Application for Marine Mammal Protection Act Incidental Harassment Authorization

Site Characterization Studies off the Coast of New England and New York Bight

Submitted by

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Submitted to

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Acronyms and Abbreviations

μPa	microPascal(s)
re 1 μPa	referenced at 1 microPascal
Applicant	Equinor Wind US LLC
BOEM	Bureau of Ocean Energy Management
CeTAP	Cetacean and Turtle Assessment Program
CFR	Code of Federal Regulations
CHIRP	Compressed High Intensity Radar Pulse
CPT	Cone Penetration Testing
C&F	Crocker and Fratantonio 2016
dB	decibel(s)
dB_{peak}	dB peak
dB re 1 μPa	decibels referenced to a pressure of 1 microPascal
DMA	Dynamic Management Area
DoN	Department of the Navy
DP	dynamic positioning
DPS	Distinct Population Segment
ECRA	Export Cable Route Area
EEZ	Exclusive Economic Zone
ESA	Endangered Species Act
FR	Federal Register
ft	feet
GAPS	Global Acoustic Positioning System
GPS	global positioning system
HF	high-frequency
HiPAP	High Precision Acoustic Positioning
HPT	high performance transceiver
HRG	high-resolution geophysical
HZ	hertz
IHA	Incidental Harassment Authorization
J	joules
kHz	kilohertz
km	kilometer(s)
km/hr	kilometers per hour
LOC	Letter of Concurrence
$L_{E,24h}$	sound exposure level, cumulative 24 hours
LF	low-frequency
L_{pk}	peak sound pressure level
$L_{pk,flat}$	peak sound pressure level (unweighted)
m	meter(s)
M	manufacturer
MF	mid-frequency
m^2	square meter(s)
mi	mile(s)
mi^2	square mile(s)
MMPA	Marine Mammal Protection Act
MPSV	Multi-Purpose Support Vessel
ms	milliseconds
nm	nautical mile(s)
M/V	motor vessel
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NUWC	Naval Undersea Warfare Center
NY DEC	New York Department of Environmental Conservation
OBIS-SEAMAP	Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations
OCS	Outer Continental Shelf
omni	omnidirectional source
OPAREA	operating area
PAM	passive acoustic monitoring
PSO	Protected Species Observer(s)
PTS	permanent threshold shift
PW	phocids in water
RMS	Root-Mean-Square
ROV	Remotely Operated Vehicle
SAP	Site Assessment Plan
SEL_{cum}	cumulative sound exposure level
SMA	seasonal management area
SBP	Sub-bottom Profiler(s)
SL_{pk}	zero to peak source level
SPL	sound pressure level
SPUE	sightings per unit effort
SROV	Survey Remotely Operated Vehicle
SSL	sound source level
SSS	Side-scan sonar
SVP	Sound Velocity Profiler(s)
TB	Teledyne Benthos
TL	transmission loss
TL_c	transmission loss coefficient
TTS	temporary threshold shift
UHR	Ultra High Resolution
UME	Unusual Mortality Event
U.S.	United States
USBL	ultra-short baseline
UXO	Unexploded Ordinance
WEA	Wind Energy Area
WFA	weighting factor adjustment
WROV	Working Class Remotely Operated Vehicle
WTG	wind turbine generator
ZOI	Zone of Influence

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1. DESCRIPTION OF SPECIFIED ACTIVITY

***A detailed description of the specific activity or class of activities that can be expected to result in incidental taking of marine mammals*.**

Equinor Wind US LLC (the Applicant) is proposing to conduct marine site characterization surveys off the coast of New England and New York Bight including Commercial Leases of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS) (OCS-A 0520 and OCS-A 0512 or Lease Areas) in the Atlantic Ocean (Figure 1-1). The Applicant submits this request for Incidental Harassment Authorization (IHA) pursuant to Section 101(a)(5) of the Marine Mammal Protection Act (MMPA) and 50 Code of Federal Regulations (CFR) § 216 Subpart I, to allow for the Level B incidental harassment of small numbers of marine mammals resulting from the operation of high-resolution geophysical (HRG) survey equipment during upcoming field activities.

Both the National Oceanic and Atmospheric Administration (NOAA) and Bureau of Ocean Energy Management (BOEM) have advised that sound-producing survey equipment operating below 200 kilohertz (kHz; e.g., sub-bottom profilers (SBPs)) has the potential to cause acoustic harassment to marine mammals. This request for an IHA is being submitted to address sound-producing data acquisition equipment that operates below 200 kHz.

The regulations set forth in Section 101(a)(5) of the MMPA and 50 CFR § 216 Subpart I allow for the Level B incidental taking of marine mammals by a specified activity if the activity is found to have a negligible impact on the species or stock(s) of marine mammals and will not result in immitigable adverse impacts on the availability of the marine mammal species or stock(s) for certain subsistence uses. In order for the National Marine Fisheries Service (NMFS) to consider authorizing the taking by United States (U.S.) citizens of small numbers of marine mammals incidental to a specified activity (other than commercial fishing), or to make a finding that incidental take is unlikely to occur, a written request must be submitted to the Assistant Administrator. Such a request is detailed in the following sections.

1.1 Survey Activities

The Applicant will conduct marine site characterization surveys composed of high-resolution geophysical (HRG) surveys and geotechnical investigations in the marine environment to support development of offshore wind facilities (including submarine cable routes) associated with the Lease Areas. A number of cable corridors extending from the Lease Areas to potential cable landfalls in the area identified as the Export Cable Route Area (ECRA) in Figure 1-1 may be investigated. For the purpose of this application and to accurately estimate potential impacts, the ECRA has been divided into four subsections, ECRAs 1-4 (Figure 1-1).

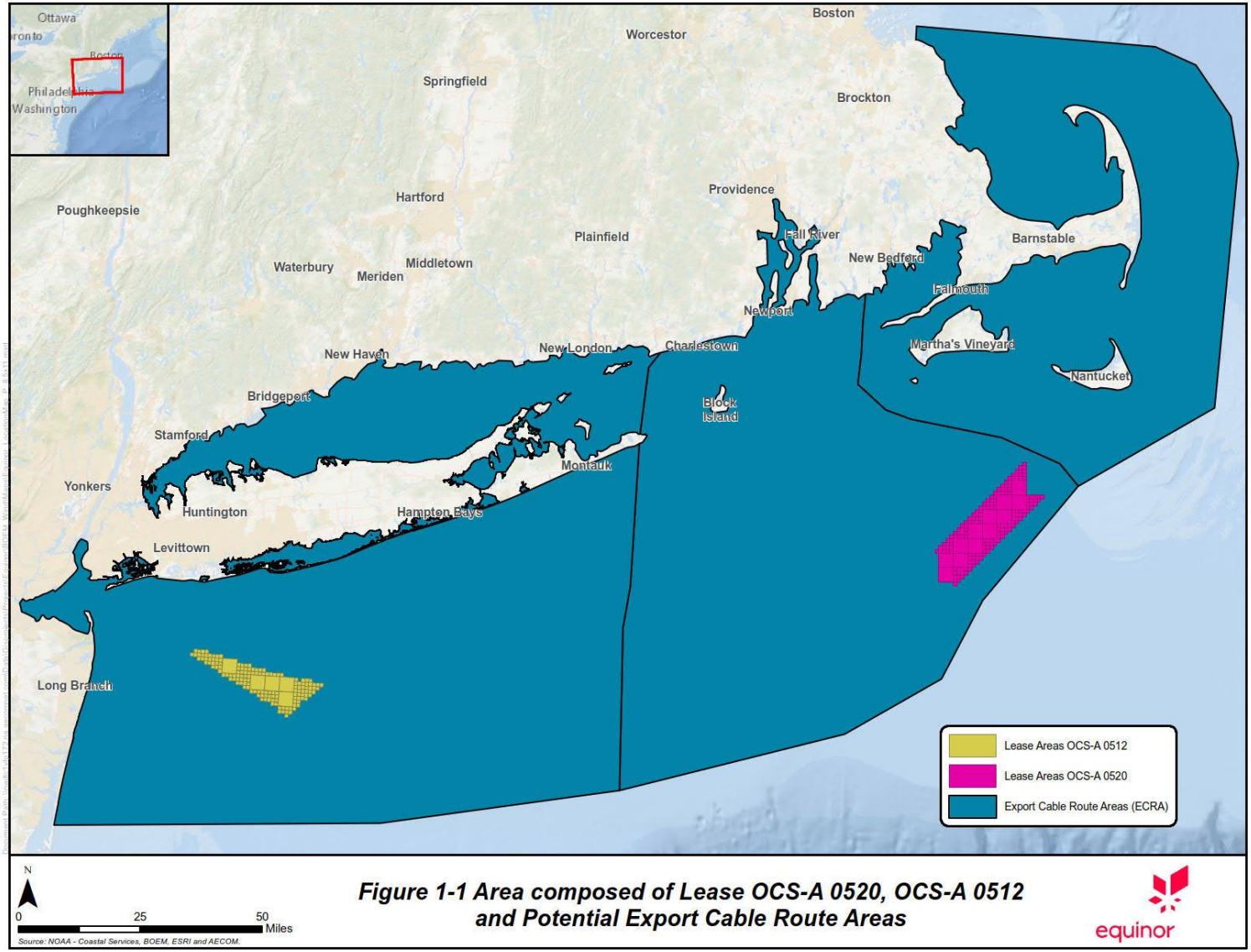

Figure 1-1 Area composed of Lease OCS-A 0520, OCS-A 0512 and Potential Export Cable Route Areas

Figure 1-1**. **Proposed Project Area

Water depths across the Lease Areas range from approximately 20 to 75 meters (m) (65 to 246 feet (ft)) and the cable route corridors will extend to shallow water areas near landfall locations. The purpose of the marine site characterization survey is to obtain a baseline assessment of the seabed and sub-surface soil conditions in the Lease Area and ECRA to support the siting of the proposed wind energy area (WEA) and optimization of future cable layout design.

The HRG survey activities may include the following, which are further described in Section 1.2:

- Depth sounding (multibeam echosounder);
- Magnetic intensity measurements (marine gradiometer);
- Seafloor imaging (side-scan sonar (SSS) survey);
- Shallow penetration Sub-Bottom Profiler (SBP; pinger/Compressed High Intensity Radar Pulse (CHIRP)/parametric);
- Medium penetration SBP (sparker/boomer); and
- Sound Velocity Profiler (SVP).

Geotechnical survey activities throughout the Lease Area and ECRA Area (Figure 1-1) will include:

- Vibracores to determine the geological and geotechnical characteristics of the sediments;
- Borings; and
- Cone Penetration Testing (CPT) to determine stratigraphy and in-situ conditions of the sediments.

1.2 HRG Survey

The HRG surveys are scheduled to begin no earlier than late April 2020. The HRG survey equipment will be equivalent to the representative survey equipment identified in Table 1-1. The make and model of the listed HRG survey equipment may vary depending on availability but will be finalized as part of the survey preparations and contract negotiations with the survey contractor. Sources operating at frequencies above 200 kHz (i.e., SSS) produce sound that is outside the functional hearing ranges of marine mammals, and therefore the potential for this equipment to result in the take of marine mammals is highly unlikely; thus, they are not included in the exposure analysis.

The HRG survey activities proposed by the Applicant may include the following:

- Single and Multibeam Depth Sounders to determine water depths and general topography. The multibeam echosounder sonar system projects sonar pulses in several angled beams from a transducer mounted to the hull. The beams radiate out from the transducer in a fan-shaped pattern orthogonally to the ship's direction. This equipment operates above 200 kHz and is not considered further in this application.
- Marine Gradiometer (magnetometer) to detect and map ferrous objects on and below the seafloor which may cause a hazard, including anchors, chains, cables, scattered shipwreck debris, unexploded ordinances, aircraft, and any other objects with a magnetic expression. The magnetometer is not a sound source and is not considered further in this application.

- SSS for seabed sediment classification purposes and to identify man-made acoustic targets on the seafloor. This sonar device emits conical or fan-shaped pulses down toward the seafloor in multiple beams at a wide angle, perpendicular to the path of the sensor through the water. The acoustic return of the pulses can be joined to form an image of the sea bottom within the swath of the beam. SSSs are typically towed behind the vessel or mounted to the hull. SSS operates above 200 kHz and is not considered further in this application.
- Shallow Penetration SBPs (Pinger/CHIRP/Parametric) to map near-surface stratigraphy (0 to 5 m [0 to 16 ft] of sediment below the seabed). SBP emit sonar pulses that increase in frequency (3.5 to 200 kHz) over time. The pulse length frequency range can be adjusted depending on project needs. Shallow Penetration SBPs are typically mounted on the hull of the vessel or from a side pole.
- Medium Penetration SBPs (Sparker/Boomer) to map deeper subsurface stratigraphy as needed. A medium SBP system emits acoustic pulses from 50 kHz to 4 kHz, omnidirectional from the source that can penetrate hundreds of meters into the seafloor. Medium penetration SBPs are usually towed behind the vessel with adjacent hydrophone arrays to detect the return signals.
- Ultra-Short Baseline (USBL) Positioning and Global Acoustic Positioning System (GAPS) to provide high accuracy ranges by measuring the time between the acoustic pulses transmitted by the vessel transceiver and the equipment necessary to produce the acoustic profile. USBL/GAPS are two-component systems usually with a hull or side pole mounted transceiver and one or more transponders on the seabed or the equipment.
- SVP to measure speed of sound to make corrections for calibration of equipment. SVP operates above 200 kHz and is not considered further in this application.

A recent technical report published by the Naval Undersea Warfare Center (NUWC), through support from BOEM and United States Geological Survey, presented measurement data from the sounds emitted during HRG surveys (Crocker and Fratantonio 2016). The equipment was tested at a wide range of settings with different acoustic levels measured. Since there are currently no standardized field measurements for HRG survey equipment, NMFS recommends that the sound source levels provided in Crocker and Fratantonio (2016) be the primary reference with manufacturer information supplementing for equipment that was not measured in the study (Table 1-1).

Table 1-1. Sound Sources for proposed HRG Survey Equipment

Equipment Type	Equipment	Deployment Platform	Source Type	Referenced Source Level	Operating Frequency (kHz)	SL rms (dB re 1 µPa m)	SL pk (dB re 1 µPa m)	Pulse Duration (Width) (millisecond)	Repetition Rate (Hz)	Beam Pattern (degrees)
Subsea Positioning / USBL[3]	Kongsberg HiPAP 501/502 USBL	Survey Vessel	Non-impulsive, mobile, intermittent	M	21 - 31	190	207	2	1	15
Shallow Sub-bottom Profiler	EdgeTech DW106	ROV	Non-impulsive, mobile, intermittent	M	1 to 6	194	197	<66	8	28 - 36
Medium Sub-bottom Profiler	Geo-Source 400 Tip Sparker Source (800 J)[1, 2]	Survey Vessel	Impulsive, mobile	M (C&F)	0.25 to 3.25	216 (203)	220 (213)	2	4	Omni-directional
Side Scan Sonar	EdgeTech DF MP 600	ROV	Non-impulsive, mobile, intermittent	M	300 / 600	-				
Multibeam Echosounder	Kongsberg EM2040Quad	ROV	Non-impulsive, mobile, intermittent	M	200 to 400	-				

"-" = not applicable or reportable; C&F = Crocker and Fratantonio 2016; dB re 1 µPa m = decibel referenced to 1 micropascal meter; HiPAP = High Precision Acoustic Positioning; Hz = Hertz; J = joules; M = manufacturer; ROV = Remotely Operated Vehicle; SL = source level; SL_{pk} = zero to peak source level; SL_{rms} = root-mean-square source level; USBL = ultra-short baseline.
[1] Sound source levels were previously approved by NMFS, [2] ELC820 sparker measured in Crocker and Fratantonio (2016) represents the most applicable model and operating parameters as a proxy to the 400-, 600-, and 800- J sparkers expected for use during surveys. [3] Manufacturer

The vessel (*M/V) Stril Explorer* (*Stril Explorer*) (Figure 1-2) is designated to conduct survey operations throughout the Lease Area and along the Cable Route Corridors in the ECRAs to a water depth of approximately 10 m. The *Stril Explorer* is a dynamic positioning (DP2) Multi-Purpose Support Vessel (MPSV) built in 2010. The vessel holds a high standard both in on-board equipment and accommodation/office facilities. *Stril Explorer* is equipped with a 60 ft crane, a deck area of 523 m^2 (shelter)/270 m^2 (cargo), and an enclosed Remotely Operated Vehicle (ROV) hangar for 2 x Working Class Remotely Operated Vehicle (WROV) handling systems.

Figure 1-2 *M/V Stril Explorer*

Equinor may utilize the Surveyor Remotely Operated Vehicle (SROV) (Figure 1-3), a specially-designed system to significantly increase the progress rate during the survey along tracklines where medium penetration sub-bottom profiler data is not required. Typical ROVs on the market have a maximum speed of 1.5 to 3 knots but the SROV has a top speed of 8 knots.

SROV operations will allow for better trackline fidelity compared to traditional survey operations, since the SROV is de-coupled from the surface motion of the water and is not affected by wind or wave action. There are additional advantages to using the SROV for the Marine Archaeology Resource Assessment Surveys. The SROV potentially will be 25 percent more efficient due to surveying at higher speeds and quicker line turns. There will be less waiting on weather conditions (5 percent with the use of the SROV compared to 30 percent without the use of the SROV), and less infill and fewer re-runs due to better line and off track control. Finally, there will be fewer potential impacts on marine mammals due to the dissipation of energy resulting from the proximity of SBPs to the seabed. It is highly unlikely that a marine mammal could swim through the beam, given its low position in the water column; lingering for any duration within the ensonified area is even less likely.

The SROV is fully controlled from the surface vessel, which allows for immediate shut down[1] (if necessary) due to the encroachment of marine mammals or sea turtles towards the exclusion zones described in Section 11.3.

The SROV is equipped with the latest design multibeam echosounders, triangulating lasers, and video-photo mosaic cameras. In addition, the SROV is equipment with side scan sonar, a shallow penetration sub-bottom profiler, and gradiometer. As such, the SROV incorporates the full suite of HRG equipment required for Marine Archaeology Resource Assessment Surveys. The SROV will maintain an altitude no higher than 6 m above the seabed in accordance with BOEM guidelines[2] for acceptable operation of a gradiometer.

The overall data criterion is designed to deliver 0.1 m grid maps, seamless photo mosaic, and high-resolution video at speeds that will surpass all other systems on the market. The laser scans from two triangulating lasers will produce very dense, high resolution point clouds with extremely low distortion in visibilities above 3 m. The typical speed at production will be 5.5 knots.

Figure 1-3 Surveyor SROV

The SROV is typically operated under the vessel slightly in front of the launch point to allow for a good relation between vessel (thrusters), umbilical, and SROV (Figure 1-4). The position will be dependent upon the weather and currents. In marginal weather, the vessel will need to point the bow to the predominant weather (wind & waves) and the SROV could be at the bow or the stern (Figure 1-4). In optimal weather conditions, the vessel heading would be the same direction as the SROV.

[1] The USBL system may not be shut down due to safety requirements associated with operating the SROV.
[2] BOEM's *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585 (*BOEM 2017).

