan sonar system consists of a top-side processor, tow cable, and towfish with transducers (or 'pingers') located on the sides, which generate and record the returning sound that travels through the water column at a known speed. BOEM assumes that lessees would use a digital dual-frequency side-scan sonar system with frequencies of 445 and 900 kiloHertz (kHz) and no less than 100 and 500 kHz to record continuous planimetric images of the seafloor. The data would be processed in a mosaic form to allow for a true plan view and 100 percent coverage of the project area. The side-scan sonar sensor would be towed above the seafloor at a distance that is 10 to 20 percent of the range of the instrument.

Shallow and Medium Penetration Sub-bottom Profilers. A high-resolution Compressed High-Intensity Radar Pulse (CHIRP) System sub-bottom profiler is used to generate a profile view below the bottom of the seabed, which is interpreted to develop a geologic cross-section of subsurface sediment conditions under the track line surveyed. A boomer sub-bottom profiler system is capable of penetrating depth ranges of 32 to 328 feet (10 to 100 meters) depending on frequency and bottom composition. The sub-bottom profiler would deliver a simple, stable, and repeatable signature that is near to minimum phase output with usable frequency content.

HRG survey method source levels and pulse lengths were used to model threshold radii for the various profiler methods for the Atlantic OCS Proposed Geological and Geophysical (G&G) Activities Mid-Atlantic and South Atlantic Planning Areas Draft Programmatic Environmental Impact Statement (DPEIS) (USDOI, BOEM 2012a). These profilers include a boomer, side-scan sonar, chirp sub-bottom profiler, and a multi-beam depth sounder. Three of the four profiler methods have operating frequencies that are within the range of cetacean and sea turtle hearing (Table 4.1). The pulse length and peak source level that were used for each profiler method modeling scenario and can be assumed to representative of profiler sources that could be used for HRG surveys during the proposed action.

Table 4.1
Summary of Peak Source Levels for HRG Survey Activities and Operating Frequencies within Cetacean Hearing Range

Source	Pulse Length	Broadband Source Level (dB re 1 μPa at 1 m)	Operating Frequencies	Within Hearing Range: Cetaceans	Within Hearing Range: Sea Turtles
Boomer	180μs	212	200 Hz – 16kHz	Yes	Yes
Side-scan sonar	20 ms	226	100 kHz	Yes	No
			400 kHz	No	No
Chirp sub-bottom Profiler	64 ms	222	3.5 kHz	Yes	No
			12 kHz	Yes	No
			200kHz	No	No
Multi-beam depth sounder	225 μs	213	240kHz	No	No

Source: USDOI, BOEM 2012

There were several modeling scenarios run for the Atlantic G&G DPEIS that captured environmental and oceanographic conditions at various depths and seasons. Based on these modeling results, threshold radii for each HRG survey method potentially used for the proposed action are displayed in Table 4.2. The threshold radii for 180 dB re 1 µPa rms (Level A harassment) from any of the survey methods is not expected to be greater than 200 meters. Threshold radii for 160 dB re 1 µPa rms (Level B harassment) is highly variable depending on the source type, but may extend beyond 2,000 meters. The potential area of ensonification within which cetaceans would experience Level B harassment is beyond what can be successfully monitored by observers on a mobile platform/sound source (as opposed to a stationary sound source found in pile driving). Thus BOEM anticipates that cetaceans present in the area (between 200 m and 2,000 m from the sound source during survey activity will be temporarily exposed to levels of sound defined by NMFS as Level B harassment.

Sea turtles would be excluded from a 200 m zone around the vessel. This zone is equivalent to the 180dB (Level A) zone, which is likely overly conservative given that sea turtles will likely only hear the boomer which has a 180 dB threshold of 45 meters (*see* Table 4.2 and Section 8). The HRG survey exclusion zones are based on preventing any whales from experiencing Level A harassment from a non-continuous noise source as defined for the purposes of the Marine Mammal Protection Act (MMPA).

Table 4.2
Estimated Ranges for Level A and Level B Harassment of Cetaceans Based on the NMFS 180dB and 160dB Criteria

Equipment	Number of Scenarios Modeled	Pulse Duration	180-dB Radius (m)	160-dB Radius (m)
			Calculated using Nominal Source Level[a]	Calculated using Nominal Source Level[a]
Boomer	14	180 µs	38-45	1,054-2,138
Side-Scan Sonar	14	20 ms	128-192	500-655
Chirp Subbottom Profiler	14	64 ms	32-42	359-971
Multibeam Depth Sounder	7	225 µs	27	147-156

Source: USDOI, BOEM 2012a.
Notes:
a. The value is the radius (Rmax) for the maximum received sound pressure level (USDOI, BOEM 2012a).

It should be noted that while the modeling scenarios are based on sites offshore of the BOEM's Mid and South Atlantic Planning Areas, the modeling scenarios included similar bottom sediments, and depth ranges as found in the North Atlantic Planning Area. The sound velocity profiles are expected to be inclusive of what would be expected in the Project Area. See Appendix D in the Atlantic OCS Proposed Geological and Geophysical Activities Mid-Atlantic and South Atlantic Planning Areas Draft Programmatic Environmental Impact Statement for a full explanation of the threshold radii modeling (USDOI, BOEM 2012a).

4.2.1.2 Proposed HRG Survey Action Scenario

It is assumed that the HRG survey would cover the entire Project Area, and geophysical surveys for shallow hazards (approximately 492 feet [150 meters] line spacing) and archaeological resources (approximately 98 feet [30 meters] line spacing) would be conducted at the same time on the same vessels conducting sweeps at the finer line spacing. This would result in about 500 NM of HRG surveys per OCS block (3 statute miles by 3 statute miles [approximately 5 kilometers by 5 kilometers]), not including turns. Assuming a vessel speed of 4.5 knots and 10 hour days (daylight hours minus transit time to the site), it would take about 11 days to survey one OCS block or about 100 days to survey an average-size lease of eight OCS blocks. To survey all of the Project Area, HRG surveys would have to be conducted by multiple vessels and/or over multiple years and potential cable routes. Assuming 100 percent coverage of the Project Area, the proposed action would result in a total of approximately 117,200 nautical miles or 25,990 hours of HRG surveys.

Table 4.3
Projected Site Characterization and Assessment Activities for the Proposed Action in the Rhode Island and Massachusetts Wind Energy Areas

WEA	Leaseholds	Site Characterization Activities		Site Assessment Activities	
		High-Resolution Geophysical (HRG) Surveys (max NM/hours)	Geotechnical Sampling (min-max)	Installation of Meteorological Towers (max)	Installation of Meteorological Buoys (max)
New Jersey	Up to 7	31,000/6,900	900-2,500	-	-
New York	Up to 1	7,200/1,600	200-600	-	-
RI/MA	Up to 4	17,500/4,000	500 - 1,400	4	8
MA	Up to 5	61,500/13,490	708 – 2,900	5	10
Total	Up to 17	117,200/25,990	2,308 – 7,400	9	18

4.2.2 Biological Resources Surveys

Vessel and/or aerial surveys would need to characterize three primary biological resources categories: (1) benthic habitats; (2) avian resources; and (3) marine fauna. Sub-marine surveys such as the shallow hazard and geological and geotechnical surveys described earlier would be able to capture all the salient features of the benthic habitat on the leasehold. These surveys would acquire information suggesting the presence or absence of exposed hard bottoms of high, moderate, or low relief; hard bottoms covered by thin, ephemeral sand layers; seagrass patches; and other algal beds, all of which are key characteristics of benthic habitat. The various remote sensing activities used in the biological resource survey will likely occur simultaneously with the HRG survey activity and is thus not repeated here. Shipboard observers would monitor and document sightings of marine mammals, sea turtles, fish and birds within the lease area.

4.2.3 Geotechnical Sampling

Geotechnical sampling is used to determine site specific geology profile of a specific site within the lease area. In order to achieve this, geotechnical sampling is typically conducted using cone penetration tests (CPT) or deep sediment boring / drilling at the location of the proposed meteorological tower or wind turbine. The purpose of this work is to assess the suitability of shallow foundation sediments to support a structure of transmission cable under any operational or environmental conditions that may be encountered, and document the soil characteristics necessary for design and installation of all structures. Vibracores may be taken when there are known or suspected archaeological/and or cultural resources present (identified through the HRG survey or other work) or for some limited geological sampling.

Vibracores would likely be deployed from a small (less than 45 foot) gasoline powered vessel. The diameter of a typical vibracore barrel is approximately 4 inches (10.15 centimeters) and the cores are advanced up to a maximum of 15 feet (4.5 meters). Deep borings would be advanced from a truck-mounted drill rig placed upon a jack-up barge that rests on spuds lowered to the seafloor. Each of the four spuds would be approximately 4 feet (1.2 meters) in diameter, with a pad approximately 10 feet (3.05 meters) on a side on the bottom of the spud. The barge would be towed from boring location to location by a tugboat. The drill rig would be powered using a gasoline or diesel powered electric generator. Crew would access the boring barge daily from port using a small boat. Geologic borings generally can be advanced to the target depth (100 to 200 feet [30.5 to 70 meters]) within 1 to 3 days, subject to weather and substrate conditions. Drive and wash drilling techniques would be used; the casting would be approximately 6 inches (15.24 centimeters) in diameter. The CPT or an alternative subsurface evaluation technique would supplement or be used in place of deep borings. A CPT rig would be mounted on a jack-up barge similar to that used for the borings. The top of a CPT drill probe is typically up to 3 inches (7.6 centimeters) in diameter, with connecting rods less than 6 inches (15.24 centimeters) in diameter

Environmental considerations for geotechnical sampling are mainly focused on benthic disturbance. This can come from vessels anchoring or from the boring activity itself. Acoustics from boring are also considered. It is anticipated that the majority of the work will be accomplished by CPT which does not require deep borehole drilling. However, should CPT be found an inappropriate technique given the conditions encountered, borehole drilling may be required. Previous estimates submitted to BOEM for geotechnical drilling have sound source levels at around 118-145 dB re 1 µPa at a frequency of 120 Hertz (Hz) (MMS, 2009b). With the standard operating conditions in place, including the 200m exclusion zone around geotechnical sampling (*see* Section 8.1) the exposure to noise from boring are expected to be below the 120 dB re 1µPa threshold established by NMFS for marine mammal harassment from continuous noise sources.

4.2.3.1 Geotechnical Sampling Scenario

In order to estimate the number of geotechnical samples per leasehold it is necessary to estimate the number of turbine foundations on each leasehold. As discussed in the Programmatic EIS (USDOI, MMS 2007), spacing between turbines is typically determined on a case-by-case basis to minimize wake effect and is based on rotor diameter associated with turbine size. In Denmark's offshore applications, for example, a spacing of seven rotor diameters between units has been used (USDOI, MMS 2007). Spacing of 6 by 9 rotor diameters, or six rotor diameters between turbines in a row and nine rotor diameters between rows was approved for the Cape Wind project (USDOI, MMS 2009b). In some land-based settings, turbines are separated by much greater distances, as much as 10 rotor diameters from each other (USDOI, MMS 2007). Based on this spacing range for a 3.6-megawatt (MW) (110 meter rotor diameter) turbine and a 5 MW (130 meter rotor diameter) turbine, it would be possible to place anywhere from 14 to 40 turbines in one OCS block (3 statute miles by 3 statute miles [approximately 5 kilometers by 5 kilometers]).

Based on the information presented above and assuming:

1) "maximum" scenario of wind development on every OCS block (which is extremely unlikely, but the lower amount of samples associated with less development would result in lower environmental impacts)
2) geotechnical sampling (vibracore, CPT, and/or deep boring) would be conducted at every potential wind turbine location throughout the Project Area
3) geotechnical sampling would be conducted every nautical mile along the projected transmission corridors to shore
4) geotechnical sampling would be conducted at the foundation of each meteorological tower and/or buoy, then a total of 2,308 to 7,400 geotechnical surveys could occur as a result of the proposed action (see Table 4.3).

4.3 Site Assessment (RI/MA and MA WEAs)

"Site assessment" describes the assessment of wind resources and ocean conditions to allow the lessee to determine whether the lease area is suitable for wind energy development, where on the lease it would propose development, and what form of development to propose in a COP. To determine this, a meteorological tower or buoy would be installed or deployed in the lease area to measure wind speeds and collect other relevant data necessary to assess the viability of a potential commercial wind facility. This scenario is only described and assessed in relation to the RI/MA and MA WEAs.

To obtain meteorological data, scientific measurement devices, consisting of anemometers, vanes, barometers, and temperature transmitters, would be mounted either directly on the tower or buoy or on instrument support arms. In addition to conventional data collection methods, buoys and/or bottom-founded structures could use LIDAR, Sonic Detecting and Ranging (SODAR) and Coastal Ocean Dynamic Applications Radar (CODAR) technologies for collecting wind resource data. At this time, no proposals have been submitted meteorological towers (towers in this case being up to the estimated hub height for a commercial wind turbine) mounted on a floating platform (e.g., spar, semi-submersible, or tension leg). This BA assumes full-size met towers will utilize a fixed, pile-supported platform (monopile, jackets, or gravity bases) and that buoys would use the floating designs (e.g., boat-shaped, spar-type, tension-leg, disc-shaped or similar).

The following scenario addresses the reasonably foreseeable range of data collection devices that lessees may install under an approved SAP. The actual tower and foundation type and/or buoy type and anchoring system would be included in a detailed SAP submitted to BOEM, along with the results of site characterization surveys. This would be done prior to the installation of any device(s).

4.3.4.1 Proposed Action Scenario

It is assumed that each of the nine leaseholds projected for the RI/MA and MA WEAs would result in zero or one meteorological tower, zero or two buoys or a combination, being constructed or deployed. This would result in a maximum of 9 meteorological towers and 18 meteorological buoys within the RI/MA and MA WEAs.

Case Study: Cape Wind Meteorological Tower

Source: Cape Wind Associates, LLC 2011a.

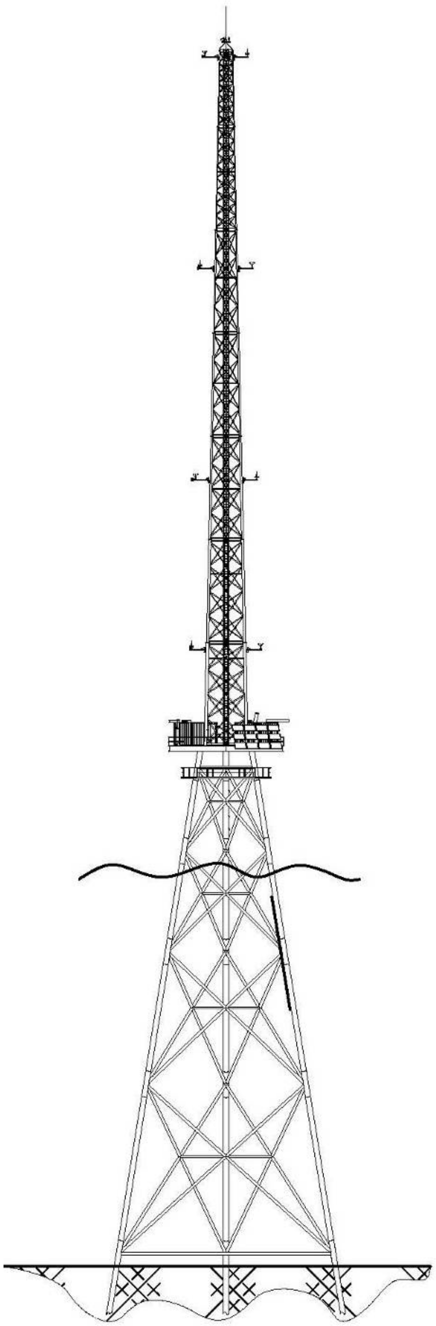
Figure 4.1. Cape Wind Meteorological Tower

The only meteorological tower currently installed on the OCS for the purposes of renewable energy site assessment is located on Horseshoe Shoal, in Nantucket Sound (Figure 4-1). As shown on Figure 4-1, a monopile mast was used for this meteorological tower. The tower was installed in 2003 and consists of three pilings supporting a single steel pile that supports the deck. The overall height of the structure is 197 feet (60 meters) above the mean lower low water datum. The Cape Wind meteorological tower represents the smaller end of the range of structures anticipated in southern New England. It is located in shallower water (8 to 10 feet [2.4 to 3 meters]) and nearer to shore (approximately 6 miles [9.7 kilometers]) than the RI/MA and MA WEAs.

4.3.4.2 Meteorological Tower

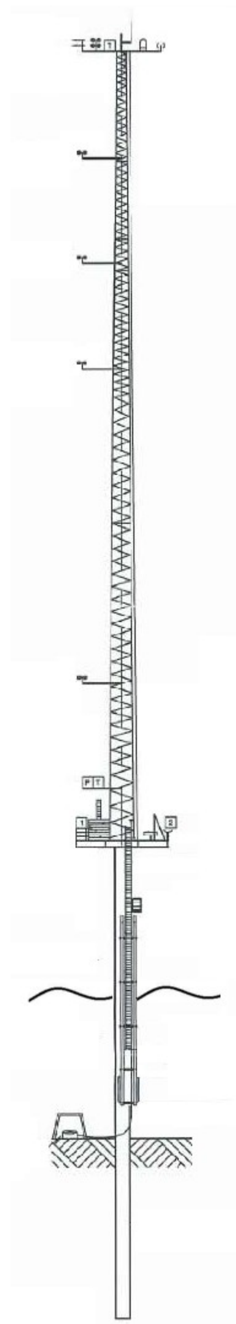
As mentioned previously in the Cape Wind example, one of the traditional instruments used for characterizing offshore wind conditions is the meteorological tower. At a maximum, a single meteorological tower would be installed per lease area. The foundation structure and a scour control system, if required based on potential seabed scour anticipated at the site, would occupy less than 2 acres. Once installed, the top of a meteorological tower would be 295 to 328 feet (90 to 100 meters) above mean sea level.

A meteorological tower consists of a mast mounted on a foundation anchored to the seafloor. The mast may be either a monopole such as that used in the Cape Wind project mentioned above (Figure 4-1) or a lattice (i.e. jacket foundation) (Figure 4-2). The mast and data-collection devices would be mounted on a fixed or pile-supported platform (monopile, jackets, or gravity bases) or floating platform (spar, semi-submersible, or tension-leg) (Figure 4-3).



Source: Deepwater Wind, LLC a*s cited in* USDOI, BOEM, OREP 2012.

Figure 4.2(a).
Lattice-type Mast Mounted on a Steel Jacket Foundation

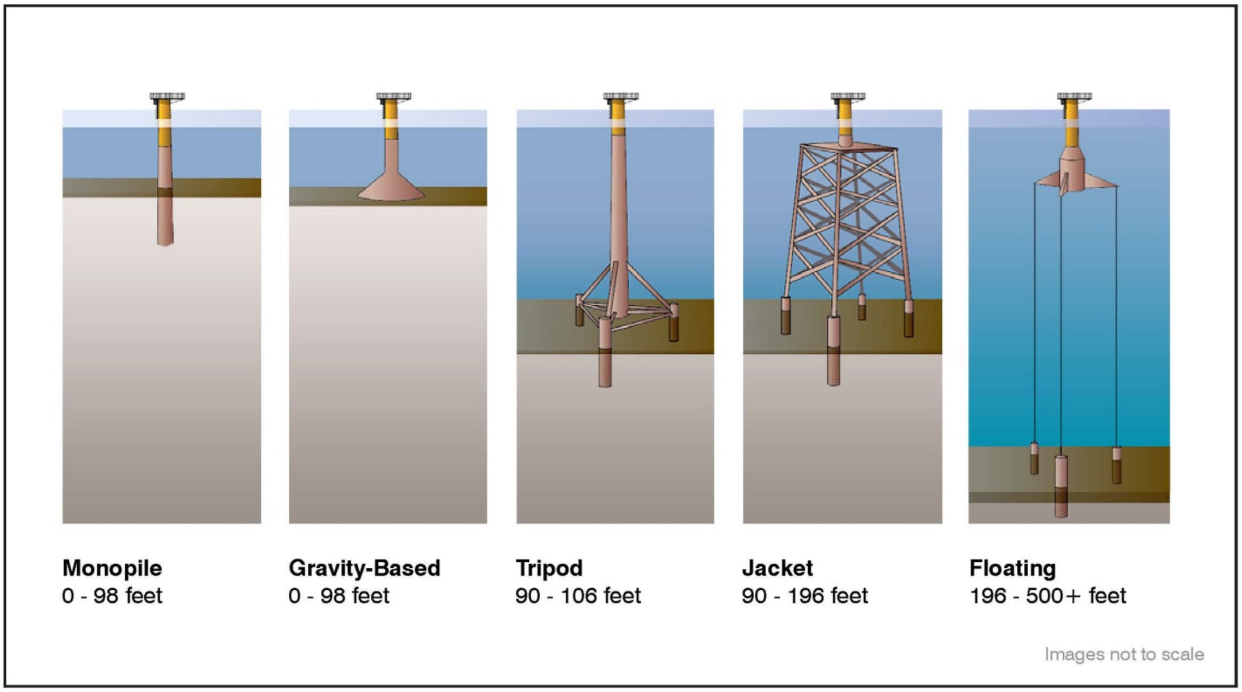


Source: Fishermen's Energy of New Jersey, LLC *as cited in* USDOI, BOEM, OREP 2012.

Figure 4.2(b).
Lattice-type Mast Mounted on a Monopile Foundation

Figure 4.2. Examples of Lattice Mast Meteorological Towers

In the case of fixed platforms, it is assumed that a deck would be supported by a single 10 foot-diameter (approximately 3 meter diameter) monopile, tripod, or a steel jacket with three to four 36-inch-diameter piles. The monopile or piles would be driven anywhere from 25 to 100 feet (7.6 to 30.5 meters) into the seafloor depending on subsea geotechnical properties. The foundation structure and a scour-control system, if required based on potential seabed scour anticipated at the site, would occupy less than 2 acres (0.81 hectare). Once installed, the top of a meteorological tower would be 295 to 328 feet (90 to 100 meters) above mean sea level. The area of ocean bottom affected by a meteorological tower would range from about 200 square ft (approximately 18.6 square meters), if supported by a monopile, to 2,000 square ft (approximately 184.1 meters) if supported by a jacket foundation.



SOURCE: Adapted from Musial, Butterfield, and Ram 2006, as cited in TetraTech EC, Inc. 2010.

Figure 4.3. Types of Foundations for Meteorological Towers

Scour Control Systems

Wave action, tidal circulation, and storm waves interact with sediments on the surface of the OCS, inducing sediment reworking and/or transport. Episodic sediment movement caused by ocean currents and waves can cause erosion or scour around the tower bases. Erosion caused by scour may undermine meteorological tower structural foundations leading to potential failure. BOEM assumes that scour control systems would be installed, based on potential seabed scour anticipated at sites. There are several methods for minimizing scour around piles, such as the placement of rock armoring and mattresses of artificial (polypropylene) seagrass.

Artificial grass mats have been found to be effective in both shallow and deep waters, therefore this is the most likely scour control system to be used for the proposed meteorological towers. These mats are made of synthetic fronds that mimic seafloor vegetation to trap sediment and become buried over time. If used, these mats would be installed by divers or underwater remotely operated vehicle (ROV). Each mat would be anchored at 8 to 16 locations, about 1 foot into the sand. Once installed the mats would not require future maintenance. Monitoring of scouring at the Cape Wind meteorological tower found that at one pile where two artificial seagrass scour mats were installed, there was a net increase of 12 inches (30.5 centimeters) of sand, and at another pile with artificial seagrass scour mats, there was a net scour of 7 inch (18 centimeter) pilings; both occurred over a three-year timeframe (Ocean and Coastal Consultants Inc. 2006).

It is anticipated that for a pile-supported platform, four mats each of about 16.4 by 8.2 feet (5 by 2.5 meters) would be placed around each pile. Including the extending sediment bank, a total area disturbance of about 5,200 to 5,900 square ft (approximately 483 to 548 square meters) for a three-pile structure and 5,900 to 7,800 square ft (approximately 548 to 724.6 square meters) for a four-pile structure is estimated. For a monopile, it is anticipated that eight mats 16.4feet by 16.4 feet (5 meters by 5 meters) would be used, and thus there would be a total disturbance area of about 3,700 to 4,000 square feet (343.74 by 371.61 square meters) per foundation.

A rock armor scour protection system may also be used to stabilize a structure's foundation area. Rock armor and filter layer material would be placed on the seabed using a clamshell bucket or a chute. The filter layer would help prevent the loss of underlying sediments and sinking of the rock armor (ESS Group, Inc. 2006). In water depths greater than 15 feet (4.5 meters), the median stone size would be about 50 pounds (approximately 22.6 kilograms) with a stone layer thickness of about 3 feet (approximately 0.9 meters) ft). The rock armor for a monopile foundation for a wind turbine has been estimated to occupy 16,000 square feet (0.37 acre [0.15 hectares]) of the seabed (ESS Group, Inc. 2006). While the piles of meteorological tower would be much smaller than those of a wind turbine, a meteorological tower may be supported by up to four piles. Therefore, the maximum area of the seabed impacted by rock armor for a single meteorological tower is estimated to also be 16,000 square feet (0.37 acre [0.15 hectares]).

A scour control system would be monitored throughout the lease term. It is expected that the foundation would be visually inspected monthly for the first year of installation, and then every year after that or after each significant storm activity. Inspections would be carried out by divers or ROV's.

Removal of the scour control system is discussed in Section 4.8.2, Removal of Scour Control System.

Installation of the Foundation Structure

A jacket or monopile foundation and deck would be fabricated onshore, transferred to barge(s) and the carried or towed to the offshore site. This equipment would typically be deployed from two barges, one containing the pile-driving equipment and a second containing a small crane, support equipment, and the balance of materials needed to erect the platform deck. These barges would be tended by appropriate tugs and workboats, as needed.

The foundation pile(s) for a fixed platform could range from either a single 10-foot (3 meter)-diameter monopile or three to four 36-inch (0.9-meter)-diameter piles (jacket). These piles would be driven anywhere from 25 to 100 feet (7.6 to 30.5 meters) below the seafloor with a pile-driving hammer typically used in marine construction operations. After approximately three days, when the pile-driving is complete, the pile-driver barge would be removed. In its place, a jack-up barge equipped with a crane would be used to assist in the mounting of the platform decking, tower, and instrumentation onto the foundation. Depending on the type of structure installed and the weather and sea conditions, the in-water construction of the foundation pilings and platform would range from several days (monopile construction in good weather) to six weeks (jacket foundation in bad weather) (USDOI, MMS 2009a). The mast sections would be raised using a separate barge-mounted crane; installation would likely be complete within a few weeks.

Piles are generally driven into the substrate using one of two methods: impact hammers or vibratory hammers (Nedwell and Howell 2004; Hansen *et al.*, 2003). Impact hammers use a heavy weight to repeatedly strike the pile and dive it into the substrate. Vibratory hammers use a combination of vibration and a heavy weight to force the pile into the sediment. Impact hammers produce sharp striking sounds, whereas vibratory hammers produce more continuous, low frequency sounds (Nedwell and Howell 2004; Hanson *et al.*, 2003). The type of hammer used depends on a variety of factors, such as the material the pile is composed of, and the sediment the pile will be driven into. Impact hammers can be used for any type of pile, and can drive piles into most all substrates. Vibratory hammers are more useful when driving a pile that has a sharp edge that can cut into the sediment (i.e. an open ended steel pile); as opposed to one that displaces the sediment (i.e. closed ended steel pile, wood, or cement). Also, vibratory hammers are most useful in softer sediments such as sand or mud (Hanson *et al.*, 2003). A combination of vibratory hammers and impact hammers can also be used, again, depending on the substrate. This method can be used when there is softer substrate in the upper layers, where the vibratory hammer is more useful at positioning the pile while hammering. The impact hammer can then be used to drive the pile the remainder of the depth when harder, more resistance substrates are encountered (Hanson *et al.*, 2003). This method may also be useful in the case of meteorological towers which must meet seismic stability criteria, which required that the supporting piles are either attached to, or driven into, the underlying hard sediment (Hanson *et al.*, 2003).

During installation, a radius of approximately 1,500 feet (457 meters) around the site would be needed for the movement and anchoring of support vessels. Total installation time for one meteorological tower would take eight days to ten weeks, depending on the type of structure to be installed and the weather and ocean conditions (USDOI, MMS 2009a).

Foundation Hammering Sounds

As with any sound in the marine environment, the type and intensity of the sound is greatly dependent on multiple factors and can vary greatly. These factors include the type and size of the pile, the type of substrate, the depth of the water, and the type and size of the impact hammer (Madsen *et al.*, 2006). Wood and concrete piles appear to produce lower sound pressures than hollow steel piles of a similar size. Firmer substrates require more energy to drive piles, and produce more intense sound pressures.

Driving hollow steel piles using the impact hammer method produces intense sharp spikes of sound. Using vibratory hammers to drive piles produces a more continuous, lower intensity sound. When comparing the two methods, vibratory hammers produce longer duration sounds with more energy in the lower frequencies (15 to 26 Hz vs. 100 to 800 Hz) (Würsig *et al.*, 2000; Carlson *et al.*, 2001; Nedwell 2007). The environmental impacts of this sound production are discussed further in Section 5.

Meteorological Tower Operation and Maintenance Activities

The length of time a meteorological tower may be present on a leasehold would be influenced by a number of factors, including how long it takes to install the tower, whether the lessee has submitted a COP, and/or how long the subsequent BOEM review of the COP takes. For the proposed action, BOEM anticipates that a tower may be present for approximately five years before the final decision is made to either allow the tower to remain or be decommissioned.

During the life of the meteorological tower, the structure and instrumentation would be accessible by boat for routine maintenance. As indicated in previous site assessment proposals submitted to BOEM, lessees with towers powered by solar panels or small wind turbines would conduct monthly or quarterly vessel trips for operation and maintenance activity over the five-year life of a meteorological tower (USDOI, MMS 2009a). However, if a diesel generator is used to power the meteorological tower's lighting and equipment, a maintenance vessel would make a trip at least once every other week, if not weekly, to provide fuel, change oil, and perform maintenance on the generator. Depending on the frequency of the trips, support for the meteorological towers in the RI/MA and MA WEAs would result in anywhere from of 36 quarterly to 468 weekly round trips per year for up to nine meteorological towers. No additional or expansion of onshore facilities would be required to conduct these tasks. It is projected that crew boats 51 to 57 feet in length with 400 to 1,000 horsepower engines and 1,800-gallon fuel capacity would be used for routine maintenance and generator refueling if diesel generators are used.

Meteorological Tower Lighting

All meteorological towers and buoys, regardless of height, would have lighting and marking for aviation and navigational purposes. Meteorological towers and buoys would be considered Private Aids to Navigation, and are required to be maintained by the individual owner under the regulations of the USCG. The USCG lighting for navigation safety would consist of two amber lights (USCG Class C) mounted on the platform deck. In accordance with FAA guidelines, the tower would be equipped with a light system consisting of a low intensity flashing red light (FAA designated L-864) for night use.

4.3.4.3 Meteorological Buoys

While a meteorological tower has been the traditional device for characterizing wind conditions, several companies have expressed their interest in installing one or two meteorological buoys per lease instead. Meteorological buoys can be used as an alternative to a meteorological tower in the offshore environment for meteorological resource data collection (i.e., wind, wave, and current). These meteorological buoys would be anchored at fixed locations and would regularly collect observations from many different atmospheric and oceanographic sensors.

These meteorological buoys, of varying designs, utilize LIDAR and/or SODAR. These may be used instead of, or in addition to, anemometers to obtain meteorological data. LIDAR is a surface-based remote sensing technology that operates via the transmission and detection of light. SODAR is also a surface-based remote sensing technology; however it operates via the transmission and detection of sound.