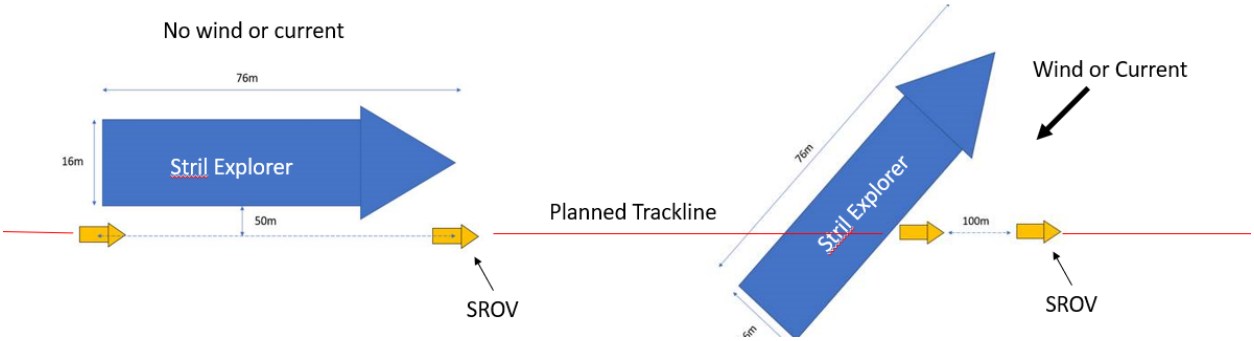

***Figure 1-4**. Representative position of SROV relative to Stril Explorer*

Surveys of the Lease Area will be conducted along tracklines spaced a minimum of 30 m (98 ft) apart, with primary and tie-lines spaced every 150 m (492 ft) and 500 m (1,640 ft), respectively. The survey will cover the entire Lease Area, including the area where the inter-array cables will be placed. The medium penetration sub-bottom system will be operated from the vessel on 150 m (492 ft) spaced primary lines and 500 m cross lines along with the SROV. The full survey protocol is designed to meet BOEM requirements as defined in the July 2015 *Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to 30 CFR Part 585* and the March 2017 *Guidelines for Providing Archeological and Historical Property Information Pursuant to 30 CFR Part 585*.

Up to two cable route corridors within the ECRAs (Figure 1-1), each 500 m (1,640 ft) wide, will be surveyed along tracklines spaced a minimum of 30 m (98 ft) apart, with tie-lines spaced every 500 m. A single channel array sub-bottom system will be operated from the vessel along the cable route centerline, while the SROV sub-bottom system would be operated on all other tracklines within the cable route corridor.

As noted previously, both NOAA and BOEM have advised that the deployment of HRG survey equipment including the use of sound-producing equipment operating below 200 kHz (e.g., SBPs) has the potential to cause acoustic harassment to marine mammals. Based on the frequency ranges of the potential equipment to be used in support of the HRG survey activities (Table 1-1), the USBL positioning system and the SBPs (shallow and medium penetration profilers) operate within the established marine mammal hearing ranges and have the potential to result in Level B Harassment of marine mammals.

Based on the information provided by Equinor in a letter to NMFS dated 3/11/20 regarding proposed geophysical investigations using SROVs, NMFS has concurred with Equinor's determination that the likelihood of marine mammal take resulting from the proposed activities is so low as to be discountable (J. Carduner, Pers. Comm. On 25 March, 2020). Therefore SROV operations are not discussed further in this application.

1.2.1 Execution Plan

Task 1 – Reconnaissance Survey (to support 2020 geotechnical campaign)
The medium penetration sub-bottom profiler and SROV will be operated along tracklines through the planned Wind Turbine Generator (WTG) locations in perpendicular directions (1855 m x 1855 m). The orientation of tracklines will be based on the orientation of the proposed turbine array to maximize survey efficiency. In general, tracklines may be oriented in a north-

east / south-west orientation, with cross-lines in a perpendicular direction. This data shall be used to derive a preliminary geological ground model and to determine locations to be targeted in a 2020 geotechnical sampling campaign[3].

In addition to the orthogonal tracklines through each WTG location, two wing lines to each side of the WTG centerline (spaced 30m apart) will be surveyed to provide data for marine archaeology and Unexploded Ordinance (UXO) clearance to support the 2020 geotechnical campaign. The wing lines will be oriented in a north-east / south-west direction and may be investigated using the SROV.

Task 2 - Shallow Hazard and Geological Condition Survey (Lease Area only)
The medium penetration sub-bottom profiler and SROV will be operated along tracklines spaced at 150m spacing and 500 m crosslines.

Task 3 - Marine Archaeology Resource Assessment Survey (Lease Area Only)
SROV-only operations will be conducted along tracklines spaced at 30 m spacing between tracklines associated with Tasks 1 and 2..

Task 4 - Cable Route Corridor(s) Survey
The medium penetration sub-bottom profiler and SROV will be operated along the centerline of each route. SROV-only operations are planned for 9 tracklines to either side of the centerline, spaced 30 m apart for a total corridor width of 540 m. Crosslines will be surveyed perpendicular to the centerline of the Cable Route Corridor at an interval of 500 m.

Sequencing
The Task 1 scope of work is most critical to complete so that the 2020 geotechnical sampling campaign can be initiated. Once Task 1 is complete, Equinor may decide to prioritize different tasks of the full survey campaign at different times based on weather, commercial fishing activity, marine mammal related dynamics, or other project-based considerations.

1.3 Geotechnical Survey

The geotechnical survey is scheduled to begin no earlier than 1 July 2020 and may last up to 135 non-consecutive days. It is anticipated that vibracore samples, borings and CPT may be obtained at each proposed WTG location in the Lease Area. The investigation activities are anticipated to be conducted from a drill ship equipped with DP thrusters and as such, the operation of a USBL system during operations is required for safe operation of the vessel and therefore cannot be shut down.

Field studies conducted off the coast of Virginia (Tetra Tech 2014) to determine the underwater noise produced by borehole drilling and CPTs confirm that these activities, including vibracore sampling, do not result in underwater noise levels that exceed NOAA current Level A and Level B harassment thresholds for marine mammals. NMFS has recently indicated that sound produced through use of DP thrusters is similar to that produced by transiting vessels and thus, the need for an MMPA IHA for the use of DP thrusters is not anticipated (83 FR 7655).

Given recent IHAs issued by NOAA which included the normal operations of vessels and the lack of acoustical impact from vibracore sampling and CPT, these geotechnical activities do not

[3] Equinor's 2020 Geotechnical Survey Plan for Lease OCS-A 0520 will be submitted separately.

warrant further discussion and will not be carried forward in this assessment (84 FR 66156). Additionally, a Letter of Concurrence (LOC) dated 15 April 2019 from NOAA to the Applicant for activities consistent with those proposed herein; confirmed the likelihood of marine mammal take resulting from the planned geotechnical surveys to be so low as to be discountable. Incidental Take Authorization is therefore not warranted for geotechnical activities and will not be requested in this IHA application.

1.4 Survey Activities Resulting in the Potential Incidental Taking of Marine Mammals

The potential effects of underwater noise resulting in takes on marine mammals are federally managed by NOAA under the MMPA to minimize the potential for both harm and harassment. Under the MMPA, Level A harassment is statutorily defined as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild; however, the actionable sound pressure level (SPL) is not identified in the statute. Level B harassment is defined as any act of pursuit, torment, or annoyance that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, feeding, breeding, or sheltering.

According to the *2018 Revision to: Technical Guidance for Assessing the Effect of Anthropogenic Sound on Marine Mammal Hearing* (April 2018), Level A harassment is said to occur as a result of exposure to high noise levels and at the onset of permanent hearing sensitivity loss, known as a permanent threshold shift (PTS) (NMFS 2018). This revision to earlier NMFS guidelines is based on findings by the Noise Criteria Group (Southall *et al*. 2007). For transient and continuous sounds, it was concluded that the potential for injury is not just related to the level of the underwater sound and the hearing bandwidth of the animal but is also influenced by the duration of exposure. The evaluation of the onset of PTS and temporary threshold shift (TTS) provides additional species-specific insight on the potential for effects that is not captured by evaluations completed using the previous NMFS thresholds for Level A harassment alone.

Frequency weighting provides a sound level referenced to an animal's hearing ability either for individual species or classes of species, and therefore is a measure of the sound's potential to cause an effect. The measure that is obtained, represents the perceived level of the sound for that animal. This is an important consideration because even loud underwater sound may not affect an animal if it is at frequencies outside the animal's hearing range. In the NMFS final technical guidance document, there are five functional hearing groups: Low-frequency (LF) cetaceans (baleen whales), Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, and bottlenose whales), High-frequency (HF) cetaceans (true porpoises, pygmy and dwarf sperm whales, and river dolphins), phocid pinnipeds (true seals), and otariid pinnipeds (sea lions and fur seals). It should be noted that otariid pinnipeds do not occur in the Lease Area and ECRA; at least one species from each of the other four functional hearing groups is expected to occur in the Lease Area and ECRA.

Specific hearing criteria thresholds are provided by NMFS for each of the functional hearing groups. These criteria apply hearing adjustment curves for each functional hearing group known as M-weighting (Table 1-2).

Table 1-2. M-Weighted PTS and TTS Criteria and Functional Hearing Range for Marine Mammals.

Functional Hearing Group	PTS Onset Impulsive	PTS Onset Non-Impulsive	TTS Onset Impulsive	TTS Onset Non-Impulsive	Functional Hearing Range
LF cetaceans	219 dB_{peak} & 183 dB SEL_{cum}	199 dB SEL_{cum}	213 dB_{peak} & 168 dB SEL_{cum}	179 dB SEL_{cum}	7 Hz to 35 kHz
MF cetaceans	230 dB_{peak} & 185 dB SEL_{cum}	198 dB SEL_{cum}	224 dB_{peak} & 170 dB SEL_{cum}	178 dB SEL_{cum}	150 Hz to 160 kHz
HF cetaceans	202 dB_{peak} & 155 dB SEL_{cum}	173 dB SEL_{cum}	196 dB_{peak} & 140 dB SEL_{cum}	153 dB SEL_{cum}	275 Hz to 160 kHz
Phocid pinnipeds	218 dB_{peak} & 185 dB SEL_{cum}	201 dB SEL_{cum}	212 dB_{peak} & 170 dB SEL_{cum}	181 dB SEL_{cum}	50 Hz to 86 kHz
Otariid pinnipeds	232 dB_{peak} & 203 dB SEL_{cum}	219 dB SEL_{cum}	226 dB_{peak} & 188 dB SEL_{cum}	199 dB SEL_{cum}	60 Hz to 39 kHz

Note: dB = decibels; dB_{peak} = peak sound level; HF = high-frequency; Hz = hertz; kHz = kilohertz; LF = low-frequency; MF = mid-frequency; PTS = Permanent Threshold Shift; SEL_{cum} = cumulative sound exposure level; TTS = Temporary Threshold Shift

NOAA has defined the threshold level for Level B harassment as 120 decibels (dB) Root-Mean-Square (RMS) acoustic pressure referenced at 1 micropascal (re 1 µPa) for continuous sound and 160 $dB_{RMS\ 90\%}$ re 1 µPa for impulsive sound. Within this zone, the sound produced by the HRG survey equipment may approach or exceed ambient sound levels (i.e., threshold of perception or zone of audibility (see Section 7.1.4)); however, actual perceptibility will be dependent on the hearing thresholds of the species under consideration and the inherent masking effects of ambient sound levels. The Level B harassment threshold was not updated with the 2018 Technical Guidance. In accordance with current NMFS guidelines, the Applicant's survey activities that could result in the incidental take of marine mammals are limited to Level B harassment takes caused by the generation of underwater noise from operation of HRG equipment, as described in Section 1.1 above.

1.4.1 Distances to Level A Regulatory Acoustic Thresholds

Sound propagation and the distances to the Level A harassment isopleths as defined under the Technical Guidance were estimated using the User Spreadsheet developed by NMFS for this purpose (NMFS 2018). The NMFS User Spreadsheet computes the distances to isopleths for the different functional hearing groups based on an unweighted sound source level (SSL) with corresponding distance. The model for a mobile source and impulsive or intermittent sound applies simple Weighting Factor Adjustments (WFA) for the five functional hearing groups and incorporates a sound source velocity, pulse duration, and repetition rate (NMFS 2018).

The noise levels of HRG survey equipment were estimated using the NMFS Level A dual criteria for cumulative sound exposure level (SEL_{cum}) and peak sound pressure level (L_{pk}) (NMFS 2018). The larger distance (SEL_{cum} or L_{pk}) was used to calculate the Zone of Influence (ZOI) for Level A harassment. Absorption loss was ignored for these calculations because the frequencies are generally below 10 kHz and the impact range is less than 100 meters (Shane Guan, NMFS, personal communication, email dated 15 January 2020).

The acoustic thresholds are presented using dual metrics of SEL_{cum} and peak sound level (dB_{peak}). The cumulative PTS criterion (Table 1-2) was applied to the formulaic spreadsheet

provided by NMFS. The instantaneous peak criterion was calculated by applying a practical spreading model to the dB_{peak} source level in Table 1-1. No M-weighting correction is applied during evaluation of the peak criterion. Calculated distances to Level A harassment from HRG surveys are presented in Table 1-3. The maximum distance to the Level A harassment threshold for any functional hearing group is 3.5 m (11.5 ft), associated with the use of the Geo-Source 400 Tip 800J sparker (Table 1-3). Distances to Level A harassment isopleths were calculated to determine the potential for Level A harassment to occur, though Equinor is not requesting take by Level A harassment of any marine mammals.

1.4.2 Distances to Level B Regulatory Acoustic Thresholds

The interim methodology from NMFS Office of Protected Resources (July 2019) described below was used to estimate isopleth distances to the Level B harassment thresholds for the proposed HRG survey. NMFS considers the data provided by Crocker and Fratantonio (2016) to represent the best available information on source levels associated with HRG equipment and therefore recommends that source levels provided by Crocker and Fratantonio (2016) be incorporated in the method described above to estimate isopleth distances to the Level B harassment threshold. In cases when the source level for a specific type of HRG equipment is not provided in Crocker and Fratantonio (2016), NMFS recommends that either the source levels provided by the manufacturer be used, or, in instances where source levels provided by the manufacturer are unavailable or unreliable, a proxy from Crocker and Fratantonio (2016) be used instead.

Source levels for HRG equipment that were provided by Crocker and Fratantonio (2016) were used when possible to calculate Level A and B harassment thresholds. If only peak source sound pressure level (SPL_{pk}) is given, the SPL_{rms} can be roughly approximated by subtracting a certain amount of decibels from the reported SPL_{pk} values to derive the corresponding SPL_{rms} values for different source types. For HRG equipment that project a wide beam angle of greater than 180 degrees, spherical spreading loss (20 log (r)) was used to calculate isopleth distances.

In order to account for the greater absorption of higher frequency sources, we applied 20 log(r) to calculate transmission loss (TL):

$$TL = 20\log10(r)$$

where *r* is the distance in meters.

If the beamwidth is less than 180 degrees and the angle of the beam axis in relation to the sea surface is known, the horizontal impact distance *R* should be calculated using:

$$R = r\cos(\varphi - \theta 2) \text{ (m)}$$

Table 1-1 shows the HRG equipment types that may be used during the proposed surveys and the sound levels associated with those HRG equipment types. Results of modeling using the methodology described above indicated that, of the HRG survey equipment planned for use by Equinor that has the potential to result in harassment of marine mammals, sound produced by the Geo-Source 400 Tip 800 J sparker would propagate farthest to the Level B harassment threshold (Table 1-3). Level A and B harassment are not anticipated to result from surveys associated with SSSs, as the frequencies are above the range of most reliable hearing for marine mammals (see Table 1-1); therefore, those equipment types were omitted from the analysis.

Table 1-3. Radial Distances to Level A and B Harassment Thresholds during HRG Surveys.

Source	Distance to Level A Threshold (m)				Distance to Level B (m)	Deployment Platform
	LF (peak SPL/SEL_{cum})	MF (peak SPL/SEL_{cum})	HF (peak SPL/SEL_{cum})	PW (peak SPL/SEL_{cum})	All	
Positioning Systems						
Kongsberg HiPAP 501/502 USBL	0	0	0	0	4	Survey Vessel
Medium Penetration Sub-bottom Profiler						
Geo-Source 400 Tip Sparker Source (800 J)	-/<1	-/0	3.5/<1	-/<1	141	Survey Vessel

Note:HF = high frequency;HiPAP = High Precision Acoustic Positioning; J = joules; LF = low frequency; m = meters; MF = mid-frequency; PW = Phocids in water; SPL =sound pressure level; SEL_{cum} = cumulative sound exposure level; USBL = ultra-short baseline.

Note: ELC820 sparker measured in Crocker and Fratantonio (2016) represents the most applicable model and operating parameters as a proxy to the 800- J sparker expected for use during surveys.

2. DATES, DURATION, AND SPECIFIED GEOGRAPHIC REGION

The date(s) and duration of such activity and the specified geographical region where it will occur.

2.1 Dates and Durations of Survey Activities

HRG surveys are anticipated to occur between 1 July 2020 and 30 June 2021. During this survey period, a total of 218 days of HRG surveys are anticipated. This schedule is based on 24-hour operation to minimize the overall duration of survey activities and the associated period of potential impact on marine species and includes estimated weather down-time. The following durations are anticipated:

- ECRA 1: 11.25 days
- ECRA 2: 70.25 days
- ECRA 3: 11.25 days
- ECRA 4: 125.25 days

Geotechnical sampling is anticipated to occur between 1 July 2020 and 30 June 2021. During this sampling period, a total of 135 days of sampling within the Lease Area is anticipated. This schedule is based on 24-hour operation to minimize the overall duration of survey activities and the associated period of potential impact on marine species and includes estimated weather down-time.

Up to two vessels may execute surveys concurrently. Daily vessel tracks will not overlap to ensure the same areas are not ensonified simultaneously by both vessels. The total number of survey days is expected to remain the same, but the number of calendar days would be reduced.

2.2 Specified Geographic Region

The Applicant's survey activities will occur in the Lease Areas and cable corridors within the ECRA identified in Figure 1-1.

Potential impacts to species or stocks of marine mammals will be limited to individuals of marine mammal species located in the northeast region of the United States and will not affect Arctic marine mammals. Given that the Project is not located in Arctic waters, the activities associated with the Applicant's proposed activities will not have an adverse effect on the availability of marine mammals for subsistence uses allowable under the MMPA.

3. SPECIES AND NUMBERS OF MARINE MAMMALS

The species and numbers of marine mammals likely to be found within the activity area.

Marine mammals are protected under the MMPA. Some marine mammal stocks (defined as a group of nonspecific individuals that are managed separately) (Hayes *et al*. 2019) may be designated as strategic under the MMPA, which may require the jurisdictional agency (NMFS for marine mammal species under consideration in this IHA application) to impose additional protective measures.

The Environmental Assessment (BOEM 2014) reports thirty-eight (38) species of marine mammals (whales, dolphins, porpoise, and seals) in the Northwest Atlantic Outer Continental Shelf (OCS) region of the mid-Atlantic that are protected by the MMPA, five of which are listed under the Endangered Species Act (ESA) and are known to be present, at least seasonally, in the Lease Area and ECRA (see Table 3-1).