A meteorological buoy can vary in height, hull type, and anchoring method. NOAA has successfully used discus-shaped hull buoys and boat-shaped hull buoys for weather data collection for many years. In addition, spar buoy and tension-leg platform buoy designs have been recently submitted to BOEM for approval. All of these buoy types will likely be utilized for offshore wind data collection. A large discus buoy has a circular hull range between 32 and 39 feet (10 and 12 meters) in diameter and is designed for many years of service (USDOC, NOAA, National Data Buoy Center [NBDC], 2008). The boat-shaped hull buoy (known as a 'NOMAD' [Naval Oceanographic and Meteorological Automated Device]) is an aluminum-hulled, boat-shaped buoy that provides long-term survivability in severe seas (USDOC, NOAA, NBDC, 2008). This buoy design could be utilized to mount a LIDAR wind assessment system. A typical NOMAD is a 19.6 feet by 10.2 feet (6 meters by 3.1 meters) aluminum hulled buoy with a draft of 10.5 ft (3.2 m). Originally designed by the U.S. Navy in the 1940s, the NOMAD has since been adopted and widely used by researchers, including NOAA's National Data Buoy Center. The following description is from Fishermen's Energy SAP (Fishermen's Energy 2011 *as cited in* USDOI, BOEM, OREP, 2012a).

Primary electrical (DC) power for all equipment on a NOMAD-type buoy could be provided by four deep cycle 12 volt batteries. Batteries will be charged by renewable sources which include two wind generators and four 40-watt solar panels. In the event that the renewable power sources fail to keep the batteries adequately charged (extended heavy cloud cover with little wind), the power monitoring system could prompt an onboard diesel fuel powered generator to start and run until the batteries reach the required charge level. The system would revert back to renewable charging once these systems return to proper operation (Fishermen's Energy 2011 *as cited in* USDOI, BOEM, OREP, 2012a). Up to 500 gallons of diesel fuel could be stored on board the buoy to operate the generator.

The anchoring system for the NOMAD-type buoy could be a via a standard ¾ inch steel chain to a 10,000 pounds (4,536 kilograms) steel or concrete block (s). The footprint of the anchor itself is conservatively estimated at 16 square feet (1.49 square meters). Fishermen's Energy conservatively estimates the total bottom-disturbing footprint from the anchor and anchor chain sweep of a disc-shaped or a boat-shaped buoy to range from 121,613 square feet (approximately 11,298 square meters) to 372440 square feet (approximately 34,600 square meters) assuming approximately 100 feet (30.5 meters) of slack chain at low tide.

Because of its size, a buoy of the NOMAD design would likely be towed by a single vessel to the site in the lease area at speeds of around 3 knots. Although USCG buoy tending vessels greater than or equal to 180 feet (approximately 55 meters) are known to be able to transport and deploy a buoy of this size from its deck, a wind developer may not have access to a vessel of this size.

Buoys can use a wide range of moorings to attach to the seabed. On the OCS, a larger discus-type or boat-shaped hull buoy may require a combination of a chain, nylon, cable and/or buoyant polypropylene materials designed for many years of ocean service. Some deep-ocean moorings have operated without failure for over 10 years (USDOC, NOAA, NBDC 2008).

A spar-type buoy can be stabilized through an on-board ballasting mechanism approximately 60 feet (18.3 meters) below the sea surface. Approximately 30 to 40 feet (approximately 9 to 12 meters) of the spar-type buoy would be above the ocean surface where meteorological and other equipment would be located. A spar buoy is a long, thin, typically cylindrical buoy, ballasted at one end so that it floats in a vertical position. This design maintains tension in the anchor chain between the buoy and the anchor, thus eliminating slack in the chain that results in chain sweep around the anchor. Tension-leg platforms use the same tension in the mooring chain, but may utilize a more traditional discus-shaped buoy with a larger mast for mounting data collection instrumentation.

Buoy Installation

Boat-shaped, spar-type and discus-shaped buoys are typically towed or carried aboard a vessel to the installation location. Once at the location site, the buoy would be either lowered to the surface from the deck of the transport vessel or placed over the final location, and then the mooring anchor dropped. A boat-shaped buoy in shallower waters of the RI/MA and MA WEAs may be moored using an all-chain mooring, while a larger discus-type buoy would use a combination of chain, nylon, and buoyant polypropylene materials (USDOC, NOAA, NBDC, 2008). Based on previous proposals, anchors for boat-shaped and discus-shaped buoys would weigh about 6,000 to 10,000 pounds (2,721 to 4,536 kilograms) with a footprint of about 16 square feet (approximately 1.49 square meters) and an anchor sweep of about 8.5 acres (approximately 3.4 hectares). After installation, the transport vessel would remain in the area for several hours while technicians configure proper operation of all systems. Boat-shaped and discus-shaped buoys would typically take one day to install. Transport and installation vessel anchoring for one day is anticipated for these types of buoys (Fishermen's Energy 2011 *as cited in* USDOI, BOEM, OREP 2012).

Typically, a spar-type buoy would take two days to install. It would be towed to the installation location by a transport vessel after assembly at a land-based facility. Deployment would occur in two phases: deployment of a clump anchor to the seabed as a pre-set anchor (Phase 1) and deployment of the spar buoy and connection to the clump anchor (Phase 2). Phase 1 would take approximately one day and would include placement of the clump anchor on a barge and transporting it to the installation site. The monitoring buoy would be anchored to the seafloor using a clump weight anchor and mooring chain. Installation could take approximately two days. Spar-type buoys may have all-chain moorings or cables. Moorings for a spar-type buoy tension leg anchoring system may weigh up to 165 tons with a 26 by 26 foot (7.9 by 7.9 meter) footprint. The total area of bottom disturbance associated with buoy and vessel anchors would be 28 by 28 feet (8.5 by 8.5 meters), with a total area of 784 square feet (73 square meters) to a 1,200-foot (356.7 meter) radius anchor sweep for the installation vessel with a total of just over 100 acres of disturbance. The maximum area of disturbance to benthic sediments would occur during anchor deployment and removal (e.g., sediment resettlement, sediment extrusion, etc.) for this type of buoy.

4.3.4.4 Other Ocean Monitoring Equipment

In addition to the meteorological buoys described above, a small tethered buoy (typically 3 meters [approximately 10 feet] or less in diameter) and/or other instrumentation also could be installed on, or tethered to, a meteorological tower to monitor oceanographic parameters and to collect baseline information on the presence of certain marine life.

To measure the speed and direction of ocean currents, Acoustic Doppler Current Profilers (ADCPs) would likely be installed on each meteorological tower or buoy. The ADCP is a remote sensing technology that transmits sound waves at a constant frequency and measures the ricochet of the sound wave off fine particles or zooplanktons suspended in the water column.

The ADCPs may be mounted independently on the seafloor or to the legs of the platform, or attached to a buoy. A seafloor-mounted ADCP would likely be located near the meteorological tower (within approximately 500 feet [152 meters]) and would be connected by a wire that is hand-buried into the ocean bottom. A typical ADCP has three to four acoustic transducers that emit and receive acoustical pulses from different directions, with frequencies ranging from 300 to 600 kHz with a sampling rate of 1 to 60 minutes. A typical ADCP is about 1 to 2 feet tall (approximately 0.3 to 0.6 meters) and 1 to 2 feet wide (approximately 0.3 to 0.6 meters). Its mooring, base, or cage (surrounding frame) would be several feet wider.

A meteorological tower or buoy also could accommodate environmental monitoring equipment, such as avian monitoring equipment (e.g., radar units, thermal imaging cameras), acoustic monitoring for marine mammals, data-logging computers, power supplies, visibility sensors, water measurements (e.g., temperature, salinity), communications equipment, material hoist, and storage containers.

4.3.4.5 Timing of Wind Resource Assessment Equipment Installation

Total installation time for a single meteorological tower would take eight days to ten weeks depending on the type of structure installed and the weather and sea state conditions. It is anticipated that an average meteorological buoy installation would likely take one to two days. Installation of meteorological towers and buoys would likely occur in the spring and summer months during calmer weather, however, installation could potentially occur at any time of year when weather permits.

4.4 Vessel Traffic (RI/MA, MA, NY, and NJ Areas)

Vessel traffic, both by air and by sea, occurs during all phases of the site characterization and assessment activities. Due to concerns with collisions and potential pollution, vessel traffic for all phases of site characterization and site assessment are addressed in this section.

In an effort to reduce ship strikes to endangered right whales, NOAA issued regulations requiring ships 65 feet (19.8 meters) or longer to travel at 10 knots or less in certain areas where right whales gather (Effective December 9, 2008 to December 9, 2013) (73 FR 60173). The Special Management Areas (SMAs) aim to reduce the likelihood of deaths and serious injuries to endangered North Atlantic right whales that result from collisions with ships, which also benefits other marine mammal species. These restrictions extend out to 20 NM (37 kilometers) around major mid-Atlantic ports. The Block Island Sound SMA includes all of the RI/MA WEA and a small portion of the MA WEA. The Delaware Bay SMA does not fully overlap with the NJ WEA, and the New York SMA partially overlaps with the NY WEA. Except for crew boats, which are typically smaller than 65 feet (19.8 meters), these restrictions would be applicable to most vessels associated with the proposed action. Speed restrictions are in effect from November 1st to April 30th. In addition to the seasonal restrictions, Dynamic Management Areas (DMAs) created by NMFS and based on recent right whale sightings (when a group of three or more right whales is confirmed) may be present within the Project Area or surrounding waters. Should a DMA become active encompassing all or a portion of the Project Area, NMFS would encourage vessel operators to voluntarily adhere to the seasonal restrictions, or, if possible, re-route their path outside of the designated DMA. Lessees in the RI/MA, MA, NY, and NJ areas would be required to abide by these otherwise voluntary restrictions (*See* Section 8.0).

4.4.1 HRG Survey Traffic

As detailed in Section 4.2.1.2, it is assumed that the HRG survey would cover the entire Project Area, and geophysical surveys for shallow hazards (492 feet [150 meters] line spacing) and archaeological resources (98 feet [30 meters] line spacing) would be conducted at the same time on the same vessels conducting sweeps at the finer line spacing array. This would result in about 500 NM of HRG surveys per OCS block (3 statute miles by 3 statute miles [approximately 5 kilometers by 5 kilometers]), not including turns. Assuming a vessel speed of 4.5 knots and 10-hour days (daylight hours minus transit time to the site), it would take about 11 days to survey one OCS block or about 100 days to survey an average-size lease of eight OCS blocks. To survey all of the Project Area, HRG surveys would have to be conducted by multiple vessels and/or over multiple years. Assuming 100 percent coverage of the Project Area, the proposed action would result in a total of approximately 117,200 NM or 25,990 hours/ 2,750 round trips of HRG surveys (see Table 4.3 and 4.4).

Vessels would be required to maintain a vigilant watch for marine mammals and sea turtles during transit to and from the survey area, as well as during the HRG survey itself. Section 8.0 details the standard operating conditions that would be required for vessels.

4.4.2 Geotechnical Sampling Vessel Traffic

As described in the geotechnical sampling activity scenario, it is anticipated that there would be approximately 2,308 – 7,400 geotechnical samples taken within the Project Area. The amount of effort and vessel trips vary greatly by the type of technology used to retrieve the sample, and each work day would be associated within one round trip. The following details the type of vessels and collection time per sample:

Vibracores: Would be likely be advanced from a single small vessel (~45 feet [~14.7 meters]), and collect 1 sample per day.

CPT: Depending on the size of the CPT, it could be advanced from medium vessel (~65 feet [~19.8 meters]), a jack-up barge, a barge with a 4-point anchoring system, or a vessel with a dynamic positioning system. Each barge scenario would include a support vessel. This range of vessels could sample between 1 location per day.

Geologic boring: Would be advanced from a jack-up barge, a barge with a 4-point anchoring system, or a vessel with a dynamic positioning system. Each barge scenario would include a support vessel. Each deep geologic boring could take 1 day.

Based on the expected number of both HRG surveys and geotechnical samples, as well as, presumed independent biological surveys, approximately 2,750 vessel trips (round trips) associated with site characterization surveys are projected to occur as a result of the proposed action over five years (2013 to 2018).

4.4.3 Meteorological Tower Construction and Operation Traffic (RI/MA and MA WEAs)

The proposed action scenario estimates a maximum of nine meteorological towers to be constructed within the RI/MA and MA WEAs. During installation, a radius of approximately

1,500 feet (457.2 meters) around the site would be needed for the movement and anchoring of support vessels. A maximum of 40 round trip vessel trips are expected during construction of each meteorological tower or 360 rounds trips for up to nine meteorological towers.

Several vessels would be involved in installing and constructing a meteorological tower. Vessels delivering construction material or crews to the site will be present in the area between the mainland and the construction site, as well as vessel being present at the site during installation. The barges, tugs and vessels delivering construction materials will typically be 65 to 270 feet (19.8 to 82.3 meters) in length, while the vessel carrying construction crews will typically be 51 to 57 feet (15.5 to 17.4 meters) in length.

After installation data would be monitored and processed. The structure and instrumentation would be accessed by boat for routine maintenance. Assuming a single maintenance trip to each meteorological tower quarterly to weekly, the proposed action would result in an additional 40 to 520 vessel trips per year for up to 9meteorological towers, or 180 to 2,340 vessel trips over a five-year period. These vessel trips would not require any additional or expansion of onshore facilities. It is projected that crew boats 51 to 57 feet (15.5 to 17.4 meters) in length would be used to service the structure.

Vessel usage during decommissioning will be similar to that during construction. Up to approximately 40 round trips by various vessels are expected during decommissioning of each meteorological tower. Similar to construction, this yields an average of 360 round trips for the decommissioning of up to nine meteorological towers.

4.4.4 Meteorological Buoy Deployment and Operation Traffic (RI/MA and MA WEAs)

The proposed action scenario estimates a maximum of 18 meteorological buoys could be deployed throughout the RI/MA and MA WEAs. As described in Section 4.3.5.3, the installation of each buoy could utilize 1-2 round trips per buoy deployment. The types of vessels involved in the deployment include barge/tug (for buoy and/or anchoring system), large work vessel (for towing and/or carrying the buoy), and an additional support vessel (for crew and other logistical needs).

Similar to the meteorological towers, it is expected that maintenance for the buoy would be required on a quarterly to weekly basis resulting in maximum of 80-1,040 to round-trips per year for up to 18 buoys, or 360-4,680 vessel trips over a five year period. It should be noted that it is unlikely that all 18 meteorological buoys would be in service at the same time over the entire period. For meteorological buoys, the decommissioning is expected to be the reverse of the deployment, with one round trip required to retrieve each buoy.

Table 4.4 Total Number of Estimated Vessel Trips for Project Area Over a Five Year Period								
WEA	**HRG Survey**	**Geotechnical sample**	**Met tower install**	**Met buoy install**	**Met tower ops**	**Met buoy ops**	**Met tower decom**	**Met buoy decom**
New Jersey	690	900-2,500	-	-	-	-	-	-
New York	160	200-600	-	-	-	-	-	-
Rhode Island / Massachusetts	400	500 – 1,400	160	8-16	80-1040	160-2080	160	8-16
Massachusetts	1500	708 – 2900	200	10-20	100-1300	200-2600	200	10-20
Total	2750	2308 – 7400	360	18-26	180-2340	360-4680	360	18-26

Note:
Met = Meteorological
ops = operations
decom = decommissioning

4.5 Onshore Activity (RI/MA and MA WEAs)

For site assessment-related activity in the RI/MA and MA WEAs there are several southern New England ports would be used as a fabrication sites, staging areas and crew/cargo launch sites. Existing ports or industrial areas are expected to be used. The fabrication facilities in the relevant major port areas are large and have high capacities, therefore BOEM does not anticipate that the fabrication of meteorological towers or buoys associated with the proposed action would have any substantial effect on the operations of, transportation to or from, or conditions at these facilities.

Several major ports exist near the RI/MA and MA WEAs that are suitable to support the fabrication and staging of meteorological towers and buoys, including the ports of New Bedford, Massachusetts and Quonset Point, Rhode Island.

A meteorological tower platform or meteorological buoy would be constructed or fabricated onshore at an existing fabrication yard or final assembly of the tower could be completed offshore. The location of these fabrication yards is directly tied to the availability of a large enough channel that would allow the towing of these structures. The average bulkhead depth needed for water access to fabrications yards is 15 to 20 feet (4.6 to 6.1 meters).

4.6 Decommissioning (RI/MA and MA WEAs)

No later than two years after the cancellation, expiration, relinquishment, or other termination of the lease, the lessee would be required to remove all devices, works, and structures from the site and restore the leased area to its original condition before issuance of the lease (30 CFR 585, Subpart I). Decommissioning is only being assessed for the RI/MA and MA WEAs.

It is estimated that the entire removal process of a meteorological tower would take one week or less. Decommissioning activities would begin with the removal of all meteorological instrumentation from the tower, typically using a single vessel. A derrick barge would be transported to the offshore site and anchored next to the structure. The mast would be removed from the deck and loaded onto the transport barge. The deck would be cut from the foundation structure and loaded onto the transport barge. The same number of vessels necessary for installation would likely be required for decommissioning. The sea bottom area beneath installed structures would be cleared of all materials that have been introduced to the area in support of the lessee's project.

Buoy decommissioning is the reverse of the installation process. Equipment recovery would be performed with support of a vessel(s) equivalent in size and capability to those used for installation. For small buoys, a crane lifting hook would be secured to the buoy. A water/air pump system would de-ballast the buoy into the horizontal position. The mooring chain(s)/cable(s) and anchor would be recovered to the deck using a winching system. The buoy would then be towed to shore by the barge. All buoy decommissioning is expected to be completed within one or two days. Buoys would be returned to shore and disassembled or reused in other applications. It is anticipated that the mooring devices and hardware would be reused or disposed of as scrap iron for recycling (Fishermen's Energy 2011 *as cited in* USDOI, BOEM, OREP, 2012a).

4.6.1 Cutting and Removing Piles

As required by BOEM, the lessee would sever bottom-founded structures and their related components at least 15 feet (5 meters) below the mud line to ensure that nothing would be exposed that could interfere with future lessees and other activities in the area (30 CFR 585.910(a)). The choice of severing tool depends on the target size and type, water depth, economics, environmental concerns, tool availability, and weather conditions (USDOI, MMS 2005). Meteorological tower piles in the RI/MA and MA WEAs would be removed using non-explosive severing methods.

Common non-explosive severing tools that may be used consist of abrasive cutters (e.g., sand cutters and abrasive water jets), mechanical (carbide) cutters, diver cutting (e.g., underwater arc cutters and oxyacetylene/oxyhydrogen torches), and diamond wire cutters. Of these, the most likely tools to be employed would be an internal cutting tool, such as a high-pressure water jet-cutting tool that would not require the use of divers to set up the system or jetting operations to access the required mud line (Kaiser *et al.*, 2005). To cut a pile internally, the sand that had been forced into the hollow pile during installation would be removed by hydraulic dredging/pumping and stored on a barge. Once cut, the steel pile would then be lifted onto a barge and transported to shore. Following the removal of the cut pile and the adjacent scour control system, the sediments would be returned to the excavated pile site using a vacuum pump and diver-assisted hoses. As a result, no excavation around the outside of the monopile or piles prior to the cutting is anticipated. Cutting and removing piles would take anywhere from several hours to one day per pile. After the foundation is severed, it would be lifted on the transport barge and towed to a decommissioning site onshore (USDOI, MMS 2009a).

4.6.2 Removal of Scour Control System

Any scour control system would be removed during the decommissioning process. Scour mats would be removed by divers or ROV and a support vessel in a similar manner to installation. Removal is expected to result in the suspension of sediments that were trapped in the mats. If rock armoring is used, armor stones would be removed using a clamshell dredge or similar equipment and placed on a barge. It is estimated that the removal of the scour control system would take a half-day per pile. Therefore, depending on the foundation structure, removal of the scour system would take from one half to two days to complete (USDOI, MMS 2009a).

4.6.3 Disposal

All materials would be removed by barge and transported to shore. The steel would be recycled and remaining materials would be disposed of in existing landfills, in accordance with applicable law.

4.6.4 Artificial Reefs

Obsolete materials have been used as artificial reefs along the coastline of the U.S. to provide valuable habitat for numerous species of fish in areas devoid of natural hard bottom. The meteorological tower structures and scour control systems may have the potential to serve as artificial reefs. However, the structure must not pose an unreasonable impediment to future development. If the lessee ultimately proposes to use the structure as an artificial reef, its plan must comply with the artificial reef permitting requirements of the USACE and the criteria in the National Artificial Reef Plan of 1985 (33 U.S.C. 35.2103). The state agency responsible for managing marine fisheries resources must accept liability for the structure before BOEM would release the federal lessee from the obligation to decommission and remove all structures from the lease area (USDOI, MMS 2009a).

5 Effects of the Proposed Action

The proposed action has five primary activities that will likely have environmental effects to ESA-listed species under NMFS jurisdiction. These activities are: (1) HRG surveys; (2) geotechnical sampling; (3) deployment of a meteorological buoy or construction of a meteorological tower; (4) operation of a meteorological buoy or meteorological tower; and (5) other activities. The potential effects from these activities can be grouped into the following categories: (1) acoustic effects; (2) benthic habitat effects; (3) vessel collision effects; and (4) other effects (e.g., contact with waterborne pollution).

5.1 Description of the Environment

Section 4.2 of the Programmatic EIS (USDOI, MMS 2007) gives a thorough description of the geology, biology, meteorology, and acoustics of the BOEM Atlantic Planning Areas. Regardless, a brief description of the physical environment is included here. Section 3.0 of this document gives a description of the species of concern that inhabit this area. The Project Area is located in the mid-Atlantic Bight (MAB) (also referred to as the Southern New England/ New York Bight in this document) of the Northeast Continental Shelf Large Marine Ecosystem. The following characterization and tables are adopted from *Characterization of the Fishing Practices and Marine Benthic Ecosystems of the Northeast U.S. Shelf* (Stevenson *et al.*, 2004). The Project Area is located on the continental shelf system that extends from the Gulf of Maine south to Cape Hatteras and east of the Gulf Stream (Stevenson *et al.*, 2004). As in the rest of the continental shelf, the MAB topography was largely shaped by sea-level changes during the last ice age. The retreat of the last ice sheet deposited shaped the profile of the continental shelf and deposited sediments. These are being continuously reworked today by currents, tides and waves (Stevenson *et al.*, 2004).

Extending out from shore between 54 to 108 NM (100 and 200 kilometers) the continental shelf gently slopes until it transitions to the slope at the shelf break in approximately 328 to 656 feet (100 to 200 meters) of water. Offshore around Georges Bank the primary morphological features of the shelf include shelf valleys ad channels, scarps, and sand ridges and swales. The sediment type covering most of MAB shelf is sand with some relatively small, localized areas of sand-shell and gravel. Silty sand, silt and clay become predominant once on the slope.

Table 5.1
Mid-Atlantic Habitat Types (Including Southern New England)

Habitat Type [after Boesch (1979)]	Depth (meters)	Characterization (Pratt (1973) faunal zone)	Characteristic Benthic Macrofauna
Inner Shelf	0-30	Coarse sands with finer sands off MD and VA (sand zone)	Polychaetes: *Polygordius*, *Goniadella*,and *Spiophanes*
Central Shelf	30-50	(sand zone)	Polychaetes: *Goniadella* and *Spiophanes* Amphipods: *Pseudunciola*
Central and inner shelf swales	0-50	Occurs in swales between sand ridges (sand zone)	Polychaetes: *Polygordius*, *Lumbrineris*, and *Spiophanes*
Outer shelf	50-100	(silty-sand zone)	Polychaetes: *Spiophanes* Amphipods: *Ampelisca vadrum* and *Erichthonius*
Outer shelf swales	50-100	Occurs in swales between sand ridges (silty-sand zone)	Amphipods: *Ampelisca agassizi*, *Unciola*, and *Erichthoniu*
Shelf break	100-200	(silt-clay zone)	NA
Continental slope	>200	(none)	NA

Source: Stevenson *et al.,* 2004

5.2 Acoustic Effects

This acoustic effects section summarizes the currently existing information on marine mammal hearing sensitivity and potential noise production resulting from site characterization and assessment activity in the Project Area.

5.2.1 Current Understanding of Noise Sensitivity in Marine Fauna

The information provided in this section is derived from previous ESA consultations issued by NMFS and BOEM for the proposed commercial wind energy lease issuance, associated site characterization activities, and subsequent site assessment activities in the mid-Atlantic WEAs, as well as the most relevant sources on marine mammal hearing sensitivity.

Sound is a major component of marine mammal survival. It is used for communication (of social and survival importance), foraging and navigation. It is also thought that marine mammals also use sound to gather information about their surrounding environment which can originate from natural sources such as sounds produced by other animals (inter- or intra- specific species), or natural occurring phenomenon such as wind or rain activity at the surface, or naturally occurring seismic activity such as earthquakes (Richardson *et al.,* 1995). Anthropogenic sound in the marine environment is increasing which has led to growing concern of the effects of such sound on marine mammals. Marine organisms can be affected by exposure to anthropogenic noise behaviorally, acoustically and physiologically (Richardson *et al.,* 1995).

Behavioral reactions can include:

- a flight response,
- change in response to predators,

- changes in diving patterns,
- changes in foraging,
- changes in breathing patterns,
- avoidance of important habitat or migration areas, and
- disruption of social relationships and interactions (Tyack 2009, Nowacek *et al.*, 2007; Richardson *et al.,* 1995).

Acoustic responses to anthropogenic noise can include:

- masking (the decreased ability for an animal to detect relevant sounds due to an increase in background noise),
- changes in call rates, and
- changes in call frequency.

Physiological responses can include:

- Temporary Threshold Shift (TTS) (temporary, fully recoverable reduction in hearing sensitivity due to exposure of higher than normal intensity sounds),
- Permanent Threshold Shift (PTS) (permanent, non-recoverable reduction in hearing sensitivity due to damage or injury caused by either a prolonged exposure to sound or a temporary exposure to very intense sound),
- increased stress, and
- direct or indirect tissue damage (such as hemorrhaging or gas bubbles developing in body fluids) (Nowacek *et al.,* 2007; Southall *et al.,* 2007; Wright *et al.,* 2007; Richardson *et al.,* 1995).

5.2.1.1 Marine Mammals

Currently, impacts to marine mammals from acoustic sources are based on levels than can cause behavioral harassment and/or physiological damage or injury. Under the MMPA, NMFS has established "do not exceed" thresholds that determine these impacts which are based on the root-mean-squared (RMS) metric. The RMS received levels for threshold criteria as established by NMFS are:

- 180 dB re 1 µPa or greater for potential injury to cetaceans and
- 190 dB re 1µPa for pinnipeds in water for potential injury to pinnipeds;
- 160 dB re 1 µPa for behavioral disturbance / harassment for non-continuous / impulsive noise to pinnipeds (in water) and cetaceans; and
- 120 dB re 1 µPa for behavioral disturbance / harassment from continuous noise to pinnipeds (in water) and cetaceans (70 FR 1871, *Marine Mammal Hearing*).

These thresholds have been developed based on limited experimental studies on captive odontocetes, controlled field experiments on wild animals, behavioral observations of wild animals exposed to anthropogenic sounds, and inferences from marine mammal vocalizations as well as inferences on hearing studies in terrestrial animals. Despite the current threshold criteria, individual marine mammal reactions to sound can vary, depending on a variety of factors such as, age and sex of the animal, prior noise exposure history of the animals which may have caused habituation or sensitization, the behavioral and motivational state of the animal at the time of exposure (i.e. if the animal is feeding and does not find it advantageous to leave its location), habitat characteristics, environmental factors that affect sound transmission, and location of the animal (i.e. distance from the shoreline) (NRC 2003). Nonetheless, the threshold levels referred to above are considered conservative based on the best available scientific information.

Marine Mammal Hearing

As discussed in Section 3.0, North Atlantic right, humpback, sei, sperm, and fin whales are the ESA-listed species likely occur and therefore be impacted by sound from site assessment and characterization activities in the Project Area. Sei and sperm whales are not expected to be exposed to noise from HRG surveys generated in the NY and NJ areas as they do not occur there. Therefore, this section will primarily address these species. In order for sound to illicit some form of response or create an impact on a marine mammal, it is important to note that the sound produced must be within the auditory threshold of that animal, meaning that the animal must be able to perceive the sound at the given frequency and sound pressure level (Gotz *et al.*, 2009).

Because of the obstacles in directly studying baleen whale hearing, hearing ranges, sensitivity, frequency, and localization of large open ocean whales, it is assumed that the sound production range of the species is an indicator of the species' hearing range (Richardson *et al.*, 1995; Ketten 1998).

Large, baleen whales generally produce low frequencies, concentrating their vocalizations at frequencies less than 1 kHz (Richardson *et al.*, 1995). However, some species, such as humpback whales, are known to be able to produce songs up to 8 kHz (Payne and Payne 1985). Large baleen whales are assumed to be most sensitive to frequencies below 1 kHz, however can hear sounds up to higher, yet unknown frequencies. The majority of anthropogenic sounds produced in the marine environment are below 1 kHz, therefore creating a potential overlap between whales and manmade sounds (Richardson *et al.*, 1995). It is thought that some or all baleen whales may hear infrasounds. These are sounds at frequencies well below those detectable by humans. Based on functional models it is expected that the functional hearing of baleen whales extends as low as 20 Hz, with an upper range of 30 Hz. Even if the range of sensitive hearing does not extend below 20-50 Hz, whales may hear strong infrasounds at considerably lower frequencies. Based on work with other marine mammals, if hearing sensitivity is good at 50 Hz, strong infrasounds at 5 Hz might be detected (Richardson *et al.*, 1995). Fin whales hearing range may extend to frequencies as low as 10-15 Hz. The right whale has been reported to produce tonal signals in the frequency range from roughly 20 to 1000 Hz (Parks & Tyack 2005). Mellinger (2004) reported right whales producing vocalizations in the 50-200 Hz range. The sounds produced were reported as the "up call," which is a frequency-modulated upsweep and were one of the more common sounds made by right whales. Table 5.2 summarizes the range of sounds produced by right, humpback, sei, sperm, and fin whales (from Richardson *et al.*, 1995):

Table 5.2
Summary of Known Right, Humpback, and Fin Whale Vocalizations

Species	Signal Type	Frequency Limits (Hz)	Dominant Frequencies (Hz)	Source Level (dB re 1µPa RMS)	References
North Atlantic Right	Moans Tonal Gunshots	< 400 20-1000	-- 100-2500 50-2000	-- 137-162 174-192	Watkins and Schevill (1972) Parks and Tyack (2005) Parks *et al.,* (2005)
Humpback	Grunts Pulses Songs	25-1900 25-89 30-8000	25-1900 25-80 120-4000	-- 176 144-174	Thompson, Cummings, and Ha (1986) Thompson, Cummings, and Ha (1986) Payne and Payne (1985)
Fin	FM moans Tonal Songs	14-118 34-150 17-25	20 34-150 17-25	160-186 186	Watkins (1981), Edds (1988), Cummings and Thompson (1994) Edds (1988) Watkins (1981)
Sei	FM Sweeps	1500-3500	-	-	T. Thompson et al 1979; Knowlton et al 1991
Sperm	Clicks	0.1 – 30 kHz 5-20 kHz	2-4 kHz 10-16 kHz	160-180	Backus & Shevill 1996; Levenson 1974; Watkins 1980; Ridgeway & Carter 2001

Most species also have the ability to hear beyond their region of best sensitivity. This broader range of hearing is most likely related to their need to detect other important environmental phenomena, such as the locations of predators or prey. Among marine mammal species, there is considerable variation in hearing sensitivity and absolute hearing range (Richardson *et al.*, 1995; Ketten 1998). However, from what is known of right, humpback, sei, sperm, and fin whale hearing and the source levels and frequencies of site assessment and characterization activities (*see* Section 4.3), it is expected that if these whales are present in the area where the underwater noise occurs they would be capable of perceiving those anthropogenic noises. The baleen whales have hearing ranges that are likely to have peak sensitivities with low frequencies (below 1 kHz) while the sperm whale is characterized as a mid-frequency cetacean (above 1kHz) that overlap with frequencies of site assessment and site characterization sounds. This assessment assumes that frequencies above 200 kHz are not able to be perceived by marine mammals in the Project Area.

5.2.1.2 Sea Turtles

The hearing capabilities of sea turtles are not as well studied or as well-known as those of marine mammals. There are limited experimental studies exploring the hearing ranges of sea turtles. It is not possible to infer potential hearing ranges based on frequencies of vocalizations, as sea turtles do not vocalize. Therefore, the information that does exist is based on studies that explored the physiological and behavioral reactions of sea turtles exposed to various sounds as well as direct hearing measurements. Ridgeway *et al.*, (1969) reported that Pacific green sea turtles displayed hearing sensitivity in air from 30-500 Hz with an effective hearing range of 60 - 1,000 Hz. Lenhardt (1994) expanded on this in-air sensitivity by suggesting that in-water sensitivity for sea turtles was 10 dB less than air. Using auditory evoked potentials, Bartol *et al.*, (1999) found that juvenile loggerheads exhibit an effective hearing range of 250–750 Hz with peak sensitivity at 250 Hz. This is similar to what Lendhardt (1994) has found by invoking a startle response from loggerhead sea turtles using a low frequency source (20-80 Hz). He determined that sea turtles have an effective hearing range of 100-800 Hz with an upper limit of 2,000 Hz. Most recently, Ketten and Bartol (2005) reported hearing ranges similar to these previous studies, however they noted some minor differences when comparing juveniles and adults, and across species. They found that the smallest of their turtles tested, which were hatchling loggerheads had the greatest range (100-900Hz), and the largest turtles tested, sub-adult green sea turtles, had the narrowest range (100-500Hz). This limited research indicates that sea turtles are capable of hearing low frequency sounds, with some variation in size, age and species of turtle.

As the hearing frequencies of sea turtles fall within the frequencies produced by construction and survey activities, these animals may be affected by exposure. In regards to source levels required by sea turtles to perceive sounds, Ridgeway *et al.*, (1969) reported that 110-126 dB re 1 µPa were required for animals to hear sounds. Further, McCauley *et al.*, (2000) reported that source levels of 166 dB re 1 µPa were required to evoke behavioral reactions from captive sea turtles. Sea turtles are not expected to perceive sounds above 1 kHz. Thus, regarding HRG survey equipment, only boomers would be heard.

5.2.1.3 Marine Fish

This section on acoustic effects is a brief summary of what is known about sound sensitivity in marine fish, particularly demersal fish that may hold some similarities to Atlantic sturgeon, and the impacts of sound that could be produced as a result of site characterization and assessment activity in the Project Area.

Fishes produce sounds that are associated with behaviors that include territoriality, mate search, courtship and aggression. It has also been speculated that sound production may provide the means for long distance communication and communication under poor underwater visibility conditions (Zelick *et al.*, 1999). Although, the fact that fish communicate at low frequency sound levels where the masking effects of ambient noise are naturally highest, suggests that very long distance communication would rarely be possible. Fishes have evolved a diversity of sound-generating organs and acoustic signals of various temporal and spectral contents. Myrberg (1980) states that members of more than 50 fish families produce some kind of sound using special muscles or other structures that have evolved for this role, or by grinding teeth, rasping spines and fin rays, burping, expelling gas, or gulping air.

Ladich (2000) measured the hearing sensitivities of closely related species that use different channels (acoustic vs. non-acoustic) for communication. Major differences in auditory sensitivity were indicated but they did not show any apparent correspondence to the ability to produce sounds. Fish sounds vary in structure, depending on the mechanism used to produce them. Generally, fish sounds are predominantly composed of low frequencies (<3 kHz). Most of the sounds are probably produced in a social context that involves interaction among individuals (i.e., communication). One of the most common contexts of sound production by fish is during reproductive behavior (Hawkins 1993). Recent research in Canada investigated the reproductive function of sound production by Atlantic cod (Rowe and Hutchings 2004). In support of other studies on cod sound production (e.g., Finstad and Nordeide 2004), Rowe and Hutchings (2004) concluded that sound production by cod could potentially be important to spawning behavior by acting as a sexually selected indicator of male size, condition and fertilization potential.

Since objects in the water scatter sound, fish are able to detect these objects through monitoring the ambient noise. Therefore, fish are probably able to detect prey, predators, conspecifics, and physical features by listening to the environmental sounds (Hawkins 1981). Lagardère *et al.*, (1994) concluded from their experiment with sole (*Solea solea*) that this species perceives and reacts to horizontal variability in ambient noise levels. Studies have also been done on the abilities of larval fish to detect sound and respond to it in order to achieve successful settlement (Leis *et al.*, 2002). There are two sensory systems that enable fish to monitor the vibration-based information of their surroundings. These two sensory systems, the inner ear and the lateral line, constitute the acoustico-lateralis system. A fishes' inner ear and the lateral line overlap in the frequency range to which they respond. Most bony fishes and elasmobranchs (e.g., sharks, skates) possess lateral lines that detect water particle motion. The essential stimulus for the lateral line consists of differential water movement between the body surface and the surrounding water and this stimulus is detected by organs known as "neuromasts" that are located on the skin or just under the skin in fluid-filled canals (Denton and Gray 1988). As is the case with the inner ear, neuromasts have sensory hair cells that move in response to the particle displacement. Generally, fish use the neuromasts to detect low frequency acoustic signals (150 to 200 Hz) over a distance of one to two body lengths (Coombs *et al.*, 1991). The ear responds to frequencies from about 20 Hz to several thousand Hz in some species (Popper and Fay 1993; Popper *et al.*, 2003).

Although the hearing sensitivities of very few fish species have been studied to date, it is becoming obvious that the intra- and inter-specific variability is considerable (Coombs and Popper 1979). A non-invasive electrophysiological recording method known as 'auditory brainstem response' (ABR) is now commonly used in the production of fish audiograms (Yan 2004). Generally, most fish have their best hearing (lowest auditory thresholds) in the low frequency range (i.e., <1 kHz). Even though some fish are able to detect sounds in the ultrasonic frequency range, the thresholds at these higher frequencies tend to be considerably higher than those at the lower end of the auditory frequency range. This generalization applies to the fish species occurring in the Project Area and its surrounding waters.

Literature relating to the impacts of sound on marine fish species can be conveniently divided into the following categories: (1) pathological effects, (2) physiological effects, and (3) behavioral effects. Pathological effects include lethal and sublethal physical damage to fish; physiological effects include primary and secondary stress responses; and behavioral effects include changes in exhibited behaviors of fish. Behavioral changes might be a direct reaction to a detected sound or as a result of the anthropogenic sound masking natural sounds that the fish normally detect and to which they respond. The three types of effects are often interrelated in complex ways. For example, some physiological and behavioral effects could potentially lead to the ultimate pathological effect of mortality. Popper and Hastings (2009) recently reviewed what is known about the effects of sound on fishes and identified studies needed to address areas of uncertainty relative to measurement of sound and the responses of fishes.

Hastings *et al.*, (1996) suggested that sounds 90 to 140 dB above a fish's hearing threshold may potentially injure the inner ear of a fish. Hastings *et al.*, (1996) exposed oscar fish (*Astronotus ocellatus*) to synthesized sounds with characteristics similar to those of commonly encountered man-made sources. The only damage observed was in fish exposed for one hour to 300 Hz continuous tones at 180 dB re 1 μPa at 1 meter (UMT), and sacrificed four days post-exposure. Enger (1981) provided the earliest evidence of the potential of loud sounds to pathologically affect fish hearing. He demonstrated that the sensory cells of the ears of Atlantic cod (*Gadus morhua*) were damaged after one to five hours of exposure to continuous synthesized sounds with a source SPL of 180 dB re 1 μPa at 1 meter (UMT). The frequencies tested included 50, 100 200, and various frequencies between 300 and 400 Hz. The cod were exposed at less than one meter from the sound source. Chapman and Hawkins (1973) found that ambient noise at higher sea states in the ocean have masking effects in cod, haddock, and pollock. Additionally, sound could also produce generalized stress (Wysocki *et al.*, 2006). Thus, based on limited data, it appears that for fish in general, communication masking and stress may occur depending on the species, sound pressure level, frequency, and duration of exposure. Specific acoustic thresholds for behavioral impacts to Atlantic sturgeon have not been established but only sounds from pile driving and boomers at close range would be expected to be perceived by Atlantic sturgeon.

5.2.2 High Resolution Geologic Survey Acoustic Effects (RI/MA, MA, NY, and NJ Areas)

High resolution geologic (HRG) surveys will be used to characterize ocean-bottom topography and subsurface geology. The HRG surveys would also investigate potential benthic biological communities and archaeological resources. The high resolution surveys would be used to characterize the potential site of the meteorological tower/buoy and potential placement of wind turbines in the future. As stated in Section 4.3.1, HRG surveys and sub-bottom profiling methods used for site characterization use less intense sounds as those used for deep penetrating seismic surveys in the oil and gas industry. Therefore, HRG surveys for siting of meteorological towers and later, wind turbines, would result in shallower seafloor penetration and less sound energy introduced in the marine environment.

A detailed proposed action scenario for HRG surveys is described in Section 4.3. The survey would likely consist of a vessel towing an acoustic source behind the ship with a streamer cable and tail buoy. Surveys would be conducted during daylight hours over a lengthy (several years) but unspecified period of time as lessees respond to requests to develop the Project Area and secure financing to conduct surveys. The total Project Area survey area includes the entire project footprint where wind turbines could be installed. Total HRG survey time is conservatively estimated at 117,200 NM or 25,990 hours for the entire Project Area (see Table 4.3).

The sound levels of the source will depend on the types of survey equipment used (i.e. boomer, sidescan sonar, etc.). A description of the potential source levels for the varying survey equipment can be found in Table 4.1 (*see* Section 4.2.1.1). It is important to indicate that the acoustic energy generated from these sources is directed downward, not horizontally. However, it is also important to note that horizontal spreading of sound will occur within the water column, dependent on varying factors such as the source level, the sub-bottom acoustics, and the environmental conditions of the area (Richardson *et al.*, 1995). The surveys would likely use the full daylight hours available, approximately 10 hours per day. However, the time that any particular area would experience elevated sound levels would be significantly shorter as the vessel would be ensonifying a limited area along each transect.

The sub-bottom profilers (e.g., boomers, sparkers, and chirpers) generate sound within the hearing thresholds of most marine mammals that may occur in the action area. The chirp has an estimated broadband sound source level of 222 dB re 1µPa rms with a typical pulse length of 64 milliseconds. A typical boomer has a sound source level of around 212 dB re 1µPa rms with the pulse duration of 180 microseconds(*see* Table 4.1 in Section 4.2.1.1). However, actual specifications may vary by manufacturer and the environment where it is to be deployed.

HRG survey method source levels and pulse lengths were used to model threshold radii for the various profiler methods for the Atlantic OCS Proposed G&G Activities Mid-Atlantic and South Atlantic Planning Areas DPEIS (USDOI, BOEM 2012). These profilers include a boomer, side-scan sonar, chirp sub-bottom profiler, and a multi-beam depth sounder. Three of the four profiler methods have operating frequencies that are within the range of cetacean hearing (Table 4.1 in Section 4.2.1.1), one (boomer) within sea turtle hearing, and one (boomer) within fish hearing. The pulse length and peak source level that were used for each profiler method modeling scenario can be assumed to be representative of profiler sources that could be used for the proposed action.

Based on these modeling results, threshold radii for each HRG survey method potentially used for the proposed action are displayed in Table 4.1 (*see* Section 4.2.1.1). As displayed in the modeling results the threshold radii for 180 dB re 1 µPa rms (NMFS Level A harassment threshold) from any of the survey methods is not expected to be greater than 200 meters. The Level B harassment level (160dB re 1 µPa rms) extends beyond 2 km from the sound source. In order to reduce the likelihood any marine mammals would experience Level A harassment sound levels, BOEM is requiring a 200 m exclusion zone for marine mammals around the surveying vessel. Marine mammals within 2 km may experience Level B harassment levels of sound when certain sound sources are being used. See Section 8.0 for the full list of standard operating conditions.

5.2.2.1 Marine Mammals

North Atlantic right, humpback, and fin whales are expected to be present within the Project Area and/or its surrounding waters during all seasons of the year (*see* Section 3.1). Sei and sperm whales are likely only to be found in or near the RI/MA and MA WEAs. Taking into account the standard operating conditions that are planned (*see* Section 8), effects on whale behavior are generally expected to be limited to avoidance of the area around the HRG survey, and changes in vocalizations due to masking caused by the additional background noise. As whales are mobile species, they have the ability to move away from the sound should disturbance occur. It is expected that areas avoided by whales during noise producing activity would be available and used by whales after the survey had left the area. Once an area has been surveyed, it is not likely that it will be surveyed again, therefore reducing the likelihood of repeated HRG-related impacts within the Project Area. Thus the exposure to Level B harassment is expected to be temporary.

As congregations of right, fin, and humpback whales have been observed in and around the Project Area, there is the a greater potential that these species may be present within the Project Area during survey activities. However, it is anticipated that they will be distributed throughout the area and not congregated in any specific location within the Project Area for periods of time greater than a day or two (based upon lack of repeat sightings in the same location over short periods of time). Based on the modeled maximum ranges of the 180 dB re 1µPa isopleth (no greater than 200 meters), and the 200 m exclusion zone, it is unlikely that any whales within the Project Area or its surrounding waters would be subjected to Level A harassment as a result of the survey activity. However, due to the potentially large area of ensonification from sub-bottom profilers marine mammals may be exposed to Level B harassing levels of sound associated with the survey. However, the potential exposure to Level B harassment is not equal to all marine mammals across all four of the North Atlantic WEAs. For instance, the sei and sperm whales are not likely to occur in the NY or NJ WEAs due to the shallower depth. This is supported in the sightings information presented in Figure 3.1.5-1.

Based on the standard operating conditions, mobility of the sound source, the variable locations and times of the surveys over several years, and the likelihood that any whales present within the area would avoid any disturbing sound levels associated with the survey while migrating through the area, it is expected that few individuals are expected to be affected by potentially injurious levels of sound during HRG surveys. HRG survey noise exposure to ESA-listed marine mammals is expected to be limited to disturbance equivalent to Level B harassment.

BOEM anticipates that if an operator can effectively monitor the 160-dB zone to prevent both Level A and B harassment of marine mammals, it would be reasonable to assume that an Incidental Take Authorization under the MMPA may not be necessary for that particular survey. Therefore, the standard operating conditions in Section 8 would allow a lessee to monitor a radius larger than 200 m (656 ft) if the lessee demonstrates that it can be effectively monitored.

5.2.2.2 Sea Turtles

It is likely that listed sea turtles will be present within the Project Area and its surrounding waters and could be exposed to sound from HRG surveys. BOEM would require that an exclusion zone of 200 m be established for sea turtles by lessees during any survey activity. Monitoring of the exclusion zone would be required to begin 60 minutes prior to the ramp up of the survey equipment. The 60-minute monitoring period is specifically to allow for the sighting of turtles between dives. The normal duration of sea turtle dives ranges from 5-40 minutes depending on species, with a maximum duration of 45-66 minutes depending on species (Spotila 2004).

The HRG surveys would use only electromechanical sources such as side-scan sonar, boomer and chirp subbottom profilers, and multibeam depth sounders. Based on their operating frequencies as summarized in Table 4.1, the side-scan sonar, chirp subbottom profiler, and multibeam depth sounder are not likely to be detectable by sea turtles, whose best hearing is mainly below 1,000 Hz. The boomer has an operating frequency range of 200 Hz–16 kHz, and so may be audible to sea turtles. However, it has a very short pulse length (120, 150, or 180 µs) and a very low source level, with a 180-dB radius ranging from 38-45 m (125-148 ft) (Table 4.2). Therefore, sea turtles are unlikely to hear any of the electromechanical sources except perhaps the boomer at very close range. Because the proposed action includes a recommended exclusion zone of 200 m from sea turtles for HRG surveys (see Section 8), auditory or behavioral impacts due to electromechanical sources are unlikely. In addition, a survey vessel would not likely travel at speeds greater than 4.5 knots while surveying. The observer will monitor the exclusion zone while the survey equipment is operating, and should any sea turtle enter within 200 m of the source, the equipment will be shut down.

During the limited occasions when a boomer is being used in the presence of a sea turtles, it is expected that sea turtles that avoided ensonified areas would return to those areas after cessation of those activities. The surveys would likely use the full daylight hours available, approximately 10 hours per day. However, the time that any particular area would experience elevated, detectable sound levels would be significantly shorter as the vessel would be ensonifying a limited area along each transect. Available information indicates that sea turtle forage items may be present in the action area, therefore if sea turtles were present and feeding or resting in an area where HRG surveys were passing through, it is expected that they could find alternative forage and resting locations within the Project Area, thereby reducing impacts to these activities. Additionally, should sea turtles be migrating through the area, (i.e. leatherbacks migrating to or from the Gulf of Maine) it is expected that they would avoid disturbing noises within the Project Area, therefore decreasing the potential for impacts from survey activities. Sea turtles are not expected to be excluded from large areas due to the temporary nature of HRG activities. The avoidance of ensonified areas will be temporary and localized. It is not expected that any impacts would result in injury or overall behavioral impairment to an individual. Major shifts in habitat use, interruption of foraging or major displacement of migration pathways, are not expected. Potential changes to individual movements are expected to be reactions restricted to one piece of survey equipment (boomer) which would be highly localized. This potential behavior change is not expected to be detectable. Thus, HRG surveys are not likely to adversely affect leatherback, loggerhead, green, and Kemp's ridley sea turtles.

5.2.2.3 Marine Fish

Section 4.3.1 details a proposed action scenario for HRG surveys, which is not repeated herein. The potential for impact of HRG survey noise on ESA-listed marine fish and species of concern that could occur in the Project Area and its surrounding waters is not well understood. The ESA-listed Atlantic sturgeon is primarily found in coastal waters, and the Project Area is not within its naturally preferred habitat. Although HRG survey work will be conducted along potential electric cable routes from the lease blocks to shore, this area is limited compared to the actual lease blocks in the Project Area.

The sound levels at the source (i.e., the boomer) will depend on the type of equipment used for the survey. As shown in Table 4.1 (*see* Section 4.2.1.1) only the boomer operates at frequencies that may be detected by fish. Estimated broadband sound pressure levels during HRG surveys are expected to range from 212 to 226 dB re 1μPa RMS at 1 meter. Generally, noise generated by HRG surveys may be detected by and may mask some communication by some fish. Hearing thresholds for Atlantic sturgeon have not yet been established. However, studies have shown that sturgeon do not generally detect sounds above 800 Hz (Lovell et al., 2005; Meyer et al., 2010). Thus, Atlantic sturgeons are only expected to detect sound from the boomer.

Acoustic modeling of HRG survey methods (i.e. boomer, side scan sonar, or chirper) for the OCS G&G DPEIS reported that noise levels of 160 dB re 1 μPa did not extend beyond 200 meters from the source (Table 4.1 in Section 4.2.1.1). Within this zone it is expected that Atlantic sturgeon may be able to perceive noise from the boomer sound source. Although broadband sound exposure levels from pile driving have been shown to cause injury to fish (salmon) above 210 dB, no such studies exist for Atlantic sturgeon. It is expected that Atlantic sturgeon will be able to swim away from any disturbing level of sound from the boomer. This would be facilitated by the ramp up of the boomer, and the slow approach speed of the vessel during survey activities.

Effects on fish are generally expected to be limited to avoidance of the area around the HRG survey activities. The region of best hearing in the majority of fish for which there are data available is from 100 to 200 Hz up to 800 Hz. The mobility of adult fish and their innate tendency to quickly leave a disturbed area should result in limited impacts. Surveys associated with the proposed action are not expected to result in detectible levels of impact from the survey equipment. Individuals displaced by the transient noise source would be able to return to the areaafter the survey has ceased.

Fish are not expected to be exposed to sound pressure levels that could cause hearing damage, and most HRG survey equipment operates at frequencies above fish hearing capabilities. Because of that lack of impact from the sound source, their coastal/estuarine affinity, and the limited immediate area of ensonification and duration of individual HRG surveys that may be conducted during site assessment, few Atlantic sturgeon or ESA candidate species may be expected to be exposed to disturbing levels of survey noise. Thus, potential impacts on ESA-listed (e.g. the 5 Atlantic sturgeon DPSs) and candidate fish from HRG surveys are expected to be negligible.

5.2.3 Geotechnical Sampling Acoustic Effects (RI/MA, MA, NY, and NJ Areas)

Limited information is available on underwater noise from underwater construction drilling operations. Richardson *et al.*, (1990) reported that shallow water measurements (19.6 to 22.9 feet [6 to 7 meters] deep) taken in the vicinity of a drill rig on an ice pad produced approximately 125 dB re 1 µPa at 130 meters, and 86 dB re 1 µPa at 480 meters. Hall *et al.*,'s (1991, as cited in Nedwell and Howell 2004) measurements of drilling from a concrete caisson showed little difference in levels of frequencies above 30 Hz between drilling and background noise. Drill ships and semi-submersible drill rigs have been reported to have a source level from 145 (Gales 1982) to 191 dB re 1 µPa at 1 meter (Greene 1987), but are unlikely to be used during windfarm development.

It is anticipated that the majority of the work will be accomplished by CPT which does not require deep borehole drilling. However, should CPT be found to be an inappropriate technique given the conditions encountered, borehole drilling may be required. Previous estimates submitted to BOEM have source sound levels not exceeding 145 dB re 1 µPa at a frequency of 120Hz (USDOI, BOEM, OREP 2012), which are similar to those from historical drilling studies cited previously. Previous submissions to BOEM also indicated that boring sound should attenuate to below 120 dB re 1 µPa by the 492 foot (150 meter) isopleth.

According to NMFS, drilling is considered a continuous, but yet temporary, noise source. Therefore, any noise that exceeds 120 dB re 1 µPa from a drilling source would be considered behavioral harassment under the MMPA. Therefore, BOEM will require a 656 foot (200 meter) exclusion zone for whales and sea turtles during geotechnical drilling activity. It is expected that the activity of setting up the drilling equipment would generate enough disturbance to deter marine mammals, sea turtles and fish from the general work area. Animals would freely be able to leave or avoid the area where drilling would take place. It is expected that other geotechnical sampling activities, such as CPT or vibracore would only have minor acoustic effects, which would primarily be from vessel engine noise.

Maintenance of the exclusion zone during drilling would ensure that no whales or sea turtles would come within 656 feet (200 meters) of the geotechnical drilling activity therefore no whale or sea turtles will be exposed to sound levels greater than 120 dB re 1 µPa. It is expected that Atlantic sturgeon, in the unlikely event they are in the offshore areas, would be able to sense the sound, but the impacts are anticipated to be negligible due to short durations, low sound levels (not greater than 145 dB), and the ability of the fish to leave the immediate area of the drilling. Thus effect of geotechnical sampling on ESA-listed marine mammals, sea turtles, and fish is expected to be undetectable and discountable.

5.2.4 Meteorological Tower Pile-Driving Noise

As with any sound in the marine environment, the type and intensity of the sound is greatly dependent on multiple factors and can vary greatly. These factors include the type and size of the pile, the type of substrate, the depth of the water, and the type and size of the impact hammer (Madsen *et al.,* 2006). Despite the potential for variance between areas and equipment, this section attempts to capture the range of acoustic impacts from pile driving.

Studies have reported that pile driving can generate sound levels greater than 200 dB re 1 µPa with a relatively broad bandwidth of 20 Hz to > 20kHz (Madsen *et al.,* 2006; Thomsen *et al.,* 2006; Nedwell and Howell 2004; Tougaard *et al.,* 2008). In the Cape Wind Draft EIS, modeling for a commercial wind turbine foundation was presented in Appendix 5-11A (Noise Report) indicating that the underwater noise levels from pile driving may be greater than the NMFS MMPA threshold for behavioral disturbance/harassment (160 dB re 1 µPa) from a non-continuous source (i.e. pulsed) within approximately 3.4 kilometers from the source. Actual measures of underwater sound levels during the construction of the Cape Wind meteorological tower in 2003 were reported between 145-167 dB re 1 µPa at 500 meters (see Table 5.3). Peak energy was reported around 500 Hz (USDOI, BOEM, OREP 2012).

Modeling was also conducted for proposed meteorological tower sites located offshore of New Jersey and Delaware under IP leases by Bluewater Wind, LLC. The 160 dB re 1µPa isopleth was modeled at 23,720.5 feet (7,230 meters) for Delaware and 21,653.5 feet (6,600 meters) for New Jersey (USDOI, BOEM, OREP 2012). It is expected that pile-driving would last 4 to 8 hours per pile being driven within the Project Area, dependent on the sediment type. Generally, during pile driving activities, the blows are delivered at 1 second intervals (Madsen *et al.,* 2006). The information from Cape Wind Associates and the Bluewater Wind are a good representation of the potential range of enosonified area with both the 180 dB re 1 µPa and 160 dB re 1 µPa sound levels (Table 5.2). However it should be noted that the sources are different sizes, the monopile diameters differ, and the environmental characteristics are likely different, causing the isopleths to vary.

Table 5.3
Modeled Areas of Ensonification from Pile-Driving

Project (modeled)	Additional Info	180 dB re 1µPa (rms)	160 dB re 1µPa (rms)
Bluewater Wind (Interim Policy Lease offshore Delaware)	3.0-meter diameter monopile; 900 kJ hammer	760 meters	7,230 meters
Bluewater Wind (Interim Policy Lease offshore New Jersey)	3.0-meter diameter monopole; 900 kJ hammer	1,000 meters	6,600 meters
Cape Wind Energy Project (Lease in Nantucket Sound)	5.05-meter monopole; 1,200 kJ hammer	500 meters	3,400 meters

Source: USDOI, BOEM, OREP 2012.
Key: kJ = kilojoule

Unmitigated pulsed noises greater than 160 dB re 1 µPa (i.e. pile driving) could cause behavioral disturbance/ harassment temporarily (4 to 8 hours over three days per lease) during meteorological tower construction. To minimize the effects of pile driving on listed species, BOEM will require lessees to follow several mitigating standard operating conditions as part of their lease or as terms and conditions on a SAP. These measures are detailed in Section 8. These measures include a “soft start” procedure and the cessation of all pile driving activity should a whale or sea turtle be found within 4 mile (7 kilometers) of the pile driving activity. It is expected that noise levels outside of 4 mile (7 kilometers) will be less than 160 dB re 1 µPa.

5.2.4.1 Marine Mammals

During meteorological tower construction noise generated by pile driving may be audible to marine mammals within the RI/MA and MA WEAs. Unmitigated acoustic interference and disturbance could cause behavioral changes, masking of inter- and intra-specifics calls, and disrupt echolocation capabilities. The potential for behavioral reactions may extend out many miles (Madsen *et al.*, 2006; Tougaard *et al.*, 2008). Near-field behavioral reactions withoust BOEM’s standard operating conditions could result in, avoidance of, or flight from the sound source, avoidance of feeding habitat, changes in breathing patterns, or changes in response to predators (Watkins and Sheville 1975; Malme et al 1984; Richardson *et al.*, 1995; Mate *et al.*, 1995; Nowacek *et al.*, 2007; Tyack 2009). Depending on the frequency and source level of the noise generated during pile driving, physiological effects such as TTS and PTS could occur at close range to the source (Richardson *et al.*, 1995; Madsen *et al.*, 2006). Currently, the biological consequences of hearing loss or behavioral responses to construction noise are not fully known (Tougaard *et al.*, 2008), and there is little information regarding short-term and long-term impacts to marine mammal populations from such activity. A recent study in a large embayment (Moray Firth) in Northeast Scotland suggested that mid- and low frequency cetaceans, such as minke whales and bottlenose dolphins, could experience behavioral disturbance (at 160 dB re 1 µPa or greater according to NMFS MMPA criteria) up to approximately 30 NM (50 kilometers) away from the source and potential injury such as PTS or TTS (at 180 dB re 1 µPa or greater according to NMFS MMPA criteria) within 328 feet (100 m) of the source (Bailey *et al.*, 2010). Although it is important to note this study, the geology of Moray Firth and size of the piles (5 MW wind turbine foundations) are not directly transferable to meteorological tower construction in the Southern New England/New York Bight RI/MA and MA WEAs. While there is the potential for individual animals to perceive the pile driving activity at great distances it is not expected to rise to a level of harassment nor is it expected to affect entire populations of marine mammals. It is expected that some species of marine mammals will leave the area when construction vessels arrive and begin their activities. This would greatly reduce their exposure to the pulsed noise source. It is expected that marine mammals that left the area during construction would be able to return to the area following the completion of the work (i.e. three days).

It is expected that potentially injurious noise levels to ESA-listed marine mammals would only occur within the immediate vicinity of the pile driving activity (i.e. within 328 feet [100 meters]). Construction of a meteorological tower would take place over a relatively short duration and would be limited to a maximum of 9 locations within the RI/MA and MA WEAs which would be constructed at any time within an approximately five year period outside of the spring migration prohibition period (see Section 8). The prohibition on pile driving between November and April is based upon the NMFS special management area in effect over a portion of the RI/MA and MA WEAs.

It is expected that disturbance/harassment (Level B) levels of sound (i.e. 160 dB re 1 µPa) would occur within 4 miles (7 kilometers), and Level A harassment (180 dB re 1 µPa) would occur within 1,000 m (3,281 ft) of the activity. BOEM will require an exclusion zone of 1,000 m to be monitored from the sound source and an additional observation vessel circling the sound source at 500 m from the source. Therefore, BOEM anticipates that no whales will be exposed to sound level greater than 180dB as pile driving would not occur should a whale enter within 1,000 m (3,281 ft) of the active source. Also, no whales are expected to be exposed to sound levels that would cause injury (i.e. above 180 dB re 1µPA). Should future field-verified acoustic data indicate the 180 dB isopleth is greater than 1,000 m (3,281 ft), then future mitigation measures in lease stipulations would be modified to reflect the new data. In the case where more than one monopole is being installed per meteorological tower (e.g. tripod structure), then field verifications could modify the mitigation measures for the installation of additional monopoles (*see* Section 8.0).

Large whales present within the RI/MA and MA WEAs and it surrounding waters are expected to be transiting between summer feeding grounds in the north, and winter calving grounds in the south, however there are also observations of large whales feeding within the vicinity of the RI/MA and MA WEAs. While large whales may be present within the RI/MA and MA WEAs or its surrounding waters throughout the year the location of these whales can be monitored and pile driving can be delayed (outside of the pile driving prohibition period of November-April) until any whales leave the potential area of influence. Based on the best available information and the standard operating conditions in Section 8.0, no right, humpback, fin, sei, or sperm whales are expected to be exposed to noise levels greater than 180 dB re 1µPa. Therefore, North Atlantic right, humpback, fin, sei, and sperm whales may experience temporary adverse impacts equivalent to Level B harassment during meteorological tower construction.

5.2.4.2 Sea Turtles

During meteorological tower construction noise generated by pile driving may be audible to sea turtles within the RI/MA and MA WEAs and its surrounding waters. Loggerhead, leatherback, green, and Kemp’s ridley sea turtles are known to occur within southern New England between June and November, during which time construction may occur. Therefore there is the potential for exposure to construction-related noise outside the pile driving prohibition period. Similar to marine mammals, noise from pile driving could cause some animals to move away from or avoid the construction area. Currently, the biological consequences of hearing loss or behavioral responses to construction noise are not known and there is little information regarding short-term and long-term impacts to sea turtle populations from pile driving noise exposure It is expected that avoidance of ensonified areas would be short term and not result in population-level effects. Large numbers of individuals are not expected to be exposed to construction noise due to the short-term duration of the construction activities, the limited spatial scale of construction, and the low density of sea turtles, as a whole, within the project area. Also, mitigation measures (as detailed in Section 8) are expected to further reduce any impacts from construction related acoustics by requiring a 60-minute observation period before pile driving begins, a 1,000 m (3,281 ft) exclusion zone during pile driving, and requiring a soft start procedure to allow animals to leave the area prior to harassing levels of sound.