The five whale species listed as endangered under the ESA that may occur or are expected or likely to occur in or transit near the Lease Area and ECRA include:

- Fin whale (*Balaenoptera physalus*);
- Sei whale (*Balaenoptera borealis*);
- Blue whale (*Balaenoptera musculus*);
- North Atlantic right whale (*Eubalaena glacialis*); and
- Sperm whale (*Physeter macrocephalus*).

The occurrence of the 38 species of marine mammals that may occur or are expected or likely to occur in or transit near the Lease Area and ECRA is based on the following criteria and/or habitat models (i.e., Roberts *et al*. 2016) for the Lease Area and ECRA and for species available in the model analyses:

- Common – occurring consistently in moderate to large numbers;
- Regular – occurring regularly, inhabitants at least seasonally and have been documented within the Lease Area and ECRA;
- Uncommon – occurring in low numbers or on an irregular basis;
- Rare – records for some years but limited; and
- Not expected – range includes the Lease Area and ECRA but due to habitat preferences and distribution information, species are not expected to occur in the Lease Area and ECRA although records may exist for adjacent waters.

Status, stock identification, abundance, and occurrence of these species are listed in Table 3-1 and each species and stock is discussed in detail in Section 4.

Table 3-1. Marine Mammals Known to Occur in or Near the Lease Area and Export Cable Route Area.

Common Name (Species Name)	Stock	Regulatory Status	Stock Abundance Best Estimate[a]	PBR[a]	Annual M/SI[a]	Offshore MA Occurrence Likelihood[b]	Seasonal Occurrence in the Lease Area and Export Cable Route Area[c]
Mysticetes							
North Atlantic right whale (*Eubalaena glacialis*)	W. North Atlantic	ESA; Endangered	451	0.9	5.56	Common	Winter and spring
Humpback whale (*Megaptera novaeangliae*)	Gulf of Maine	MMPA	896	14.6	9.7	Common	Year-round
Fin whale (*Balaenoptera physalus physalus*)	W. North Atlantic	ESA; Endangered	1,618	2.5	2.5	Common	Year-round
Sei whale *(Balaenoptera borealis borealis)*	Nova Scotia	ESA; Endangered	357	0.5	0.8	Common	Spring and summer
Minke whale (*Balaenoptera acutorostrata acutorostrata*)	Canadian East Coast	MMPA	2,591	14	7.7	Common	Spring, summer, and fall
Blue whale (*Balaenoptera musculus musculus*)	W. North Atlantic	ESA; Endangered	Unknown	0.9	0.9	Not Expected	N/A
Odontocetes							
Sperm whale (*Physeter macrocephalus*)	North Atlantic	ESA; Endangered	2,288	3.6	0.8	Uncommon	Summer and fall
Dwarf and pygmy sperm whale (*Kogia sima* and *Kogia breviceps*)	W. North Atlantic	MMPA	3,785	21	3.5	Rare	N/A
Risso's dolphin (*Grampus griseus*)	W. North Atlantic	MMPA	18,250	126	49.9	Uncommon	Year-round
Pilot whale, long-finned (*Globicephalus melas*)	W. North Atlantic	MMPA	5,636	35	27	Uncommon	Year-round
Pilot whale, short-finned	W. North Atlantic	MMPA	28,924	236	168	Rare	N/A

Common Name (Species Name)	Stock	Regulatory Status	Stock Abundance Best Estimate[a]	PBR[a]	Annual M/SI[a]	Offshore MA Occurrence Likelihood[b]	Seasonal Occurrence in the Lease Area and Export Cable Route Area[c]
(*Globicephalus macrorhynchus*)							
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	W. North Atlantic	MMPA	48,819	304	30	Common	Year-round
Short-beaked common dolphin (*Delphinus delphis delphis*)	W. North Atlantic	MMPA	70,184	557	406	Common	Year-round
Common bottlenose dolphin (*Tursiops truncatus truncatus*)	W. North Atlantic, Offshore	MMPA	77,532	561	39.4	Common	Year-round
Common bottlenose dolphin (*Tursiops truncatus truncatus*)	W. North Atlantic, Northern Coastal Migratory	MMPA	6,639	48	6.1-13.2	Common	Year-Round
Atlantic spotted dolphin (*Stenella frontalis*)	W. North Atlantic	MMPA	44,715	316	0	Uncommon	Year-round
Harbor porpoise (*Phocoena phocoena phocoena*)	Gulf of Maine/ Bay of Fundy	MMPA	79,833	706	256	Common	Yea-round
Cuvier's beaked whale (*Ziphius cavirostris*)	W. North Atlantic	MMPA	6,532	50	0.4	Rare	N/A
Blainville's, Gervais', True's, and Sowerby's Beaked Whales (*Mesoplodon densitostris*, *M. europaeus*, *M. mirus*, and *M. bidens*)	W. North Atlantic	MMPA	7,092	46	0-0.2	Rare	N/A
Striped dolphin (*Stenella coeruleoalba*)	W. North Atlantic	MMPA	54,807	428	0	Rare	N/A
Clymene dolphin (*Stenella clymene*)	W. North Atlantic	MMPA	Unknown	Undetermined	0	Rare	N/A

Common Name (Species Name)	Stock	Regulatory Status	Stock Abundance Best Estimate[a]	PBR[a]	Annual M/SI[a]	Offshore MA Occurrence Likelihood[b]	Seasonal Occurrence in the Lease Area and Export Cable Route Area[c]
Fraser's dolphin (*Lagenodelphis hosei*)	W. North Atlantic	MMPA	Unknown	Unknown	0	Rare	N/A
Pantropical spotted dolphin (*Stenella attenuata*)	W. North Atlantic	MMPA	3,333	17	0	Rare	N/A
Rough-toothed dolphin (*Steno bredanensis*)	W. North Atlantic	MMPA	136	0	0.7	Rare	N/A
Spinner dolphin (*Stenella longirostris*)	W. North Atlantic	MMPA	Unknown	Unknown	0	Rare	N/A
White-beaked dolphin (*Lagenorhynchus albirostris*)	W. North Atlantic	MMPA	2,003	10	0	Rare	N/A
Killer whale (*Orcinus orca*)	W. North Atlantic	MMPA	Unknown	Unknown	0	Rare	N/A
Pygmy killer whale (*Feresa attenuata*)	W. North Atlantic	MMPA	Unknown	Unknown	0	Rare	N/A
False killer whale (*Pseudorca crassidens*)	W. North Atlantic	MMPA	442	2.1	Unknown	Rare	N/A
Northern bottlenose whale (*Hyperoodon ampullatus*)	W. North Atlantic	MMPA	Unknown	Unknown	0	Rare	N/A
Melon-headed whale (*Peponocephala electra*)	W. North Atlantic	MMPA	Unknown	Unknown	0	Rare	N/A
Pinnipeds							
Harbor seal (*Phoca vitulina vitulina*)	W. North Atlantic	MMPA	75,834	2,006	345	Common	Year-round
Gray seal (*Halichoerus grypus atlantica*)	W. North Atlantic	MMPA	27,131	1,389	5,688	Common	Year-round
Harp seal (*Pagophilus groenlandicus*)	W. North Atlantic	MMPA	Unknown	Unknown	225,687	Uncommon	Winter and spring

Common Name (Species Name)	Stock	Regulatory Status	Stock Abundance Best Estimate[a]	PBR[a]	Annual M/SI[a]	Offshore MA Occurrence Likelihood[b]	Seasonal Occurrence in the Lease Area and Export Cable Route Area[c]
Hooded seal (*Phoca groenlandica*)	W. North Atlantic	MMPA	Unknown	Unknown	1,680	Rare	N/A

Notes: ESA = Endangered Species Act; M / SI = Mortality / Serious Injury; MA = Massachusetts; MMPA = Marine Mammal Protection Act; N/A = Not applicable; PBR = Potential Biological Removal; W. = Western.
*Northern migratory species
Sources:

a. Hayes *et al*. 2019
b. Kenney and Vigness-Raposa 2010; Kraus *et al*. 2016; Roberts *et al*. 2016; Hayes *et al*. 2019
c. Kenney and Vigness-Raposa 2010; Kraus *et al*. 2016; Roberts *et al*. 2016

4. AFFECTED SPECIES STATUS AND DISTRIBUTION

A description of the status and distribution, including seasonal distribution (when applicable), of the affected species or stocks of marine mammals likely to be affected by such activities.

As described in Section 3, there are up to 38 marine mammal species (whales, dolphins, porpoises, and seals) that are known to be present (some year–round, and some seasonally) in the Northwest Atlantic OCS region; however, only 17 are most likely found within the Lease Area and ECRA, and descriptions are provided below. The marine mammal species with potential to occur in the Lease Area and ECRA are noted in Table 3-1. All 38 marine mammal species identified in Table 3-1 are protected by the MMPA and five are also listed under the ESA. The five ESA-listed marine mammal species known to be present year-round or seasonally in the waters of southern New England are the sperm whale, North Atlantic right whale, fin whale, blue whale, and sei whale.

The West Indies humpback whale Distinct Population Segment (DPS), which inhabits the east coast of the U.S., was delisted from the endangered species list in 2016 (81 FR 62259). This large whale population is generally migratory, and individuals typically do not spend extended periods of time in a localized area. The waters of southern New England (including the Lease Area) are used by some of the other large whale species either seasonally to feed, or as habitat during seasonal movements between the more northern feeding areas and southern hemisphere breeding grounds (although some winter breeding areas exist farther offshore versus in the southerly latitudes). The mid-sized whale species (e.g., minke whale) and other large baleen whales are present year-round in the continental shelf and slope waters of the Lease Area. Their presence typically varies with prey availability and other habitat factors. The fin, sei, and North Atlantic right whales are likely to occur within the Lease Area and ECRA. The blue whale is not anticipated to occur within the Lease Area and ECRA and therefore will not be considered further in this analysis. While the presence of sperm whales in the survey location would be unlikely, species density data, as reported in Roberts *et al*. (2016), indicate the possibility of minimal project interaction with this species. This same dataset indicates that for other deep-diving marine mammal species, such as *Kogia* and beaked whales, species density approaches zero along the continental shelf landward of slope waters. Sightings data for these species are also almost exclusively along the continental shelf edge and slope areas (Waring *et al*. 2015). Therefore, the likelihood of occurrence of these other deep-diving whale species was discounted. Other species with some likelihood to occur in the Lease Area and ECRA include long-finned pilot whales, bottlenose dolphins, short-beaked common dolphins, Atlantic white-sided dolphins, Atlantic spotted dolphins, and Risso's dolphins, harbor porpoise, and gray seals, harbor seals, and harp seals (BOEM 2014).

The following subsections provide additional information on the biology, habitat use, abundance, distribution, and existing threats to marine mammals that are both common in the waters of southern New England and have the likelihood of occurring, at least seasonally, in the Lease Area and ECRA. The remaining species listed in Table 3-1 are not expected to occur within the Lease Area and ECRA because they would be expected to occur further offshore as they prefer deeper water, or range further north/south; therefore, these species will not be described further in this analysis.

4.1 Mysticetes

4.1.1 North Atlantic Right Whale (*Eubalaena glacialis*) – Endangered

The North Atlantic right whale was listed as a federal endangered species in 1970 and is considered one of the most critically endangered large whale species in the world (Clapham *et al*. 1999; Weinrich *et al*. 2000; Hayes *et al*. 2019; 71 FR 77704; 73 FR 12024). The North Atlantic right whale has seen a nominal two percent recovery rate since it was listed as a protected species (Waring *et al*. 2015), which is much lower than the recovery rate of seven to eight percent documented for the Southern right whale DPS in the Southern Hemisphere (Knowlton and Kraus 2001). Right whales are considered grazers as they swim slowly with their mouths open. They are the slowest swimming whales and can only reach speeds up to 10 miles (mi) (16 km) per hour. They typically dive between 80 and 175 m and stay submerged for typically 10 to 15 minutes, following their prey below the surface (Baumgartner and Mate 2003). Right whales' hearing is in the low-frequency range (Southall *et al*. 2007, 2019).

The North Atlantic right whale is a strongly migratory species that moves annually between high-latitude feeding grounds and low-latitude calving and breeding grounds. The present range of the western North Atlantic right whale population extends from the southeastern U.S., which is utilized for wintering and calving, to summer feeding and nursery grounds in New England, the Bay of Fundy, and the Gulf of St. Lawrence (Kenney 2017; Hayes *et al*. 2019). The winter distribution of North Atlantic right whales is largely unknown, although offshore surveys have reported one to 13 detections annually from 1996 to 2001 in northeastern Florida and southeastern Georgia (Hayes et al 2019). A few events of right whale calving have been documented from shallow coastal areas and bays (Kenney 2017). Some evidence provided through acoustic monitoring suggests that not all individuals of the population participate in annual migrations, with a continuous presence of North Atlantic right whales occupying their entire habitat range throughout the year, particularly north of Cape Hatteras (Davis *et al*. 2017). These data also recognize changes in population distribution throughout the right whale habitat range that could be due to environmental or anthropogenic effects, a response to short-term changes in the environment, or a longer-term shift in the right whale distribution cycle. For example, since 2010, there has been an apparent shift in North Atlantic right whale habitat use, with decreasing use of the Great South Channel and increasing use of Cape Cod Bay (Davis *et al*. 2017; Mayo *et al*. 2018).

Three critical habitat areas were designated for this species in 1994: (1) the Cape Cod Bay/Stellwagen Bank, (2) the Great South Channel, and (3) waters adjacent to the coasts of Georgia and the east coast of Florida (59 FR 28805). In 2016, NMFS issued a final rule to replace the critical habitat for right whales in the North Atlantic with two new areas. The areas being designated as critical habitat contain approximately 29,763 square nautical miles of marine habitat in the Gulf of Maine and Georges Bank region (Unit 1) and off the Southeast U.S. coast (Unit 2) (81 FR 4837). No critical habitat for the North Atlantic right whale occurs in the Lease area; however, the Northeastern U.S. Foraging Area Unit 1 (Figure 4-1) falls within a potential ECRA. Unit 1 contains approximately 29,763 nm^2 of marine habitat in the Gulf of Maine and Georges Bank region (Figure 4-1).

Observations in December 2008 noted congregations of more than 40 individual North Atlantic right whales in the Jordan Basin area of the Gulf of Maine, leading researchers to believe this may be a wintering ground (NOAA Fisheries 2008). A right whale satellite tracking study within the northeast Atlantic (Baumgartner and Mate 2005) reported that this species often visited waters exhibiting low bottom water temperatures, high surface salinity, and high surface

stratification, most likely for higher food densities. North Atlantic right whales may be found in feeding grounds within New England waters between February and May, with peak abundance in late March (NOAA 2005). While in New England, North Atlantic right whales feed mostly on copepods belonging to the *Calanus* and *Pseudocalanus* genera (Hayes *et al*. 2019).

The North Atlantic right whale was the first species targeted during commercial whaling operations and was the first species to be greatly depleted as a result of whaling operations (Kenney 2017). North Atlantic right whales were hunted in southern New England until the early twentieth century. Shore-based whaling in Long Island involved catches of right whales year-round, with peak catches in spring during the northbound migration from calving grounds off the southeastern U.S. to feeding grounds in the Gulf of Maine (Kenney and Vigness-Raposa 2010). Abundance estimates for the North Atlantic right whale population vary. From the 2003 United States Atlantic and Gulf of Mexico Marine Mammal Stock Assessments, there were only 291 North Atlantic right whales in existence, which is fewer than what was reported in the Northern Right Whale Recovery Plan written in 1991 (NMFS 1991a; Waring *et al*. 2004). Pre-exploitation numbers are estimated at around 1,000 individuals. When the right whale was finally protected in the 1930s, the North Atlantic right whale population was roughly 100 individuals (Waring *et al*. 2004). In 2015, the Western North Atlantic population size was estimated to be at least 476 individuals (Waring *et al*. 2016). That population size estimate decreased to 440 individuals in 2017 (Hayes *et al*. 2017), with a median estimate of abundance of 451 in 2018 (Hayes *et al*. 2019). Additional information provided by Pace *et al*. (2017) confirms that the probability that the North Atlantic right whale population has declined since 2010 is 99.99 percent. Data indicate that the number of adult females dropped from 200 in 2010 down to 186 in 2015, while males dropped from 283 to 272 in the same timeframe. Also cause for concern is the confirmed mortality of 14 individuals in 2017 alone (Pace *et al*. 2017).

The most recent stock assessment report noted that studies by van der Hoop *et al*. (2015) have concluded large whale vessel strike mortalities decreased inside active Seasonal Management Areas (SMAs) (Figure 4-2) but have increased outside inactive SMAs. An unusual mortality event (UME) for the species was declared in June 2017 and since then, 30 North Atlantic right whales have stranded (21 in Canada; 9 in the U.S.) (NOAA Fisheries 2019a). The major cause of the UME is vessel strikes and gear entanglement. Figure 4-2 presents speed restrictions for vessels during North Atlantic right whale migration season.

North Atlantic right whales have been observed in or near waters south of New England during all four seasons; however, they are most common in the spring when they are migrating north and in the fall during their southbound migration (Kenney and Vigness-Raposa 2010; Roberts *et al*. 2016). In the Massachusetts and Rhode Island WEA, there were 59 sightings (144 individuals) of this species between 2011 and 2015, with greatest abundance in spring (Leiter *et al*. 2017; Stone *et al*. 2017).

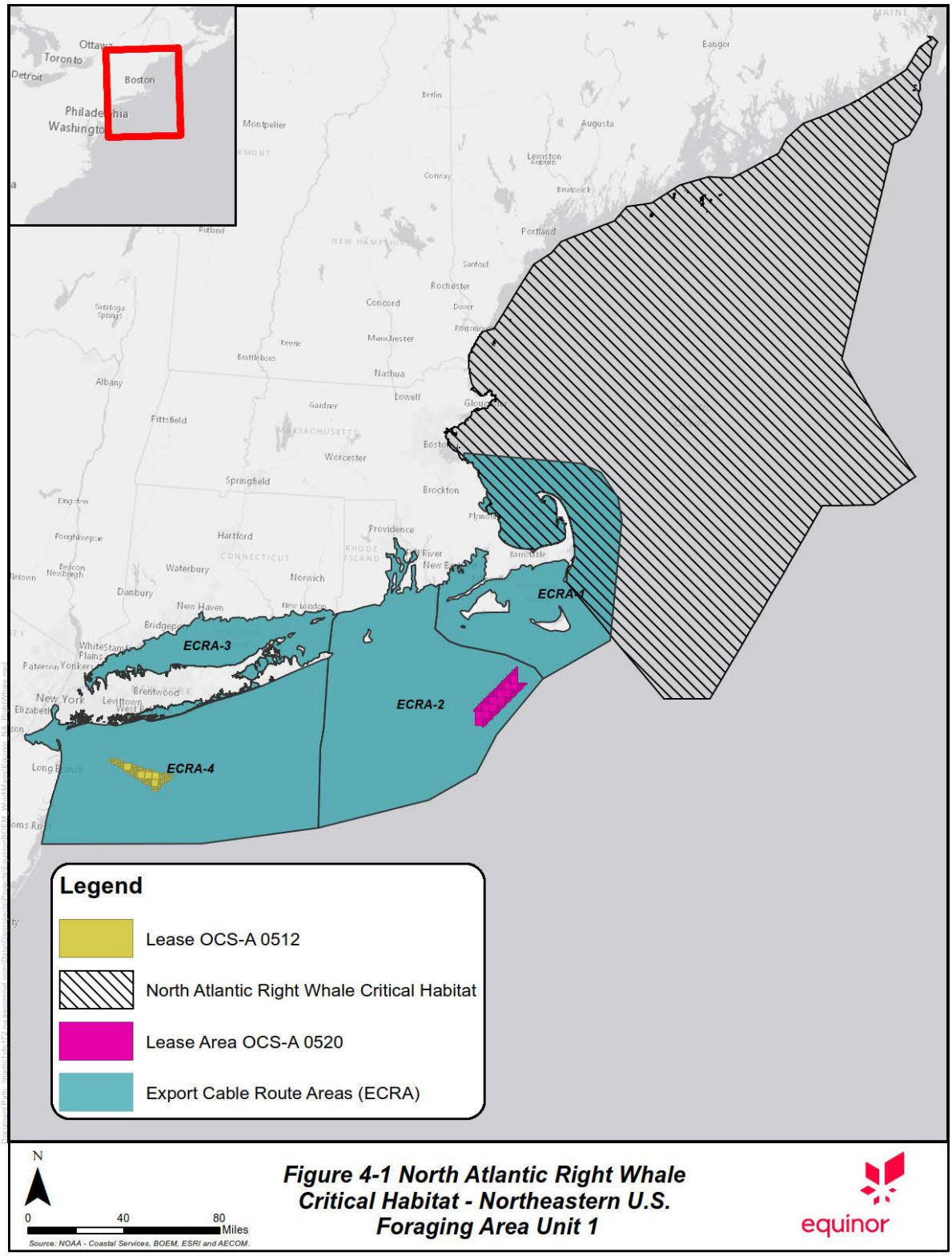

***Figure 4-1**. North Atlantic Right Whale Critical Habitat Foraging Area Unit 1*.

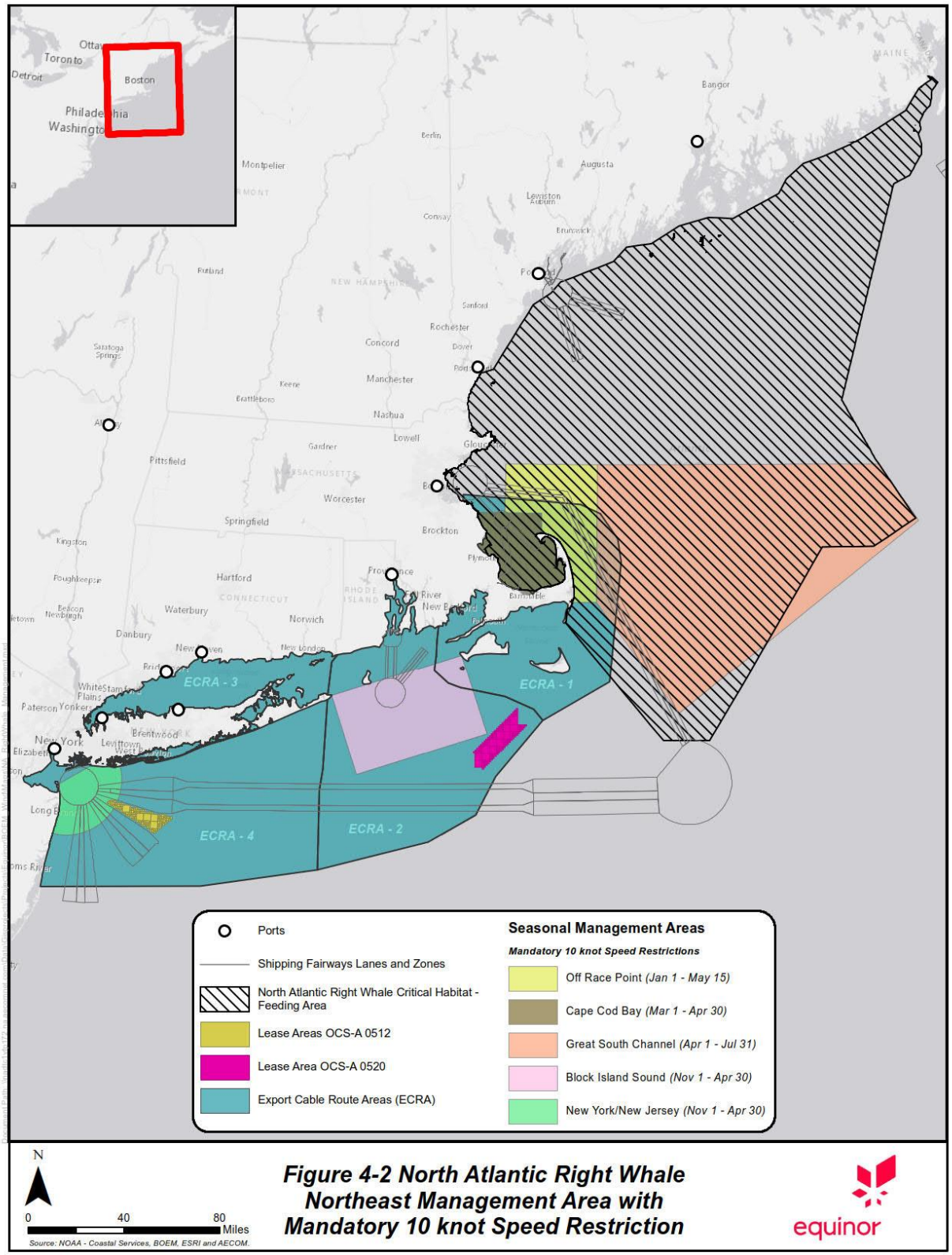

Figure 4-2 North Atlantic Right Whale Northeast Management Area with Mandatory 10 knot Speed Restriction

***Figure 4-2**. North Atlantic Right Whale Management Area with Speed Restriction*

4.1.2 Humpback Whale (*Megaptera novaeangliae*) – Non-Strategic

The humpback whale was listed as endangered in 1970 due to population decreases resulting from overharvesting. In September 2016, NMFS revised the ESA listing for the humpback whale to identify 14 DPSs based on breeding populations: West Indies, Cape Verde Islands/Northwest Africa, Hawaii, Mexico, Central America, Brazil, Gabon/Southwest Africa, Southeast Africa/Madagascar, West Australia; East Australia, Oceania, Southeastern Pacific, and Arabian Sea (81 FR 62259). Under this new final rule, humpback whales are considered endangered in the Cape Verde Islands/Northwest Africa, Western North Pacific, Central America, and Arabian Sea DPSs and are considered threatened in the Mexico DPS. For all the remaining DPSs, including the West Indies DPS, to which humpback whales along the east coast of the U.S. belong, humpback whales are no longer listed as endangered or threatened.

Humpback whales feed on small prey that is often found in large concentrations, including krill and fish such as herring and sand lance (Kenney and Vigness-Raposa 2010; Hayes *et al*. 2019). Humpback whales are thought to feed mainly while migrating and in summer feeding areas; little feeding is known to occur in their wintering grounds. Humpback whales feed over the continental shelf in the North Atlantic between along the east coast of the U.S, the Gulf of St. Lawrence, Newfoundland/Labrador, and western Greenland (Katona and Beard 1990), consuming roughly 95 percent small schooling fish and five percent zooplankton (i.e., krill), and they will migrate throughout their summer habitat to locate prey (Kenney and Winn 1986). They swim below the thermocline to pursue their prey, so even though the surface temperatures may be warm, they are frequently swimming in cold water (NMFS 1991b). Humpback whales from the North Atlantic migrate to the breeding grounds in the West Indies during winter (Clapham and Mayo 1987; Robbins *et al*. 2001; MacKay *et al*. 2016; Hayes *et al*. 2019), where calves are born between January and March (Baraff and Weinrich 1993; Robbins 2007). Their hearing is in the low-frequency range (Southall *et al*. 2007, 2019).

Humpback whales occur off southern New England in all four seasons, with peak abundance in spring and summer. The whales exhibit consistent fidelity to feeding areas within the northern hemisphere (Stevick *et al*. 2006). In winter, whales from waters in the Gulf of Maine, Gulf of St. Lawrence, western Greenland, Iceland, and Norway migrate to mate and calve primarily in the West Indies (including the Bahamas, Turks and Caicos Islands, Silver Bank, Samaná Bay, Puerto Rico and the Lesser Antilles), where spatial and genetic mixing among these groups occurs (Katona and Beard 1990; Mattila *et al*. 1989; MacKay *et al*. 2016; Stevick *et al*. 2018). While migrating, humpback whales utilize the mid-Atlantic as a migration pathway between calving/mating grounds to the south and feeding grounds in the north (Waring *et al*. 2007). Since 1989, observations of juvenile humpback whales in the mid-Atlantic have been increasing during the winter months, peaking January through March (Swingle *et al*. 1993). Biologists theorize that non-reproductive animals may be establishing a winter-feeding range in the mid-Atlantic since they are not participating in reproductive behavior in the Caribbean. Swingle *et al*. (1993) identified a shift in distribution of juvenile humpback whales in the nearshore waters of Virginia, primarily in winter months (Aschettino *et al*. 2015, 2016, 2017, 2018, 2019) (Virginia had the greatest number of strandings from 2016 to 2019; NOAA Fisheries 2019b). This is exemplified from 2016 to May 2019, where Virginia had the highest number of strandings along the western Atlantic coast from Maine to Florida (NOAA Fisheries 2019b).

Humpback whales were hunted as early as the seventeenth century, with most whaling operations having occurred in the nineteenth century (Kenney and Vigness-Raposa 2010). Before whaling activities, it was thought that the abundance of whales in the North Atlantic stock was in excess of 15,000 (Nowak 2002). By 1932, commercial hunting within the North Atlantic

may have reduced the humpback whale population to as few as 700 individuals (Breiwick *et al*. 1983). Humpback whales were commercially exploited by whalers throughout their range until they were protected in the North Atlantic in 1955 by the International Whaling Commission ban. Humpback whaling ended worldwide in 1973 (Jefferson *et al*. 2015).

A UME for humpback whales was declared in January 2016, and since then, 105 humpback whales have stranded between Maine and Florida, with approximately 50% due to ship strike or entanglement (NOAA Fisheries 2019b). The humpback whale population within the North Atlantic has been estimated to include approximately 11,570 individuals (Waring *et al*. 2015, 2016). Through photographic population estimates, humpback whales within the Gulf of Maine have been estimated to consist of 600 individuals in 1979 (NMFS 1991b). According to the latest species stock assessment report, the most reliable estimate of abundance for the Gulf of Maine stock of humpback whales is, at a minimum, 896 individuals (Hayes *et al*. 2019).

Humpback whales have been observed in or near waters south of New England during all four seasons; however, they are most common in the spring and summer when they are migrating north (Roberts *et al*. 2016; Stone *et al*. 2017). Twelve humpback whales were sighted in the vicinity of the Lease Area and ECRA between 2011 and 2012 in the southern portion of the Massachusetts WEA (Kraus *et al*. 2013). In the Massachusetts and Rhode Island WEA, there were 82 sightings (160 individuals) of this species between 2011 and 2015, with greatest abundance in spring (Stone *et al*. 2017).

4.1.3 Fin Whale (*Balaenoptera physalus*) – Endangered

The fin whale was listed as federally endangered in 1970 and is considered a strategic stock although no critical habitat is designated. The fin whale is MMPA depleted throughout its range. NMFS initiated a 5-year review of the fin whale in January 2018 to determine whether a reclassification or delisting may be warranted (83 FR 4032; NMFS 2019). In February 2019, the review indicated that, based on the most reliable available scientific and commercial information, the fin whale should be downlisted from endangered to threatened; however, this downlisting has not occurred and is recommended for future action (NMFS 2019). A final recovery plan was written for fin whales in 2010 (NMFS 2010).

Fin whales' range in the North Atlantic extends from the Gulf of Mexico, Caribbean Sea, and Mediterranean Sea in the south to Greenland, Iceland, and Norway in the north (Jonsgård 1966; Gambell 1985). They are the most commonly sighted large whales in continental shelf waters from the mid-Atlantic coast of the U.S. to Nova Scotia (Sergeant 1977; Sutcliffe and Brodie 1977; Cetacean and Turtle Assessment Program (CeTAP) 1982; Hain *et al*. 1992; Waring *et al*. 2008). Fin whales, much like humpback whales, seem to exhibit site fidelity (Kenney and Vigness-Raposa 2010; Hayes *et al*. 2019). However, fin whales habitat use has shifted in the southern Gulf of Maine, most likely due to changes in the abundance of sand lance and herring, both of which are major prey species along with squid, krill, and copepods (Kenney and Vigness-Raposa 2010). While fin whales typically feed in the Gulf of Maine and the waters surrounding New England, mating and calving (and general wintering) areas are still largely unknown (Hayes *et al*. 2019).

The overall pattern of fin whale movement is complex, consisting of a less obvious north-south pattern of migration than that of right and humpback whales. Based on acoustic recordings from hydrophone arrays, Clark (1995) reported a general southward flow pattern of fin whales in the fall from the Labrador/Newfoundland region, past Bermuda, and into the West Indies. The overall distribution may be based on prey availability, as this species preys opportunistically on

both invertebrates and fish (Watkins *et al*. 1984). Fin whale abundance off the coast of the northeastern U.S. is highest between spring and fall, with some individuals remaining during the winter (Hain *et al*. 1992). Past estimates of fin whale abundance conducted between Georges Bank and the Gulf of St. Lawrence during the feeding season in August 2006, places the western North Atlantic fin whale populations at 2,269 individuals (Waring *et al*. 2007). More recent estimates indicate the western North Atlantic fin whale population is 1,618 individuals (Hayes *et al*. 2019). Fin whales are the second largest living whale species on the planet (Kenney and Vigness-Raposa 2010). The gestation period for fin whales is approximately 11 months and calve births occur between late fall and winter. Females can give birth every two to three years. Their hearing is in the low-frequency range (Southall *et al*. 2007, 2019).
From 2008 to 2012, the minimum annual rate of mortality for the North Atlantic stock from anthropogenic causes was approximately 3.35 per year (Waring *et al*. 2015) while from 2010 to 2014, this number has increased to 3.8 (Hayes *et al*. 2017). There have not been any UMEs documented for fin whales in the last three decades. Increase in ambient noise has also impacted fin whales, for whales in the Mediterranean have demonstrated at least two different avoidance strategies after being disturbed by tracking vessels (Jahoda *et al*. 2003). The most reliable abundance estimate available for the western North Atlantic fin whale stock is 1,618 (Hayes *et al*. 2019).

Fin whales are present in waters south of New England waters during all four seasons. In spring, summer, and fall, the main center of their distribution is in the Great South Channel area to the east of Cape Cod, which is a well-known feeding ground (Kenney and Winn 1986). Winter is the season of lowest overall abundance, but they do not depart the area entirely. Fin whales are the most common large whale encountered in continental shelf waters. They are the whales most often encountered by local whale-watching operations in most years and are likely to occur in the vicinity of the Lease Area and ECRA. From 2011 and 2012 surveys, the fin whale was the most acoustically present species during all 12 months (Kraus *et al*. 2013). Fin whales were sighted 86 times (154 individuals) in WEA surveys from 2011 to 2015 in Massachusetts and Rhode Island and were the most commonly encountered large whale, with highest abundance in spring and summer (Stone *et al*. 2017).

4.1.4 Sei Whale (*Balaenoptera borealis*) – Endangered

The sei whale was listed as federally endangered in 1970 and a final recovery plan was published for the species in 2011 (NOAA Fisheries 2011). The stock that resides in the U.S. Exclusive Economic Zone (EEZ) is the Nova Scotian stock, which is highly migratory from the northeast U.S. to Newfoundland (Hayes *et al*. 2017). Sei whales typically inhabit deeper offshore waters of the OCS (Hain *et al*. 1985; BOEM 2014). However, they have been known to episodically enter shallow inshore waters (Payne *et al*. 1990; Flinn *et al*. 2002; Hayes *et al*. 2017). Of the other large whales considered in this application, sei whales are the least abundant species in the Lease Area and ECRA (Kraus *et al*. 2016). However, there is still a possibility that this species may be encountered during surveying in the Lease Area and ECRA (Right Whale Consortium 2014). The major prey of sei whales are copepods, in addition to small schooling fish and squid (Flinn *et al*. 2002). Sei whales are generally sighted traveling in small groups (less than five individuals), but it is not unusual for larger congregations to be found in feeding grounds (NOAA Fisheries 2018). Their hearing is in the low-frequency range (Southall *et al*. 2007, 2019).

Sei whales migrate from south of Cape Cod to the eastern Canadian coast in June and July and return again in September and October (Waring *et al*. 2014, 2016). Sei whales are most abundant in deep southern New England waters in summer and absent in winter (Waring *et al*.

2014, 2016; Roberts *et al*. 2016). This species was sighted 25 times (41 individuals) in the Massachusetts and Rhode Island WEA from 2011 and 2015 only in spring and summer (Stone *et al*. 2017). The most recent estimate of abundance for the Nova Scotia stock of sei whales is 357 (Hayes *et al*. 2019). This is considered a low estimate as sei whales inhabit deep offshore waters that has not been surveyed to a great extent. In addition, there is insufficient information to determine population trends for the species.

4.1.5 Common Minke Whale (*Balaenoptera acutorostrata*) – Non-Strategic

Common minke whales (referred to as minke whales) are among the most widely distributed of all the baleen whales. They occur in the North Atlantic and North Pacific, from tropical to polar waters. Minke whales range between 6 and 9 m (20 and 30 ft) with maximum lengths of 9 to 10 m (30 to 33 ft) and are the smallest of the North Atlantic baleen whales (Jefferson *et al*. 1993; Wynne and Schwartz 1999; Kenney and Vigness-Raposa 2010). The primary prey species for minke whales are most likely sand lance, clupeids, gadoids, and mackerel (Kenney and Vigness-Raposa 2010). These whales basically feed below the surface of the water, and calves are usually not seen in adult feeding areas. Minke whales are almost absent from OCS waters off the western Atlantic in winter; however, they are common in the fall and abundant in spring and summer (CeTAP 1982; Kenney and Vigness-Raposa 2010). In the 2015 stock assessment, the estimate for minke whales in the Canadian East Coast stock was 20,741 (Waring *et al*. 2016). This population estimate substantially decreased to 2,591 individuals in the most recent stock assessment because estimates older than eight years were excluded from the newest estimate (Hayes *et al*. 2019). This new estimate should not be interpreted as a decline in abundance of this stock, as previous estimates are not directly comparable (Hayes *et al*. 2019). Minke whales have been observed south of New England during all four seasons; however, widespread abundance is highest in spring through fall (Waring *et al*. 2016). Their hearing is in the low-frequency range (Southall *et al*. 2007, 2019). This species has been sighted in the vicinity of the Lease Area and ECRA in surveys from 2011 and 2012 in all months but October and December (Kraus *et al*. 2013). During WEA surveys from 2011 to 2015, 105 minke whales were sighted 85 times, with highest abundance in spring (Stone *et al*. 2017).

Minke whales are usually seen either alone or in small groups, although large aggregations sometimes occur in feeding areas (Reeves *et al*. 2002). Minke whale populations are often segregated by sex, age, or reproductive condition. Known for their curiosity, minke whales often approach boats.