Little information is available addressing sea turtle behavioral reactions to levels of sound below the estimated TTS and injury levels. The existing studies related to sea turtle hearing have found that sea turtles may have a limited capacity to detect sound, however this is based on a limited number of individuals and should be interpreted with caution. Ridgeway *et al.*, (1969) reported that Pacific green sea turtles displayed hearing sensitivity in air from 30-500 Hz with an effective hearing range of 60-1,000 Hz. Whereas, Bartol *et al.,* (1999) found that juvenile loggerheads exhibit an effective hearing range of 250 – 750 Hz with peak sensitivity at 250 Hz. Ridgeway *et al.,* (1969) reported that 110-126 dB re 1 µPa were required for sea turtles to hear sounds. However, McCauley *et al.,* (2000) reported that source levels of 166 dB re 1 µPa were required to evoke behavioral reactions from captive sea turtles

According to available information on sea turtle behavioral response to intense pulsed sounds (i.e. pile driving), sea turtles are likely to actively avoid disturbing levels of sound (O'Hara and Wilcox 1990; McCauley *et al.,* 2000). While avoidance may aid in reducing exposure to disturbing sounds, it may also result in the alteration of normal behaviors such as migration and foraging. However, these alterations are expected to be localized and temporary due to the nature of the pile-driving activities within the RI/MA and MA WEAs.

Sea turtles would be expected to return areas previously avoided due to sound levels following the cessation of pile-driving activities. As pile driving would occur for approximately 4 to 8 hours a day, it is likely that sea turtles would only be excluded from the area with disturbing levels of sound for at least this period each day. Information indicates that sea turtle forage items are present throughout the action area. Therefore, could sea turtles be present and feeding or resting in an area where pile-driving occurred, it is expected that they could find alternative forage and resting locations elsewhere within the RI/MA and MA WEAs and its surrounding waters.

Additionally, should sea turtles be migrating through the area, (i.e. leatherbacks migrating to or from the Gulf of Maine) it is expected that they would avoid disturbing noises within the RI/MA and MA WEAs, therefore decreasing the potential for impacts from the survey activities. The avoidance of the area due to sound would therefore affect individuals, however it is expected that these effect would be temporary and localized. It is expected that foraging, migrating or resting sea turtles would only be minimally impacted, and no injury or impairment of an individual's ability to complete essential behavioral functions is expected.

As explained in the marine mammal discussion above, a 1,000 m (3,281 ft) exclusion zone will be monitored by trained protected species observers from two distances (0 and 500 m form the sound source) for at least 60 minutes prior to the start of any pile driving. It is expected that the observers will be able to detect the presence of sea turtles within the 1,000 m exclusion zone. Sea turtle dive durations range from 5-40 minutes depending on the species, with a maximum duration of 45 – 66 minutes depending on the species (Spotila, 2004). Based on this information it is reasonable to expect that monitoring the exclusion zone for at least 60 minutes will allow protected species observers to detect any sea turtle within the exclusion zone prior to the start of construction activities. Sound levels during pile driving are expected to dissipate below 180 dB re 1µPa within 1,000 m of the source. It is expected that the pile driving activity while following the standard operating conditions would result in short term avoidance of some ensonified areas. Thus, sea turtles may be temporarily adversely affected by pile driving sound outside of the 1,000 m (3,281 ft) exclusion zone.

5.2.4.3 Marine Fish

Sections 4.3.5.2 detail a proposed action scenario and acoustic effects for pile driving, which is not repeated herein. Nedwell and Howell (2004) provide information on three paths (airborne, waterborne and groundborne) for noise propagation in underwater environments during pile-driving. The pulsive sounds during pile-driving are expected to be less than the pulses from the air guns used in offshore seismic surveys by the oil and gas industry. Such surveys routinely have source levels of 250 dB re 1 µPa at 1 meter. Available information suggests that seismic exploration has minimal effects on fish and fisheries.

Unmitigated construction noise could disturb normal behaviors (e.g., feeding) of ESA-listed and candidate fish if they occur within the area during these activities. However, the soft start procedure for pile driving (see Section 8) is expected to allow fish, including Atlantic sturgeon, that may be impacted to leave the area.

The standard operating conditions required by BOEM, primarily the pile driving “soft start” provision, will reduce impacts to ESA-listed and ESA candidate marine fish. This measure will be included as a condition on any leases and/or term and condition of SAPs approved under this proposed action. Due to the “soft start” procedure, it is anticipated that the majority of fish would flee the area during the period of disturbance and return to normal activity in the area post-construction. All 5 DPSs of the ESA-listed Atlantic sturgeon, which typically occurs more often in coastal areas, are not anticipated to occur in large densities in the offshore areas of the RI/MA and MA WEAs where pile driving may occur thus greatly reducing the likelihood of their exposure to pile driving noise. Due to the offshore location of the activity and the soft start provision, it is not expected that Atlantic sturgeon, or any ESA candidates species will be exposed to potentially injurious levels of noise.

5.2.5 Vessel Traffic Noise (RI/MA, MA, NJ, and NY Areas)

Marine mammals, sea turtles, and marine fish may also be affected by noise generated by surface vessels traveling to and from the Project Area, as well as operating within the Project Area. Underwater noise associated with vessel traffic is attributed to the low frequency reverberation of the engines and its propellers. As the propeller moves through the water small bubbles are produced and collapse (a process known as cavitation). As these bubbles collapse a low frequency sound is produced (Jasney *et al.,* 2005). Larger vessels, such as commercial container ships, produce sounds at approximately 180 – 190 dB re 1 µPa rms at less than 200-500 Hz (Thomsen *et al.,* 2009; Jasney *et al.,* 2005). Smaller vessels produce less intense sounds at 160 – 180 dB re 1 µPa rms at less than 1,000 Hz (Thomsen *et al.,* 2009). Vessels associated with the proposed action are anticipated to produce sounds within the range of 150-170 dB re 1 µPa-meter at less than 1,000 Hz.

Vessels would mainly be traveling to and from the Project Area with limited activity within the Project Area, therefore it is expected that exposure of marine mammals to vessel noise would be transient. Because individual vessels produce unique acoustic signatures (Hildebrand 2009), and the physical characteristics of the marine environment determine how that sound will travel (Richardson *et al.*, 1995), the intensity of noise from various vessels can differ greatly; therefore, exposures to individual marine mammals can differ as well. Marine mammals can exhibit various reactions when exposed to vessel noise. Potential reactions include indifference to the sound, temporary altered breathing patterns, heading during travel, and swimming speed when interacting with smaller vessels, or avoidance of the vessel (Nowacek *et al.*, 2001; Richardson *et al.*, 1995; Nowacek *et al.*, 2001). Exposure to individual vessel noise by ESA-listed marine mammals, sea turtles, and fish within the Project Area or in the surrounding waters would be transient and temporary as vessels passed through the area. ESA-listed marine mammal, sea turtle, and fish behavior and use of the habitat would be expected to return to normal following the passing of a vessel. Therefore, impacts from vessel noise would be short term and negligible.

5.3 Benthic Effects

Effects to endangered and threatened species from impacts associated with benthic communities are anticipated to be negligible due to the limited amount of utilization of benthos, and the expected limited impact to the benthos. Potential benthic forage items for ESA-listed species may occur within the Project Area; sand lance (forage for cetaceans), and seagrass, macroalgae, and benthic invertebrates (forage for sea turtles). Benthic invertebrates and small fish, serve as forage for Atlantic sturgeon.

As a result, effects to benthic communities could cause indirect, short-term effects to these species. The following sections discuss those impacts in relation to Atlantic sturgeon, sea turtles and marine mammals and their habitat. It is not anticipated that impacts to benthic communities would result insignificant negative impacts to Atlantic sturgeon, sea turtle or marine mammal populations.

5.3.1 Geotechnical Sampling (RI/MA, MA, NY, and NJ Areas)

Sub-bottom sampling will result in small areas of the seafloor being disturbed. This may occur at the bore hole, grab-sample area, or vessel anchor placement locations. It is expected that this effect would result in a negligible, temporary loss of some benthic organisms (i.e., less than one ft diameter would be disturbed in the areas where cores are taken), and a localized increase in disturbance due to vessel activity, including noise and anchor cable placement and retrieval. This activity could impact ESA-listed marine mammals, sea turtles, and Atlantic sturgeon by removing a small amount of forage items. Atlantic sturgeon, however, are not expected to forage in offshore marine environments on a regular basis. Little information was found regarding the species' use of offshore benthic environments as feeding areas. Therefore, due to the small footprint, the temporary nature of the action, and extensive availability of similar benthic habitat regionally, it is expected that this activity would have negligible impacts on the ESA-listed species.

5.3.2 Meteorological Tower / Meteorological Buoy Installation (RI/MA and MA WEAs)

The installation of a meteorological buoy and/or the construction of a meteorological tower would have benthic effects that are temporary in nature. Construction of the tower would result in direct effects to benthic invertebrates by burying or crushing them. Also, it is anticipated that sediment would become suspended around deployed anchoring systems and around monopoles during the installation activity, however this sediment would quickly disperse and settle onto the surrounding seafloor. Depending upon the currents, benthic organisms could be smothered. However, the Southern New England-New York Bight is considered a high energy environment where sediment transport occurs under normal conditions. It is expected that any sedimentation that would occur around an installed tower or buoy would have only minor temporary effects on the benthic community and food availability for ESA-listed species.

The loss of benthic habitat as a result of scour and/or scour control systems around foundations and moorings is discussed in Section 4.3.5.2 of this BA. Sessile marine invertebrates, including molluscan shellfish, would be lost in the footprint of the foundation/mooring and any scour control system. However, a single meteorological tower or buoy within a lease area is not expected to result in significant changes to the availability of habitat and forage items for marine mammals, sea turtles or Atlantic sturgeon in the RI/MA and MA WEAs. Therefore, negligible impacts to the ESA-listed species are expected from installation of meteorological buoys and/or construction of meteorological towers within the RI/MA and MA WEAs.

5.3.3 Meteorological Tower / Meteorological Buoy Operation (RI/MA and MA WEAs)

Occurrence of a meteorological tower and anchoring system in soft sediments would create artificial ‘hard bottom’ substrate for potential colonization by fauna that prefer such substrates. In addition, minor, temporary changes in benthic assemblages associated with soft sediments would occur due to scouring around the pilings (Hiscock *et al.*, 2002). Although some marine fish species would likely be attracted to the newly formed habitat complex on hard structure, the Atlantic sturgeon’s feeding mechanism (benthic foraging) would not be affected by increased epibenthic community densities. Long-term changes to the local benthic community assemblage and diversity are not expected from a single meteorological tower / meteorological buoy, nor are the availability of habitat and forge items for ESA-listed species expected to be altered in the long-term. Therefore, negligible impact to marine mammals, sea turtles, and Atlantic sturgeon are expected from operation of meteorological buoys and/or meteorological towers within the RI/MA and MA WEAs.

5.4 Collision Effects (RI/MA, MA, NY, and NJ Areas)

This section discusses the potential for impacts to protected species resulting from collisions with vessels and structures associated with the proposed action. Collisions with vessels and/or structures associated with the proposed action could result in injury to the animal and/or damage to the vessel or structure. BOEM anticipates that marine animals will avoid fixed structures, such as meteorological towers, reducing the risk of collisions with these structures.

Vessels associated with site characterization and assessment activities could collide with marine mammals, sea turtles and other marine animals present in the area during transit.

However, BOEM's required standard operating conditions include vessel strike avoidance measures to reduce this possibility. This would limit the likelihood of collisions between vessels and marine mammals. The guidelines contain vessel approach protocols and navigational practices when encountering marine mammals that are based on speed and distance restrictions. Two primary driving factors in marine mammal, sea turtle or other marine animals and vessel collisions are the spatial and temporal relationships between vessels and marine animal abundance, and the speed of vessels (Merrick and Cole, 2007). The amount of vessel traffic and navigational visibility are also factors.

5.4.1 Marine Mammals

Vessel traffic providing support to the meteorological tower construction site (i.e. carrying equipment or personnel) may affect marine mammals through either direct collision or disturbance from their presence. According to Laist *et al.*, (2001), eleven species of whales are known to have been struck by a vessel throughout the world's oceans. Of those eleven, the most frequently struck species is the fin whale, followed by the North Atlantic right whale, humpback whale, sperm whale and grey whale (Laist *et al.*, 2001). Of these, the fin, North Atlantic right whale and the humpback whale are of concern for potential encounters with vessels in the Project Area and its surrounding waters. North Atlantic right, humpback and fin whales are the most common large cetaceans found in and around the project area. Therefore, these three species are considered the most likely to encounter vessels supporting meteorological tower construction and site characterization activities and therefore have the greatest potential risk for collision from project activity.

Ship strikes have been recorded in almost every coastal state in the U.S., as well as within three National Marine Sanctuaries (NMS) (Stellwagen Bank NMS, Channel Islands NMS and the Hawaiian Islands Humpback Whales NMS). Vessel strikes are most common on the east coast of the U.S.. Strikes on the west coast of the U.S. and Alaska/Hawaii are the second most common, and strikes in the Gulf of Mexico are the least common (Jensen and Silber 2004). Also, most strikes tend to occur over or near the continental shelf (Laist *et al.*, 2001).

The majority of whale interactions with vessels that have been reported as lethal are with vessels greater than 260 feet (80 meters). However whale strikes can occur with any size vessel from large tankers to small recreational boats (Jensen and Silber, 2004). Vessels associated with the proposed action are not anticipated to be greater than 80 m, therefore reducing the potential for a lethal vessel-whale interaction. Strike information has also been reported in relation to the speed of the vessel at the time of collision. Strikes have been reported for vessels traveling between 2 and 51 knots (2 and 59 miles per hour [mph]), with most lethal or severe injuries occurring when vessels are traveling 14 knots (16 mph) or more (Jensen and Silber, 2004; Laist *et al.*, 2001; Vanderlaan and Taggart, 2006).

All vessels associated with the proposed action and construction activity under their lease are subject to NMFS vessel speed restriction for vessels 65 feet (19.8 meters) or longer. Under these restrictions vessels will travel at no greater than 10 knots (11.5 mph) in certain areas where right whales gather (SMAs). These regulations are in place to reduce the likelihood of death or serious injury to the endangered North Atlantic right whales that could result from a vessel collision. These regulations also benefit other marine mammals in the area by reducing the overall speed of transiting vessels. The restrictions extend out to 20 NM (37 kilometers) around major mid-Atlantic ports, (of which Rhode Island is included). With the exception of crew boats, which generally are smaller than 65 feet (19.8 meters), these restrictions would be applicable to most vessels associated with the proposed action. In addition to the SMA speed restrictions, vessels associated with the proposed action would be required to check with NOAA's Sighting Advisory System and abide by dynamic management areas (DMAs) speed limits when they are in effect. Based on the current regulatory measures in place, and the intermittent travel of vessels associated with the proposed action, the potential for a vessel strike is greatly reduced. Therefore, no significant impacts due to vessel collisions are anticipated.

5.4.2 Sea Turtles

Similar to marine mammals, sea turtles have been killed or injured due to collisions with vessels. Hatchlings and juveniles are more susceptible to vessel interactions than adults due to their limited swimming ability. The small size and darker coloration of hatchlings also makes them difficult to spot from transiting vessels. While adults and juveniles are larger in size and may be easier to spot when at the surface than hatchlings, they often spend time below the surface of the water, which makes them difficult to spot from a moving vessel. Due to the lack of nesting habitat present within the northeast, hatchlings are not likely to be present in the Project Area and its surrounding waters, therefore there would be no impacts to this life stage.

While adults and juveniles are more likely to be present within the Project Area and its surrounding waters, should HRG surveys occur between June and November, the slow speed of the survey vessels (typically about 4.5 knots) and the 45 m separation distance reduces the potential for interaction with vessels and the associated towed survey gear. At these speeds, sea turtles are expected to be able to avoid the vessels and gear. Hazel *et al.,* (2007) reported that green sea turtles ability to avoid an approaching vessel decreases significantly as the vessel speed increases. The amount of vessel traffic associated with meteorological tower/buoy construction, operation and decommissioning is expected to be low, occurring during a short duration and operating at slow speeds. Therefore, potential for vessel collisions is discountable.

5.4.3 Marine Fish

Impacts to Atlantic sturgeon as a result of vessel strikes would primarily be expected only in coastal, nearshore areas where wind energy-associated vessels transit during Project Area site assessment activities. The most current analysis of these types of impacts to Atlantic sturgeon is presented by Brown and Murphy (2010) for the Delaware Estuary. They reported that 28 sturgeon were killed between 2005 and 2008 in the Delaware Estuary. Sixty one percent of the mortalities were of adult size and 50 percent were too decomposed to determine the cause of death. Water depths in navigable waters throughout the estuary ranged from 12 to 40 feet (3.6 to 12.2 meters). Brown and Murphy reported that sturgeon mortalities in the Delaware Estuary, and others in Virginia, appeared to be the result of long vessel transits through narrow shipping channels to ports in upstream areas of estuaries.

The Project Area site assessment activities as proposed in this BA (see Section 4.3.5) suggest that vessel traffic volume would be limited, and thus it is predicted that the potential for Atlantic sturgeon strikes would be unlikely. Although vessel ports have yet to be determined, it is expected that selected locations would be at coastal ports most accessible to the Project Area, and not in upstream estuarine locations. Since most strikes noted by Brown and Murphy (2010) were within channelized, shallow estuarine areas, it is expected that any vessel-sturgeon interactions under the proposed action is discountable.

5.5 Discharge of Waste Materials and Accidental Fuel Leaks (RI/MA, MA, NY, and NJ Areas)

Operational waste generated from all vessels associated with the proposed action includes bilge and ballast waters, trash and debris, and sanitary and domestic wastes. A vessel collision with a meteorological tower or other vessel has the potential to result in the spillage of diesel fuel into the marine environment. Vessels associated with the proposed action are expected to comply with the USCG requirements for the prevention and control or oil and fuel spills. Approximately 10 percent of vessel collisions with fixed structures on the OCS caused diesel spills.

Most equipment on the meteorological towers and buoys would be powered by batteries charged by small wind turbines or solar panels. However, there is a possibility that diesel generators may be used on some of the meteorological towers and buoys, which may cause minor diesel fuel spills during refueling of generators. If a diesel fuel spill were to occur it would be expected to be small and dissipate quickly, then evaporate and biodegrade within a few days (USDOI, MMS 2007).

5.5.1 Marine Mammals

Marine mammals could be adversely impacted by the presence of pollutants (i.e. spilled diesel fuel) or accidentally released solid debris in the water column. Both pollutants and solid debris could be ingested by the animals. Sanitary and domestic wastes would be processed through on-site waste treatment facilities however would not be discharged in state waters. Domestic waste such as gray water could be discharged overboard outside of state waters, however sanitary waste would be retained and disposed of at shore-side facilities. Deck drainage would also be processed prior to discharge. Therefore, waste discharges from construction vessels would not be expected to directly affect marine mammals.

Should marine mammals come in contact with solid debris, such as plastics, ingestion could lead to internal blockage and later starvation, damage the stomach lining, or lessen the drive to forage and feed (Laist 1987). Ingested plastics could also contain or be composed of toxic substances that could have lethal or sub-lethal effects on the animal. Solid debris could also cause entanglement that can lead to drowning, abrasions (which could potentially be lethal), reduced mobility, and reduced ability to forage and avoid predators (Laist 1987). The discharge or disposal of solid debris into offshore waters from OCS structures and vessels is prohibited by BOEM (30 CFR 250.300) and the USCG (MARPOL, Annex V, Pub. L.100−220 (101 Stat. 1458). Therefore, the risk of ingestion of or entanglement in solid debris produced as a result of the proposed action would not be expected during normal circumstances.

During the course of site characterizations and site assessments vessel traffic and offshore activity associated with surveys and the construction/installation of meteorological tower/buoys would be minimal. Therefore the release of liquid wastes would be infrequent. During the time frame of the proposed action, collisions leading to accidental discharges would be more likely to occur during active construction/installation or decommissioning period, as there would be more than one vessel operating in close proximity. Collisions are less likely during surveys as only single vessels traveling at slow speeds would be operating at any one time. Therefore, impacts to marine mammals from the discharge of liquid and solid waste or the accidental release of fuel are expected to be negligible.

5.5.2 Sea Turtles

Sea turtles could be exposed to pollutants, sanitary waste and other fluids, as well as miscellaneous trash and debris generated during meteorological tower construction. Juvenile and adult sea turtles may be exposed to these waste discharges during periods of meteorological tower construction. If operational discharges such as diesel fuel were to occur it would be expected to be small and dissipate quickly, then evaporate and biodegrade within a few days. Also, domestic waste such as gray water could be discharged overboard outside of state waters, however sanitary waste would be retained and disposed of at shore-side facilities. Deck drainage would also be processed prior to discharge.

There is the potential for sea turtle ingestion of solid debris, as the ingestion of marine debris is widely reported among species of sea turtle worldwide (Tourinho *et al.*, 2010; Lazar & Gracen 2011). Ingestion of marine debris can lead to starvation, malnutrition, and absorption of chemicals (US EPA 2012; McCauly and Bjorndal 1999). Loggerheads are known to ingest all types of marine debris with little discrimination on size of debris ingested (Thomas *et al.*, 2002). Leatherbacks, whose primary prey item is jellyfish, commonly ingest floating surface and subsurface translucent plastic material and sheeting which is believed to be mistaken for these prey items. Sub-lethal quantities of ingested plastic can also result in positive buoyancy, causing the sea turtles to be at a greater risk for vessel collisions by reducing their ability to dive (Lutcavage *et al.*, 1997). Also of concern regarding debris is the risk of entanglement, which can result in reduced mobility, suffocation, starvation, and increased vulnerability to predators (USEPA 2012).

The discharge or disposal of solid debris into offshore waters from OCS structures and vessels is prohibited by BOEM (30 CFR 250.300) and the USCG (MARPOL, Annex V, Pub. L. 100−220 (101 Stat. 1458)). Therefore, the risk of ingestion of or entanglement in solid debris produced as a result of the proposed action would not be expected during normal circumstances.

5.5.3 Marine Fish

Fish could be exposed to operational discharges or accidental fuel releases near construction sites and construction vessels and to accidentally released solid debris. Non-toxic operational discharges from construction vessels would be released into the open ocean where they would rapidly dilute and disperse, or they would be collected and taken to shore for treatment and disposal. Domestic waste such as gray water could be discharged overboard outside of state waters, however sanitary waste would be retained and disposed of at shore-side facilities. Thus, waste discharges from construction vessels would not be expected to directly affect ESA-listed fish or their habitat.

Fish can be adversely impacted by the ingestion of, or entanglement with, solid debris. Fish that have ingested debris, such as plastic, may experience intestinal blockage, which in turn may lead to starvation, while toxic substances present in the ingested materials (especially in plastics) could lead to a variety of lethal and sub-lethal toxic effects. Entanglement in plastic debris can result in reduced mobility, starvation, exhaustion, drowning, and constriction of, and subsequent damage to, limbs caused by tightening of the entangling material. The discharge or disposal of solid debris into offshore waters from OCS structures and vessels is prohibited by

BOEM (30 CFR 250.300) and the USCG (MARPOL, Annex V, Pub. L. 100−220 (101 Stat. 1458)). Thus, entanglement in, or ingestion of, OCS-related trash and debris by fish would not be expected during normal operations. Because of the limited duration and area for vessel traffic and construction activity that might occur with construction, operation, and decommissioning of a meteorological tower and/or meteorological buoy, the release of debris and liquid wastes would be infrequent and impacts to ESA-listed fish (Atlantic sturgeon) negligible.

Although collisions or allisions between wind energy vessels / meteorological towers and buoys are considered unlikely, if one were to occur, and in the unlikely event that it resulted in a discharge, the most likely pollutant to be discharged would be diesel fuel. If a minor diesel spill were to occur, it would be expected to dissipate very rapidly in the water column, then evaporate and biodegrade within a few days (*see* Section 3.2.3 of this EA). Potentially, higher fish densities near meteorological towers and buoys could attract recreational fishermen to the area. As a result, a potential exists for collision of recreational fishing boats with towers and thus the accidental release of fuels (diesel or gas). A spill from this potential scenario would be expected to be small and dissipate quickly. The impacts to ESA-listed fish (Atlantic sturgeon) as a result of a fuel spill are expected to be temporary and minor.

5.6 Meteorological Tower and Buoy Decommissioning (RI/MA and MA WEAs)

Section 4.6 discusses in detail the proposed scenario for the decommissioning of meteorological towers and buoys. This section focuses on the decommissioning of a meteorological tower as it is a more extensive process than that of a meteorological buoy. The decommissioning of a meteorological tower involves more than potential impacts from vessel trips (which are addressed separately in Section 5.4).

5.6.1 Marine Mammals

Upon completion of site assessment activities, the meteorological tower would be removed and transported by barge to shore. During this activity, marine mammals may be exposed to sound and/or operational discharges as described for meteorological tower construction. Removal of piles would be accomplished by cutting the pile (using mechanical cutting or high-pressure water jets) at a depth of 15 feet (4.6 meters) below the mudline (30 CFR 585.910). Marine mammals could be affected by noise produced by pile-cutting activities; however, sound levels for these activities have not yet been tested for Atlantic wind energy projects. Despite this lack of information, it is expected that pile cutting activities would produce less noise than pile driving. It is also expected that only marine mammals within the immediate vicinity of pile cutting (i.e. those that had not left the area upon the arrival of decommission vessels) would be expected to be affected during tower removal, transport, and pile-cutting. Disturbance of marine mammals is expected to be lower than that of construction activities, and impacts from vessel disturbance associated with decommissioning are expected to negligible.

5.6.2 Sea Turtles

Upon completion of site assessment activities, the meteorological tower would be removed and transported by barge to shore. During this activity, sea turtles may be affected by sound and/or operational discharges as described for meteorological tower construction. Removal of piles would be accomplished by cutting the pile (using mechanical cutting or high-pressure water jets) at a depth of 15 feet (4.6 meters) below the sea bed. Sea turtles could be affected by noise produced by pile cutting activities, however sound levels for these activities have not yet been tested for Atlantic wind energy projects. It is expected that only sea turtles within the immediate vicinity of pile cutting (i.e. those that had not left the area upon the arrival of decommission vessels) would be expected to be affected during tower removal, transport, and pile cutting. Disturbance of sea turtles is expected to be lower than that of construction activities, and impacts from vessel disturbance associated with decommissioning are expected to be negligible.

5.6.3 Marine Fish

The decommissioning of meteorological towers and buoys is described in Section 4.6 of this BA. Upon completion of site assessment activities, the meteorological tower would be removed and transported by barge to shore. During this activity, if present, Atlantic sturgeon may be affected by noise and operational discharges as described for meteorological tower construction. Removal of the piles would be accomplished by cutting the piles (using mechanical cutting or high-pressure water jet) at a depth of 15 feet (4.6 meters) below the seabed. Fish could be affected by noise produced by pile-cutting equipment, although cutting produces less intense noise than pile driving. Only fish in the immediate vicinity of the site (those that had not moved away from the area upon arrival of decommissioning vessels) would be expected to be exposed to noise during tower removal and transport, and pile cutting. Again, Atlantic sturgeon is not expected to occur regularly in offshore marine environments thus impacts to the species from decommissioning activities is expected to be negligible.

6 Natural and Unanticipated Events (RI/MA and MA WEAs)

The potential exists for natural and/or unanticipated events to cause environmental impacts during site assessment or characterization activities. A natural event such as a hurricane or severe storm could impact meteorological towers or buoys at some point during their operation. Depending on the severity of the event, components of the facility could be damaged, destroyed or lost from the structure. These could cause temporary sea hazards and would be retrieved, removed or repaired as soon as possible. Buoys are equipped with GPS systems that alert operators when they have moved outside their operating area. Mariners would be alerted if this were to happen, or if a tower had experienced severe damage.

A vessel collision with the meteorological structures or collision with other vessels may result in the spillage of diesel fuel. Vessels are expected to comply with USCG requirements relating to prevention and control of oil spills. Spills are not projected to have significant impacts due to the small size of a projected spill. A vessel spill could occur while en route to and from the Project Area, but this is considered unlikely. If a spill were to occur, either inside or outside of the Project Area, the spill size would likely be small. From 2000 to 2009, the average spill size for vessels similar to those anticipated to be used during activities associated with the proposed action was 88.36 gallons (USCG, 2011). Vessel allision with a meteorological buoy containing diesel powered generator may also occur. It is estimated that a buoy generator could contain 240 gallons of diesel fuel (Fishermen's Energy 2011 *as cited in* USDOI, BOEM, OREP 2012). If a diesel spill of this size were to occur, it would be expected to dissipate very rapidly in the water column of the open ocean, then evaporate and biodegrade within a few days.

It is also possible that larger vessels, such as tankers or container ships, could collide with meteorological structures within the Project Area. Such a collision is considered unlikely, as these structures would be sparsely placed on the OCS offshore Massachusetts and Rhode Island, and will be lit and marked for navigational purposes (*see* Section 5 of this BA). If a larger vessel should collide with a meteorological facility/structure, a large spill would be extremely unlikely (*see* Section 5 of this BA). Thus, the largest spill that could result in the unlikely event that a larger ship were to collide with a meteorological facility is on the order of 240 gallons (as indicated above for a buoy-mounted generator).

7 Conclusions

The following are the conclusions reached by BOEM regarding the anticipated impacts of lease issuance, site assessment, and site characterization activities described herein for the Project Area to ESA-listed marine mammals, sea turtles, and marine fish. Impacts to ESA-listed species under USFWS jurisdiction (e.g. birds and bats) are assessed in a separate document. There is no critical habitat for any ESA-listed species in the Project Area or its surrounding waters. Site assessment impacts were only evaluated for the Rhode Island/Massachusetts and Massachusetts Wind Energy Areas.

7.1 Marine Mammals

The proposed action and the potential effects of HRG survey noise on ESA-listed marine mammals, specifically North Atlantic right, humpback, fin, sei, and sperm whales are expected to be limited to short-term behavior changes, such as avoidance of the HRG survey activities during migration and changes in vocalizations in response to masking by the additional noise. Although North Atlantic right, humpback, fin, sei, and sperm whales are included in that assessment, the likelihood of exposure to HRG survey noise to sperm and sei whales is likely limited to just the RI/MA and MA WEAs and even in those WEAs sperm and sei whales have been documented to have only limited occurrence. No long-term changes or physiological effects are expected. Measures (exclusion zones, ramp-up) have been adopted to ensure that injurious levels of noise are not experienced by marine mammals. However, during the operation of some survey equipment (sub-bottom profilers such as boomers and chirpers) marine mammals may be exposed to sound levels equivalent to Level B harassment as defined for purposes of the MMPA. Therefore, the survey activity is likely to result in temporary adverse impacts to North Atlantic right, humpback, fin, sei, and sperm whales from HRG surveys.

Meteorological tower construction noise (e.g. pile driving), which is only assessed for the RI/MA and MA WEAs, could result in short-term behavioral change such as avoidance of, or flight from, the sound source and changes in vocalizations in response to masking to North Atlantic right, humpback, fin, sei, and sperm whales. The level of impacts from pile driving is anticipated to be limited to Level B harassment. Also, if marine mammals were to be in close enough proximity to the sound source, the potential for injurious noise could exist. However, it is highly unlikely that this would occur due to the standard operating conditions such as the seasonal prohibition on pile driving, exclusion zone, and soft start that would be required when pile driving is occurring (see Section 8). Thus, North Atlantic right, humpback, fin, sei, and sperm whales may experience temporary adverse impacts during pile driving equivalent to Level B harassment.

Due to the limited geotechnical sampling footprint expected, this activity would have negligible effects on the benthic community that could impact ESA-listed marine mammals. Impacts related to meteorological tower/buoy installation, operation and decommissioning are expected to be minor. Marine mammals could be exposed to operational discharges or accidental fuel releases from construction equipment or construction vessels, as well as accidentally released solid debris. The entanglement in or ingestion of OCS-related trash and debris by marine mammals would not be expected during normal operations. Impacts to marine mammals from the discharge of waste materials or the accidental release of fuels are expected to be minor due to the limited number of structures and vessels involved with their construction, operation, and decommissioning.

Site characterization and site assessment activities for the proposed action are not expected to generate a large volume of vessel traffic compared to the status quo. Due to vessel speed restrictions currently in place, and the standard operating conditions detailed in Section 8, it is expected the whale/ship interactions will be rare and therefore impacts would be negligible.

As a result of the above, BOEM concludes that the effects of the proposed action on ESA-listed marine mammals are likely to result in temporary adverse impacts to North Atlantic right, humpback, fin, sei, and sperm whales as a result of being exposed to noise between 180 and 160 dB re 1 µPa at 1 m during HRG survey and pile driving activity. BOEM does not believe this noise exposure would result in any population level impacts.