A UME was declared for minke whales in January 2017, with 78 total strandings since then from Maine to South Carolina due to entanglement and infectious disease (NOAA Fisheries 2019c). In addition, hunting for minke whales continues today, by Norway in the northeastern North Atlantic, and by Japan in the North Pacific and Antarctic (Reeves *et al*. 2002). International trade in the species is currently banned. The most reliable available current abundance estimate is 2.591 individuals; however, this estimate only covers U.S. waters and slightly beyond into Canadian waters, and thus does not cover the habitat of the entire Canadian East Coast stock. The recent abundance estimate for the entire Canadian East Coast stock is 20,741 individuals from 2007, which covers a larger portion of this stock including Nova Scotian and Newfoundland Canadian waters (Hayes *et al*. 2019). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NMFS considers this species as “non-strategic” (Hayes *et al*. 2019).

4.2 Odontocetes

4.2.1 Sperm Whale (*Physeter macrocephalus*) – Endangered

Sperm whales are listed as endangered under the ESA and are considered a strategic stock by NMFS (Hayes *et al*. 2019). Data are insufficient to assess population trends, and the current abundance estimate was based on only a fraction of the known stock range (Hayes *et al*. 2019). For the North Atlantic, the most reliable estimate of abundance of 2,288 and the minimum population size estimate of 1,815 individuals (NMFS 2015; Hayes *et al*. 2019).

Sperm whales are highly social, with a basic social unit consisting of 20 to 40 adult females, calves, and some juveniles (Rice 1998; Whitehead 2017). During their prime breeding period and old age, male sperm whales are essentially solitary. Males rejoin or find nursery groups during prime breeding season. While foraging, sperm whales typically gather in small clusters. Between diving bouts, sperm whales are known to raft together at the surface. Adult males often forage alone. Groups of females may spread out over distances greater than 0.5 nm (0.9 km) when foraging. When socializing, they generally gather into larger surface-active groups (Whitehead 2003; Jefferson *et al*. 2015). In the Northern Hemisphere, the peak breeding season for sperm whales occurs between March and June, and in the Southern Hemisphere, between October and December (Best *et al*. 1984; NMFS 2015). Sperm whale hearing is in the mid-frequency range (Southall *et al*. 2007, 2019).

This species primarily preys on squid and octopus and are also known to prey on fish, such as lumpsuckers and redfish (Clarke 1980, 1996; Martin and Clarke 1986). Although sperm whales are generalists in terms of prey, specialization does appear to occur in a few places. The main sperm whale feeding grounds are correlated with increased primary productivity caused by upwelling.

The sperm whale is thought to have a more extensive distribution than any other marine mammal, except possibly the killer whale. Sperm whales are found in polar to tropical waters, from approximately 70° N to 70° S (Rice 1998; Whitehead 2003). This species has a range throughout global deep oceans, essentially from equatorial zones to the edges of the polar pack ice. In the Atlantic, sperm whales are found throughout the Gulf Stream and North Central Atlantic Gyre. Sperm whales were sighted four times (nine individuals) in 2011 to 2015 surveys in the Massachusetts and Rhode Island WEAs (Stone *et al*. 2017).

Sperm whales show a strong preference for deep waters (Rice 1998; Whitehead 2003). Sperm whale concentrations near bathymetric drop-offs and areas with strong currents and steep topography are correlated with high prey productivity. These whales occur almost exclusively at the shelf break, regardless of season (New York Department of State (NYDOS) 2013). Their distribution is typically associated with waters over the continental shelf break and the continental slope and into deeper waters (Whitehead *et al*. 1992; Jefferson *et al*. 2015). Migrations of sperm whales are not as regular or as well understood as those of most baleen whales. Sperm whales are widely distributed and dependent on their food source. Their migrations are not as specifically tied to seasons as seen in large baleen whale species. In some mid-latitudes, there appears to be a general seasonal north-south migration, with whales moving poleward in summer, but, in equatorial and some temperate areas, there is no clear seasonal migration. In the North Atlantic, specifically off New York and Nova Scotia, sperm whales are sighted regularly in waters less than 300 m deep (Rice 1998; Whitehead 2003).

4.2.2 Risso's Dolphin (*Grampus griseus*) – Non-Strategic

Risso's dolphins have a worldwide distribution (CeTAP 1982; Jefferson *et al*. 2014, 2015), and are common to the U.S. east coast OSC and shelf edge (BOEM 2014) and are found in the northwest Atlantic from Florida to Newfoundland (Leatherwood *et al*. 1976; Baird and Stacey 1991; Hayes *et al*. 2019). Risso's dolphins tend to feed primarily on squid, but also prey on anchovies, krill, or other cephalopods (NOAA 2018b). There is currently not enough information to distinguish between separate stocks in the northwest Atlantic, but the Gulf of Mexico and Atlantic are treated as two separate stocks (Hayes *et al*. 2019).

Risso's dolphins are common on the continental northwest Atlantic shelf in summer and fall, with low abundance in winter and spring (Payne *et al*. 1984; Roberts *et al*. 2016). They have been sighted mostly outside and south of the Massachusetts WEA, primarily in summer and fall (BOEM 2014). Risso's dolphins were only sighted three times (one individual for each sighting) in the Massachusetts and Rhode Island WEA surveys from 2011 to 2015 (Stone *et al*. 2017). While the Risso's dolphin is thought to be relatively abundant in New England waters, they inhabit deeper, offshore waters compared to the Lease Area and Export Cable Route Area (Kenney and Vigness-Raposa 2010). The most reliable abundance estimate for Risso's dolphin is 18,250, as derived from 2011 surveys (Waring *et al*. 2016; Hayes *et al*. 2019).

4.2.3 Pilot Whale (*Globicephala* spp.) – Strategic

There are two species of pilot whales that occur in the western North Atlantic. These two species, the long-finned pilot whale (*Globicephala melas*) and short-finned pilot whale (*Globicephala macrorhynchus*), are difficult to identify to species level at sea (Rone *et al*. 2012; Hayes *et al*. 2017). Pilot whales are social animals that tend to be found in large, stable aggregations (Olson 2017). They feed on squid, but also prey on small and medium-sized fish (NOAA Fisheries 2018c, 2018d). While long and short-finned pilot whales are likely to overlap between New Jersey and Georges Bank (Payne and Heinemann 1993; Hayes *et al*. 2017), long-finned pilot whales have the more northerly distribution and are more likely to be found in the Lease Area and ECRA than short-finned pilot whales. Long-finned pilot whales have been found stranded as far south as South Carolina while short-finned pilot whales have been found stranded as far north as Massachusetts (Pugliares *et al*. 2016; Hayes *et al*. 2017). However, the latitudinal distributions of these two species are uncertain (Hayes *et al*. 2019). Both species are present in deep offshore waters of the U.S. east coast in winter and spring (CeTAP 1982; Payne and Heinemann 1993; Abend and Smith 1999; Hamazaki 2002). Pilot whales also tend to follow migrations of their prey and move inshore in summer and fall (Reeves *et al*. 2002). One hundred twenty-one mixed pilot whale individuals were sighted 15 times from 2011 to 2015 in surveys of the Massachusetts and Rhode Island WEAs (Stone *et al*. 2017).

For both species of pilot whale, habitat-based density models provide an abundance estimate of 18,977 animals in the U.S. EEZ (Roberts *et al*. 2016). The most reliable estimate of abundance for western North Atlantic long-finned pilot whales is 5,636 animals and for short-finned pilot whales is 28,924 animals (Hayes *et al*. 2019).

4.2.4 Atlantic White-Sided Dolphin (*Lagenorhynchus acutus*) – Non-Strategic

The Atlantic white-sided dolphin is typically found at a depth of 100 m (330 ft) in the cool temperate and subpolar waters of the North Atlantic, generally along the continental shelf between the Gulf Stream and the Labrador current to as far south as North Carolina (Bulloch 1993; Reeves *et al*. 2002; Jefferson *et al*. 2015). They are the most abundant dolphin in the Gulf of Maine and the Gulf of St. Lawrence but seem relatively rare along the North Atlantic coast of Nova Scotia (Kenney and Vigness-Raposa 2010).

Atlantic white-sided dolphins range between 2.5 m and 2.8 m (8.2 ft and 9.2 ft) in length, with females being approximately 20 centimeters (shorter than males (Kenney and Vigness-Raposa 2010). Their hearing is in the mid-frequency range (Southall *et al*. 2007, 2019). This species is highly social and is commonly seen feeding with fin whales (NOAA 1993). Atlantic white-sided dolphins feed on a variety of small species, such as herring, hake, smelt, capelin, cod, and squid, with regional and seasonal changes in the species consumed (Kenney and Vigness-Raposa 2010). Sand lance is an important prey species for these dolphins in the Gulf of Maine during the spring. Other fish prey include mackerel, silver hake, herring, smelt, and several other varieties of gadoids (Kenney and Vigness-Raposa 2010). There are seasonal shifts in the distribution of Atlantic white-sided dolphins off the northeastern U.S. coast, with low abundance in winter between Georges Basin and Jeffreys Ledge and high abundance in the Gulf of Maine during spring. During the summer, Atlantic white-sided dolphins are most abundant between Cape Cod and the lower Bay of Fundy. During the fall, the distribution of Atlantic white-sided dolphins is similar to that in the summer, although they are less abundant (Department of the Navy (DoN) 2005). Recent population estimates for Atlantic white-sided dolphins in the Western North Atlantic Ocean places this species at 48,819 individuals (Hayes *et al*. 2019).

This species may be found off the coast of southern New England during all seasons of the year but is usually most numerous in areas farther offshore at depth range of 100 m (330 ft) (Bulloch 1993; Reeves *et al*. 2002; Kenney and Vigness-Raposa 2010). Atlantic white-sided dolphins were sighted 7 times (222 individuals) in 2011 to 2015 surveys of the Massachusetts and Rhode Island WEAs (Stone *et al*. 2017).

4.2.5 Short-Beaked Common Dolphin (*Delphinus delphis*) – Non-Strategic

The short-beaked common dolphin is one of the most widely distributed cetaceans and occurs in temperate, tropical, and subtropical regions (Jefferson *et al*. 2015). Short-beaked common dolphins feed on squids and small fish, including species that school in proximity to surface waters as well as mesopelagic species found near the surface at night (Jefferson *et al*. 2015; Perrin 2017). They have been known to feed on fish escaping from fishermen's nets or fish that are discarded from boats (NOAA 1993). This species is found between Cape Hatteras and Georges Bank from mid-January to May, although they migrate onto Georges Bank and the Scotian Shelf between mid-summer and fall, where large aggregations occur on Georges Bank in fall (Hayes *et al*. 2019). These dolphins can gather in schools of hundreds or thousands, although the schools generally consist of smaller groups of 30 or fewer. They are eager bow riders and are active at the surface (Reeves *et al*. 2002). The short-beaked common dolphin feeds on small schooling fish and squid. While this dolphin species can occupy a variety of habitats, short-beaked common dolphins occur in greatest abundance within a broad band of the northeast edge of Georges Bank in the fall (Kenney and Vigness-Raposa 2010). According to the species stock report, the most reliable population estimate for the western North Atlantic short-beaked common dolphin is approximately 70,184 individuals (Hayes *et al*. 2019). Its hearing is in the mid-frequency range (Southall *et al*. 2007, 2019).

Short-beaked common dolphins can be found either along the 100- to 2,000-m (650- to 6,500-ft isobaths over the continental shelf and in pelagic waters of the Atlantic and Pacific Oceans (Hayes *et al*. 2019). They are present in the western Atlantic from Newfoundland to Florida (Perrin 2017; Hayes *et al*. 2019). The short-beaked common dolphin is especially common along shelf edges and in areas with sharp bottom relief such as seamounts and escarpments (Reeves *et al*. 2002). They show a strong affinity for areas with warm, saline surface waters. Off the coast of the eastern U.S., they are particularly abundant in continental slope waters from Georges Bank southward to about 35 degrees north (Reeves *et al*. 2002) and usually inhabit tropical, subtropical, and warm-temperate waters (Hayes *et al*. 2019). This species has been sighted in the vicinity of the Lease Area and Export Cable Route Area in 2011 and 2012 surveys (Kraus *et al*. 2013). 2,634 individuals were sighted over 64 sightings from 2011 to 2015 surveys of the Massachusetts and Rhode Island WEA areas.

4.2.6 Common Bottlenose Dolphin (*Tursiops truncatus*) – Non-Strategic

The common bottlenose dolphin (referred to as bottlenose dolphin) is a light- to slate-gray dolphin, roughly 2.4 to 3.7 m (8 to 12 ft) long with a short, stubby beak. Because this species occupies a wide variety of habitats, it is regarded as possibly the most adaptable cetacean (Reeves *et al*. 2002). It occurs in oceans and peripheral seas at both tropical and temperate latitudes. In North America, bottlenose dolphins are found in surface waters with temperatures ranging from 10 to 32°C (50 to 90°F). Its hearing is in the mid-frequency range (Southall *et al*. 2007, 2019).

There are two distinct bottlenose dolphin morphotypes: coastal and migratory. The coastal morphotype resides along the inner continental shelf (within 7.5 km [4.5 mi] of shore) and around islands and is subdivided into seven stocks based largely upon spatial distribution (Hayes *et al*. 2019). These animals often move into or reside in bays, estuaries, and the lower reaches of rivers (Reeves *et al*. 2002). Generally, the offshore migratory morphotype is found exclusively seaward of 34 km (21 mi) and in waters deeper than 34 m (112 ft) (Hayes *et al*. 2017). This offshore population extends along the entire continental shelf break from Georges Bank to Florida during the spring and summer months and has been observed in the Gulf of Maine during the late summer and fall. However, south of Cape Hatteras, these morphotype ranges overlap to some degree. NMFS species stock assessment report estimates the population of western North Atlantic offshore bottlenose dolphin stock at approximately 77,532 individuals (Hayes *et al*. 2019). This species has been sighted in the vicinity of the Lease Area and ECRA in 2011 and 2012 (Kraus *et al*. 2013). In addition, there were 34 sightings of 275 total individual common bottlenose dolphins during 2011 to 2015 surveys of the Massachusetts and Rhode Island WEA (Stone *et al*. 2017).

Bottlenose dolphins feed on a large variety of organisms depending on their habitat. The coastal, shallow population tends to feed on benthic fish and invertebrates, while deepwater populations consume pelagic or mesopelagic fish such as croakers, sea trout, mackerel, mullet, and squid (Reeves *et al*. 2002). Bottlenose dolphins appear to be active both during the day and night. Their activities are influenced by the seasons, time of day, tidal state, and physiological factors such as reproductive seasonality (Wells and Scott 2017).

4.2.7 Atlantic Spotted Dolphin (*Stenella frontalis*) – Non-Strategic

The Atlantic spotted dolphin inhabits tropical, warm waters of the western North Atlantic typically along the continental shelf (Leatherwood *et al*. 1976). They have a wide range of distribution in the western North Atlantic from southern New England through the Gulf of Mexico, extending south to the Caribbean and Venezuela (Leatherwood *et al*. 1976; Perrin *et al*. 1994). The diet of the Atlantic spotted dolphin consists of a wide variety of prey, such as fish, squid, and benthic invertebrates (Herzing 1997). The seasonal distribution of the Atlantic spotted dolphin is not well known, but it has been suggested that they travel more inshore in spring (Caldwell and Caldwell 1966; Fritts *et al*. 1983). The Atlantic spotted dolphin is hard to distinguish from the pantropical spotted dolphin (S. attenuata) at sea, and their range is likely to overlap in tropical waters (Perrin *et al*. 1987; Fulling *et al*. 2003; Mullin and Fulling 2003; Waring *et al*. 2016). Additionally, there are two ecotypes of Atlantic spotted dolphin, but one the smaller, less-spotted ecotype is not likely to occur in the Gulf of Mexico (Fulling *et al*. 2003; Mullin and Fulling 2003; Viricel and Rosel 2014). It is likely that the Atlantic spotted dolphin is relatively rare in the Lease Area and ECRA, as these dolphins typically spend their time along the continental shelf and southern New England is the northernmost area of their range, but they may still be affected by surveying activities (BOEM 2014). Their hearing is in the mid-frequency range (Southall *et al*. 2007, 2019). The most reliable abundance estimates for Atlantic spotted dolphins, from 2011 surveys, is 44,715 individuals (Hayes *et al*. 2019). There have been no recent UMEs declared for the Atlantic spotted dolphin. During the 2011 to 2015 surveys of the Massachusetts and Rhode Island WEA, Atlantic spotted dolphins were not seen (Stone *et al*. 2017).

4.2.8 Harbor Porpoise (*Phocoena phocoena*) – Non-Strategic

The harbor porpoise inhabits shallow, coastal waters, often found in bays, estuaries, and harbors. In the western Atlantic, they are found from Cape Hatteras north to Greenland (Hayes *et al*. 2019). They are likely to occur frequently in southern New England waters year-round but are most likely to be present in spring when migration brings them toward the Gulf of Maine feeding grounds from their wintering areas offshore and in the mid-Atlantic (Kenney and Vigness-Raposa 2010). After April, they migrate north towards the Gulf of Maine and Bay of Fundy. Harbor porpoises are the smallest North Atlantic cetacean, measuring at only 1.4 to 1.9 m (4.6 to 6.2 ft), and feed primarily on fish, but also prey on squid and crustaceans (Reeves and Reed 2002; Kenney and Vigness-Raposa 2010).

Sighting records from the 1978 to 1981 CeTAP surveys showed porpoises in spring exhibited highest densities in the southwestern Gulf of Maine in proximity to the Nantucket Shoals and western Georges Bank, with presence throughout the southern New England shelf and Gulf of Maine (CeTAP 1982). While strandings have occurred throughout the south shore of Long Island and coastal Rhode Island, many sightings have occurred offshore in the OCS area (Kenney and Vigness-Raposa 2010). From 2011 to 2015, there were 18 sightings of 91 total harbor porpoises in the Massachusetts and Rhode Island WEAs (Stone *et al*. 2017). The North Atlantic harbor porpoise population is likely to be over 500,000 (Kenney and Vigness-Raposa 2010). The current population estimate for harbor porpoise for the Gulf of Maine/Bay of Fundy stock is 79,833 (Hayes *et al*. 2019). Harbor porpoise hearing is in the high-frequency range (Southall *et al*. 2007, 2019).

In 2001, the harbor porpoise was removed from the candidate species list for the ESA; a review of the biological status of the stock indicated that a classification of “Threatened” was not warranted (Waring *et al*. 2009). This species has been listed as “non-strategic” because average annual human-related mortality and injury does not exceed the potential biological removal (Hayes *et al*. 2019).

4.3 Pinnipeds

4.3.1 Gray Seal (*Halichoerus grypus*) – Non-Strategic

The gray seal occurs in cold temperate to sub-arctic waters in the North Atlantic and is partitioned into three major populations occurring in eastern Canada, northwestern Europe, and the Baltic Sea (Kenney and Vigness-Raposa 2010; Jefferson *et al*. 2015). The western North Atlantic stock is considered to be the same population as the one found in eastern Canada, and ranges between New England and Labrador (Waring *et al*. 2007). As exhibited in harbor seal populations, gray seals occur most often in the waters off of Maine during winter and spring and spend summer and fall off northern Maine and in Canadian waters (DoN 2005). Gray seals exhibit sexual dimorphism, with adult males reaching 7.5 ft (2.3 m) long and females reaching 6.6 ft (2.0 m) (Jefferson *et al*. 1993; Wynne and Schwartz 1999; Kenney and Vigness-Raposa 2010). The gray seal is primarily found in coastal waters and forages in OCS regions (Lesage and Hammill 2001).

Gray seals are gregarious, gathering to breed, molt, and rest in groups of several hundred or more at island coasts and beaches or on land-fast ice and pack-ice floes. They are thought to be solitary when feeding and telemetry data indicates that some seals may forage seasonally in waters close to colonies, while others may migrate long distances from their breeding areas to feed in pelagic waters between the breeding and molting seasons (Reeves *et al*. 2002). Gray seals molt in late spring or early summer and may spend several weeks ashore during this time. When feeding, most seals remain within 45 mi (72 km) of their haul out sites. Gray seals feed on numerous fish species and cephalopods (Kenney and Vigness-Raposa 2010). Gray seal scat samples from Muskeget Island, Massachusetts, included species such as sand lance, skates, flounder, silver hake, and gadids (Kenney and Vigness-Raposa 2010).

Gray seals form colonies on rocky island or mainland beaches, though some seals give birth in sea caves or on sea ice, especially in the Baltic Sea. Gray seals prefer haul out and breeding sites that are surrounded by rough seas and riptides where boating is hazardous. Pupping colonies have been identified at Muskeget Island (Nantucket Sound), Monomoy National Wildlife Refuge, and in eastern Maine (Rough 1995). Total western Atlantic gray seal population estimates are not currently available (Hayes *et al*. 2019). However, the gray seal colony off Massachusetts has more than 5,600 seals total and there are more than 1,700 individuals in Maine (Waring *et al*. 2007). This species has been reported with greater frequency in waters south of Cape Cod in recent years, likely due to a population rebound in southern New England and the mid-Atlantic (Kenney and Vigness-Raposa 2010); however, most gray seals present are juveniles dispersing in the spring. The only consistent haul-out locations within the vicinity of the Lease Area and ECRA are along the sandy shoals around Monomoy and Nantucket in Massachusetts. WEA surveys from Massachusetts and Rhode Island have not reported any gray seal sightings; however, there were vertical camera detections of this species (Kraus *et al*. 2016).

Since July 2018, increased numbers of gray seal and harbor seal mortalities have occurred across Maine, New Hampshire, and Massachusetts (NOAA Fisheries 2019d). This event has been declared a 2018-2019 Pinniped UME along the northeast coast which encompasses all seal strandings from Maine to Virginia (NOAA Fisheries 2019d). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NMFS considers this species as “non-strategic” (Hayes *et al*. 2019).

4.3.2 Harbor Seal (*Phoca vitulina*) – Non-Strategic

Harbor seals are the most abundant seals in eastern U.S. waters and are commonly found in all nearshore waters of the Atlantic Ocean and adjoining seas above northern Florida; however, their "normal" range is probably only south to New Jersey. While harbor seals occur year-round north of Cape Cod, they only occur during winter migration, typically September through May, south of Cape Cod (Southern New England to New Jersey) (Kenney and Vigness-Raposa 2010; Hayes *et al*. 2019). During the summer, most harbor seals can be found north of New York, within the coastal waters of central and northern Maine, as well as the Bay of Fundy (DoN 2005). Harbor seals are relatively small pinnipeds, with adults ranging between 1.7 and 1.9 m (5.6 and 6.2 ft) in length, with females being slightly smaller than males (Jefferson *et al*. 1993; Wynne and Schwartz 1999; Kenney and Vigness-Raposa 2010). Their hearing ranges from 100 Hz to 12 kHz (Southall *et al*. 2007). WEA surveys from Massachusetts and Rhode Island have not reported any harbor seal sightings; however, there were vertical camera detections of this species (Kraus *et al*. 2016).

Harbor seals prey upon small to medium-sized fish, followed by octopus and squid, and lastly by shrimp and crabs (Kenney and Vigness-Raposa 2010). Fish eaten by harbor seals include commercially important species such as mackerel, herring, cod, hake, smelt, shad, sardines, anchovy, capelin, salmon, rockfish, sculpins, sand lance, trout, and flounders. They spend about 85 percent of the day diving, and much of the diving is presumed to be active foraging in the water column or on the seabed. They dive to depths of about 10 to 150 m (30 to 500 ft), depending on location. Harbor seals forage in a variety of marine habitats, including deep fjords, coastal lagoons and estuaries, and high-energy, rocky coastal areas. They may also forage at the mouths of freshwater rivers and streams, occasionally traveling several hundred miles upstream (Reeves *et al*. 2002). They haul out on sandy and pebble beaches, intertidal rocks and ledges, and sandbars, and occasionally on ice floes in bays near calving glaciers.

Except for a strong bond between mothers and pups, harbor seals are generally intolerant of close contact with other seals. Nonetheless, they are gregarious, especially during the molting season, which occurs between spring and autumn, depending on geographic location. They may haul out to molt at a tide bar, sandy or cobble beach, or exposed intertidal reef. During this haul-out period, they spend most of their time sleeping, scratching, yawning, and scanning for potential predators such as humans, foxes, coyotes, bears, and raptors (Reeves *et al*. 2002). In late autumn and winter, harbor seals may be at sea continuously for several weeks or more, presumably feeding to recover body mass lost during the reproductive and molting seasons and to fatten up for the next breeding season.

See Section 4.1.14 above regarding the 2018-2019 Pinniped UME along the Northeast Coast. Currently, the most reliable abundance estimate for harbor seals is approximately 75,834 for the Western North Atlantic stock (Hayes *et al*. 2019). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NMFS considers this species as "non-strategic" (Hayes *et al*. 2019).

4.3.3 Harp Seal (*Pagophilus groenlandicus*) – Non-Strategic

The harp seal occurs throughout much of the North Atlantic and Arctic Oceans (Ronald and Healey 1981; Lavigne and Kovacs 1988). The Western North Atlantic stock is also known as the Front/Gulf stock, which is a combination of the Front and Gulf herds that breed off the coast of Newfoundland and Magden Island in the Gulf of St. Lawrence, respectively (Hayes *et al*. 2019). Harp seals consume a variety of prey, such as pelagic and benthic fish species, invertebrates, and krill (NOAA Fisheries 2018d). They are a highly migratory species that congregate for

breeding from late February to April then assemble again for the annual molt (Sergeant 1965; Stenson and Sjare 1997). They continue north in the summer to their feeding grounds in the Arctic.

The southern limit of the harp seal's range extends into the U.S. EEZ in winter and spring (Hayes *et al*. 2019). Since the 1990's, harp seal sightings and strandings have increased in the U.S. from the coasts of Maine to New Jersey (Katona *et al*. 1993; Rubinstein 1994; Stevick and Fernald 1998; McAlpine 1999; Lacoste and Stenson 2000; Soulen *et al*. 2013). Most sightings or strandings have occurred from January to May when harp seals are at the southern extent of their yearly migration (Harris *et al*. 2002). While harp seals are the least likely pinniped to occur in the Lease Area and ECRA compared to gray seals or harbor seals (Kenney and Vigness-Raposa 2010), there is potential they may be encountered. However, WEA surveys from Massachusetts and Rhode Island have not reported any harp seal sightings (Kraus *et al*. 2016).

There is insufficient data to calculate the minimum population present in the U.S. due to low sighting rates (Hayes *et al*. 2019). The most reliable abundance estimate of the Western North Atlantic stock is 6.9 million harp seals. From 2012 to 2016, 174 harp seals stranded in the U.S. Since July 2018, increased numbers of gray seal and harbor seal mortalities have occurred across Maine, New Hampshire, and Massachusetts (NOAA Fisheries 2019d). This event has been declared a 2018-2019 Pinniped UME along the northeast coast which encompasses seal strandings from Maine to Virginia (NOAA Fisheries 2019d). Harp seals have also started stranding with clinical signs, again not in elevated numbers, and this species has been added to the UME investigation (NOAA Fisheries 2019d).

5. TYPE OF INCIDENTAL TAKING AUTHORIZATION REQUESTED

The type of incidental taking authorization that is being requested and the method of incidental taking.

5.1 Incidental Harassment Authorization

The Applicant is requesting authorization for take by Level B harassment of small numbers of marine mammals pursuant to Section 101(a)(5) of the MMPA and in accordance with 50 CFR § 216 Subpart I, incidental to the Applicant's marine site characterization surveys within the Lease Area and ECRA (see Section 2.2). If the activities specified in this request for an IHA are not completed within one year of IHA issuance, the Applicant plans to seek an IHA renewal.

5.2 Take Authorization Request

The exposure assessment methodology used in this request for an IHA quantifies potential noise exposures of marine mammals resulting from HRG surveys in the marine environment (Section 6). The applicant does not anticipate exposure to Level A threshold and thus is not requesting take authorization for Level A harassment. Sound levels associated with operation of certain types of HRG survey equipment may result in Level B harassment as defined under the MMPA. The Applicant's mitigation measures for HRG surveys are described in Section 11 and will decrease the likelihood that marine mammals will be exposed to sound pressure levels that would cause Level B harassment, although the amount of that decrease cannot be quantified.

The total number of potential exposure events listed in Section 6 is understood to be conservative. However, to allow for uncertainty regarding the exact mechanisms of the physical and behavioral effects, the Applicant is requesting authorization for potential take of 2,747 marine mammals by Level B harassment as detailed in Section 6.

5.3 Method of Incidental Taking

As detailed in Section 1, HRG surveys have the potential to disturb or displace small numbers of marine mammals. Certain types of HRG survey equipment is expected to generate underwater sound levels exceeding the 160 $dB_{RMS90\%}$ re 1 µPa threshold for Level B harassment for impulsive sound. Specifically, the proposed action may result in "take" in the form of Level B harassment from underwater noise generated during HRG surveys. Level A harassment is not anticipated (Section 1.4.1). See Section 11.1 for more details on the impact reduction and mitigation measures proposed.

6. TAKE ESTIMATES FOR MARINE MAMMALS

By age, sex, and reproductive condition (if possible), the number of marine mammals (by species) that may be taken by each type of taking identified in Section 5, and the number of times such takings by each type of taking are likely to occur.

The Applicant is requesting the "take" of small numbers of marine mammals. The only anticipated impacts to marine mammals are associated with noise and are limited to the use of geophysical survey equipment. This request is being submitted to specifically address survey sound-producing data acquisition equipment that operate below 200 kHz, in support of the Applicant's survey activities as detailed in Section 1.4. The 16 species potentially taken are described in Section 4.

The Applicant requests authorization for Level B harassment for the following 16 species:

1. Fin whale (*Balaenoptera physalus*)
2. Sei whale (*Balaenoptera borealis*)
3. Common minke whale (*Balaenoptera acutorostrata acutorostrata*)
4. Humpback whale (*Megaptera novaeangliae*)
5. Sperm whale (*Physeter macrocephalus*)
6. Atlantic white-sided dolphin (*Lagenorhynchus acutus*)
7. Atlantic spotted dolphin (*Stenella frontalis*)
8. Common bottlenose dolphin (*Tursiops truncatus truncatus*)
9. Pilot whale (Long-finned and Short-finned) (*Globicephalus melas* and *Globicephalus macrorhynchus*)
10. Risso's dolphin (*Grampus griseus*)
11. Short-beaked common dolphin (*Delphinus delphis delphis*)
12. Harbor porpoise (*Phocoena phocoena phocoena*)
13. Gray seal (*Halichoerus grypus atlantica*)
14. Harbor seal (*Phoca vitulina vitulina*)
15. Harp seal (*Pagophilus groenlandicus*)

Although the North Atlantic right whale occurs in the Lease Area and ECRA, Level B harassment is not anticipated from operation of HRG and geotechnical survey equipment during field activities.

6.1 Zone of Influence Calculations

The ZOI is a representation of the maximum extent of the ensonified area around a sound source over a 24-hour period. The ZOI for each piece of equipment operating below 200 kHz was calculated per the following formulae:

$$\text{Stationary Source: ZOI} = \pi r^2$$
$$\text{Mobile Source: ZOI} = (\text{Distance/day} \times 2r) + \pi r^2$$

where r is the linear distance from the source to the isopleth for Level A or Level B thresholds and day = 1.

The estimated distance of the daily vessel trackline was determined using the estimated average speed of the vessel (4 knots [7.4 km/hr]) and the 24-hour operational period. Using the maximum distance to the Level B harassment threshold for vessel surveys of 141 m (463 ft;

Table 1-3) associated with the Geo-Source 400 Tip 800 J sparker, and the estimated vessel track of approximately 177.6 linear km (110.3 mi) per 24-hour day, a maximum ZOI of 50.08 km^2 (19.34 square miles (mi^2)) was calculated (Table 6-1). For the purposes of the exposure analysis, it was assumed the Geo-Source 400 Tip 800 J sparker would be active during the entirety of the survey for that day. Thus, the ZOI of 50.08 km^2 (Table 6-1) calculated using the isopleth corresponding to the threshold for Level B harassment for the Geo-Source 400 Tip 800 J sparker (Table 1-3) was used as the basis of the take calculations for all marine mammals during vessel surveys.

For HF cetaceans, using the maximum distance to the Level A harassment threshold of 3.5 m (11.5 ft; Table 1-3) and estimated daily vessel track of approximately 177.6 km (110.3 mi), a maximum ZOI of 1.24 km^2 (0.48 mi^2) was calculated (Table 6-1). The Level A zones for all functional hearing groups are small (Table 1-3), and the likelihood of a Level A take is negligible, however; the zones are included here for completeness.

Table 6-1. Daily ZOI for to Level A and B Harassment during HRG Surveys.

Source	Areas of Level A ZOIs (km^2)				Areas of Level B ZOIs (km^2)	Deployment Platform
	LF (peak SPL/SEL_{cum})	MF (peak SPL/SEL_{cum})	HF (peak SPL/SEL_{cum})	PW (peak SPL/SEL_{cum})	All	
Medium Penetration Sub-bottom Profiler						
Geo-Source 400 Tip Sparker Source 800J	< 0.35	0	0.2	1.2	50.08	Survey Vessel

Note: HF = high-frequency; HPT = high performance transceiver; HRG = high-resolution geophysical; J = joules; km^2 = square kilometers; LF = low-frequency; MF = mid-frequency; PW = phocids in water; SBP = sub-bottom profiler; SEL_{cum} = cumulative sound exposure level; SPL = sound pressure level; ZOI = Zone of Influence.

6.2 Marine Mammal Density Estimates

The density calculation methodology applied to take estimates for this application is derived from the model results produced by Roberts *et al*. (2016), Curtice *et al.* (2019), and updated cetacean and pinniped densities in Roberts *et al.* (2018) for the East Coast region. Equinor was provided the most current marine mammal density data from the authors, updated during the 2019 field season (email dated March 2020). The Duke University cetacean density data represent models derived from aggregating line-transect surveys conducted over 23 years by five institutions (NOAA NMFS Northeast Fisheries Science Center, New Jersey Department of Environmental Protection, NOAA NMFS Southeast Fisheries Science Center, University of North Carolina Wilmington, and Virginia Aquarium and Marine Science Center), the results of which are freely available online at the Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP) repository.

In order to determine marine mammal densities for take estimates, the density coverages included two strata: (1) any portion inside the Lease Area, and (2) the ECRAs (the area outside of the Lease Area, ECRA 1-4; Figure 1-1 and Figure 6-1). Estimated average seasonal and average annual densities (individuals per km^2) of potentially affected marine mammals the ECRAs (Table 6-2 through Table 6-5) are calculated based on monthly habitat density models. Average seasonal densities were calculated for winter (December through February), spring

(March through May), summer (June through August), and fall (September through November). These estimates are considered by NMFS to be the most reliable information currently available for calculating marine mammal densities in the U.S. Atlantic. Though Figure 6-1 indicates density data are lacking for fin whales in Long Island Sound, Roberts *et al.* (2020) includes updated data for marine mammals including within ECRA-3.

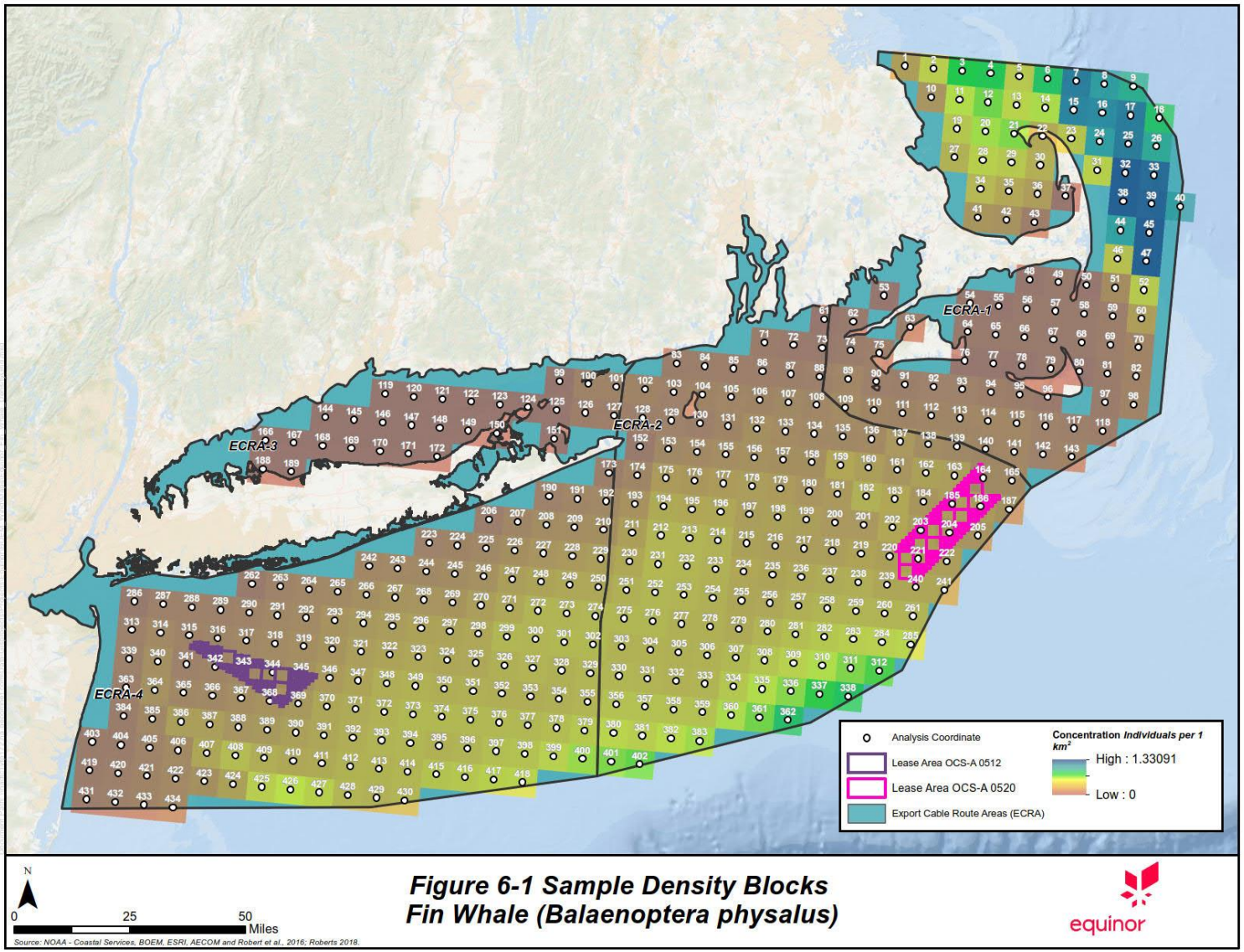

Figure 6-1. Sample Density Blocks (Fin Whale)

Table 6-2. Estimated Average Seasonal and Average Annual Density (individuals per km2) of Potentially Affected Marine Mammals in the Export Cable Route Area (ECRA) 1 Based on Monthly Habitat Density Models (Roberts et al. 2016, 2020).