7.2 Sea Turtles

The proposed action and the potential effects of HRG survey noise on ESA-listed sea turtles, specifically leatherback, loggerhead, green and Kemp's ridley, are expected to be limited to avoidance of the HRG survey activities. The standard operating conditions include a 200-meter exclusion zone, a 60-minute "all clear" period, and shut down requirements to further reduce the likelihood of exposure to harmful levels of sound. Due to these provisions, and what is known about the auditory system of sea turtles, they are unlikely to hear any of the electromechanical sources except perhaps the boomer at very close range. Thus auditory or behavioral impacts due to electromechanical sources are discountable and not likely to adversely affect sea turtles.

Meteorological tower construction noise, primarily pile driving, will be detectable by sea turtles at low frequencies. The sound levels produced could cause avoidance of the sound source. Also, if sea turtles were to be in close enough proximity to the sound source, the potential for injury could exist. However, it is very unlikely that this would happen due to the required standard operating conditions (see Section 8) for a 1,000-meter exclusion zone and 60-minute "all clear" period for pile driving. However, given the larger area of ensonification that results from pile driving and the known regular occurrence of leatherback and loggerhead sea turtles in the RI/MA and MA WEAs in the summer and fall (see Sections 3.2.1, 3.2.2 and Figures 3.2.1-1a, 3.2.2-1a) it can be reasonably be assumed that some leatherback and loggerhead sea turtles may exposed to disturbing/harassing levels of noise beyond the 1,000 meter exclusion zone. Kemp's ridley and green sea turtles do not occur in densities, or with regularity, that would reasonably result in exposure to a pile driving event. Disturbance from pile driving is anticipated to be limited to the time necessary drive the piles (estimated at 27 days [3 days per each of 9 foundations] over 5 years).

Due to the limited geotechnical sampling footprint expected, this activity would have negligible effects on the benthic community that could impact ESA-listed sea turtles. Impacts related to meteorological tower/buoy installation, operation and decommissioning are expected to be negligible. Sea turtles could be exposed to operational discharges or accidental fuel releases from construction equipment or construction vessels, as well as accidentally released solid debris. The entanglement in or ingestion of OCS-related trash and debris by sea turtles would not be expected during normal operations. Impacts to sea turtles from the discharge of waste materials or the accidental release of fuels are expected to be negligible due to the limited number of structures and vessels involved with their construction, operation, and decommissioning and standard operating conditions.

Site assessment activities for the proposed action are not expected to generate a large volume of vessel traffic above status quo. Due to the vessel speed restriction currently in place, and the mitigation measures detailed in Section 8, it is expected the sea turtle / ship interactions will be rare and therefore impacts would be negligible.

As a result, BOEM concludes that the proposed activity will result in temporary adverse effects to leatherback and loggerhead sea turtles in the RI/MA and MA WEAs during pile driving associated with site assessment activities. HRG survey work may affect, but will not likely adversely affect leatherback, loggerhead, green, or Kemp's ridley sea turtles in the RI/MA, MA, NY, and NJ areas.

7.3 Marine Fish

HRG survey activity is will generally operate at levels above known hearing thresholds of fish including Atlantic sturgeon. Because of that lack of impact from the sound source, species coastal/estuarine affinity, and the limited immediate area of ensonification and duration of individual HRG surveys that may be conducted during site assessment, few Atlantic sturgeon or ESA candidate species may be expected to be exposed to disturbing levels of survey noise. Thus, potential impacts on ESA-listed (e.g. the 5 Atlantic sturgeon DPSs) and candidate fish from HRG surveys are expected to be negligible.

Meteorological tower construction noise in the RI/MA and MA WEAs could disturb normal behavior including avoidance of, or flight from, the sound source in the unlikely event they are present in the offshore area during pile driving activities. Disturbance from pile driving is anticipated to be limited to the time necessary drive the piles (estimated at 27 days [3 days per each of 9 foundations] over 5 years). In addition, mitigation measures employed (*see* Section 8), including the implementation of a "soft start" procedure, will minimize the possibility of exposure to injurious sound levels by prompting any Atlantic Sturgeon to leave the area prior to exposure to disturbing levels of sound. Thus impacts to Atlantic sturgeon are expected to be negligible.

Due to the limited geotechnical sampling footprint expected, this activity would have negligible benthic community effects that could impact Atlantic sturgeon that may occur in the Project Area. Impacts related to meteorological towers/buoys installation, operation and decommissioning is expected to be minor. If found in the area, Atlantic sturgeon could be exposed to operational discharges or accidental fuel releases from construction sites and construction vessels, and to accidentally released solid debris. The entanglement in or ingestion of OCS-related trash and debris by fish would not be expected during normal operations. Impacts to fish from the discharge of waste materials or the accidental release of fuels are expected to be minor due to the limited number of structures and vessels involved with their construction, operation, and decommissioning.

Site assessment activities as proposed in this BA suggest that vessel traffic volume would be limited. Because the predominant historical information on sturgeon mortalities is from channelized, shallow estuarine areas, and because the majority of the vessel traffic will be in the offshore Project Area, it is expected that vessel-sturgeon interactions would be remote, and thus impacts negligible.

As a result, BOEM concludes that the effects of the proposed site assessment and site characterization activities in the RI/MA, MA, NY, and NJ areas are not detectable, discountable, and not likely to adversely affect the ESA-listed Atlantic Sturgeon.

8 Standard Operating Conditions for Protected Species

This section outlines the standard operating conditions that BOEM will require in order to minimize or eliminate potential impacts to protected species including ESA-listed species of whales and sea turtles. For the purposes of consultation with NMFS under the ESA these standard operating conditions are only being submitted for review as they apply to their protections for endangered species and are only binding under that consultation insofar as they apply to endangered species.

Additional conditions, including mitigation, monitoring or reporting measures, may be included in any BOEM issued lease or other authorization, including those that may be developed during Federal ESA Section 7 consultations. These conditions are divided into five sections: (1) those required during all project activity associated with SAP and/or COP submittal or activity under a SAP; (2) those required during geological and geophysical (G&G) survey activity in support of plan (i.e., SAP and/or COP) submittal; (3) those required during pile driving of a meteorological tower foundation; (4) reporting requirements; and (5) other requirements.

8.1 General Requirements

8.1.1 Vessel Strike Avoidance Measures

The Lessee must ensure that all vessels conducting activity in support of a plan (i.e., SAP and/or COP) comply with the vessel strike avoidance measures specified below except under extraordinary circumstances when the safety of the vessel or crew are in doubt or the safety of life at sea is in question:

1) The lessee must ensure that vessel operators and crews maintain a vigilant watch for cetaceans, pinnipeds, and sea turtles and slow down or stop their vessel to avoid striking protected species.
2) <u>North Atlantic right whales</u>.
   a) The lessee must ensure all vessels maintain a separation distance of 457 m (1,500 ft) or greater from any sighted North Atlantic right whale (50 CFR 224.103).
   b) The lessee must ensure that any vessel underway remain parallel to a sighted right whale’s course whenever possible, and avoid excessive speed or abrupt changes in direction until the right whale has left the exclusion zone.
   c) When a right whale is sighted in a moving vessel’s path or in close proximity to the vessel, the lessee must reduce the vessel’s speed and shift the engine to neutral, and must not engage the engines until the right whale has left the exclusion zone.
   d) The lessee must reduce vessel speed to 10 knots (18.5 km/h) or less when mother/calf pairs, pods, or large assemblages of right whales are observed near an underway vessel.
3) <u>Non-delphinoid cetaceans other than the North Atlantic right whale</u>.
   a) The lessee must ensure all vessels maintain a separation distance of 91 m (300 ft) or greater from any sighted non-delphinoid cetacean other than a North Atlantic right whale.
   b) The lessee must ensure that any vessel underway remain parallel to a sighted non-delphinoid cetacean’s course whenever possible, and avoid excessive speed or abrupt changes in direction until the non-delphinoid cetacean has left the exclusion zone.

   c) When a non-delphinoid cetacean is sighted in a moving vessel's path or in close proximity to the vessel, the lessee must reduce the vessel's speed and shift the engine to neutral, and must not engage the engines until the non-delphinoid cetacean has left the exclusion zone.
   d) The lessee must reduce vessel speed to 10 knots (18.5 km/h) or less when mother/calf pairs, pods, or large assemblages of non-delphinoid cetaceans are observed near an underway vessel.
4) Delphinoid cetaceans.
   a) The lessee must ensure that all vessels maintain a separation distance of 45 m (150 ft) or greater from any sighted delphinoid cetacean.
   b) The lessee must ensure that any vessel underway remain parallel to a sighted delphinoid cetacean's course whenever possible, and avoid excessive speed or abrupt changes in direction until the delphinoid cetacean has left the exclusion zone.
   c) The lessee must reduce vessel speed to 10 knots (18.5 km/h) or less when mother/calf pairs, pods, or large assemblages of delphinoid cetaceans are observed near an underway vessel.
5) Sea turtles. The lessee must ensure all vessels maintain a separation distance of 45 m (150 ft) or greater from any sighted sea turtle.
6) The lessee must ensure that all vessels 65 feet in length or greater, operating from November 1 through April 30, operate at speeds less than 10 knots.
7) The lessee must ensure that vessel operators are briefed to ensure they are familiar with the above requirements.

8.1.2 Marine Debris Awareness

The lessee must ensure that vessel operators, employees and contractors engaged in activity in support of a plan (i.e., SAP and/or COP) are briefed on marine trash and debris awareness elimination as described in the BSEE NTL No. 2012-G01 ("Marine Trash and Debris Awareness and Elimination"). BOEM (the Lessor) will not require the lessee to undergo formal training or post placards, as described under this NTL. Instead, the lessee must ensure that its employees and contractors are made aware of the environmental and socioeconomic impacts associated with marine trash and debris and their responsibilities for ensuring that trash and debris are not intentionally or accidentally discharged into the marine environment. The above referenced NTL provides information the lessee may use for this awareness training.

8.1.3 Rationale for Vessel Strike Avoidance and Marine Debris Awareness Measures

The vessel strike avoidance measures required above are based on the Joint BOEM-BSEE Notice To Lessees and Operators (NTL) of Federal Oil, Gas, and Sulphur Leases in the OCS, Gulf of Mexico of Mexico OCS Region on "Vessel Strike Avoidance and Injured/Dead Protected Species Reporting" (NTL 2012-JOINT-G01) (see http://www.bsee.gov/Regulations-and-Guidance/Notices-to-Lessees-and-Operators.aspx), which in turn is based upon the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service's (NMFS) Vessel Strike Avoidance

Measures and Reporting for Mariners. These measures have become standard means to protect marine mammals and sea turtles by maintaining a vigilant watch for these species and reducing speed and/or course to reduce or eliminate the potential for injury. A single cetacean at the surface may indicate the presence of submerged animals in the vicinity of the vessel thus requiring the precautionary vessel-strike avoidance measures. Given that delphinoid cetaceans often bow ride and are far more quick to react to vessel movement than large non-delphinoid cetaceans, the requirement to shift the engine into neutral is not required for those species.

The temporal speed restriction from November 1 – April 30 is based upon vessel strike reduction measures implemented through the Special Management Areas (SMAs) for North Atlantic right whales by NMFS. BOEM has taken a conservative, risk-adverse approach to these restrictions and applied them throughout the action area.

Marine debris awareness measures are intended to reduce the risk marine debris poses to protected species from ingestion and entanglement. These simple measures will reduce the potential for debris ending up in the marine environment.

8.2 Geological and Geophysical (G&G) Survey Requirements

Visibility. The Lessee must not conduct G&G surveys in support of plan (i.e., SAP and/or COP) submittal at any time when lighting or weather conditions (e.g., darkness, rain, fog, sea state) prevents visual monitoring of the exclusion zones for HRG surveys and geotechnical surveys as specified below. This requirement may be modified as specified below.

Modification of Visibility Requirement. If the Lessee intends to conduct G&G survey operations in support of a plan at night or when visual observation is otherwise impaired, an alternative monitoring plan detailing the alternative monitoring methodology (e.g. active or passive acoustic monitoring technologies) must be submitted to the Lessor for consideration. The Lessor may, after consultation with NMFS, decide to allow the Lessee to conduct G&G surveys in support of a plan at night or when visual observation is otherwise impaired using the proposed alternative monitoring methodology.

Protected-Species Observer. The Lessee must ensure that the exclusion zone for all G&G surveys performed in support of plan (i.e., SAP and/or COP) submittal is monitored by a NMFS-approved protected-species observer. The Lessee must provide to the Lessor a list of observers and their résumés no later than forty-five (45) calendar days prior to the scheduled start of surveys performed in support of plan submittal. The résumés of any additional observers must be provided fifteen (15) calendar days prior to each observer’s start date. The Lessor will send the observer information to NMFS for approval.

Optical Device Availability. The Lessee must ensure that binoculars or other suitable equipment are available to each observer to adequately perceive and monitor distant objects within the exclusion zone during surveys conducted in support of plan (i.e., SAP and/or COP) submittal.

8.2.1 High Resolution Geophysical Survey Requirements

1) Establishment of Exclusion Zone. The lessee must ensure that a 200 meter radius exclusion zone for cetaceans, pinnipeds, and sea turtles will be monitored by a protected species

observer around a survey vessel actively using electromechanical survey equipment. In the case of the North Atlantic right whale, the minimum separation distance of 457 m (1,500 ft) is in effect when the vessel is underway as described in the vessel-strike avoidance measures (see Section 8.1).

a) If the Lessor determines that the exclusion zone does not encompass the 180-dB Level A harassment radius calculated for the acoustic source having the highest source level, the Lessor will consult with NMFS about additional requirements.

b) The Lessor may authorize surveys having an exclusion zone larger than 200 m (656 ft) to encompass the 160-dB Level B harassment radius if the Lessee can demonstrate the zone can be effectively monitored.

2) Modification of Exclusion Zone. The Lessee may use the field-verification method described below to modify the HRG survey exclusion zone for specific HRG survey equipment being utilized. Any new exclusion zone radius must be based on the most conservative measurement (i.e., the largest safety zone configuration) of the 160 dB or 180 dB zone. This modified zone must be used for all subsequent use of field-verified equipment and may be periodically reevaluated based on the regular sound monitoring described below. The Lessee must obtain Lessor approval of any new exclusion zone before it may be implemented.

3) Field Verification of Exclusion Zone. If the Lessee wishes to modify the exclusion zone as described above, the Lessee must conduct field verification of the exclusion zone for specific HRG survey equipment. The results of the sound measurements from the survey equipment must be used to establish a new exclusion zone which may be greater than or less than the 200-meter default exclusion zone depending on the results of the field tests. The Lessee must take acoustic measurements at a minimum of two reference locations. The first location must be at a distance of 200 meters from the sound source and the second location must be as close to the sound source as technically feasible. Sound measurements must be taken at the reference locations at two depths (i.e., a depth at mid-water and a depth at approximately 1 meter above the seafloor). Sound pressure levels must be measured and reported in the field in dB re 1 μPa rms (impulse). An infrared range finder may be used to determine distance from the sound source to the reference location.

4) Clearance of Exclusion Zone. The lessee must ensure that active acoustic sound sources must not be activated until the protected species observer has reported the exclusion zone clear of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

5) Electromechanical Survey Equipment Ramp-Up. The lessee must ensure that when technically feasible a "ramp-up" of the electromechanical survey equipment occur at the start or re-start of HRG survey activities. A ramp-up would begin with the power of the smallest acoustic equipment for the HRG survey at its lowest power output. The power output would be gradually turned up and other acoustic sources added in a way such that the source level would increase in steps not exceeding 6 dB per 5-min period.

6) Shut Down for Non-Delphinoid Cetaceans and Sea Turtles. If a non-delphinoid cetacean or sea turtle is sighted within or transiting towards the 200 m exclusion zone, an immediate shutdown of the electromechanical survey equipment is required. The vessel operator must comply immediately with such a call by the observer. Any disagreement or discussion should occur only after shut-down. Subsequent restart of the electromechanical survey equipment must use the ramp-up provisions described above and may only occur following

clearance of the 200 m exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

7) Power Down for Delphinoid Cetaceans and Pinnipeds. If a delphinoid cetacean or pinniped is sighted within or transiting towards the 200 m exclusion zone, the electromechanical survey equipment must be powered down to the lowest power output that is technically feasible. The vessel operator must comply immediately with such a call by the observer. Any disagreement or discussion should occur only after power-down. Subsequent power up of the electromechanical survey equipment must use the ramp-up provisions described above and may occur after (1) as soon as the 200 m exclusion zone is clear of a delphinoid cetacean and/or pinniped or (2) a determination by the protected species observer after a minimum of 10 minutes of observation that the delphinoid cetacean and/or pinniped is approaching the vessel or towed equipment at a speed and vector that indicates voluntary approach to bow-ride or chase towed equipment. An incursion into the exclusion zone by a non-delphinoid cetacean or sea turtle during a power-down requires implementation of the shut-down procedures described above.

8) Pauses in Electromechanical Survey Sound Source. The lessee must ensure that if the electromechanical sound source shuts down for reasons other than encroachment into the exclusion zone by a non-delphinoid cetacean or sea turtle, including, but not limited to, mechanical or electronic failure, resulting in the cessation of the sound source for a period greater than 20 minutes, the lessee must restart the electromechanical survey equipment using the full ramp-up procedures and clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes. If the pause is less than 20 minutes the equipment may be re-started as soon as practicable at its operational level as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of cetaceans, pinnipeds, and sea turtles. If visual surveys were not continued diligently during the pause of 20-minutes or less, the lessee must restart the electromechanical survey equipment using the full ramp-up procedures and clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

8.2.2 Geotechnical Survey Requirements

1) Establishment of Exclusion Zone. The lessee must ensure that a 200 meter radius exclusion zone for all cetaceans, pinnipeds, and sea turtles will be monitored by a protected species observer around any vessel conducting geotechnical surveys (i.e. drilling, cone penetrometer tests, etc.).

1) Modification of Exclusion Zone. The Lessee may use the field-verification method as described below to modify the geotechnical survey exclusion zone for specific geotechnical sampling equipment being utilized. Any new exclusion zone radius must be based on the most conservative measurement (i.e., the largest safety zone configuration) of the 160 dB zone. This modified zone must be used for all subsequent use of field-verified equipment and may be periodically reevaluated based on the regular sound monitoring described below. The Lessee must obtain Lessor approval of any new exclusion zone before it may be implemented.

2) Field Verification of Exclusion Zone. If the Lessee wishes to modify the exclusion zone as described above, the Lessee must conduct field verification of the exclusion zone for specific

geotechnical sampling equipment. The results of the measurements from the equipment must be used to establish a new exclusion zone, which may be greater than or less than the 200-meter default exclusion zone depending on the results of the field tests. The Lessee must take acoustic measurements at a minimum of two reference locations. The first location must be at a distance of 200 meters from the sound source and the second location must be as close to the sound source as technically feasible. Sound measurements must be taken at the reference locations at two depths (i.e., a depth at mid-water and a depth at approximately 1 meter above the seafloor). Sound pressure levels must be measured and reported in the field in dB re 1 μPa rms (impulse). An infrared range finder may be used to determine distance from the sound source to the reference location.

3) Clearance of Exclusion Zone. The lessee must ensure that geotechnical sound source must not be activated until the protected species observer has reported the exclusion zone clear of all cetaceans, pinnipeds, and sea turtles for 60 minutes.
4) Shut Down for Non-Delphinoid Cetaceans and Sea Turtles. If any non-delphinoid cetaceans or sea turtles are sighted within or transiting towards the 200 m exclusion zone, an immediate shutdown of the geotechnical survey equipment is required. The vessel operator must comply immediately with such a call by the observer. Any disagreement or discussion should occur only after shut-down. Subsequent restart of the geotechnical survey equipment may only occur following clearance of the 200 m exclusion zone for 60 minutes.
5) Pauses in Geotechnical Survey Sound Source. The lessee must ensure that if the geotechnical sound source shuts down for reasons other than encroachment into the exclusion zone by a non-delphinoid cetacean or sea turtle, including, but not limited to, mechanical or electronic failure, resulting in the cessation of the sound source for a period greater than 20 minutes, the lessee must restart the geotechnical survey equipment using the full ramp-up procedures and clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes. If the pause is less than 20 minutes the equipment may be re-started as soon as practicable as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of cetaceans, pinnipeds, and sea turtles. If visual surveys were not continued diligently during the pause of 20-minutes or less, the lessee must restart the geotechnical survey equipment only after the clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

8.2.3 Rationale for G&G Survey Measures

Clearance Period and Sea Turtle Exclusion Zone. Previous ESA consultations for G&G activity near the action area concluded if the G&G survey activities occurred between June and November, listed sea turtles could be exposed to acoustic impacts from the survey. BOEM is requiring that the applicant maintain a 200 meter exclusion zone during the survey and that this exclusion zone be monitored for at least 60 minutes prior to ramp up of the survey equipment. The normal duration of sea turtle dives ranges from 5-40 minutes depending on species, with a maximum duration of 45-66 minutes depending on species (Spotila 2004). As sea turtles typically surface at least every 60 minutes, it is reasonable to expect that monitoring the exclusion zone for at least 60 minutes will allow the endangered species monitor to detect any sea turtles that may be submerged in the exclusion zone. The 200 m exclusion zone is extremely conservative for sea turtles given that they would only perceive the low frequencies of the boomer, whose 180 dB level is expected to not exceed 45 m from the sound source.

Considerations, including the simplification for exclusion zone monitoring, were considered in applying the 200 m zone.

Modification of Exclusion Zone. The modification of the exclusion zone reflects several principles: 1) the lessee may utilize a type of survey equipment whose sound profile was not captured by BOEM's model and the lessee would like initiate modification of the exclusion zone; 2) equipment specifications submitted to BOEM with the lessee's plan documents indicate a sound profile that exceeds BOEM's modeled area of ensonification at the 180 dB level; and 3) the lessee may wish to expand the exclusion zone to encompass the 160 dB level if it can be effectively monitored in order to reduce potential for needing an incidental harassment authorization issued under the Marine Mammal Protection Act.

Shutdown Provisions. Prior to beginning either HRG or geotechnical surveys the exclusion zone must be clear of all cetaceans, pinnipeds, and sea turtles. This will ensure that these species are far enough from the sound source prior to the activity that harassment does not occur. After the initial startup of the sound source shutdown of either electromechanical or geotechnical survey equipment is only required for non-delphinoid cetaceans and sea turtles. This is primarily a precautionary measure targeted at endangered species. Incursion of the exclusion zone after the start of the sound source by pinnipeds and delphinoid cetaceans must be recorded by the observer, but -especially in the case of delphinoid cetaceans- because of their documented curiosity and voluntary approach of seismic sound sources (air guns) in the Gulf of Mexico (Barkaszi et al 2012) it was determined that a shutdown of the active sound source was not appropriate for these species.

8.3 Requirements for Pile Driving of a Meteorological Tower Foundation

Visibility. The Lessee must not conduct pile driving for a meteorological tower foundation at any time when lighting or weather conditions (e.g., darkness, rain, fog, sea state) prevents visual monitoring of the exclusion zones for meteorological tower foundation pile driving as specified below. This requirement may be modified as specified below.

Modification of Visibility Requirement. If the Lessee intends to conduct pile driving for a meteorological tower foundation at night or when visual observation is otherwise impaired, an alternative monitoring plan detailing the alternative monitoring technologies (e.g. active or passive acoustic monitoring technologies) must be submitted to the Lessor for consideration. The Lessor may, after consultation with NMFS, decide to allow the Lessee to conduct pile driving for a meteorological tower foundation at night or when visual observation is otherwise impaired.

Protected-Species Observer. The Lessee must ensure that the exclusion zone for all pile driving for a meteorological tower foundation is monitored by a NMFS-approved protected-species observer. The Lessee must provide to the Lessor a list of observers and their résumés no later than forty-five (45) calendar days prior to the scheduled start of meteorological tower construction activity. The résumés of any additional observers must be provided fifteen (15) calendar days prior to each observer's start date. The Lessor will send the observer information to NMFS for approval.

Optical Device Availability. The Lessee must ensure that binoculars or other suitable equipment are available to each observer to adequately perceive and monitor distant objects within the exclusion zone during meteorological tower construction activities.

Pre-Construction Briefing. Prior to the start of construction, the lessee must hold a briefing to establish responsibilities of each involved party, define the chains of command, discuss communication procedures, provide an overview of monitoring purposes, and review operational procedures. This briefing must include construction supervisors and crews, and the protected species observer(s) (see further below). The Resident Engineer (or other authorized individual) will have the authority to stop or delay any construction activity, if deemed necessary by the Resident Engineer. New personnel must be briefed as they join the work in progress.

8.3.1 Requirements for Pile Driving

Prohibition on Pile Driving. The lessee must ensure that no pile-driving activities (e.g. pneumatic, hydraulic, or vibratory installation of foundation piles) occur from November 1 – April 30 nor during an active Dynamic Management Area (DMA) if the pile driving location is within the boundaries of the DMA as established by the National Marine Fisheries Service or within 7 kilometers of the boundaries of the DMA**.**

Establishment of Exclusion Zone. The lessee must ensure the establishment of a default 3281-foot (1,000-meter) radius exclusion zone for cetaceans, sea turtles, and pinnipeds around each pile driving site. The 3,281 feet (1,000 meter) exclusion zone must be monitored from two locations. One observer must be based at or near the sound source and will be responsible for monitoring out to 1,640 feet (500 meters) from the sound source. An additional observer must be located on a separate vessel navigating approximately 3,281 feet (1,000 meters) around the pile hammer and will be responsible for monitoring the area between 500 m to 1,000 m from the sound source.

Modification of Exclusion Zone. If multiple piles are being driven, the lessee may use the field verification method described below to modify the default exclusion zone provided above for pile driving activities. Any new exclusion zone radius must be based on the most conservative measurement (i.e., the largest safety zone configuration) of the 180 dB zone.

Field Verification of Exclusion Zone. If the lessee wishes to modify the exclusion zone the lessee must conduct a field verification of the exclusion zone during pile driving of the first pile if the meteorological tower foundation design includes multiple piles. The results of the measurements from the first pile must be used to establish a new exclusion zone which may be greater than or less than the 3281-foot (1,000-meter) default exclusion zone, depending on the results of the field tests. Acoustic measurements must take place during the driving of the last half (deepest pile segment) for any given open-water pile. A minimum of two reference locations must be established at a distance of 1,640 feet (500 meters) and 3281-foot (1,000-meter) from the pile driving. Sound measurements must be taken at the reference locations at two depths (a depth at mid-water and a depth at approximately 1m above the seafloor). Sound pressure levels must be measured and reported in the field in dB re 1 μPa rms (impulse). An infrared range finder may be used to determine distance from the pile to the reference location.

Clearance of Exclusion Zone. The lessee must ensure that visual monitoring of the 1,000 m exclusion zone must begin no less than 60 minutes prior to the beginning of soft start and continue until pile driving operations cease or sighting conditions do not allow observation of the sea surface (e.g., fog, rain, darkness). If a cetacean, pinniped, or sea turtle is observed, the observer must note and monitor the position, relative bearing and estimated distance to the animal until the animal dives or moves out of visual range of the observer. The observer must continue to observe for additional animals that may surface in the area, as often there are numerous animals that may surface at varying time intervals.

Implementation of Soft Start. The lessee must ensure that a "soft start" be implemented at the beginning of each pile installation in order to provide additional protection to cetaceans, pinnipeds, and sea turtles near the project area by allowing them to vacate the area prior to the commencement of pile driving activities. The soft start requires an initial set of 3 strikes from the impact hammer at 40 percent energy with a one minute waiting period between subsequent 3 strike sets.

Shut Down for Cetaceans, Pinnipeds, and Sea Turtles. The lessee must ensure that any time a cetacean, pinniped, and/or sea turtle is observed within the 1,000 m exclusion zone, the observer must notify the Resident Engineer (or other authorized individual) and call for a shutdown of pile driving activity. The pile driving activity must cease as soon as it is safe to do so. Any disagreement or discussion should occur only after shut-down, unless such discussion relates to the safety of the timing of the cessation of the pile driving activity. Subsequent restart of the pile driving equipment may only occur following clearance of the 1,000 m exclusion zone of any cetacean, pinniped, and/or sea turtle for 60 minutes.

Pauses in Pile Driving Activity. The lessee must ensure that if pile driving ceases for 30 minutes or more and a cetacean, pinniped, and/or sea turtle is sighted within the exclusion zone prior to re-start of pile driving, the observer(s) must notify the Resident Engineer (or other authorized individual) that an additional 60 minute visual and acoustic observation period must be completed, as described above, before restarting pile driving activities.

A pause in pile driving for less than 30 minutes must still begin with soft start but will not require the 60 minute clearance period as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of cetaceans, pinnipeds, and sea turtles. If visual surveys were not continued diligently during the pause of 30-minutes or less, the lessee must clear the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

8.3.2 Rationale for Meteorological Tower Construction Measures

The 3281 feet (1,000 meters) exclusion zone is based upon the field of ensonification at the 180 dB level and based upon previous reports to BOEM on modeled areas of ensonification from pile driving activities. Because at the greater risk of injury to cetaceans, pinnipeds, and sea turtles from pile driving BOEM has adopted a very conservative shutdown requirement that would apply to all incursions into the exclusion zone during pile driving.

8.4 Protected Species Reporting Requirements

The Lessee must ensure compliance with the following reporting requirements for site characterization activities performed in support of plan (i.e., SAP and/or COP) submittal and must use contact information provided by the Lessor, to fulfill these requirements:

1. Reporting Injured or Dead Protected Species. The Lessee must ensure that sightings of any injured or dead protected species (e.g., marine mammals or sea turtles) are reported to the NMFS Northeast Region's Stranding Hotline (800-900-3622 or current) within 24 hours of sighting, regardless of whether the injury or death is caused by a vessel. In addition, if the injury or death was caused by a collision with a project-related vessel, the Lessee must ensure that the Lessor is notified of the strike within 24 hours. The notification of such strike must include the date and location (latitude/longitude) of the strike, the name of the vessel involved, and the species identification or a description of the animal, if possible. If the Lessee's activity is responsible for the injury or death, the Lessee must ensure that the vessel assist in any salvage effort as requested by NMFS.
2. Reporting Observed Impacts to Protected Species. The observer must report any observations concerning impacts on Endangered Species Act listed marine mammals or sea turtles to the Lessor and NMFS within 48 hours. Any observed Takes of listed marine mammals or sea turtles resulting in injury or mortality must be reported within 24 hours to the Lessor and NMFS.
3. Report Information. Data on all protected-species observations must be recorded based on standard marine mammal observer collection data by the protected-species observer. This information must include: dates, times, and locations of survey operations; time of observation, location and weather; details of marine mammal sightings (e.g., species, numbers, and behavior); and details of any observed Taking (e.g., behavioral disturbances or injury/mortality).
4. Final Report of G&G Survey Activities and Observations. The lessee must provide the Lessor and NMFS with a report within ninety (90) calendar days following the commencement of HRG and/or geotechnical sampling activities that includes a summary of the survey activities and an estimate of the number of listed marine mammals and sea turtles observed or Taken during these survey activities.
5. Final Technical Report for Meteorological Tower Construction and Observations. The lessee must provide the Lessor and NMFS a report within 120 days after completion of the pile driving and construction activities. The report must include full documentation of methods and monitoring protocols, summarizes the data recorded during monitoring, estimates the number of listed marine mammals and sea turtles that may have been taken during construction activities, and provides an interpretation of the results and effectiveness of all monitoring tasks.

Reports must be sent to:

Bureau of Ocean Energy Management
Environment Branch for Renewable Energy
Phone: 703-787-1340
Email: renewable_reporting@boem.gov

National Marine Fisheries Service
Northeast Regional Office, Protected Resources Division
Section 7 Incidental Take Coordinator
Phone: 978-281-9328
Email: incidental.take@noaa.gov

8.5 Other Requirements

8.5.1 Requirements for Meteorological Tower Decommissioning

Section 4 of this BA contains detail on the proposed scenario for decommissioning and removal of the meteorological towers and buoys. Essentially, the decommissioning process is the reverse of the construction process (absent pile driving), and the impacts from decommissioning would likely mirror those of construction. In addition, vessel activity during decommissioning would be essentially the same as that required during construction. Therefore, the vessel mitigation measures outlined in Section 8.1.1 of this BA will be required.