Species	Winter	Spring	Summer	Fall	Average Annual Density (km^2)
Low-Frequency Cetaceans					
Fin Whale	0.0018766	0.0028709	**0.0048318**	0.0033222	0.0032254
Sei Whale	0.00006574	**0.0003972**	0.0001506	0.0001115	0.0001813
Common Minke Whale	0.0005763	0.0041769	**0.0044061**	0.0023815	0.0028852
Humpback Whale	0.001237	0.0040208	**0.0054269**	0.0048654	0.0038875
North Atlantic Right Whale	0.0043035	**0.0063398**	0.0001199	0.00006054	0.0027059
Mid-Frequency Cetaceans					
Sperm Whale	0.00000397	0.00001714	**0.0001033**	0.00007693	0.00005034
Atlantic White-Sided Dolphin	0.0205935	0.0468122	**0.057509**	0.0546804	0.0448988
Atlantic Spotted Dolphin	0.00000236	0.00000967	**0.00005057**	0.00004865	0.00002781
Common Bottlenose Dolphin	0.0066421	0.0077245	**0.0847306**	0.052642	0.0379348
Pilot Whale spp.	no data	no data	no data	no data	**0.0014728**
Risso's Dolphin	0.00003164	0.00001942	**0.00007374**	0.00007045	0.00004881
Short-Beaked Common Dolphin	0.0102739	0.0038268	0.0209971	**0.0224355**	0.0143833
High-Frequency Cetaceans					
Harbor Porpoise	**0.05438**	0.047789	0.0108856	0.0379962	0.0377627
Pinnipeds					
All seals	0.2311594	**0.3330293**	0.0771209	0.0675949	0.1772261

Bold font in table indicates maximum seasonal average density, as available.

Table 6-3. Estimated Average Seasonal and Average Annual Density (individuals per km^2) of Potentially Affected Marine Mammals within Export Cable Route Area (ECRA) 2 Including 0520 Lease Area Based on Monthly Habitat Density Models (Roberts et al. 2016, 2020).

Species	Winter	Spring	Summer	Fall	Average Annual Density (km^2)
Low-Frequency Cetaceans					
Fin Whale	0.00194506	0.00347868	**0.00392609**	0.00261407	0.002990975
Sei Whale	0.00002292	**0.00028884**	0.00014206	0.0000409	0.00012368
Common Minke Whale	0.00056786	**0.0020292**	0.00133162	0.00064265	0.001142833
Humpback Whale	0.00036639	**0.00147951**	0.00114716	0.00143523	0.001107073
North Atlantic Right Whale	0.00071292	**0.00192015**	0.00039174	0.00004532	0.000767533
Mid-Frequency Cetaceans					
Sperm Whale	0.00008085	0.00010719	**0.00029419**	0.00013681	0.00015476
Atlantic White-Sided Dolphin	0.04236202	**0.05269613**	0.04210811	0.03596382	0.04328252
Atlantic Spotted Dolphin	0.00009432	0.00027427	0.00161423	0.**00212995**	0.001028193
Common Bottlenose Dolphin	0.00937701	0.00833992	**0.02955662**	0.00937701	0.019596735
Pilot Whale spp.	no data	no data	no data	no data	**0.00011263**
Risso's Dolphin	0.00090567	0.00049659	**0.00294218**	0.00133569	0.001420033
Short-Beaked Common Dolphin	**0.2121851**	0.07952862	0.1225645	0.17572294	0.14750029
High-Frequency Cetaceans					
Harbor Porpoise	0.0441922	**0.07252193**	0.00369917	0.00640972	0.031705755
Pinnipeds					
All seals	**0.0717368**	0.04339597	0.00696984	0.00492373	0.031756585

Bold font in table indicates maximum seasonal average density, as available.

Table 6-4. Estimated Average Seasonal and Average Annual Density (individuals per km^2) of Potentially Affected Marine Mammals in the Export Cable Route Area (ECRA) 3 Based on Monthly Habitat Density Models (Roberts et al. 2016, 2020).

Species	Winter	Spring	Summer	Fall	Average Annual Density (km^2)
Low-Frequency Cetaceans					
Fin Whale	0.00004895	0.0001411	**0.000154**	0.0001147	0.0001147
Sei Whale	0.00000042	**0.00002179**	0.00000017	0.00000011	0.00000562
Common Minke Whale	0.00006499	**0.00006959**	0.00001538	0.00001734	0.000041825
Humpback Whale	0.0001919	0.000488	**0.0003133**	0.0013869	0.000595
North Atlantic Right Whale	**0.0002612**	0.0002039	0.00002728	0.00001707	0.0001274
Mid-Frequency Cetaceans					
Sperm Whale	0.00000521	**0.00004323**	0.0000081	0.00002014	0.00001917
Atlantic White-Sided Dolphin	0.0005687	0.0014533	0.0008864	**0.0015548**	0.0011158
Atlantic Spotted Dolphin	0.00000062	0.00000103	0.00005087	**0.00008059**	0.00003328
Common Bottlenose Dolphin	0.0059467	0.0034507	**0.0684936**	0.0272473	0.0262846
Pilot Whale spp.	no data	no data	no data	no data	**0.00002895**
Risso's Dolphin	0.00000043	0.00000014	**0.00000215**	0.00000103	0.00000094
Short-Beaked Common Dolphin	0.0012204	0.0006719	0.002001	**0.0043119**	0.0020513
High-Frequency Cetaceans					
Harbor Porpoise	**0.1348293**	0.0105564	0.0035243	0.0091139	0.039506
Pinnipeds					
All seals	**0.0506316**	0.0118088	0.0073132	0.004116	0.0184674

Bold font in table indicates maximum seasonal average density, as available.

Table 6-5. Estimated Average Seasonal and Average Annual Density (individuals per km^2) of Potentially Affected Marine Mammals in the Export Cable Route Area (ECRA) 4 Including 0512 Lease Area Based on Monthly Habitat Density Models (Roberts et al. 2016, 2020).

Species	Winter	Spring	Summer	Fall	Average Annual Density (km^2)
Low-Frequency Cetaceans					
Fin Whale	0.001358	0.0024555	**0.0029756**	0.0020575	0.0022117
Sei Whale	0.00001292	**0.000146**	0.00003384	0.00002173	0.000053615
Common Minke Whale	0.0004367	**0.0015375**	0.0006486	0.0003909	0.0007534
Humpback Whale	0.0004064	**0.0007076**	0.0004367	0.0006664	0.0005543
North Atlantic Right Whale	**0.0008549**	0.0006573	0.0000853	0.00005156	0.0004123
Mid-Frequency Cetaceans					
Sperm Whale	0.00002401	0.00005331	**0.0003508**	0.0001497	0.0001444
Atlantic White-Sided Dolphin	0.0220921	**0.0305044**	0.017794	0.0172023	0.0218982
Atlantic Spotted Dolphin	0.0001177	0.0001504	**0.0020008**	0.0018726	0.0010354
Common Bottlenose Dolphin	0.0105426	0.0094028	**0.0527685**	0.0312268	0.0259852
Pilot Whale spp.	no data	no data	no data	no data	**0.0058357**
Risso's Dolphin	0.0003326	0.0001125	**0.000818**	0.0003107	0.0003934
Short-Beaked Common Dolphin	**0.1539656**	0.0361096	0.0493511	0.0871895	0.0816539
High-Frequency Cetaceans					
Harbor Porpoise	0.0632792	**0.0671625**	0.0008294	0.0067176	0.0344972
Pinnipeds					
All seals	**0.0539549**	0.0537283	0.0033331	0.0022374	0.0283134

Bold font in table indicates maximum seasonal average density, as available.

6.3 Marine Mammal Exposure Estimates

Exposure estimates by species were calculated using a simple formula that takes into account marine mammal species density, area of ensonification, and number of survey days:

$$\text{Estimated Exposure or Take} = D \times ZOI \times (d)$$

where D = average highest species density (individuals per km^2); ZOI = maximum ensonified area to MMPA thresholds for impulsive noise (160 $dB_{RMS90\%}$ re 1 μPa); and d = number of survey days.

An average seasonal density for each species was calculated by averaging monthly densities across the three months in each season (winter, spring, summer, and fall), resulting in four density estimates for each species. The greatest of the four average seasonal densities was selected as the input for the exposure estimate for each species. Seasonal density was not available for gray seals, harbor seals, harp seals, and pilot whales. For these species, average available data for seals combined, and these annual densities were used. To estimate take, the maximum seasonal density of each marine mammal species (or average annual density) within the Lease Area or within each ECRA (individuals per km^2) from Tables 6-2 through 6-5 was multiplied by the daily ensonified area (ZOI in km^2) for vessel surveys. That result was then multiplied by the number of survey days to arrive at the estimated exposure or take.

Exposure estimates for vessel surveys within each area were based on the following anticipated durations:

- ECRA 1: 11.25 days
- ECRA 2: 70.25 days
- ECRA 3: 11.25 days
- ECRA 4: 125.25 days

Exposure estimates represent the maximum potential number of exposures of marine mammals to sounds above the Level B harassment threshold over the duration of the surveys. The proportions of each of the three seal species in the combined density estimate and within the project area are indeterminate because the data provided by Roberts et al. 2020 were for seals as a single cohort. Therefore, it was conservatively assumed that each species of seal could comprise the entire exposure estimate as an exposure estimate.

The Applicant has agreed to implement extensive mitigation measures to minimize potential Level B harassment and avoid Level A harassment. The Level A zones for all functional hearing groups are small (Table 1-3), and the likelihood of a Level A take is negligible given the robust monitoring program that will be implemented (Section 11). Exclusion (shutdown) zones will be established to ensure that marine mammals do not encounter Level A harassment sound levels (Section 11.3). The exclusion zones of 100 meters for ESA-listed species and humpback whales and 50 meters for small cetaceans (dolphins and porpoises) and pinnipeds are larger than the largest Level A zone of 3.5 m (Table 1-3) (see Section 11.1). A 500-m exclusion zone will be implemented for North Atlantic right whales, which further diminishes the potential of Level A exposure. Therefore, no Level A take is anticipated or requested. Further, the Applicant is proposing to avoid Level A and Level B take by harassment of ESA-listed North Atlantic right whales.

Table 6-6. Marine Mammal Exposure Estimates for Level B Harassment during HRG Vessel Surveys within the Lease Area and Export Cable Route Areas.

Species	Stock	Abundance	Level B Exposure Estimate Export Cable Route Area 1	Level B Exposure Estimate Export Cable Route Area 2 and Lease Area 0520	Level B Exposure Estimate Export Cable Route Area 3	Level B Exposure Estimate Export Cable Route Area 4 and Lease Area 0512	Total Level B Exposures Requested	% of Stock
Low-Frequency Cetaceans								
Fin whale	**W. North Atlantic**	1,618	3	14	0	19	36	2.22
Sei whale	**Nova Scotia**	357	1	1	0	1	3	0.84
Common minke whale	**Canadian East Coast**	2,591	3	7	0	10	20	0.77
Humpback whale	**Gulf of Maine**	896	3	5	1	4	13	1.45
North Atlantic right whale	**W. North Atlantic**	451	4	7	0	5	0[1]	0
Mid-Frequency Cetaceans								
Sperm Whale	**North Atlantic**	2,288	0	1	0	2	3	0.13
Atlantic white-sided dolphin	**W. North Atlantic**	48,819	33	185	1	191	410	0.84
Atlantic spotted dolphin	**W. North Atlantic**	44,715	0	8	0	13	21	0.05
Common bottlenose dolphin	**W. North Atlantic (offshore and coastal)**	84,171	48	104	39	331	522	0.62
Pilot Whale spp.	**W. North Atlantic (long and short finned)**	34,560	1	1	0	37	39	0.11
Risso's dolphin	**W. North Atlantic**	18,250	0	10	0	5	15	0.08
Short-beaked common dolphin	**W. North Atlantic**	70,184	13	747	2	966	1,728	2.46
High-Frequency Cetaceans								
Harbor porpoise	**Gulf of Maine/ Bay of Fundy**	79,833	31	255	76	421	783	0.98
Pinnipeds								
Gray seal	**W. North Atlantic**	27,131	188	253	29	338	808	2.98
Harbor seal	**W. North Atlantic**	75,834	188	253	29	338	808	1.07
Harp Seal	**W. North Atlantic**	unknown	188	253	29	338	808	
Total Exposures			**704**	**759**	**206**	**2,104**	**6,033**	

W. = Western.
*Abundance estimates taken from Hayes *et al*. 2019.
[1] Though exposures were calculated for North Atlantic Right Whales, the project intends to avoid all Level A and B take, so zero exposures are requested.

Species	Stock	Abundance	Level B Exposure Estimate Lease Area 0520	Level B Exposure Estimate Export Cable Route Area 1	Level B Exposure Estimate Export Cable Route Area 2	Level B Exposure Estimate Export Cable Route Area 3	Level B Exposure Estimate Export Cable Route Area 4	Total Level B Exposures Requested	% of Stock
Low-Frequency Cetaceans									
Fin whale	**W. North Atlantic**	1,618	10	3	2	0	217	1732	1.062.01
Sei whale	**Nova Scotia**	357	1	1	0	0	01	23	0.4869
Common minke whale	**Canadian East Coast**	2,591	5	3	1	0	19	1018	0.3869
Humpback whale	**Gulf of Maine**	896	3	3	1	1	04	812	0.931.34
North Atlantic right whale	**W. North Atlantic**	451	6	4	1	0	05[1]	0	0
Mid-Frequency Cetaceans									
Sperm Whale	**North Atlantic**	2,288	1	0	0	0	02	13	0.0614
Atlantic white-sided dolphin	**W. North Atlantic**	48,819	143	33	23	1	17174	217374	0.4477
Atlantic spotted dolphin	**W. North Atlantic**	44,715	4	0	1	0	111	616	0.0104
Common bottlenose dolphin	**W. North Atlantic (offshore and coastal)**	84,171	73	48	18	39	30301	208479	0.0557
Pilot Whale spp.	**W. North Atlantic (long and short finned)**	34,560	26	1	7	0	333	3767	0.1119
Risso's dolphin	**W. North Atlantic**	18,250	1	0	2	0	15	48	0.0204
Short beaked common dolphin	**W. North Atlantic**	70,184	413	13	98	2	87879	6131,405	0.872.00
High-Frequency Cetaceans									
Harbor porpoise	**Gulf of Maine/ Bay of Fundy**	79,833	288	31	39	76	38383	472817	0.591.02
Pinnipeds									
Gray seal	**W. North Atlantic**	27,131	117	188	20	29	30308	384662	1.412.44
Harbor seal	**W. North Atlantic**	75,834	117	188	20	29	30830	384662	0.5187
Harp Seal	**W. North Atlantic**	unknown	117	188	20	29	30308	384662	–
Total Exposures			**1,325**	**704**	**253**	**206**	**2692,748**	**2,7475,220**	–

7. ANTICIPATED IMPACT OF THE ACTIVITY

The anticipated impact of the activity to the species or stock of marine mammal.

Consideration of negligible impact is required for NMFS to authorize the incidental take of marine mammals. In 50 CFR § 216.103, NMFS defines negligible impact to be "an impact resulting from a specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stocks [of marine mammals] through effects on annual rates of recruitment or survival." Based upon best available data regarding the marine mammal species (including density, status, and distribution) that are likely to occur in the survey area, the Applicant concludes that exposure to marine mammal species and stocks during marine site characterization surveys would result in short-term minimal effects and would not affect the overall annual recruitment or survival for the following reasons:

- As detailed in Section 1.4, potential acoustic exposures from survey activities are within the non-injurious behavioral effects zone (Level B harassment);
- The potential for take as estimated in Section 6.3 represents a highly conservative estimate of harassment based upon typical HRG survey operations utilizing an overly conservative ZOI and without taking into consideration the effects of standard mitigation and monitoring measures; and
- The protective measures as described in Section 11.0 are designed to avoid and/or minimize the potential for interactions with and exposure to marine mammals.

Marine mammals are mobile free-ranging animals and have the capacity to exit an area when noise-producing survey activities are initiated. Based on the conservative take estimations, survey activities may disturb more than one individual for some species (mainly dolphins), but in conjunction with other aforementioned factors we conclude the short-term survey activities are not expected to result in population-level effects and that individuals will return to normal behavioral patterns after activities have ceased or after the animal has left the area under survey.

8. ANTICIPATED IMPACTS ON SUBSISTENCE USES

The anticipated impact of the activity on the availability of the species or stocks of marine mammals for subsistence uses.

There are no traditional subsistence hunting areas in the Lease Area and ECRA; therefore, no impacts on the availability of species or stocks for subsistence use are considered.

9. ANTICIPATED IMPACTS ON HABITAT

The anticipated impact of the activity upon the habitat of the marine mammal populations and the likelihood of restoration of the affected habitat.

This section addresses NFMS' requirement to characterize the short- and long-term impacts of the proposed activity on marine mammals associated with the predicted loss or modification of habitat and to address available methods and likelihood of restoration of lost or modified habitat. The site characterization surveys will include activities between 1 April 2020 and 31 March 2021; therefore, long-term impacts are not expected.

The proposed activity has the potential to affect marine mammal habitat primarily through short-term impacts from increases in ambient noise levels from vessel activities. These impacts arise from a variety of impact producing factors (i.e., noise, discharges, physical presence, lights, and turbidity) with the potential to temporarily affect marine mammal prey availability. Various pelagic and benthic fish species, cephalopods, and crustaceans are expected to occur in the Lease Area and ECRA. Elevated noise levels may cause these species to leave the immediate area of operations, temporarily disrupting feeding behavior; however, displaced individuals are expected to return shortly after work is completed. Sediment disturbance is expected during geotechnical sampling and coring within the immediate area (<1 m [<3 ft] diameter). This disturbance and associated increase in water turbidity is expected to be short-term and temporary with minimal effects on marine mammal habitat.

Due to the short duration of the potential activities and the minimal acoustic disturbance expected, no long-term impacts associated with loss or modification of habitat are anticipated.

10. ANTICIPATED EFFECTS OF HABITAT IMPACTS ON MARINE MAMMALS

The anticipated impact of the loss or modification of the habitat on the marine mammal populations involved.

This section addresses the NFMS requirement to characterize the short- and long-term impacts of the proposed activity on marine mammals, resulting from the predicted habitat loss or modification described in Section 9.

No significant short- or long-term impacts on marine mammals are expected.

11. MITIGATION MEASURES TO PROTECT MARINE MAMMALS AND THEIR HABITAT

The availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks, their habitat, and their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.

11.1 Vessel Strike Avoidance Procedures

The Applicant will ensure that all vessels conducting activities in support of Site Assessment Plan (SAP) submittal, including those transiting to and from local ports and the lease area, comply with the vessel-strike avoidance measures specified in the lease stipulations. Survey vessel crew members responsible for navigation duties will receive site-specific training on marine mammal sighting/reporting and vessel strike avoidance measures. Vessel strike avoidance measures will include, but are not limited to, the following, except under extraordinary circumstances when complying with these requirements would put the safety of the vessel or crew at risk:

- All vessel operators and crew will maintain vigilant watch for marine mammals (whales, dolphins, porpoises, and seals), sea turtles, and giant manta rays, and slow down or stop their vessel to avoid striking these protected species.
- All vessel operators of vessels 19.8 m (65 feet) in length or greater that operate between November 1 through July 31, operate at speeds of 10 knots (18.5 kilometers per hour [km/hr]) or less.
- The Applicant will ensure that vessel operators monitor NMFS North Atlantic Right Whale reporting systems (e.g., the Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System) from November 1 through July 31 and whenever a Dynamic Management Area (DMA) is established within area vessels operate. The Applicant will ensure that all vessel operators comply with 10 knot (18.5 km/hr) speed restrictions in any DMA.
- All vessel operators will reduce vessel speed to 10 knots (18.5 km/hr) or less when mother/calf pairs, pods, or large assemblages of marine mammals are observed near an underway vessel. All survey vessels will maintain a separation distance of 500 m (1,640 ft) or greater from any sighted North Atlantic right whale or unidentified large marine mammal.
- If a vessel comes within 500 m (1,640 ft) of any North Atlantic right whale:
    - If underway, any vessel must steer a course away from any North Atlantic right whale at 10 knots (18.5 km/hr) or less until the 500 m (1,640 ft) minimum separation distance has been established.
    - If a North Atlantic right whale is sighted within 100 m (328 ft) to an underway vessel, the vessel operator must immediately reduce speed and promptly shift the engine to neutral. The vessel operator must not engage the engines until the North Atlantic right whale has moved beyond 100 m (328 ft). If a vessel is

stationary, the vessel must not engage engines until the North Atlantic right whale has moved beyond 100 m (328 ft).

- All vessels will maintain a separation distance of 100 m (328 ft) or greater from any sighted Endangered Species Act (ESA)-listed whales or humpback whales. If sighted, the following avoidance measures will be taken if a vessel comes within 10 m (328 ft) of whale:
    - If underway, the vessel must reduce speed and shift the engine to neutral, and must not engage the engines until the whale has moved beyond 100 m.
    - If a survey vessel is stationary, the vessel will not engage engines until the whale has moved beyond 100 m.
- All vessels underway will not divert to approach any small cetacean, seal, sea turtle, or giant manta ray.
- All vessels will maintain a separation distance of 50 m (164 ft) or greater from any sighted small cetacean, seal, sea turtles, or giant manta ray, except when a small cetacean or seal approaches the vessel, in which case the vessel underway will avoid excessive speed or abrupt changes in direction to avoid injury to the animal.

11.2 Seasonal Operating Requirements

Between watch shifts, members of the monitoring team will consult NMFS North Atlantic right whale reporting systems for the presence of North Atlantic right whales throughout survey operations.

11.3 Exclusion and Monitoring Zone Implementation

We have defined three distinct zones to better describe the monitoring activities and mitigation actions associated with the detection of a marine mammals during the survey:

- **Monitoring zone:** the monitoring zone will encompass the exclusion zone, Level B Harassment (Level B) zone, and general waters surrounding the vessel out to a distance that can be visually monitored with the naked eye. The monitoring zone is continuously scanned by protected species observers (PSOs) in order to conduct observations of marine mammals within the immediate area of the survey. There are no visibility requirements or mitigation requirements associated with the monitoring zone but all observation conditions and marine mammal detections within this zone are recorded.

- **Level B zone:** the Level B zone is the distance to which a SPL_{rms} of 160dB re 1 µPa extends from a source whereby marine mammals may be exposed to sound pressure levels of sufficient amplitude to result in potential behavioral harassment. Animals detected within the Level B zone while geophysical sources with frequencies <200 kHz are in operation may constitute take under the MMPA. PSO will note visibility of the Level B zone but there is no visibility requirement for this zone to proceed with the survey. The Level B zone may not be visible in its entirety and in such cases, the Applicant will apply NMFS-accepted alternatives for calculating potential Level B exposures.

- **Exclusion zone**: the exclusion zone is a species-specific zone around the geophysical source. The exclusion zone only delineates the area in which mitigation actions (ramp up

delay, operational shutdown) are required for species entering the zone. The exclusion zone may or may not encompass the Level B zone and an animal's entry into the exclusion zone does not necessarily represent a take. Species' exclusion zones inside the Level B zone must be visible at all times. Species' exclusion zones outside of the Level B zone may have intermittent visibly without affecting survey operations.

The Applicant will employ the following zones during all HRG survey activities (Figure 11-1):

- **Monitoring zone:**
  - Waters surrounding the sound sources and the vessel. All marine mammals detected will be recorded.
- **Level B zone:**
  - 141 m (463 ft) for all marine mammals around active geophysical sound sources that have operating frequencies less than 200 kHz.
- **Exclusion zones:**
  - North Atlantic right whale exclusion zone: 500 m (1,640 ft) for North Atlantic right whales;
  - ESA-listed species and humpback whales: 100 m (328 ft); and
  - Small cetaceans, porpoises, and pinnipeds: 100-m (164 ft) with the exception of dolphins that approach the vessel / HRG equipment or bow ride, as determined by lead PSO

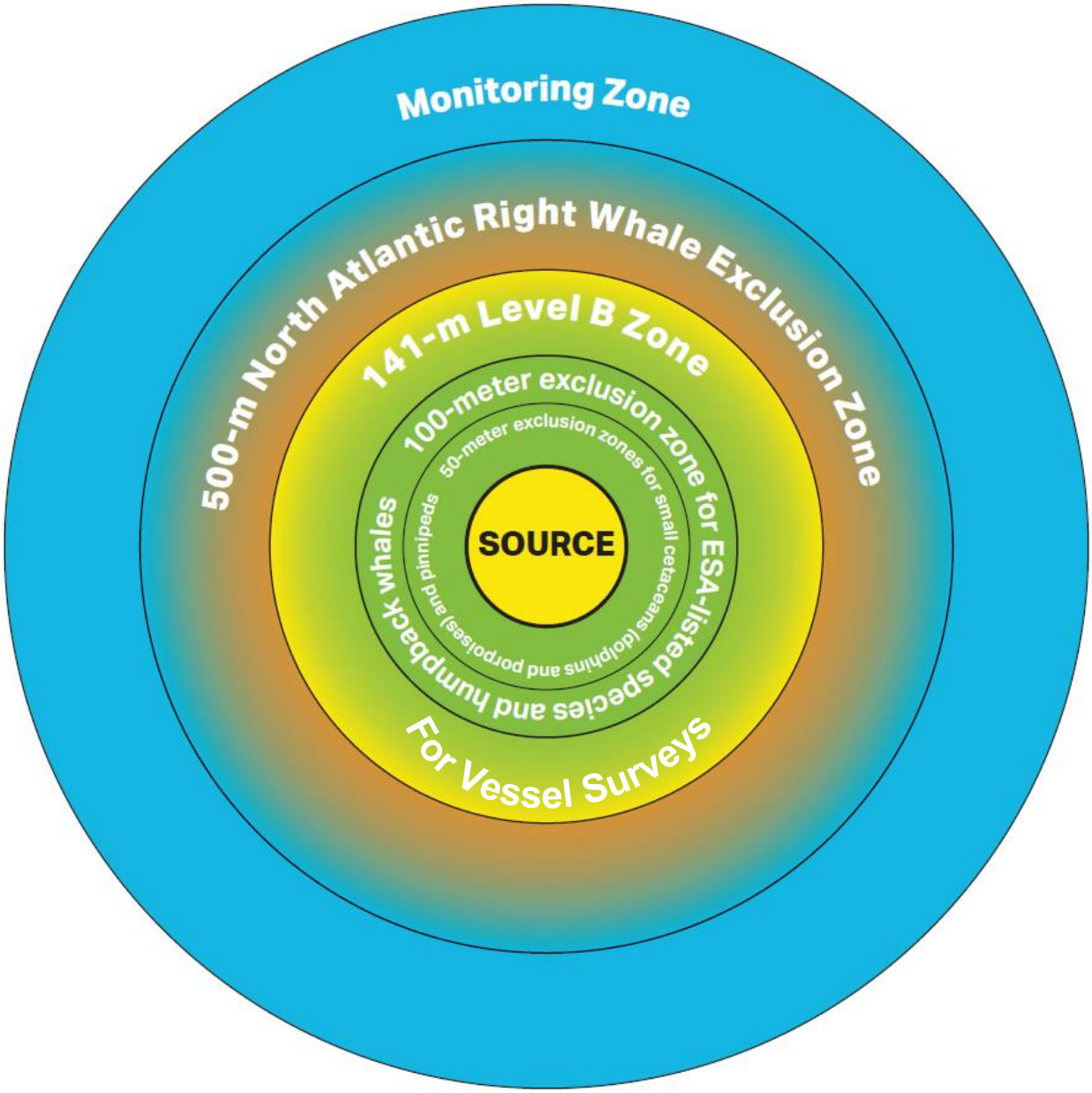

***Figure 11-1**. **Graphical Representation for Monitoring Marine Mammal Exclusion Zones (not to scale)**.*

11.4 Visual Monitoring Program

Visual monitoring of the established exclusion and monitoring zone will be performed by qualified and NMFS-approved PSOs.

Observer qualifications will include direct field experience on a marine mammal observation vessel and/or aerial surveys in the Atlantic Ocean/Gulf of Mexico. Project-specific training can be substituted for experience when a PSO will work as part of a PSO team. An observer team comprising a minimum of four NMFS-approved PSOs and two certified Passive Acoustic

Monitoring (PAM) operators, operating in shifts, will be stationed aboard either the survey vessel or a dedicated PSO-vessel. PSOs and PAM operators will work in shifts such that no one monitor will work more than 4 consecutive hours without a break or longer than 12 hours during any 24-hour period. During daylight hours, the PSOs will rotate in shifts of 1 on and 3 off, and during nighttime operations PSOs will work in pairs. The PAM operators will also be on call as necessary during daytime operations should visual observations become impaired. Each PSO will monitor 360 degrees of the field of vision. The Applicant will provide resumes of all proposed PSOs and PAM operators (including alternates) to BOEM for review and approval by NMFS at least 7 days prior to the start of survey operations. Submitted resumes will be approved by NMFS within 7 days; approval of resumes will be considered tacit if no response from NMFS is received within 7 days of submittal.

It will be the responsibility of the Lead PSO on duty to communicate the presence of marine mammals as well as to communicate and enforce the action(s) that are necessary to ensure mitigation and monitoring requirements are implemented as appropriate. PAM operators will communicate detected vocalizations to the Lead PSO on duty, who will then be responsible for implementing the necessary mitigation procedures.

PSOs will be equipped with binoculars and have the ability to estimate distances to marine mammals located in proximity to the vessel and/or exclusion zone using range finders. Reticulated binoculars will also be available to PSOs for use as appropriate based on conditions and visibility to support the sighting and monitoring of marine species. Digital single-lens reflex camera equipment will be used to record sightings and verify species identification. During night operations, PAM, night-vision equipment, and infrared technology will be used. Specifications for the PAM, night-vision, and infrared equipment will be provided to both NOAA and BOEM for review and acceptance prior to the start of surveys. Position data will be recorded using hand-held or vessel global positioning system (GPS) units for each sighting.

Observations will take place from the highest available vantage point on the survey vessel. General 360-degree scanning will occur during the monitoring periods, and target scanning by the PSO will occur when alerted of a marine mammal presence. In addition, PSOs will continue to monitor the zone for 30 minutes after HRG survey equipment is shut down or survey activity has concluded.

Data on PAM/PSO observations will be recorded based on standard PSO collection requirements. This will include dates and locations of construction operations; time of observation, location and weather; details of the sightings (e.g., species, age classification [if known], numbers, behavior); and details of any observed “taking” (behavioral disturbances or injury/mortality). The data sheet will be provided to both NMFS and BOEM for review and approval prior to the start of survey activities. In addition, prior to initiation of survey work, all crew members will undergo environmental training, a component of which will focus on the procedures for sighting and protection of marine mammals. A briefing will also be conducted between the survey supervisors and crews, the PSOs, and the Applicant. The purpose of the briefing will be to establish responsibilities of each party, define the chains of command, discuss communication procedures, provide an overview of monitoring purposes, and review operational procedures.

11.5 Passive Acoustic Monitoring Program

To support 24-hour survey operations, the Applicant will include PAM as part of the project monitoring during the HRG survey during nighttime operations to provide for optimal acquisition of species detections at night. In addition, PAM systems shall be employed during daylight hours as needed to support system calibration and PSO and PAM team coordination.

Given the range of species that could occur in the Lease Area and ECRA, the PAM system will consist of an array of hydrophones with both broadband (sampling mid-range frequencies of 2 kHz to 200 kHz) and at least one LF hydrophone (sampling range frequencies of 75 Hz to 30 kHz).

The PAM operator(s) will monitor the hydrophone signals in real time both aurally (using headphones) and visually (via the monitor screen displays). PAM operators will communicate detections to the Lead PSO on duty who will ensure the implementation of the appropriate mitigation measure.

11.6 Pre-Clearance of the Exclusion Zone

For all HRG survey activities, the Applicant will implement a 30-minute clearance period of the exclusion zone prior to the initiation of ramp-up (Section 11.6). During this period the marine mammal exclusion zone must be visible. After 30 minutes of monitoring, if any marine mammal has entered their respective exclusion zone, ramp up will not be initiated until the animal is confirmed outside the exclusion zone or until the following time has elapsed since the last sighting of the animal in the exclusion zone:

- 15 minutes for delphinoid cetaceans and pinnipeds; and
- 30 minutes for whales, including the North Atlantic right whale.

This condition is a modification to Lease stipulation 4.3.6.5 and thus the Applicant is requesting a reduction in the exclusion zone clearance protocol in accordance with the precedent established by NMFS in recent IHAs issued on the Atlantic OCS (83 FR 19532; 84 FR 51118).

11.7 Ramp-Up Procedures

Where technically feasible, a ramp-up procedure will be used for HRG survey equipment capable of adjusting energy levels at the start or re-start of HRG survey activities. A ramp-up procedure will be used at the beginning of HRG survey activities in order to provide additional protection to marine mammals near the Lease Area and ECRA by allowing them to vacate the area prior to the commencement of HRG survey equipment use. The ramp-up procedure will not be initiated if the exclusion zone cannot be adequately monitored by the PSOs using the appropriate visual technology (e.g., reticulated binoculars, night-vision equipment) and/or PAM for the intervals described in Section 11.6. A ramp-up would begin with the power of the smallest acoustic equipment at its lowest practical power output appropriate for the survey. When technically feasible, the power would then be gradually turned up and other acoustic sources added in way such that the source level would increase in steps not exceeding 6 dB per 5-minute period.

Ramp-up activities will be delayed if a marine mammal(s) enters an exclusion zone(s). Ramp-up will continue if the animal has been observed exiting the exclusion zone or until an additional time period has elapsed with no further sighting.

11.8 Shut-Down and Power-Down Procedures

The vessel operator must comply immediately with any call for shutdown by the Lead PSO. Any disagreement should be discussed only after shutdown. The following outlines the shut-down procedures:

- If a whale is sighted at or within the established exclusion zone, an immediate shutdown of the HRG survey equipment is required. Subsequent restart of the equipment may be initiated if the animal is observed exiting its respective exclusion zone or has not been re-sighted within the exclusion zone for 30 minutes.
- If a porpoise or pinniped is sighted at or within the exclusion zone, the HRG survey equipment (including the SBP) must be powered down to the lowest power output that is technically feasible. Subsequent power up of the HRG survey equipment must use the ramp-up procedures described above and may occur after the animal is observed exiting its respective exclusion zone or has not been re-sighted within the exclusion zone for 15 minutes. Additionally, in the event that the lead PSO determines after a minimum of 10 minutes of observation that the porpoise or pinniped is approaching the vessel or towed equipment at a speed and vector that indicates a voluntary approach to bow-ride or chase towed equipment, equipment may be restarted.
- If the HRG sound source (including the SBP) shuts down for reasons other than encroachment into the exclusion zone by an animal, including but not limited to a mechanical or electronic failure resulting in the cessation of sound source for a period greater than 20 minutes, a restart for the HRG survey equipment (including the SBP) is required using the full ramp-up procedures and clearance of the exclusion zone. If the pause is less than less than 20 minutes, the equipment may be restarted 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.
- During operation of the geotechnical sampling equipment, for the sake of vessel/vehicle safety, the USBL may not be shut down. In these instances, the shut-down procedures shall not apply.

12. MITIGATION MEASURES TO PROTECT SUBSISTENCE USES

Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses, you must submit either a plan of cooperation (POC) or information that identifies what measures have been taken and/or will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses.

Potential impacts to species or stocks of marine mammals will be limited to individuals of marine mammal species located in the northeast region of the U.S. and will not affect Arctic marine mammals. Given that the Lease Area and ECRA is not located in Arctic waters, the activities associated with the Applicant's marine characterization surveys will not have an adverse effect on the availability of marine mammals for subsistence uses allowable under the MMPA.

13. MONITORING AND REPORTING

The suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species, the level of taking or impacts on populations of marine mammals that are expected to be present while conducting activities and suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to persons conducting such activity. ***Monitoring plans should include a description of the survey techniques that would be used to determine the movement and activity of marine mammals near the activity site(s) including migration and other habitat uses, such as feeding***.

Monitoring measures will be implemented along with mitigation measures as described in Section 11 to avoid and minimize impacts on marine mammals during survey activities.

13.1 Monitoring

Visual and PAMprotocols are described in Section 11.0.

13.2 Reporting

The Applicant will provide the following reports:

- The Applicant will contact BOEM and NMFS within 24 hours of the commencement of survey activities and again within 24 hours of the completion of the activity;

- Any observed significant behavioral reactions (e.g., animals departing the area) or injury or mortality to any marine mammals will be reported to BOEM and NMFS within 24 hours of observation. Dead or injured protected species (e.g., marine mammals, sea turtles, and sturgeon) are reported to NMFS Northeast Region's Stranding Hotline (800-900-3622) within 24 hours of sighting, regardless of whether the injury is caused by a vessel; and

- Within 90 days after completion of the survey, a report will be provided to NMFS that documents the 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 survey activities.

14. SUGGESTED MEANS OF COORDINATION

Suggested means of learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing such incidental taking and evaluating its effects.

The applicant will immediately share all North Atlantic right whale sightings with NOAA.

All marine mammal data collected by the Applicant during marine characterization survey activities will be provided to NMFS, BOEM, and other interested government agencies, and be made available upon request to educational institutions and environmental groups. Data may provide valuable information to direct or refine future research on marine mammal species present in the area. Sightings data (e.g., date, time, weather conditions, species identification, approximate sighting distance, direction, heading in relation to sound sources, behavioral observations) may be useful in designing the location and scope of future marine mammal survey and monitoring programs.

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