Foundation structures must be removed by cutting at least 15 feet (4.6 meters) below mudline (see 30 CFR 585.910(a). BOEM assumes the meteorological towers to be constructed in southern New England can be removed using non-explosive severing methods. As detailed in 30 CFR Part 585.902, before the lessee decommissions the facilities under their SAP, the lessee must submit a decommissioning application and receive approval from the BOEM. Furthermore, the approval of the decommissioning concept/methodology in the SAP is not an approval of a decommissioning application.

8.5.2 Other Non-ESA Related Standard Operating Conditions

The regulations for site assessment plans found at 30 CFR Part 585.610 specify the requirements of a site assessment plan. These include a description of the measures the lessee will use to avoid or minimize adverse effects and any potential incidental take of endangered species before conducting activities on the lease, and how the lessee will mitigate environmental impacts from their proposed activities. 30 CFR 585 Subpart F also specifies measures the lease must take to comply with the Endangered Species Act and the Marine Mammal Protection Act.

8.5.3 Site Characterization Data Collection

In addition to the collection of meteorological and oceanographic data, the purpose of these meteorological towers/buoys and site characterization surveys are to also collect biological and archaeological data. This data will assist in future analysis of proposed wind facilities. In addition to required reports, all site characterization data will be shared with NMFS, USFWS, and appropriate State agencies, upon request.

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Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Rhode Island and Massachusetts

For U.S. Fish and Wildlife Service

Biological Assessment (October 2012)

U.S. Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs

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Acronyms and Abbreviations

ADCP	Acoustic Doppler Current Profiler
BOEM	Bureau of Ocean Energy Management
C	Celsius
CODAR	Coastal Ocean Dynamic Application Radar
COP	Construction and Operations Plan
CPT	Cone Penetrometer Test
EA	Environmental Assessment
EPACT	Energy Policy Act of 2005
ESA	Endangered Species Act
F	Fahrenheit
GGARCH	Geological, Geophysical, and Archeological
GIS	Geographic Information System
HRG	High Resolution Geophysical
IP	Interim Policy
LIDAR	Light Detecting and Ranging
NM	Nautical Mile
NMFS	National Marine Fisheries Service
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
ROV	Remotely Operated Vehicle
SAMP	Special Area Management Plan
SAP	Site Assessment Plan
SODAR	Sonic Detection And Ranging
USACE	United States Army Corps of Engineers
USDOC	United States Department of Commerce
USDOI	United States Department of Interior
USFWS	United States Fish and Wildlife Service
WEA	Wind Energy Area

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1 Introduction

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

This document is a biological assessment (BA) of impacts to endangered and threatened species listed under the Endangered Species Act (ESA) from proposed commercial wind energy lease issuance, associated site characterization activities, and subsequent site assessment activities on the OCS off Rhode Island and Massachusetts. This BA initiates informal consultation under Section 7 of the ESA.

1.1 Project Area

The Project Area comprises two "Wind Energy Areas" (WEAs) on the OCS, off the coasts of Massachusetts and Rhode Island: the "Massachusetts" WEA (MA WEA) and the "Rhode Island and Massachusetts" WEA (RI/MA WEA) (*see* Figure 1.1). These WEAs comprise a total area of approximately 1,419 square statute miles (907,724 acres) and contain 130 whole OCS lease blocks and 49 partial OCS lease blocks. These WEAs were developed through collaboration and consultation with state intergovernmental task forces, Federal agencies, Native American Tribes, the general public, and other stakeholders. Both WEAs are located in relatively shallow waters (approximately 30-60 m) of the OCS, in the Southern New England planning region of the Northeast Continental Shelf Large Marine Ecosystem (NCSLME) (Cook and Auster, 2007; Sherman, 1991). The coastal waters and OCS in this region are described in detail in the Massachusetts Ocean Management Plan (MAEEA, 2009) and the Rhode Island Ocean Special Area Management Plan (RICRMC and URI, 2011).

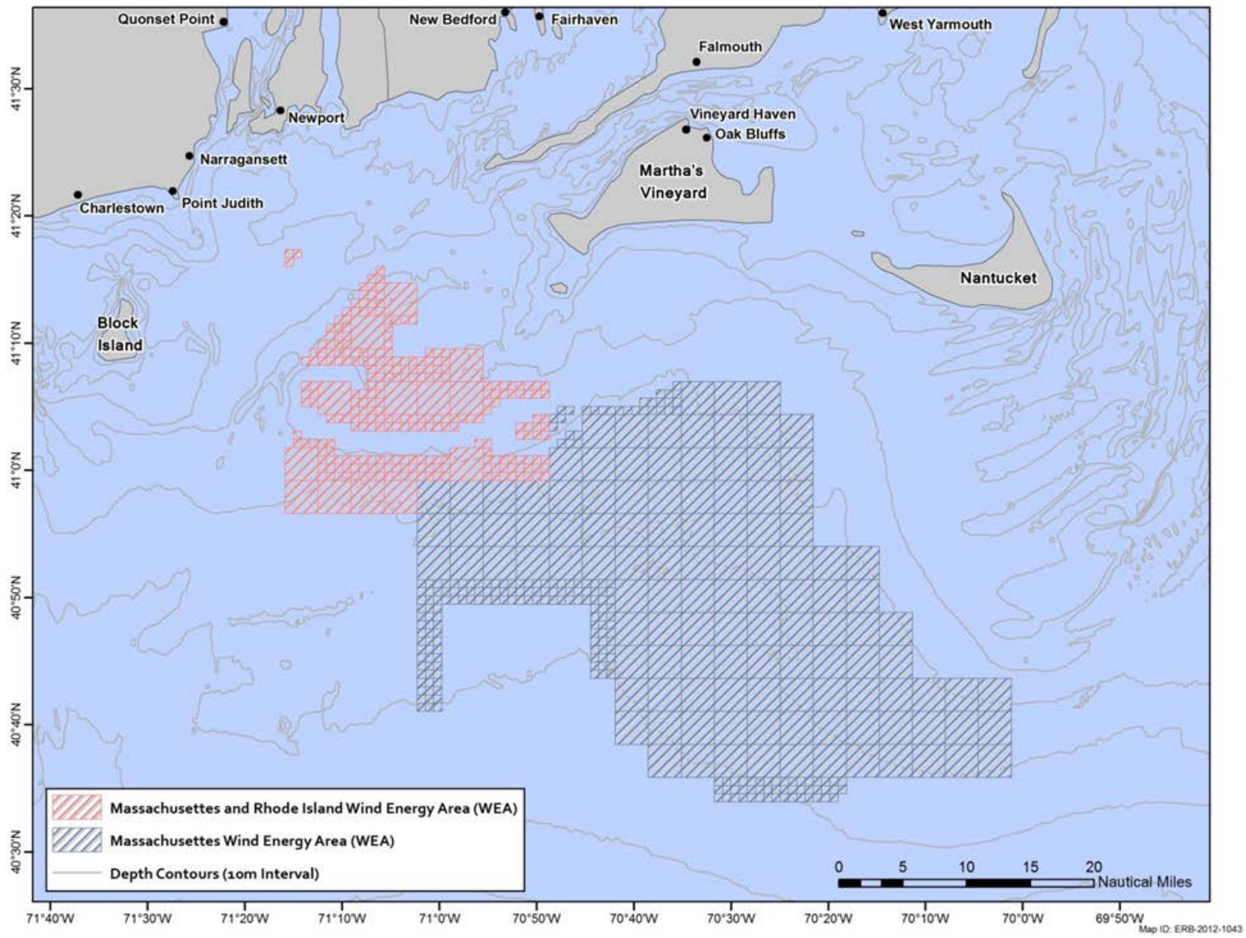

Figure 1.1. Project Area showing the RI/MA and MA WEAs

1.2 Proposed Action

The proposed action, that is the subject of this BA, is the issuance of commercial wind energy leases and the approval of site assessment plans to provide for the responsible development of wind energy resources within all or some of the RI/MA WEA and the MA WEA. This BA will consider the environmental consequences associated with reasonably foreseeable site characterization scenarios associated with leasing (including geophysical, geotechnical, archeological and biological surveys), and site assessment activities (including the installation, operation and decommissioning of meteorological towers and buoys) in the Project Area.

1.3 Renewable Energy Process

Under the renewable energy regulations, the issuance of leases and subsequent approval of wind energy development on the OCS is a staged decision-making process. BOEM's wind energy program occurs in four distinct phases:

1) **Planning and Analysis.** The first phase is to identify suitable areas to be considered for wind energy project leases through collaborative, consultative, and analytical processes using the state's task forces, public information meetings, input from the states, Native American Tribes, and other stakeholders.

2) **Lease Issuance.** The second phase is the issuance of a commercial wind energy lease. The competitive lease process is set forth at 30 CFR 585.210 to 585.225, and the noncompetitive process is set forth at 30 CFR 585.230 to 585.232. A commercial lease gives the lessee the exclusive right to subsequently seek BOEM approval for the development of the leasehold. The lease does not grant the lessee the right to construct any facilities; rather, the lease grants the right to use the leased area to develop its plans, which must be approved by BOEM before the lessee can move on to the next stage of the process (30 CFR 585.600 and 585.601).

3) **Approval of a Site Assessment Plan (SAP).** The third stage of the process is the submission of a SAP, which contains the lessee's detailed proposal for the construction of a meteorological tower and/or the installation of meteorological buoys on the leasehold (30 CFR 585.605 to 585.618). The lessee's SAP must be approved by BOEM before it conducts these "site assessment" activities on the leasehold. BOEM may approve, approve with modification, or disapprove a lessee's SAP (30 CFR 585.613). As a condition of SAP approval, meteorological towers will be required to have visibility sensors to collect data on climatic conditions above and beyond wind speed, direction and other associated metrics generally collected at meteorological towers. These data will assist BOEM and USFWS with evaluating the impacts of future offshore wind facilities on threatened and endangered birds, migratory birds, and bats.

4) **Approval of a Construction and Operation Plan (COP).** The fourth and final stage of the process is the submission of a COP, a detailed plan for the construction and operation of a wind energy project on the lease (30 CFR 585.620 to 585.638). BOEM approval of a COP is a precondition to the construction of any wind energy facility on the OCS (30 CFR 585.628). As with a SAP, BOEM may approve, approve with modification, or disapprove a lessee's COP (30 CFR 585.628).

The regulations also require that a lessee provide the results of surveys with its SAP or COP, including a shallow hazards survey (30 CFR 585.626 (a)(1)), geological survey (30 CFR 585.616(a)(2)), geotechnical survey (30 CFR 585.626(a)(4)), and an archaeological resource survey (30 CFR 585.626(a)(5)). BOEM refers to these surveys as "site characterization" activities. Although BOEM does not issue permits or approvals for these site characterization activities, it will not consider approving a lessee's SAP or COP if the required survey information is not included. *See* "Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information Pursuant to 30 CFR Part 585,"[1] referred to herein as the 'GGARCH guidelines' (USDOI, BOEMRE, OAEP, 2011).

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[1] *see* http://www.boem.gov/Renewable-Energy-Program/Regulatory-Information/Index.aspx#Notices_to_Lessees,_Operators_and_Applicants

2 ESA Section 7 Consultation History

The proposed action is similar in many respects to the consultation for *Issuance of Leases for Wind Resource Data Collection on the Outer Continental Shelf Offshore Delaware and New Jersey Environmental Assessment* (IP EA) that was concluded in the Spring of 2009 (USDOI MMS 2009) and the action described in the *Environmental Assessment (EA) for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia* (NJ-VA EA) and its associated biological assessment which were finalized in January 2012 (USDOI, BOEM, OREP, 2012a). Each of these assessments considered the issuance of leases for wind resource data collection, including geological and geophysical, hazards, and archaeological (GGARCH) site characterization surveys. The IP EA considered issuing leases for seven lease blocks and the NJ-VA EA considered issuing leases within all or part of four WEAs while the project area in the NJ-VA EA was comprised of approximately 117 OCS lease blocks across four states.

This BA addresses activities within the RI/MA WEA and the MA WEA, which together comprise a total of 130 whole and 49 partial lease blocks (13 whole and 29 partial lease blocks within the RI/MA WEA and 117 whole and 20 partial lease blocks within the MA WEA) (Figure 1.1). The primary activities that would occur as part of the site assessment described in the Proposed Action for this BA include: geological and geophysical surveys (sonar and sediment work), wind resource assessments (meteorological towers and buoys), biological assessments, and cultural/archeological assessments. This type of activity would be similar across both the MA and RI/MA WEAs.

Informal ESA Section 7 consultations for the IP EA were initiated with USFWS on January 9, 2009. The consultation was concluded in a letter from USFWS dated February 26, 2009. The informal consultation concluded that the site assessment activities would not jeopardize the continued existence of the federally listed roseate tern (*Sterna dougallii dougallii*) and piping plover (*Charadrius melodius*), and the candidate species, red knot (*Calidris canutus rufa*). In addition, USFWS stated that although the extent to which these species occur 8 or more miles offshore is not well known, the likelihood to which these species occur offshore was concluded to be low. USFWS further stated that the greater threat posed to avian species from site assessment activities, specifically the construction of meteorological towers, was the threat collisions between vessels and the structures and subsequent spilling of oil in the case of oil tankers. However, given the low number of proposed structures and the U.S. Coast Guard (USCG) requirements for navigational aids, the risk was still considered to be low. In order to evaluate future collision risk assessment USFWS recommended the placement of a visibility sensor, which measures transparency of the atmosphere by calculating a meteorological optical range, on the meteorological tower in addition to the biological monitoring devices already included.

More recently, there was an informal ESA Section 7 consultation with USFWS on March 24, 2011, for lease issuance and site assessment activities off of NJ-VA. The consultation was concluded in a letter from USFWS dated June 20, 2011, concurring with the determination that the meteorological tower and buoy construction activities are not likely to adversely affect the three listed species under USFWS jurisdiction (roseate tern, piping plover or red knot). USFWS also found that although the extent to which these species occur between 7 and 37 miles (11.3

and 59.5 kilometers) offshore is not well known, the collision risk throughout these mid-Atlantic WEAs was considered to be negligible. USFWS recommended the placement of visibility sensors on meteorological towers to provide measures of visibility such as how often low visibility conditions occur during various times of year.

3 Threatened and Endangered Species in the Proposed Action Area

The proposed action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). For this activity, the proposed action area includes the Project Area (the two WEAs) as well as waters between the Project Area and shore (*see* Figure 1.1). This area is expected to encompass all effects of the proposed action. Several ESA-listed species occur both seasonally and year round in the action area. Since the proposed activities could occur year-round it can be assumed that these species could be present for all or some of the proposed activity. The Programmatic EIS for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf (USDOI, MMS, 2007) gives greater detail of the life histories of the species outlined in this Section and is thus incorporated by reference and not repeated herein.

3.1 Marine Birds

3.1.1 Species of Concern

The Atlantic coast is a major flyway for birds, including terrestrial species, shorebirds, waterbirds, and marine birds. Two species of federally listed threatened or endangered bird species are known to occur in the coastal counties of both Rhode Island and Massachusetts – the federally threatened piping plover (*Charadius melodus*) (USFWS, 2012a) and the federally endangered roseate tern (*Sterna dougallii dougallii*) (USFWS, 2012b). Both species use coastal habitats, with the piping plover primarily using beaches, marshes, and intertidal. The roseate tern breeds almost exclusively on small islands that may either be composed of glacial till or barrier islands, although occasionally they may nest on beaches (USFWS, 2010). The red knot (*Caladris canutus rufa*), a candidate for listing under the ESA (USFWS, 2012c), is found along the coastal habitats of Rhode Island and Massachusetts during spring and fall migration. All three species may pass through the Project Area during spring and fall migration.

3.1.2 Piping Plover

The piping plover (*Charadrius melodus*) is a small migratory shorebird that breeds in sandy dune-beach-riparian habitat along the Atlantic Coast, the Great Lakes, and the Great Plains regions of the U.S., and winters in coastal habitats of the southeastern US, coastal Gulf of Mexico, and the Caribbean (Elliot-Smith *et al.*, 2004; USFWS, 2009). The Great Lakes breeding population is listed as endangered, while the Atlantic Coast and Great Plains breeding populations are listed as threatened (USFWS, 2009). Critical wintering habitat has been established for the species along the coast of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas (66 FR 36038-36143). Only the Atlantic Coast population is likely to occur within the Project Area.

The most likely cause of its population declines and the primary anthropogenic threat to piping plovers is coastal development. Other threats include disturbance by humans, dogs, and vehicles on sandy beach and dune habitat (Elliott-Smith *et al.*, 2004; USFWS, 2009). Despite these population pressures, there is little risk of near-term extinction of the Atlantic Coast population of piping plovers (Plissner and Haig, 2000). From 1989 and 2011, the New England portion of the Atlantic Coast population of breeding pairs has increased from 206 to 825 (preliminary) and has continued to increase in recent years (USFWS, 2011a, 2011b), while other portions of the population (New York-New Jersey, Eastern Canada, and Southern) have slightly decreased since 2007 from 1,185 to 934 (Hecht and Melvin, 2009; USFWS, 2011a, 2011b.)).

As of 2010, there were 591 nesting pairs nested in Massachusetts and 85 in Rhode Island (USFWS, 2011b). In Massachusetts, piping plovers occur in Barnstable, Bristol, Dukes, Essex, Nantucket, Plymouth, and Suffolk counties (USFWS, 2012a). In Rhode Island, plovers occur in Newport and Washington counties (USFWS, 2012a).

In general, Atlantic Coast piping plovers are found in sandy coastal habitats for nesting, although they may use coastal sand flats, mud flats, ephemeral pools, as well as the wrack line on sandy beaches for foraging. Piping plovers arrive at breeding locations beginning mid-March and extending into April. The piping plover breeding season extends from April through August. Post-breeding staging in preparation for migration and southward migration extends from late July through September; only occasionally are piping plovers observed in October. The breeding season and spring and fall migration overlap; therefore, at either end of the breeding season, there may be plover movement through the project area.

The Atlantic Coast population of piping plovers winters along the southern Atlantic Coast from North Carolina to Florida and in the Bahamas and West Indies (Elliott-Smith and Haig, 2004). The migratory pathways along the coast and to the Bahamas are not well known (USFWS, 2009; Normandeau Associates, 2011), and there are no definitive observations of this species in offshore environments greater than three miles from the Atlantic Coast (Normandeau Associates, 2011). However, it may be very difficult to detect piping plovers in the offshore environment during migration because of nocturnal and/or high elevation migratory flights (Normandeau Associates, 2011). Both breeding and wintering sites include islands greater than three miles from the coast, and significant pre-migratory concentrations of this species have been observed in southeastern Cape Cod and Monomoy Island in late summer (Normandeau Associates, 2011).

3.1.3 Roseate Tern

The roseate tern (*Sterna dougallii dougallii*) is a small tern that breeds in colonies. Only terns in the Northwestern Atlantic population are likely to occur within the Project Area. Birds in this population breed along the coast of the northeastern U.S. and the maritime provinces of Canada and winters along the Northeastern coast of South America. Roseate terns in the Northwestern Atlantic population are listed under the ESA as endangered (USFWS, 2010). No critical habitat has been designated for this species (52 FR 42064-42068). The USFWS recently published a five-year status review of the roseate tern (USFWS, 2010).

In the late 19th Century, roseate terns suffered a drastic population decline in the U.S. due to egg collecting and hunting for their feathers (Gochfeld *et al.*, 1998). Following protection of colonies in North America, their numbers have increased (Gochfeld *et al.*, 1998). However, roseate terns have been displaced from their traditional sites by encroaching gull colonies, resulting in fewer tern colonies and a reduced population size (Gochfeld *et al.*, 1998). Additionally, erosion continues to reduce the number of suitable nest sites for terns and limits the ability of the species to avoid nesting on islands that have high predation rates (Northeast Roseate Tern Recovery Team, 1998).

The Northwestern Atlantic roseate tern population currently breeds on a handful of island colonies from Long Island, New York to the Canadian maritime provinces (Gochfeld *et al.,* 1998; USFWS, 2010). There are many roseate terns breeding in Massachusetts. In 2009, there were 50 breeding pairs of roseate terns each on Norton's Point and Penikese Island, 645 breeding pairs on Ram Island, and 782 pairs on Bird Island (USFWS, 2010). Although roseate terns did breed in Rhode Island (USFWS, 2010), there are currently no breeding populations in Rhode Island (Paton *et al.,* 2010),

Although a group of several uncommon tern species (including roseate terns) is predicted to be in the northern parts of the Project Area near Martha's Vineyard and Nantucket islands (Figure 3.1) (Menza, *et al.,* 2012), very little roseate tern activity is expected to occur within the Project Area during both nesting and post-breeding staging periods. The modeled results from Menza and others (2012) are based on the relationship between of terns (Roseate, Least, Royal, Arctic, Sooty, Bridled, Caspian, and Forster's and unidentified species) and bathymetry, zooplankton biomass, and distance from shore (Menza *et al.,* 2012 [Figure 6.29]). Tern observations from 97 independent surveys from March 1 to August 31 were used to build the model. The model predicts (in blue) that terns are virtually absent from the Project Area with high certainty. Caution should be exercised because the modeling analysis lumped observations of several tern species together which may add to uncertainty to the predicted distribution of roseate terns.

In spring, roseate terns arrive on their Northwestern Atlantic breeding colony sites to initiate courtship activities prior to nesting (Gochfeld *et al.*, 1998). During the nesting period (mid-May to late-July), breeding birds typically remain within 7 km of their nesting colonies while foraging for fish to provision their young (Rocky *et al.,* 2007), but may occasionally travel up to 30 km from their colony (Burger *et al.,* 2011). Roseate terns complete nesting activity between late July to mid-August, and then the adults and young move to the post-breeding staging areas until mid-September before migrating southward (Burger *et al.*, 2011). The coastal region of southeastern Cape Cod, Massachusetts, near Chatham and Monomoy Island, is the most important post-breeding staging area for this species, hosting up to 7,000 individuals representing nearly the entire Northwestern Atlantic population (Burger *et al.,* 2011). During post-breeding period, most foraging activity is concentrated in shallow water close to shore, but some individuals may occur up to 16 km from the coast (Burger *et al.,* 2011).

The migration routes of roseate terns are very poorly known, but are believed to be largely or exclusively pelagic (far from shore) in both spring and fall (Nisbet, 1984; Gochfeld *et al.,* 1998; USFWS, 2010), hence it is likely that roseate terns will traverse the Project Area during this period (Burger *et al.,* 2011). Only a small amount of offshore roseate tern observations have been recorded, including five recoveries of banded individuals at sea on ships (Nisbet, 1984), as well as a small number of additional boat-based observations (Normandeau Associates, 2011).

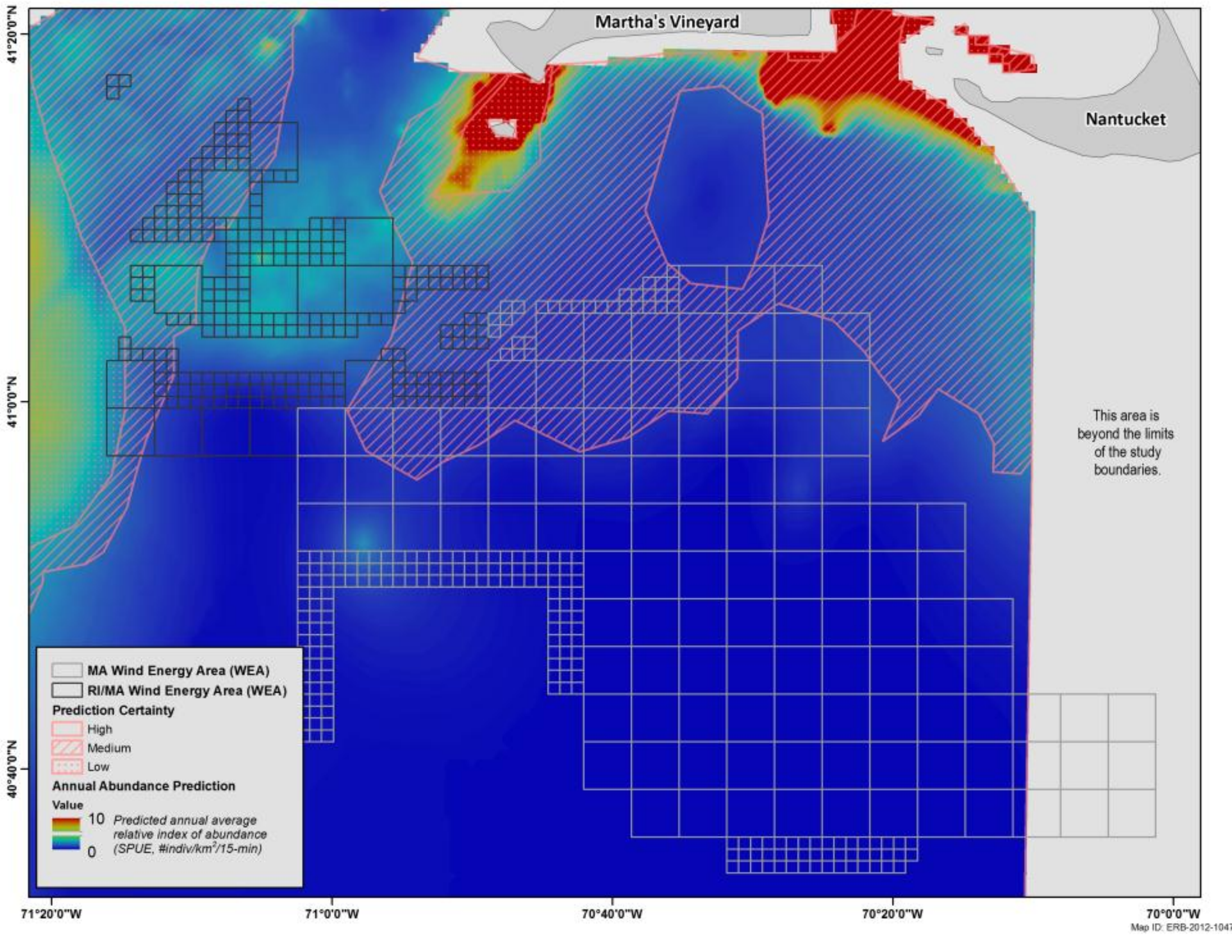


Figure 3.1. Predicted annual distribution and relative abundance of several less common tern species in the project area.

3.1.4 Red Knot (ESA Candidate Species)

The red knot is one of the longest-distance migrants in the world. It breeds in the central Canadian arctic and winters as far south as Tierra del Fuego in South America. In 2006, the USFWS designated the red knot as a candidate species for ESA listing (71 FR 53756-53835). During the past 20 years, the red knot population has declined dramatically from an estimated 100,000 to 150,000 down to 18,000 to 33,000 (Niles *et al.*, 2008). Each spring, red knots congregate in Delaware Bay during their northward migration to feed on horseshoe crab eggs (*Limulus polyphemus*) and refuel for breeding in the Artic. However, the availability of horseshoe crab eggs has been reduced due to the increase in the harvest of adult crabs for bait in the conch and eel fishing industries (Niles *et al.*, 2008). Despite restrictions on the crab harvest, the 2007 horseshoe crab harvest was still larger than the harvest in 1990, and there still has been no detectable recovery in the red knot population (Niles *et al.*, 2009). Other threats to the species include human development and beach replenishment (Niles *et al.*, 2008).

Red knots have the potential to occur in both Massachusetts and Rhode Island, although their locations within these states have not been documented to the county level (USFWS, 2012c). For the last 50 years, Cape Cod and Massachusetts Bay have been important staging areas for red knots during fall migration (Niles *et al.*, 2008). Red knots are found in large numbers throughout fall migration on South Monomoy and South Beach in Chatham, Massachusetts, although they are not as concentrated as in Delaware Bay during spring migration. Nevertheless, during the fall migration, concentrations of 250 to 1000 red knots have been documented at the Monomoy/South Beach island complex, 250 to 600 in the Plymouth Bay area, 150 to 250 at Cape Cod National Seashore and 400 or more at Parker River National Wildlife Refuge (data collected from e-bird at http://ebird.org/content/ebird/ and M. Hake, Cape Cod National Seashore, pers. comm.). In Rhode Island, the species has been documented sporadically at three stop-over locations (Napatree Point-Sandy Point Island, Westerly, Ninigret Pond, Charlestown; and Quicksand Pond, Little Compton), but there are rarely more than 50 individuals at any of the sites, and none of the sites are considered to be critical for the species (Niles *et al.,* 2008).

Red knot occurrence in the Project Area is most likely during the southward fall migration from their breeding to their wintering grounds. Migratory routes of this species are not very well characterized, but recent studies using birds tracked with light-sensitive geo-locators, as well as analysis of large geospatial datasets of coastal observations have begun to reveal some migratory patterns of red knots in the U. S. Atlantic OCS (Niles *et al.*, 2010; Normandeau Associates, 2011; Burger *et al.,* 2012a, 2012b). These studies have revealed that migratory pathways of red knots through this region are fairly widespread and diverse, with some individuals traversing northern sections of the US Atlantic OCS as they travel directly between northeastern U.S. migratory stopover sites and wintering areas or stopover sites in South America and the Caribbean, and others following the U.S. Atlantic coast or traversing the U.S. Atlantic OCS further to the south, as they move between U.S. Atlantic coastal stopover sites and wintering areas in the southern U.S., Caribbean, or northern South America (Niles *et al.,* 2010; Normandeau Associates, 2011; Burger *et al.,* 2012b). Amid this migratory route variation, there appears to be more of a mid-Atlantic and southerly concentration of red knot coastal arrivals in spring, compared with a more northerly concentration, particularly in Massachusetts, of fall migrant activity and departure (Niles *et al.,* 2010; Normandeau Associates, 2011; Burger *et al.,* 2012b), hence it is likely that more red knot migratory passage occurs through the offshore Massachusetts area of interest during fall migration than during spring migration.

3.2 Bats

There are no ESA-listed or ESA-candidate bat species in Massachusetts and Rhode Island (USFWS, 2012d). Although bats have been known to fly on the Atlantic OCS, the neighboring states Maine, New Hampshire, and Connecticut do not have any ESA-listed or ESA-candidate bat species either (USFWS, 2012d). Therefore, no ESA-listed or ESA-candidate bat species are expected to be in the Project Area. Additional information or a more detailed analysis and migration descriptions of bats can be found in the Cape Wind Energy Project DEIS (USDOI, MMS, 2008) and the Alternative Energy Programmatic EIS (USDOI, MMS, 2007).

4 Proposed Action

4.1 Overview

The actions being evaluated as a part of this consultation are the issuance of a renewable energy lease and subsequent site assessment activities to aid in the siting of potential wind turbine generators in the OCS off of Rhode Island and Massachusetts. The issuance of the lease does not constitute an irreversible commitment of the resources toward full development of the lease area. Thus this action does not authorize, and the consultation does not evaluate, the construction of any commercial electricity generating facilities or transmission cables with the potential to export electricity.

The type of activities evaluated for this action includes, but is not limited, to the following:

1. GGARCH assessment
   - High resolution geophysical surveys (surface and subsurface seismic profiling, extent/intensity determined by the area being considered for development (primarily high to mid frequency sonar (i.e., side scan sonar, echo sounder, sub-bottom profilers). The use of airguns is NOT being considered as a part of this activity.
   - Geotechnical sub-bottom sampling (includes CPTs, geologic borings, vibracores, etc).
2. Wind resource assessment
   - Construction of meteorological towers
   - Installation of LIDAR buoys
3. Biological resource assessment:
   - Presence/absence of threatened and endangered species
   - Presence/absence of sensitive biological resources/habitats
4. Archaeological resource assessment
5. Assessment of coastal and marine use

4.1.1 Project Area

The two WEAs offshore of Rhode Island/Massachusetts and Massachusetts comprise a total area of approximately 1,419 square statute miles (907,724 acres) and contain 130 whole OCS lease blocks and 49 partial OCS lease blocks. These areas are collectively referred to as the Project Area (*see* Figure 1.1).

The proposed action consists of the issuance of commercial wind energy leases in the Project Area and implementation of BOEM-approved site assessment and characterization activities on those leaseholds. This action presumes reasonably foreseeable scenarios for leasing, site characterization, and site assessment. Because of the expressions of commercial wind energy interests, BOEM assumes that the entire Project Area would be leased. It should be noted that for the New Jersey WEA only site characterization activities are being assessed. The biological assessment of site assessment activities that was included in the consultation for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia (USDOI, BOEM, OREP, 2012a) remains valid and unchanged. It is also wholly consistent with the site assessment affects analysis in this document. The assessment of site characterization activities off New Jersey is being updated to ensure it remains consistent with the Atlantic G&G DPEIS.

4.2 Site Characterization Surveys

Site characterization surveys include a number of activities that allow the lessee to locate shallow hazards, physical restrictions and cultural and biological resources in the area where a project may take place. The activities are described below.

4.2.1 High-resolution Geophysical (HRG)

Data obtained from the HRG surveys will provide information on geophysical shallow hazards, the presence or absence of archaeological resources, biological resources and to conduct bathymetric charting. This information is used in the design construction and operations of meteorological towers and future wind turbine placement to mitigate the potential impacts to installations, operations and production activities, and structure integrity. The scope of HRG surveys will be sufficient to reliably cover any portion of the site that may be affected by the renewable energy project's construction, operation, and decommissioning. This includes the project area encompassing all seafloor/bottom-disturbing activities. The maximum project area includes but is not limited to the footprint of all seafloor/bottom-disturbing activities (including the areas in which installation vessels, barge anchorages, and/or appurtenances may be placed) associated with construction, installation, inspection, operation, maintenance, and removal of structures.

The geophysical survey grid(s) for the proposed transmission cable route(s) to shore would be oriented with respect to the bathymetry, shallow geologic structures, and renewable energy structure locations. The grid pattern for each survey would cover the project area for all anticipated physical disturbances from construction and operation of a wind facility. Parameters for line spacing include:

For collection of geophysical data for shallow hazard assessments using side scan-sonar/sub-bottom profilers, spacing would not likely exceed 492 feet (150 meter) throughout the project area.

For collecting geophysical data for archaeological resource assessment using magnetometers, side-scan sonar, and all sub-bottom profilers, lines are to be flown at approximately 98 feet (30 meter) throughout the project area.

For bathymetric charting using a multi-beam echo-sounder or side-scan sonar mosaic, construction may vary based on water depth but will provide full coverage of the seabed plus suitable overlap and resolution of small discrete targets of 1.6 to 3.3 feet (0.5 to 1.0 meters) in diameter. This is also necessary for the identification of potential archaeological resources.

4.2.1.1 HRG Survey Instrumentation

Below is an overview of the types of instrumentation that could be used during HRG survey work in the Project Area.

Bathymetry/Depth Sounder. The depth sounder system would record with a sweep appropriate to the range of depths expected in the survey area. Lessees can use multi-beam and/or single-beam bathymetry systems. The use of a multi-beam bathymetry system may be more appropriate for characterizing those lease areas containing complex topography or fragile habitats.

Magnetometer. Magnetometer surveys would be used to detect the identification of ferrous, ferric, or other objects having a distinct magnetic signature. The magnetometer sensor is typically towed as near as possible to the seafloor, which is anticipated to be approximately 20 feet (6 meters) above the seafloor.

Seafloor Imagery / Side-Scan Sonar. A typical side-scan sonar system consists of a top-side processor, tow cable, and towfish with transducers (or ‘pingers’) located on the sides, which generate and record the returning sound that travels through the water column at a known speed. BOEM assumes that lessees would use a digital dual-frequency side-scan sonar system with frequencies of 445 and 900 kiloHertz (kHz) and no less than 100 and 500 kHz to record continuous planimetric images of the seafloor. The data would be processed in a mosaic form to allow for a true plan view and 100 percent coverage of the project area. The side-scan sonar sensor would be towed above the seafloor at a distance that is 10 to 20 percent of the range of the instrument.

Shallow and Medium Penetration Sub-bottom Profilers. A high-resolution Compressed High-Intensity Radar Pulse (CHIRP) System sub-bottom profiler is used to generate a profile view below the bottom of the seabed, which is interpreted to develop a geologic cross-section of subsurface sediment conditions under the track line surveyed. A boomer sub-bottom profiler system is capable of penetrating depth ranges of 32 to 328 feet (10 to 100 meters) depending on frequency and bottom composition. The sub-bottom profiler would deliver a simple, stable, and repeatable signature that is near to minimum phase output with usable frequency content.

4.2.1.2 Proposed HRG Survey Action Scenario

It is assumed that the HRG survey would cover the entire Project Area, and geophysical surveys for shallow hazards (approximately 492 feet [150 meters] line spacing) and archaeological resources (approximately 98 feet [30 meters] line spacing) would be conducted at the same time on the same vessels conducting sweeps at the finer line spacing. This would result in about 500 NM of HRG surveys per OCS block (3 by 3 statute miles [approximately 5 by 5 kilometers]), not including turns. Assuming a vessel speed of 4.5 knots and 10 hour days (daylight hours minus transit time to the site), it would take about 11 days to survey one OCS block or about 100 days to survey an average-size lease of eight OCS blocks. To survey all of the Project Area, HRG surveys would have to be conducted by multiple vessels and/or over multiple years and potential cable routes. Assuming 100 percent coverage of the Project Area, the proposed action would result in a total of approximately 79,000 NM or 17,490 hours of HRG surveys (Table 4.1).

Table 4.1
Projected Site Characterization and Assessment Activities for the Proposed Action in the Rhode Island and Massachusetts Wind Energy Areas

WEA	Leaseholds	Site Characterization Activities: High-Resolution Geophysical (HRG) Surveys (max NM/hours)	Site Characterization Activities: Geotechnical Sampling (min-max)	Site Assessment Activities: Installation of Meteorological Towers (max)	Site Assessment Activities: Installation of Meteorological Buoys (max)
RI/MA	Up to 4	17,500/4,000	500 - 1,400	4	8
MA	Up to 5	61,500/13,490	708 – 2,900	5	10
Total	Up to 9	79,000/17,490	1,208 – 4,300	9	18

4.2.2 Biological Resources

Vessel and/or aerial surveys would need to characterize three primary biological resources categories: (1) benthic habitats; (2) avian resources; and (3) marine fauna. Sub-marine surveys such as the shallow hazard and geological and geotechnical surveys described earlier would be able to capture all the salient features of the benthic habitat on the leasehold. These surveys would acquire information suggesting the presence or absence of exposed hard bottoms of high, moderate, or low relief; hard bottoms covered by thin, ephemeral sand layers; seagrass patches; and other algal beds, all of which are key characteristics of benthic habitat. The various remote sensing activities used in the biological resource survey will likely occur simultaneously with the HRG survey activity and is thus not repeated here. Shipboard observers would monitor and document sightings of marine mammals, sea turtles, fish and birds within the lease area.

4.2.3 Geotechnical Sampling

Geotechnical sampling is used to determine site specific geology profile of a specific site within the lease area. In order to achieve this, geotechnical sampling is typically conducted using cone penetration tests (CPT) or deep sediment boring / drilling at the location of the proposed meteorological tower or wind turbine. The purpose of this work is to assess the suitability of shallow foundation sediments to support a structure of transmission cable under any operational or environmental conditions that may be encountered, and document the soil characteristics necessary for design and installation of all structures. Vibracores may be taken when there are known or suspected archaeological/and or cultural resources present (identified through the HRG survey or other work) or for some limited geological sampling.

Vibracores would likely be deployed from a small (less than 45 foot) gasoline powered vessel. The diameter of a typical vibracore barrel is approximately 4 inches (10.15 centimeters) and the cores are advanced up to a maximum of 15 feet (4.5 meters). Deep borings would be advanced from a truck-mounted drill rig placed upon a jack-up barge that rests on spuds lowered to the seafloor. Each of the four spuds would be approximately 4 feet (1.2 meters) in diameter, with a pad approximately 10 feet (3.05 meters) on a side on the bottom of the spud. The barge would be towed from boring location to location by a tugboat. The drill rig would be powered using a gasoline or diesel powered electric generator. Crew would access the boring barge daily from port using a small boat. Geologic borings generally can be advanced to the target depth (100 to 200 feet [30.5 to 70 meters]) within 1 to 3 days, subject to weather and substrate conditions. Drive and wash drilling techniques would be used; the casting would be approximately 6 inches (15.24 centimeters) in diameter. The CPT or an alternative subsurface evaluation technique would supplement or be used in place of deep borings. A CPT rig would be mounted on a jack-up barge similar to that used for the borings. The top of a CPT drill probe is typically up to 3 inches (7.6 centimeters) in diameter, with connecting rods less than 6 inches (15.24 centimeters) in diameter

Environmental considerations for geotechnical sampling are mainly focused on benthic disturbance. This can come from vessels anchoring or from the boring activity itself. Acoustics from boring are also considered. It is anticipated that the majority of the work will be accomplished by CPT which does not require deep borehole drilling. However, should CPT be found an inappropriate technique given the conditions encountered, borehole drilling may be required.

4.2.3.1 Geotechnical Sampling Scenario

In order to estimate the number of geotechnical samples per leasehold it is necessary to estimate the number of turbine foundations on each leasehold. As discussed in the Programmatic EIS (USDOI, MMS, 2007), spacing between turbines is typically determined on a case-by-case basis to minimize wake effect and is based on rotor diameter associated with turbine size. In Denmark's offshore applications, for example, a spacing of seven rotor diameters between units has been used (USDOI, MMS, 2007). Spacing of 6 by 9 rotor diameters, or six rotor diameters between turbines in a row and nine rotor diameters between rows was approved for the Cape Wind project (USDOI, MMS, 2009b). In some land-based settings, turbines are separated by much greater distances, as much as 10 rotor diameters from each other (USDOI, MMS, 2007). Based on this spacing range for a 3.6-megawatt (MW) (110 meter rotor diameter) turbine and a 5 MW (130 meter rotor diameter) turbine, it would be possible to place anywhere from 14 to 40 turbines in one OCS block (3 statute miles by 3 statute miles [approximately 5 kilometers by 5 kilometers]).

Based on the information presented above and assuming:

1) "maximum" scenario of wind development on every OCS block (which is extremely unlikely, but the lower amount of samples associated with less development would result in lower environmental impacts)
2) geotechnical sampling (vibracore, CPT, and/or deep boring) would be conducted at every potential wind turbine location throughout the Project Area
3) geotechnical sampling would be conducted every nautical mile along the projected transmission corridors to shore
4) geotechnical sampling would be conducted at the foundation of each meteorological tower and/or buoy, then a total of 1,208 to 4,300 geotechnical surveys could occur as a result of the proposed action (*see* Table 4.1).

4.2.4 Site Assessment

"Site assessment" describes the assessment of wind resources and ocean conditions to allow the lessee to determine whether the lease area is suitable for wind energy development, where on the lease it would propose development, and what form of development to propose in a COP. To determine this, a meteorological tower or buoy would be installed or deployed in the lease area to measure wind speeds and collect other relevant data necessary to assess the viability of a potential commercial wind facility.

To obtain meteorological data, scientific measurement devices, consisting of anemometers, vanes, barometers, and temperature transmitters, would be mounted either directly on the tower or buoy or on instrument support arms. In addition to conventional data collection methods, buoys and/or bottom-founded structures could use LIDAR, Sonic Detecting and Ranging (SODAR) and Coastal Ocean Dynamic Applications Radar (CODAR) technologies for collecting wind resource data. At this time, no proposals have been submitted meteorological towers (towers in this case being up to the estimated hub height for a commercial wind turbine) mounted on a floating platform (e.g., spar, semi-submersible, or tension leg). This BA assumes full-size met towers will utilize a fixed, pile-supported platform (monopile, jackets, or gravity bases) and that buoys would use the floating designs (e.g., boat-shaped, spar-type, tension-leg, disc-shaped or similar).

The following scenario addresses the reasonably foreseeable range of data collection devices that lessees may install under an approved SAP. The actual tower and foundation type and/or buoy type and anchoring system would be included in a detailed SAP submitted to BOEM, along with the results of site characterization surveys. This would be done prior to the installation of any device(s).

Source: Cape Wind Associates, LLC 2011a.

Figure 4.1. Cape Wind Meteorological Tower

4.2.4.1 Proposed Action Scenario

It is assumed that each of the nine leaseholds projected for the Project Area would result in zero or one meteorological tower, zero or two buoys or a combination, being constructed or deployed. This would result in a maximum of 17 meteorological towers and 34 meteorological buoys within the Project Area.

Case Study: Cape Wind Meteorological Tower

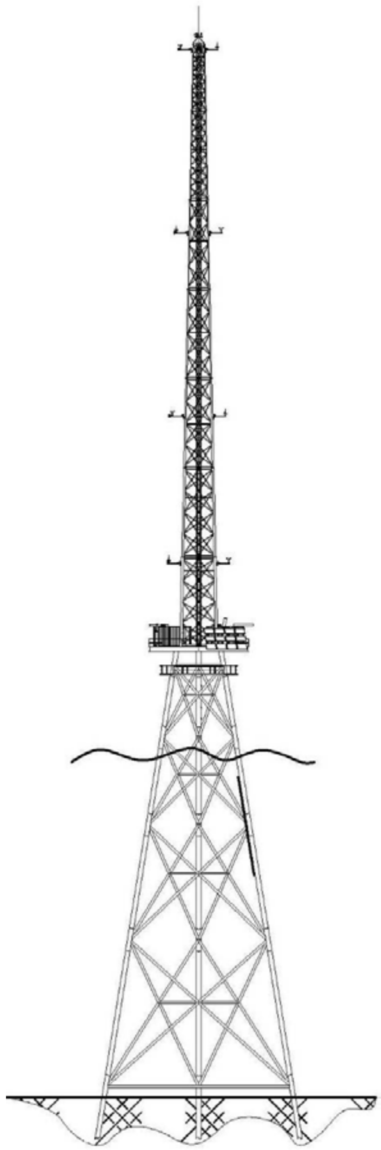
The only meteorological tower currently installed on the United States OCS for the purposes of renewable energy site assessment is located on Horseshoe Shoal, in Nantucket Sound. As shown on Figure 4.1, a monopile mast was used for this meteorological tower. The tower was installed in 2003 and consists of three pilings supporting a single steel pile that supports the deck. The overall height of the structure is 197 feet (60 meters) above the mean lower low water datum with a deck

30 feet off the sea surface. The Cape Wind meteorological tower represents the smaller end of the range of structures anticipated in southern New England. It is located in shallower water (8 to 10 feet [2.4 to 3 meters]) and nearer to shore (approximately 6 miles [9.7 kilometers]) than the Project Area.

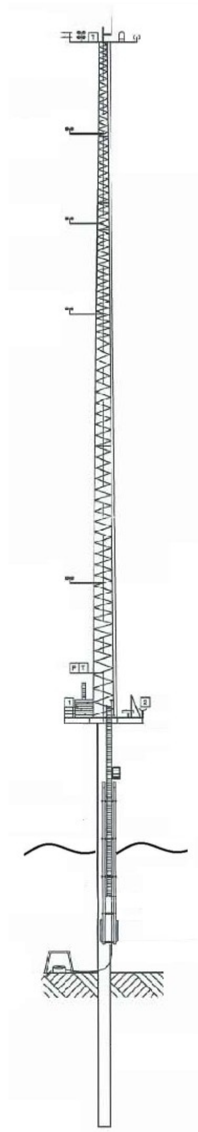
4.2.4.2 Meteorological Tower

As mentioned previously in the Cape Wind example, one of the traditional instruments used for characterizing offshore wind conditions is the meteorological tower. At a maximum, a single meteorological tower would be installed per lease area. The foundation structure and a scour control system, if required based on potential seabed scour anticipated at the site, would occupy less than 2 acres. Once installed, the top of a meteorological tower would be 295 to 328 feet (90 to 100 meters) above mean sea level.

A meteorological tower consists of a mast mounted on a foundation anchored to the seafloor. The mast may be either a monopole, such as that used in the Cape Wind project mentioned above (*see* Figure 4.1) or a lattice (i.e. jacket foundation; Figure 4.2). The mast and data-collection devices would be mounted on a fixed or pile-supported platform (monopile, jackets, or gravity bases) or floating platform (spar, semi-submersible, or tension-leg) (Figure 4.3).



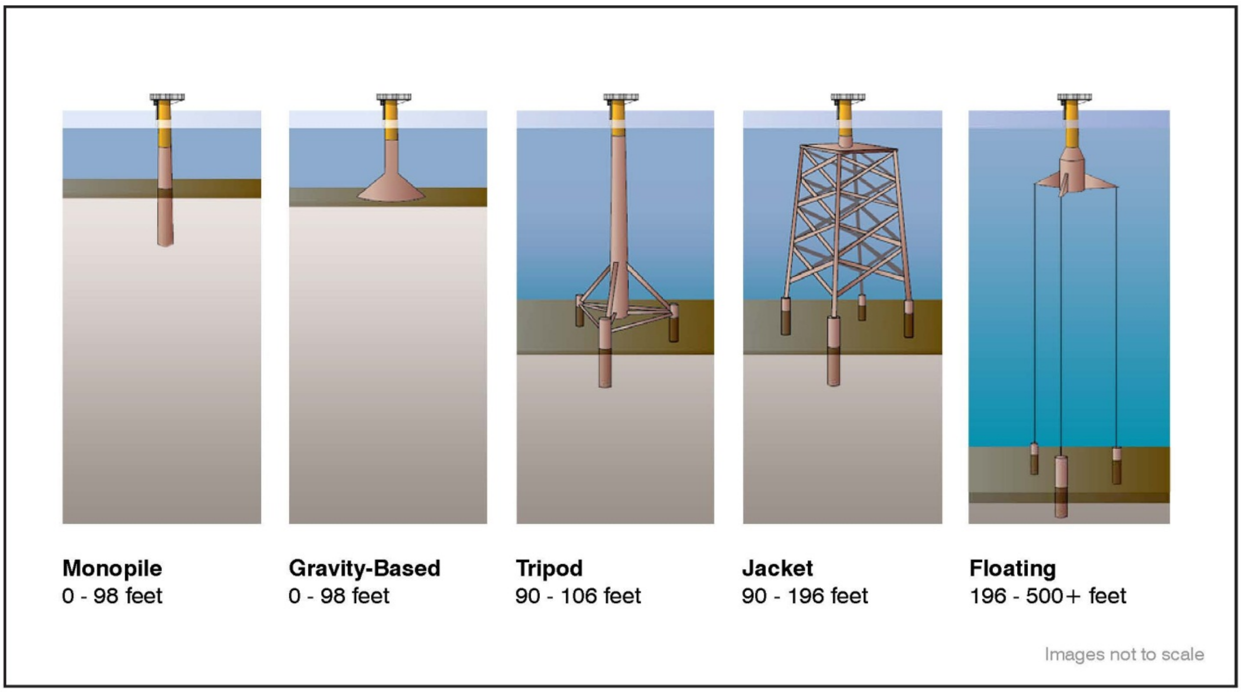
Source: Deepwater Wind, LLC a*s cited in* USDOI, BOEM, OREP 2012a.



Source: Fishermen's Energy of New Jersey, LLC *as cited in* USDOI, BOEM, OREP 2012a.

Figure 4.2. Examples of Lattice Mast Meteorological Towers. The tower on the left depicts a lattice-type mast mounted on a steel jacket foundation whereas the tower on the right depicts a lattice-type mast mounted on a monopole foundation.

In the case of fixed platforms, it is assumed that a deck would be supported by a single 10 foot-diameter (approximately 3 meter diameter) monopile, tripod, or a steel jacket with three to four 36-inch-diameter piles. The monopile or piles would be driven anywhere from 25 to 100 feet (7.6 to 30.5 meters) into the seafloor depending on subsea geotechnical properties. The foundation structure and a scour-control system, if required based on potential seabed scour anticipated at the site, would occupy less than 2 acres (0.81 hectare). Once installed, the top of a meteorological tower would be 295 to 328 feet (90 to 100 meters) above mean sea level. The area of ocean bottom affected by a meteorological tower would range from about 200 square ft (approximately 18.6 square meters), if supported by a monopile, to 2,000 square ft (approximately 184.1 meters) if supported by a jacket foundation. It is important to note that the meteorological towers considered in this BA are anticipated to be much larger and taller, have a larger footprint, and be further from shore than the Cape Wind meteorological tower.



SOURCE: Adapted from Musial, Butterfield, and Ram 2006, as cited in TetraTech EC, Inc. 2010.

Figure 4.3. Types of Foundations for Meteorological Towers

Scour Control Systems

Wave action, tidal circulation, and storm waves interact with sediments on the surface of the OCS, inducing sediment reworking and/or transport. Episodic sediment movement caused by ocean currents and waves can cause erosion or scour around the tower bases. Erosion caused by scour may undermine meteorological tower structural foundations leading to potential failure. BOEM assumes that scour control systems would be installed, based on potential seabed scour anticipated at sites. There are several methods for minimizing scour around piles, such as the placement of rock armoring and mattresses of artificial (polypropylene) seagrass.

Artificial grass mats have been found to be effective in both shallow and deep waters, therefore this is the most likely scour control system to be used for the proposed meteorological towers. These mats are made of synthetic fronds that mimic seafloor vegetation to trap sediment and become buried over time. If used, these mats would be installed by divers or underwater remotely operated vehicle (ROV). Each mat would be anchored at 8 to 16 locations, about 1 foot into the sand. Once installed the mats would not require future maintenance. Monitoring of scouring at the Cape Wind meteorological tower found that at one pile where two artificial seagrass scour mats were installed, there was a net increase of 12 inches (30.5 centimeters) of sand, and at another pile with artificial seagrass scour mats, there was a net scour of 7 inch (18 centimeter) pilings; both occurred over a three-year timeframe (Ocean and Coastal Consultants Inc. 2006).

It is anticipated that for a pile-supported platform, four mats each of about 16.4 by 8.2 feet (5 by 2.5 meters) would be placed around each pile. Including the extending sediment bank, a total area disturbance of about 5,200 to 5,900 square ft (approximately 483 to 548 square meters) for a three-pile structure and 5,900 to 7,800 square ft (approximately 548 to 724.6 square meters) for a four-pile structure is estimated. For a monopile, it is anticipated that eight mats 16.4feet by 16.4 feet (5 meters by 5 meters) would be used, and thus there would be a total disturbance area of about 3,700 to 4,000 square feet (343.74 by 371.61 square meters) per foundation.

A rock armor scour protection system may also be used to stabilize a structure's foundation area. Rock armor and filter layer material would be placed on the seabed using a clamshell bucket or a chute. The filter layer would help prevent the loss of underlying sediments and sinking of the rock armor (ESS Group, Inc., 2004). In water depths greater than 15 feet (4.5 meters), the median stone size would be about 50 pounds (approximately 22.6 kilograms) with a stone layer thickness of about 3 feet (approximately 0.9 meters). The rock armor for a monopile foundation for a wind turbine has been estimated to occupy 16,000 square feet (0.37 acre [0.15 hectares]) of the seabed (ESS Group, Inc., 2004). While the piles of meteorological tower would be much smaller than those of a wind turbine, a meteorological tower may be supported by up to four piles. Therefore, the maximum area of the seabed impacted by rock armor for a single meteorological tower is estimated to also be 16,000 square feet (0.37 acre [0.15 hectares]).

A scour control system would be monitored throughout the lease term. It is expected that the foundation would be visually inspected monthly for the first year of installation, and then every year after that or after each significant storm activity. Inspections would be carried out by divers or ROVs. Removal of the scour control system is discussed in Section 4.5.

Installation of the Foundation Structure

A jacket or monopile foundation and deck would be fabricated onshore, transferred to barge(s) and the carried or towed to the offshore site. This equipment would typically be deployed from two barges, one containing the pile-driving equipment and a second containing a small crane, support equipment, and the balance of materials needed to erect the platform deck. These barges would be tended by appropriate tugs and workboats, as needed.

The foundation pile(s) for a fixed platform could range from either a single 10-foot (3 meter)-diameter monopile or three to four 36-inch (0.9-meter)-diameter piles (jacket). These piles would be driven anywhere from 25 to 100 feet (7.6 to 30.5 meters) below the seafloor with a pile-driving hammer typically used in marine construction operations. After approximately three days, when the pile-driving is complete, the pile-driver barge would be removed. In its place, a jack-up barge equipped with a crane would be used to assist in the mounting of the platform decking, tower, and instrumentation onto the foundation. Depending on the type of structure installed and the weather and sea conditions, the in-water construction of the foundation pilings and platform would range from several days (monopile construction in good weather) to six weeks (jacket foundation in bad weather) (USDOI, MMS, 2009a). The mast sections would be raised using a separate barge-mounted crane; installation would likely be complete within a few weeks. Total installation time for one meteorological tower would take eight days to ten weeks, depending on the type of structure to be installed and the weather and ocean conditions (USDOI, MMS, 2009a).

During installation, a radius of approximately 1,500 feet (457 meters) around the site would be needed for the movement and anchoring of support vessels. Piles are generally driven into the substrate using impact hammers and/or vibratory hammers (Hansen *et al.,* 2003; Nedwell and Howell 2004). Impact hammers use a heavy weight to repeatedly strike the pile and dive it into the substrate. Vibratory hammers use a combination of vibration and a heavy weight to force the pile into the sediment. As with any sound in the marine environment, the type and intensity of the sound is greatly dependent on multiple factors and can vary greatly. Impact hammers produce sharp striking sounds, whereas vibratory hammers produce more continuous, low frequency sounds (Hanson *et al.,* 2003; Nedwell and Howell 2004). The type of hammer used depends on a variety of factors, such as the material the pile is composed of, and the sediment the pile will be driven into. Impact hammers can be used for any type of pile, and can drive piles into most all substrates. Vibratory hammers are more useful when driving a pile that has a sharp edge that can cut into the sediment (i.e. an open ended steel pile); as opposed to one that displaces the sediment (i.e. closed ended steel pile, wood, or cement). Also, vibratory hammers are most useful in softer sediments such as sand or mud (Hanson *et al.,* 2003). Depending on the substrate a combination of vibratory hammers and impact hammers may be used. For example, a vibratory hammer can be used when there is softer substrate in the upper layers while a impact hammer can then be used to drive the pile the remainder of the depth when harder, more resistance substrates are encountered (Hanson *et al.,* 2003). This method may also be useful in the case of meteorological towers which must meet seismic stability criteria, which required that the supporting piles are either attached to, or driven into, the underlying hard sediment (Hanson *et al.,* 2003).

Meteorological Tower Operation and Maintenance Activities

For the proposed action, BOEM anticipates that a tower may be present for approximately five years before the final decision is made to either allow the tower to remain or be decommissioned. During the life of the meteorological tower, the structure and instrumentation would be accessible by boat for routine maintenance. As indicated in previous site assessment proposals submitted to BOEM, lessees may use solar panels and/or micro wind turbines (diameter of rotor swept up to 2 meters) mounted near or on the platform to charge the batteries that power the equipment on the tower (Figure 4.4). In this case, the lessees would conduct monthly or quarterly vessel trips for operation and maintenance activity over the five-year life of a meteorological tower (USDOI, MMS, 2009a). However, if a diesel generator is used to power the meteorological tower's lighting and equipment, a maintenance vessel would make a trip at least once every other week, if not weekly, to provide fuel, change oil, and perform maintenance on the generator. The maintenance vessel could be 51 to 57 feet in length, powered by 400 to 1,000 horsepower engines and have a 1,800-gallon fuel capacity. Support for the meteorological towers in the Project Area would result in anywhere from of 36 quarterly to

468 weekly round trips per year for up to nine meteorological towers. No additional or expansion of onshore facilities would be required to conduct these tasks.

Figure 4.4. Cape Wind meteorological tower platform with a micro wind turbine (*see* arrow) that has a rotor diameter of approximately four feet.

Meteorological Tower Lighting

All meteorological towers and buoys, regardless of height, would have lighting and marking for aviation and navigational purposes. Meteorological towers and buoys would be considered Private Aids to Navigation, and are required to be maintained by the individual owner under the regulations of the USCG. The USCG lighting for navigation safety would consist of two amber lights (USCG Class C) mounted on the platform deck. In accordance with FAA guidelines, the tower would be equipped with a light system consisting of a low intensity flashing red light (FAA designated L-864) for night use.

4.2.4.3 Meteorological Buoys

While a meteorological tower has been the traditional device for characterizing wind conditions, several companies have expressed their interest in installing one or two meteorological buoys per lease instead. Meteorological buoys can be used as an alternative to a meteorological tower in the offshore environment for meteorological resource data collection (i.e., wind, wave, and current). These meteorological buoys would be anchored at fixed locations and would regularly collect data from atmospheric and oceanographic sensors.

Meteorological buoys vary in designs and utilize anemometers, LIDAR and/or SODAR to collect meteorological data. LIDAR is a surface-based remote sensing technology that operates via the transmission and detection of light. SODAR is also a surface-based remote sensing technology; however it operates via the transmission and detection of sound.

A meteorological buoy can vary in height, hull type, and anchoring method. NOAA has successfully used discus-shaped hull buoys and boat-shaped hull buoys for weather data collection for many years. In addition, spar buoy and tension-leg platform buoy designs have been recently submitted to BOEM for approval. Each buoy type will likely be utilized for offshore wind data collection. A large discus buoy has a circular hull range between 32 and 39 feet (10 and 12 meters) in diameter and is designed for many years of service (USDOC, NOAA, NBDC, 2008). The boat-shaped hull buoy (known as a 'NOMAD' [Naval Oceanographic and

Meteorological Automated Device]) is an aluminum-hulled, boat-shaped buoy that provides long-term survivability in severe seas (USDOC, NOAA, NBDC, 2008). This buoy design could be utilized to mount a LIDAR wind assessment system. A typical NOMAD is a 19.6 feet by 10.2 feet (6 meters by 3.1 meters) aluminum hulled buoy with a draft of 10.5 ft (3.2 m). Originally designed by the U.S. Navy in the 1940s, the NOMAD has since been adopted and widely used by researchers, including NOAA's National Data Buoy Center. The following description is from Fishermen's Energy SAP (Fishermen's Energy 2011 *as cited in* USDOI, BOEM, OREP, 2012a).

Primary electrical (DC) power for all equipment on a NOMAD-type buoy could be provided by four deep cycle 12 volt batteries. Batteries will be charged by renewable sources which include two micro wind generators and four 40-watt solar panels. In the event that the renewable power sources fail to keep the batteries adequately charged (extended heavy cloud cover with little wind), the power monitoring system could prompt an onboard diesel fuel powered generator to start and run until the batteries reach the required charge level. The system would revert back to renewable charging once these systems return to proper operation (Fishermen's Energy 2011 *as cited in* USDOI, BOEM, OREP, 2012a). Up to 500 gallons of diesel fuel could be stored on board the buoy to operate the generator.

The anchoring system for the NOMAD-type buoy could be a via a standard ¾ inch steel chain to a 10,000 pounds (4,536 kilograms) steel or concrete block (s). The footprint of the anchor itself is conservatively estimated at 16 square feet (1.49 square meters). Fishermen's Energy conservatively estimates the total bottom-disturbing footprint from the anchor and anchor chain sweep of a disc-shaped or a boat-shaped buoy to range from 121,613 square feet (approximately 11,298 square meters) to 372,440 square feet (approximately 34,600 square meters) assuming approximately 100 feet (30.5 meters) of slack chain at low tide.

Buoys can use a wide range of moorings to attach to the seabed. On the OCS, a larger discus-type or boat-shaped hull buoy may require a combination of a chain, nylon, cable and/or buoyant polypropylene materials designed for many years of ocean service. Some deep-ocean moorings have operated without failure for over 10 years (USDOC, NOAA, NBDC, 2008).

A spar-type buoy can be stabilized through an on-board ballasting mechanism approximately 60 feet (18.3 meters) below the sea surface. Approximately 30 to 40 feet (approximately 9 to 12 meters) of the spar-type buoy would be above the ocean surface where meteorological and other equipment would be located. A spar buoy is a long, thin, typically cylindrical buoy, ballasted at one end so that it floats in a vertical position. This design maintains tension in the anchor chain between the buoy and the anchor, thus eliminating slack in the chain that results in chain sweep around the anchor. Tension-leg platforms use the same tension in the mooring chain, but may utilize a more traditional discus-shaped buoy with a larger mast for mounting data collection instrumentation. As indicated in previous site assessment proposals submitted to BOEM, lessees may use diesel generators, solar panels and/or micro wind turbines (diameter of rotor swept up to 2 meters) mounted near or on the platform to charge the batteries that power the equipment on the buoy (Figure 4.5).

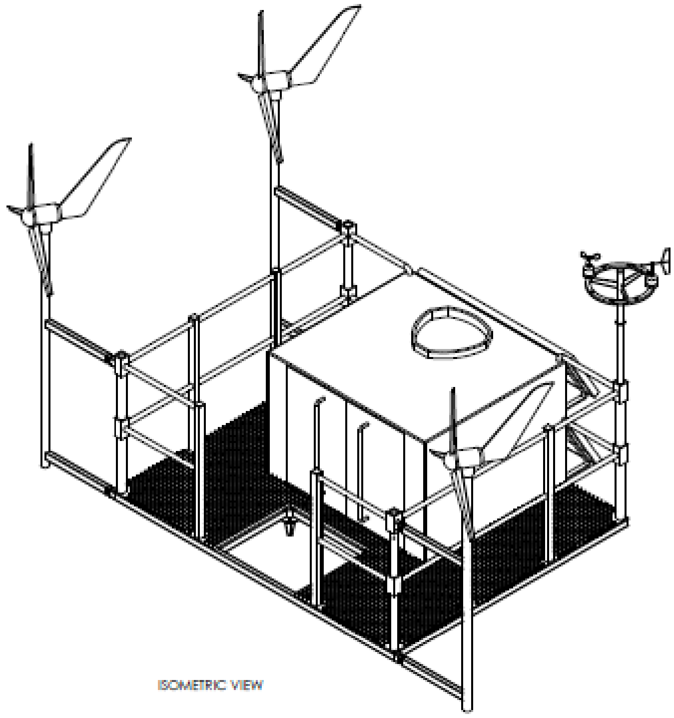


Figure 4.5. Micro wind turbines and equipment on a spar buoy platform.

Buoy Installation

Boat-shaped, spar-type and discus-shaped buoys are typically towed or carried aboard a vessel to the installation location. Once at the location site, the buoy would be either lowered to the surface from the deck of the transport vessel or placed over the final location, and then the mooring anchor dropped. A boat-shaped buoy in shallower waters of the Project Area may be moored using an all-chain mooring, while a larger discus-type buoy would use a combination of chain, nylon, and buoyant polypropylene materials (USDOC, NOAA, NBDC, 2008). Based on previous proposals, anchors for boat-shaped and discus-shaped buoys would weigh about 6,000 to 10,000 pounds (2,721 to 4,536 kilograms) with a footprint of about 16 square feet (approximately 1.49 square meters) and an anchor sweep of about 8.5 acres (approximately 3.4 hectares). After installation, the transport vessel would remain in the area for several hours while technicians configure proper operation of all systems. Boat-shaped and discus-shaped buoys would typically take one day to install. Transport and installation vessel anchoring for one day is anticipated for these types of buoys (Fishermen's Energy 2011 *as cited in* USDOI, BOEM, OREP, 2012a).

Typically, a spar-type buoy would take two days to install. It would be towed to the installation location by a transport vessel after assembly at a land-based facility. Deployment would occur in two phases: deployment of a clump anchor to the seabed as a pre-set anchor (Phase 1) and deployment of the spar buoy and connection to the clump anchor (Phase 2). Phase 1 would take approximately one day and would include placement of the clump anchor on a barge and transporting it to the installation site. The monitoring buoy would be anchored to the seafloor using a clump weight anchor and mooring chain. Installation could take approximately two days. Spar-type buoys may have all-chain moorings or cables. Moorings for a spar-type buoy tension leg anchoring system may weigh up to 165 tons with a 26 by 26 foot (7.9 by 7.9 meter) footprint. The total area of bottom disturbance associated with buoy and vessel anchors would be 28 by 28 feet (8.5 by 8.5 meters), with a total area of 784 square feet (73 square meters) to a 1,200-foot (356.7 meter) radius anchor sweep for the installation vessel with a total of just over 100 acres of disturbance. The maximum area of disturbance to benthic sediments would occur during anchor deployment and removal (e.g., sediment resettlement, sediment extrusion, etc.) for this type of buoy.

4.2.4.4 Other Ocean Monitoring Equipment

In addition to the meteorological buoys described above, a small tethered buoy (typically 3 meters [approximately 10 feet] or less in diameter) and/or other instrumentation also could be installed on, or tethered to, a meteorological tower to monitor oceanographic parameters and to collect baseline information on the presence of certain marine life.

To measure the speed and direction of ocean currents, Acoustic Doppler Current Profilers (ADCPs) would likely be installed on each meteorological tower or buoy. The ADCP is a remote sensing technology that transmits sound waves at a constant frequency and measures the ricochet of the sound wave off fine particles or zooplanktons suspended in the water column. The ADCPs may be mounted independently on the seafloor or to the legs of the platform, or attached to a buoy. A seafloor-mounted ADCP would likely be located near the meteorological tower (within approximately 500 feet [152 meters]) and would be connected by a wire that is hand-buried into the ocean bottom. A typical ADCP has three to four acoustic transducers that emit and receive acoustical pulses from different directions, with frequencies ranging from 300 to 600 kHz with a sampling rate of 1 to 60 minutes. A typical ADCP is about 1 to 2 feet tall (approximately 0.3 to 0.6 meters) and 1 to 2 feet wide (approximately 0.3 to 0.6 meters). Its mooring, base, or cage (surrounding frame) would be several feet wider.

A meteorological tower or buoy also could accommodate environmental monitoring equipment, such as avian monitoring equipment (e.g., radar units, thermal imaging cameras), acoustic monitoring for marine mammals, data-logging computers, power supplies, visibility sensors, water measurements (e.g., temperature, salinity), communications equipment, material hoist, and storage containers.

4.2.4.5 Timing of Wind Resource Assessment Equipment Installation

Total installation time for a single meteorological tower would take eight days to ten weeks depending on the type of structure installed and the weather and sea state conditions. It is anticipated that an average meteorological buoy installation would likely take one to two days. Installation of meteorological towers and buoys would likely occur in the spring and summer months during calmer weather, however, installation could potentially occur at any time of year when weather permits.

4.3 Vessel Traffic

Vessel traffic, both by air and by sea, occurs during all phases of the site characterization and assessment activities. Due to concerns with collisions and potential pollution, vessel traffic for all phases of the site assessment is addressed in this section.

4.3.1 HRG Survey Traffic

As detailed in Section 4.2.1.2, it is assumed that the HRG survey would cover the entire Project Area, and geophysical surveys for shallow hazards (492 feet [150 meters] line spacing) and archaeological resources (98 feet [30 meters] line spacing) would be conducted at the same time on the same vessels conducting sweeps at the finer line spacing array. This would result in about 500 NM of HRG surveys per OCS block (3 by 3 statute miles [approximately 5 by 5 kilometers]), not including turns. Assuming a vessel speed of 4.5 knots and 10-hour days (daylight hours minus transit time to the site), it would take about 11 days to survey one OCS block or about 100 days to survey an average-size lease of eight OCS blocks. To survey all of the Project Area, HRG surveys would have to be conducted by multiple vessels and/or over multiple years. Assuming 100 percent coverage of the Project Area, the proposed action would result in a total of approximately 79,000 NM or 17,490 hours/ 1,900 round trips of HRG surveys (*see* Tables 4.1 and 4.2).

Vessels would be required to maintain a vigilant watch for marine mammals and sea turtles during transit to and from the survey area, as well as during the HRG survey itself.

4.3.2 Geotechnical Sampling Vessel Traffic

As described in the geotechnical sampling activity scenario, it is anticipated that there would be approximately 1,208 – 4,300 geotechnical samples taken within the Project Area. The amount of effort and vessel trips vary greatly by the type of technology used to retrieve the sample, and each work day would be associated within one round trip. The following details the type of vessels and collection time per sample:

Vibracores: Would be likely be advanced from a single small vessel (~45 feet [~14.7 meters]), and collect 1 sample per day.

Cone Penetrometer Test (CPT): Depending on the size of the CPT, it could be advanced from medium vessel (~65 feet [~19.8 meters]), a jack-up barge, a barge with a 4-point anchoring system, or a vessel with a dynamic positioning system. Each barge scenario would include a support vessel. This range of vessels could sample 1 location per day.

Geologic boring: Would be advanced from a jack-up barge, a barge with a 4-point anchoring system, or a vessel with a dynamic positioning system. Each barge scenario would include a support vessel. Each deep geologic boring could take 1 day.

Based on the expected number of both HRG surveys and geotechnical samples, as well as, presumed independent biological surveys (approximately 432-672 surveys in both WEAs), approximately 3,540 to 6,872 vessel trips (round trips) associated with site characterization surveys are projected to occur as a result of the proposed action over five years (2013 to 2018).

4.3.3 Meteorological Tower Construction and Operation Traffic

The proposed action scenario estimates a maximum of nine meteorological towers to be constructed within the Project Area. During installation, a radius of approximately 1,500 feet (457.2 meters) around the site would be needed for the movement and anchoring of support vessels. A maximum of 40 round trip vessel trips are expected during construction of each meteorological tower or 360 rounds trips for up to nine meteorological towers.

Several vessels would be involved in installing and constructing a meteorological tower. Vessels delivering construction material or crews to the site will be present in the area between the mainland and the construction site, as well as vessel being present at the site during installation. The barges, tugs and vessels delivering construction materials will typically be 65 to 270 feet (19.8 to 82.3 meters) in length, while the vessel carrying construction crews will typically be 51 to 57 feet (15.5 to 17.4 meters) in length.

After installation data would be monitored and processed. The structure and instrumentation would be accessed by boat for routine maintenance. Assuming a single maintenance trip to each meteorological tower quarterly to weekly, the proposed action would result in an additional 36 to 468 vessel trips per year for up to nine meteorological towers, or 180 to 2,340 vessel trips over a five-year period (Table 4.2). These vessel trips would not require any additional or expansion of onshore facilities. It is projected that crew boats 51 to 57 feet (15.5 to 17.4 meters) in length would be used to service the structure.

Vessel usage during decommissioning will be similar to that during construction. Up to approximately 40 round trips by various vessels are expected during decommissioning of each meteorological tower. Similar to construction, this yields an average of 360 round trips for the decommissioning of up to nine meteorological towers (Table 4.2).

4.3.4 Meteorological Buoy Deployment and Operation Traffic

The proposed action scenario estimates a maximum of 18 meteorological buoys could be deployed throughout the Project Area. The installation of each buoy could utilize 1-2 round trips per buoy deployment. The types of vessels involved in the deployment include barge/tug (for buoy and/or anchoring system), large work vessel (for towing and/or carrying the buoy), and an additional support vessel (for crew and other logistical needs).

Similar to the meteorological towers, it is expected that maintenance for the buoy would be required on a quarterly to weekly basis resulting in maximum of 72-936 to round-trips per year for up to 18 buoys, or 360-4,680 vessel trips over a five year period (Table 4.2). It should be noted that it is unlikely that all 18 meteorological buoys would be in service at the same time over the entire period. For meteorological buoys, the decommissioning is expected to be the reverse of the deployment, with one round trip required to retrieve each buoy.

Table 4.2 Total Number of Estimated Vessel Trips for Project Area Over a Five Year Period								
WEA	**HRG Survey**	**Geotechnical sample**	**Met tower install**	**Met buoy install**	**Met tower ops**	**Met buoy ops**	**Met tower decom**	**Met buoy decom**
Rhode Island / Massachusetts	400	500 – 1,400	160	8-16	80-1,040	160-2,080	160	8-16
Massachusetts	1500	708 – 2,900	200	10-20	100-1,300	200-2,600	200	10-20
Total	1900	1,208 – 4,300	360	18-36	180-2,340	360-4,680	360	18-36

Note:
Met = Meteorological
ops = operations
decom = decommissioning

4.4 Onshore Activity

Several southern New England ports would be used as a fabrication sites, staging areas and crew/cargo launch sites. Existing ports or industrial areas are expected to be used. The fabrication facilities in the relevant major port areas are large and have high capacities, therefore BOEM does not anticipate that the fabrication of meteorological towers or buoys associated with the proposed action would have any substantial effect on the operations of, transportation to or from, or conditions at these facilities.

Several major ports exist near the Project Area that are suitable to support the fabrication and staging of meteorological towers and buoys, including the ports of New Bedford, Massachusetts and Quonset Point, Rhode Island. A meteorological tower platform or meteorological buoy would be constructed or fabricated onshore at an existing fabrication yard or final assembly of the tower could be completed offshore. The location of these fabrication yards is directly tied to the availability of a large enough channel that would allow the towing of these structures. The average bulkhead depth needed for water access to fabrications yards is 15 to 20 feet (4.6 to 6.1 meters).

4.5 Decommissioning

No later than two years after the cancellation, expiration, relinquishment, or other termination of the lease, the lessee would be required to remove all devices, works, and structures from the site and restore the leased area to its original condition before issuance of the lease (30 CFR 585, Subpart I).

It is estimated that the entire removal process of a meteorological tower would take one week or less. Decommissioning activities would begin with the removal of all meteorological instrumentation from the tower, typically using a single vessel. A derrick barge would be transported to the offshore site and anchored next to the structure. The mast would be removed from the deck and loaded onto the transport barge. The deck would be cut from the foundation structure and loaded onto the transport barge. The same number of vessels necessary for installation and frequency of use would likely be required for decommissioning. The sea bottom area beneath installed structures would be cleared of all materials that have been introduced to the area in support of the lessee's project.

Buoy decommissioning is the reverse of the installation process. Equipment recovery would be performed with support of a vessel(s) equivalent in size and capability to those used for installation. For small buoys, a crane lifting hook would be secured to the buoy. A water/air pump system would de-ballast the buoy into the horizontal position. The mooring chain(s)/cable(s) and anchor would be recovered to the deck using a winching system. The buoy would then be towed to shore by the barge. All buoy decommissioning is expected to be completed within one or two days. Buoys would be returned to shore and disassembled or reused in other applications. It is anticipated that the mooring devices and hardware would be reused or disposed of as scrap iron for recycling (Fishermen's Energy 2011 *as cited in* USDOI, BOEM, OREP, 2012a).

4.5.1 Cutting and Removing Piles

As required by BOEM, the lessee would sever bottom-founded structures and their related components at least 15 feet (5 meters) below the mud line to ensure that nothing would be exposed that could interfere with future lessees and other activities in the area (30 CFR 585.910(a)). The choice of severing tool depends on the target size and type, water depth, economics, environmental concerns, tool availability, and weather conditions (USDOI, MMS, 2005). Meteorological tower piles in the Project Area would be removed using non-explosive severing methods.

Common non-explosive severing tools that may be used consist of abrasive cutters (e.g., sand cutters and abrasive water jets), mechanical (carbide) cutters, diver cutting (e.g., underwater arc cutters and oxyacetylene/oxyhydrogen torches), and diamond wire cutters. Of these, the most likely tools to be employed would be an internal cutting tool, such as a high-pressure water jet-cutting tool that would not require the use of divers to set up the system or jetting operations to access the required mud line (Kaiser *et al.,* 2005). To cut a pile internally, the sand that had been forced into the hollow pile during installation would be removed by hydraulic dredging/pumping and stored on a barge. Once cut, the steel pile would then be lifted onto a barge and transported to shore. Following the removal of the cut pile and the adjacent scour control system, the sediments would be returned to the excavated pile site using a vacuum pump and diver-assisted hoses. As a result, no excavation around the outside of the monopile or piles prior to the cutting is anticipated. Cutting and removing piles would take anywhere from several hours to one day per pile. After the foundation is severed, it would be lifted on the transport barge and towed to a decommissioning site onshore (USDOI, MMS, 2009a).

4.5.2 Removal of Scour Control System

Any scour control system would be removed during the decommissioning process. Scour mats would be removed by divers or ROV and a support vessel in a similar manner to installation. Removal is expected to result in the suspension of sediments that were trapped in the mats. If rock armoring is used, armor stones would be removed using a clamshell dredge or similar equipment and placed on a barge. It is estimated that the removal of the scour control system would take a half-day per pile. Therefore, depending on the foundation structure, removal of the scour system would take from one half to two days to complete (USDOI, MMS, 2009a).

4.5.3 Disposal

All materials would be removed by barge and transported to shore. The steel would be recycled and remaining materials would be disposed of in existing landfills, in accordance with applicable law.

4.5.4 Artificial Reefs

Obsolete materials have been used as artificial reefs along the coastline of the U.S. to provide valuable habitat for numerous species of fish in areas devoid of natural hard bottom. The meteorological tower structures and scour control systems may have the potential to serve as artificial reefs. However, the structure must not pose an unreasonable impediment to future development. If the lessee ultimately proposes to use the structure as an artificial reef, its plan must comply with the artificial reef permitting requirements of the USACE and the criteria in the National Artificial Reef Plan of 1985 (33 U.S.C. 35.2103). The state agency responsible for managing marine fisheries resources must accept liability for the structure before BOEM would release the federal lessee from the obligation to decommission and remove all structures from the lease area (USDOI, MMS, 2009a).

5 Effects of the Proposed Action

The proposed action has five primary activities that will likely have environmental effects. These activities are: (1) HRG surveys; (2) geotechnical sampling; (3) deployment of a meteorological buoy or construction of a meteorological tower; (4) operation of a meteorological buoy or meteorological tower; and (5) other activities. The potential effects from these activities can be grouped into the following categories: (1) acoustic effects; (2) vessel and tower collision effects; (3) lighting effects; and (4) other effects (e.g., contact with waterborne pollution).

5.1 Acoustic Effects

5.1.1 High Resolution Geologic Survey and Geotechnical Sampling

As with any sound in the marine environment, the type and intensity of the sound is greatly dependent on multiple factors and can vary greatly. High resolution geologic (HRG) surveys will be used to characterize ocean-bottom topography and subsurface geology and to investigate potential benthic biological communities and archaeological resources. In addition, geotechnical sampling (vibracore, CPT, and/or deep boring) would be conducted at every potential tower location throughout the Project Area. In both cases, sound will be traveling in the water column. Roseate terns, piping plovers, and red knots are unlikely to be on the OCS during HRG surveys and geotechnical sampling, therefore no impacts are anticipated.

5.1.2 Meteorological Tower Pile-Driving and Construction

As with any sound in the marine environment, the type and intensity of the sound is greatly dependent on multiple factors and can vary greatly. These factors include the type and size of the pile, the type of substrate, the depth of the water, and the type and size of the impact hammer (Madsen *et al.*, 2006). Although loud noises from pile driving and construction activities can disturb nesting birds, the noise associated with these activities will occur on the Atlantic OCS, far from the nesting habitat of piping plovers in Massachusetts and Rhode Island and the nesting colonies of roseate terns in Massachusetts. Thus, noise from these activities will have no impact on nesting roseate terns and piping plovers. Additionally, noise from these activities is not anticipated to impact the migratory movement or migratory behavior of the piping plover, roseate tern, or the red knot through the two WEAs. Therefore, acoustic effects to ESA-listed and candidate bird species are considered negligible.

5.2 Collision Effects

This section discusses the potential for impacts to protected species resulting from collisions with vessels and structures associated with the proposed action. BOEM anticipates that marine animals will avoid fixed structures, such as meteorological towers, reducing the risk of collisions with these structures. Collisions with vessels and/or structures associated with the proposed action could result in injury to the animal and/or damage to the vessel or structure. A bird that collides into meteorological tower maybe injured or killed. However, the area over which up to 9 meteorological towers may be placed is over 1,200 sq. nautical miles and the distance from shore will exclude nesting or foraging roseate terns and piping plovers. Only migrating roseate terns, piping plovers, and red knots are anticipated to cross the WEA for a short period of time during migration, and the number of passages would be very low (i.e., one bird = one pass per migration). Therefore, the likelihood of a roseate terns, piping plovers, and red knots encountering a meteorological tower under climatological conditions that would force a migrating bird low enough to actually collide with a tower is so small that the impact such collisions on federally listed or ESA candidate bird species is discountable.

5.3 Lighting Effects

Under poor visibility conditions (fog and rain), migrating birds become disoriented and circle lighted communication towers instead of continuing on their migratory path, greatly increasing their risk of collision (Huppop *et al.,* 2006). Meteorological tower lighting would have the greatest impact on bird species during evening hours when nocturnal migration occurs. However, red flashing lights are commonly used at land-based wind facilities without any observed increase in avian mortality compared with unlit turbine towers (Kerlinger *et al.*, 2010). Thus, red flashing lights would be used at the meteorological towers to reduce the risk of bird collisions. Though there is the potential for the lighting of the meteorological towers to affect the collision probability of the piping plover, roseate tern, and red knot during migration, the anticipated small number of meteorological towers that will be present will greatly decrease the likelihood of these species being in proximity of a tower. Finally, it is anticipated that any additional lights (e.g., work lights) on towers and support vessels will be used only when necessary and be hooded downward and directed when possible to reduce upward illumination and illumination of adjacent waters. Therefore, the potential impacts from the artificial lighting of the meteorological towers on federally listed or ESA candidate bird species would be negligible.

5.4 Micro Wind Turbines

Small turbines might be mounted near the platform of meteorological towers and buoys to charge batteries to power electrical equipment (*see* Figures 4.4 and 4.5). These micro turbines are commonly used to charge batteries in the marine environment and are anticipated to have a rotor swept diameter of two meters or less. It is possible that a bird flying near the deck of a tower or buoy could collide with a rotor and get injured or killed. However, the likelihood that a bird would collide with a meteorological tower is already discountable, the addition of micro turbines does not expand the footprint of the meteorological tower or buoy, and the rotor swept zone of micro turbines is very small. Therefore, the likelihood of a collision with micro turbine is also very, very small and the potential impacts from micro turbines on federally listed or ESA candidate bird species would be negligible.

5.5 Discharge of Waste Materials and Accidental Fuel Leaks

Operational waste generated from all vessels associated with the proposed action includes bilge and ballast waters, trash and debris, and sanitary and domestic wastes. A vessel collision with a meteorological tower or other vessel has the potential to result in the spillage of diesel fuel into the marine environment. Vessels associated with the proposed action are expected to comply with the USCG requirements for the prevention and control or oil and fuel spills. Approximately 10 percent of vessel collisions with fixed structures on the OCS caused diesel spills.

Most equipment on the meteorological towers and buoys would be powered by batteries charged by micro wind turbines or solar panels. However, there is a possibility that diesel generators may be used on some of the meteorological towers and buoys, which may cause minor diesel fuel spills during refueling of generators. If a diesel fuel spill were to occur it would be expected to be small and dissipate quickly, then evaporate and biodegrade within a few days (USDOI, MMS, 2007).

Marine and coastal birds could be exposed to operational discharges or accidental fuel releases from construction sites and construction vessels and to accidentally released solid debris. Many species of marine birds (such as gulls) often follow ships to forage on fish and other prey inured or disoriented by the passing vessel. In doing so, these birds may be affected by discharges of waste fluids (such as bilge water) generated by the vessels. Operational discharges from construction vessels would be released into the open ocean where they would be rapidly diluted and dispersed, or collected and taken to shore for treatment and disposal. Sanitary and domestic wastes would be processed through on-site waste treatment facilities before being discharged overboard. Deck drainage would also be processed prior to discharge. Thus, impacts to marine and coastal birds from waste discharges from construction vessels are expected to be negligible.

Coastal and pelagic birds may become entangled in or ingest floating, submerged, and beached debris. Entanglement may result in strangulation, the injury or loss of limbs, entrapment, or the prevention or hindrance of the ability to fly or swim, and all of these effects may be considered lethal (Ryan, 1990; Gregory, 2009). However, the discharge or disposal of solid debris into offshore waters from OCS structures and vessels is prohibited by the BOEM (30 CFR 250.300) and the USCG (MARPOL, Annex V, Public Law 100-220 [101 Statute 1458]), Thus, entanglement or ingestion of OCS-related trash and debris by marine and coastal birds is not expected, and impacts to marine and coastal birds would be negligible.

Because of the very limited amount of vessel traffic and construction activity that might occur with construction and operation of a meteorological tower, the release of wastes, debris, hazardous materials, or fuels would occur infrequently and would cease following completion of the geological and geophysical surveys, meteorological tower construction, and meteorological tower decommissioning. The likelihood of an accidental fuel release would also be limited to the active construction and decommissioning periods of the site characterization. Piping plovers and red knots are strictly terrestrial foragers, and roseate terns typically feed only in shallow waters, so these species are not expected to follow vessels to forage. In addition, the areas where these impacts could occur do not strictly overlap with the foraging range of breeding piping plovers and roseate terns and only encompass a very small proportion of the migratory range of the piping plover, roseate tern, and red knot. As such, impacts to ESA-listed and candidate bird species from the discharge of waste materials or the accidental release of fuels are expected to be negligible.

5.6 Meteorological Tower and Buoy Decommissioning

Section 4.5 discusses in detail the proposed scenario for the decommissioning of meteorological towers and buoys. This section focuses on the decommissioning of a meteorological tower as it is a more extensive process than that of a meteorological buoy. The decommissioning of a meteorological tower involves more than potential impacts from vessel trips (which are addressed separately in Section 5.2). Decommissioning activities are not expected to have any impacts on ESA-listed birds or bats.

6 Natural and Unanticipated Events

The potential exists for natural and/or unanticipated events to cause environmental impacts during site assessment or characterization activities. A natural event such as a hurricane or severe storm could impact meteorological towers or buoys at some point during their operation. Depending on the severity of the event, components of the facility could be damaged, destroyed or lost from the structure. These could cause temporary sea hazards and would be retrieved, removed or repaired as soon as possible. Buoys are equipped with GPS systems that alert operators when they have moved outside their operating area. Mariners would be alerted if this were to happen, or if a tower had experienced severe damage.

A vessel collision with the meteorological structures or collision with other vessels may result in the spillage of diesel fuel. Vessels are expected to comply with USCG requirements relating to prevention and control of oil spills. Spills are not projected to have significant impacts due to the small size of a projected spill. A vessel spill could occur while en route to and from the Project Area, but this is considered unlikely. If a spill were to occur, either inside or outside of the Project Area, the spill size would likely be small. From 2000 to 2009, the average spill size for vessels similar to those anticipated to be used during activities associated with the proposed action was 88.36 gallons (USCG, 2012). Vessel allision with a meteorological buoy containing diesel powered generator may also occur. It is estimated that a buoy generator could contain 240 gallons of diesel fuel (Fishermen's Energy 2011 *as cited in* USDOI, BOEM, OREP, 2012a). If a diesel spill of this size were to occur, it would be expected to dissipate very rapidly in the water column of the open ocean, then evaporate and biodegrade within a few days.

It is also possible that larger vessels, such as tankers or container ships, could collide with meteorological structures within the project area. Such a collision is considered unlikely, as these structures would be sparsely placed on the OCS offshore Massachusetts and Rhode Island, and will be lit and marked for navigational purposes. If a larger vessel should collide with a meteorological facility/structure, a large spill would be extremely unlikely (*see* Section 5 of this BA). Thus, the largest spill that could result in the unlikely event that a larger ship was to collide with a meteorological facility is on the order of 240 gallons (as indicated above for a buoy-mounted generator).

6.1 Non-Routine or Accidental Activities

Non-routine activities also include hurricanes or severe storms impacting meteorological towers or buoys and/or blowing birds into the two WEAs, resulting in an increased risk of collision with a meteorological tower or buoy. These events are anticipated to be infrequent. In addition, given the small number of structures, their small footprint size, and their distance from shore and each other, impacts to federally listed and ESA candidate bird species resulting from this type of non-routine activity are expected to be negligible.

Accidental activities that could cause impacts to the environment during site assessment activities might include vessel collision with meteorological towers or buoys, causing damage to the structure and/or vessel and resulting in the discharge of the vessel's cargo (i.e., oil, liquefied natural gas, chemicals, or other commodities). Vessel collision is unanticipated since it would require a loss of vessel power or steerage, high winds, or a sea state that would drive the vessel toward the structure, and failure of the vessel's and/or structure's design to withstand the impact.

As such, impacts to federally listed and ESA candidate bird species resulting from accidental activities are also expected to be negligible.

7 Conclusions

The following are the conclusions reached by BOEM regarding the anticipated impacts of lease issuance, site assessment, and site characterization activities described herein for the Project Area to ESA-listed birds / bats. There is no critical habitat for any ESA-listed species in the Project Area or its surrounding waters.

The proposed action is not anticipated to impact the ESA-listed piping plover and roseate tern and the ESA candidate species red knot as the action area has no overlap with both species' nesting and foraging areas. Due to the small number of structures, the anticipated use of flashing red aviation hazard lights on towers, and the restricted time period of exposure during migration, BOEM concludes that the effects of the proposed action are discountable and is not likely to adversely affect the piping plover, roseate tern, or red knot.

8 Standard Operating Conditions for Protected Species

This section outlines the standard operating conditions that are part of the proposed action and which minimize or eliminate potential impacts to protected species including ESA-listed species of birds. Additional conditions, including mitigation, monitoring or reporting measures, may be included in any issued BOEM lease or other authorization, including those that may be developed during the Federal ESA Section 7 consultation process.

8.1 Measures for ESA-Listed Birds and Bats

Based on the following assumptions regarding the Proposed Action (*see* Section 1.2) within the Project Area (*see* Figure 1.1), no additional mitigations for ESA-listed and ESA candidate species are necessary.

- It is anticipated that metrological towers constructed for site assessment activities would be self-supported structures and would not require guy wires for support or stability.
- It is anticipated that only red flashing strobe-like lights metrological towers will be used for metrological towers to meet FAA requirements. In addition, it also anticipated that navigation lights for towers and buoys will be compliance with USCG requirements. Finally, it is anticipated that any additional lights (e.g., work lights) on towers and support vessels will be used only when necessary and be hooded downward and directed when possible to reduce upward illumination and illumination of adjacent waters.

In addition, meteorological towers will be required to have visibility sensors to collect data on climatic conditions above and beyond wind speed, direction and other associated metrics generally collected at meteorological towers. This information will assist BOEM and USFWS with evaluating the impacts of future offshore wind facilities on threatened and endangered birds, migratory birds, and bats.

8.2 Requirements During Decommissioning

Section 4 of this BA contains detail on the proposed scenario for decommissioning and removal of the meteorological towers and buoys. Essentially, the decommissioning process is the reverse of the construction process (absent pile driving), and the impacts from decommissioning would likely mirror those of construction. In addition, vessel activity during decommissioning would be essentially the same as that required during construction.

Foundation structures must be removed by cutting at least 15 feet (4.6 meters) below mudline (*see* 30 CFR 585.910(a)). BOEM assumes the meteorological towers to be constructed in southern New England can be removed using non-explosive severing methods. As detailed in 30 CFR Part 585.902, before the lessee decommissions the facilities under their SAP, the lessee must submit a decommissioning application and receive approval from the BOEM. Furthermore, the approval of the decommissioning concept/methodology in the SAP is not an approval of a decommissioning application.

8.3 Other Non-ESA Related Standard Operating Conditions

The regulations for site assessment plans found at 30 CFR Part 585.610 specify the requirements of a site assessment plan. These include a description of the measures the lessee will use to avoid or minimize adverse effects and any potential incidental take of endangered species before conducting activities on the lease, and how the lessee will mitigate environmental impacts from your proposed activities. 30 CFR 585.801 also specify requirements of the lessee to reduce impacts to protected species.

8.4 Site Characterization Data Collection

In addition to the collection of meteorological and oceanographic data, the purpose of these meteorological towers/buoys and site characterization surveys are to also collect biological and archaeological data. This data will assist in future analysis of proposed wind facilities. In addition to required reports, all site characterization data will be shared with NMFS, USFWS, and appropriate State agencies, upon request.

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