Orsted Wind Power North America, LLC

Application for Incidental Harassment Authorization for the Non-Lethal Taking of Marine Mammals: Site Characterization Surveys

Lease OCS-A 0486, 0487, 0500 and Associated Export Cable Routes

Prepared by CSA Ocean Sciences Inc.

April 2022

Application for Incidental Harassment Authorization for the Non-Lethal Taking of Marine Mammals:

Site Characterization Surveys Lease OCS-A 0486, 0487, and 0500

DOCUMENT NO. CSA-ORSTED-FL-22-81585-3673-301,2,3-REP-01-VER01

Internal review process					
Version	Date	Description	Prepared by:	Reviewed by:	Approved by:
INT-01	04/13/2022	Initial draft for science review	K. Hartigan	Mary Jo Barkaszi	K. Hartigan

Client deliverable			
Version	Date	Description	Project Manager Approval
01	04/19/2022	Client deliverable Preliminary draft	K. Hartigan

Suggested citation: CSA Ocean Sciences Inc. 2022. Application for Incidental Harassment Authorization for the Non-Lethal Taking of Marine Mammals: Site Characterization Surveys Lease OCS-A 0486, 0487, and 0500. Submitted to Orsted April 2022. 80 pp.

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List of Acronyms

µPa	micropascal
AA	Applied Acoustics
AMAPPS	Atlantic Marine Assessment Program for Protected Species
AWS	Atlantic white-sided (dolphin)
BOEM	Bureau of Ocean Energy Management
CETAP	Cetacean and Turtles Assessment Program
CFR	Code of Federal Regulations
CHIRP	Compressed High-Intensity Radiated Pulse
dB	decibel
DMA	Dynamic Management Area
DoN	Department of the Navy
DPS	distinct population segment
EA	environmental assessment
EBS	environmental baseline study
ECR	export cable route
EIS	environmental impact statement
ESA	Endangered Species Act
ET	EdgeTech
EZ	exclusion zone
FR	*Federal Register*
G&G	geophysical and geotechnical
GAPS	Global Acoustic Positioning System
HF	high-frequency
HRG	high-resolution geophysical
IHA	Incidental Harassment Authorization
ISO	International Organization for Standardization
J	joule
LF	low-frequency
MAI	Marine Acoustics, Inc.
MABS	Mid-Atlantic Baseline Studies/Maryland Baseline Studies
MBES	multibeam echosounder
MF	mid-frequency
MMPA	Marine Mammal Protection Act
NARW	North Atlantic right whale
NJDEP	New Jersey Department of Environmental Protection
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OCS	Outer Continental Shelf
OPR	Office of Protected Resources
Orsted	Orsted Wind Power North America LLC
PBR	Potential Biological Removal
PK	zero-to-peak sound pressure level
PSEG	PSEG Services Corporation
PSO	Protected Species Observer
PTS	permanent threshold shift
PW	phocid pinniped in water
re	referenced to

List of Acronyms (Continued)

ROV	remotely operated vehicle
RPM	Reasonable and Prudent Measure
RWSAS	Right Whale Sighting Advisory System
SAR	Stock Assessment Report
SBP	sub-bottom profiler
SEL_{24h}	sound exposure level over 24-hours
SFV	sound field verification
SL	source level
SMA	Seasonal Management Area
SPL	root-mean-square sound pressure level
SSS	side-scan sonar
TL	transmission loss
TTS	temporary threshold shift
UHD	ultra-high definition
UME	Unusual Mortality Event
USBL	ultra-short baseline
USFWS	U.S. Fish and Wildlife Service
WEA	wind energy area
WFA	weighing factor adjustment

Orsted Wind Power North America LLC (Applicant) submits this request for Incidental Harassment Authorization (IHA) pursuant to Section 101(a)(5) of the Marine Mammal Protection Act (MMPA) for the incidental take of small numbers of marine mammals by Level B harassment during site characterization surveys, including high resolution geophysical (HRG) sources operating at frequencies less than 180 kHz, to support the development of offshore wind farm technology within the Bureau of Ocean Energy Management (BOEM) Rhode Island (RI) – Massachusetts (MA) Wind Energy Area (WEA). The information provided in this document is submitted in response to the requirements of 50 Code of Federal Regulations (CFR) § 216.104 to allow for the incidental harassment of small numbers of marine mammals resulting from site characterization surveys.

1.1 PROJECT DESCRIPTION

The Applicant, on its behalf and on behalf of any successors in interest or assignee, submits this application to the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) requesting the issuance of an IHA to allow for the incidental harassment of small numbers of marine mammals resulting from site characterization surveys to support the development of offshore wind farm technology. The Applicant is proposing to conduct site characterization surveys within federal waters located in the area of Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS) Lease Areas OCS-A 0486, 0487, and 0500 (Lease Areas) and along potential export cable routes (ECRs) to landfall locations between Raritan Bay (part of the New York Bight) and Falmouth, Massachusetts. **Figure 1** shows the Lease Area and survey boundaries (gray shaded area) for the site characterization surveys, which include potential cable routes (Project Area).

Geophysical and geotechnical (G&G) surveys are necessary to provide data concerning seabed (geophysical, geotechnical, and geohazard), ecological, and archeological conditions in support of the development of an offshore electric transmission system. The IHA is being requested to allow for the incidental harassment of small numbers of marine mammals resulting from the operation of HRG sources with frequencies less than 180 kHz. An existing IHA renewal, published in the Federal Register (*FR*) on 3 March 2022 (87 *FR* 13975), for the same Lease Areas and ECRs is valid through 24 September 2022. The period of coverage for HRG activities included in this Application is 25 September 2022 through 24 September 2023.

Survey equipment will be deployed from multiple vessels or remotely operated vehicles (ROVs) during the site characterization activities conducted within the Project Area Typically, a survey ROV used for the proposed activities is a tethered platform that carries additional HRG equipment to increase the swath of the survey or the depth at which the equipment can be operated. The equipment deployed from an ROV would be identical to the sources deployed from the survey vessel; however, sparker and boomer systems (described further in **Section 1.3**) are not normally deployed from an ROV due to the power supply required. HRG surveys will include the use of seafloor mapping equipment with operating frequencies above 180 kHz (e.g., side scan sonar [SSS], multibeam echosounder [MBES]); magnetometers and gradiometers that have no acoustic output; and shallow- to medium-penetration sub-bottom profiling (SBP) (e.g., parametric sonars, compressed high-intensity radiated pulses [CHIRPs], boomers, sparkers) equipment with operating frequencies below 180 kHz. No deep-penetration SBP surveys (e.g., airgun or bubble gun surveys) will be conducted.

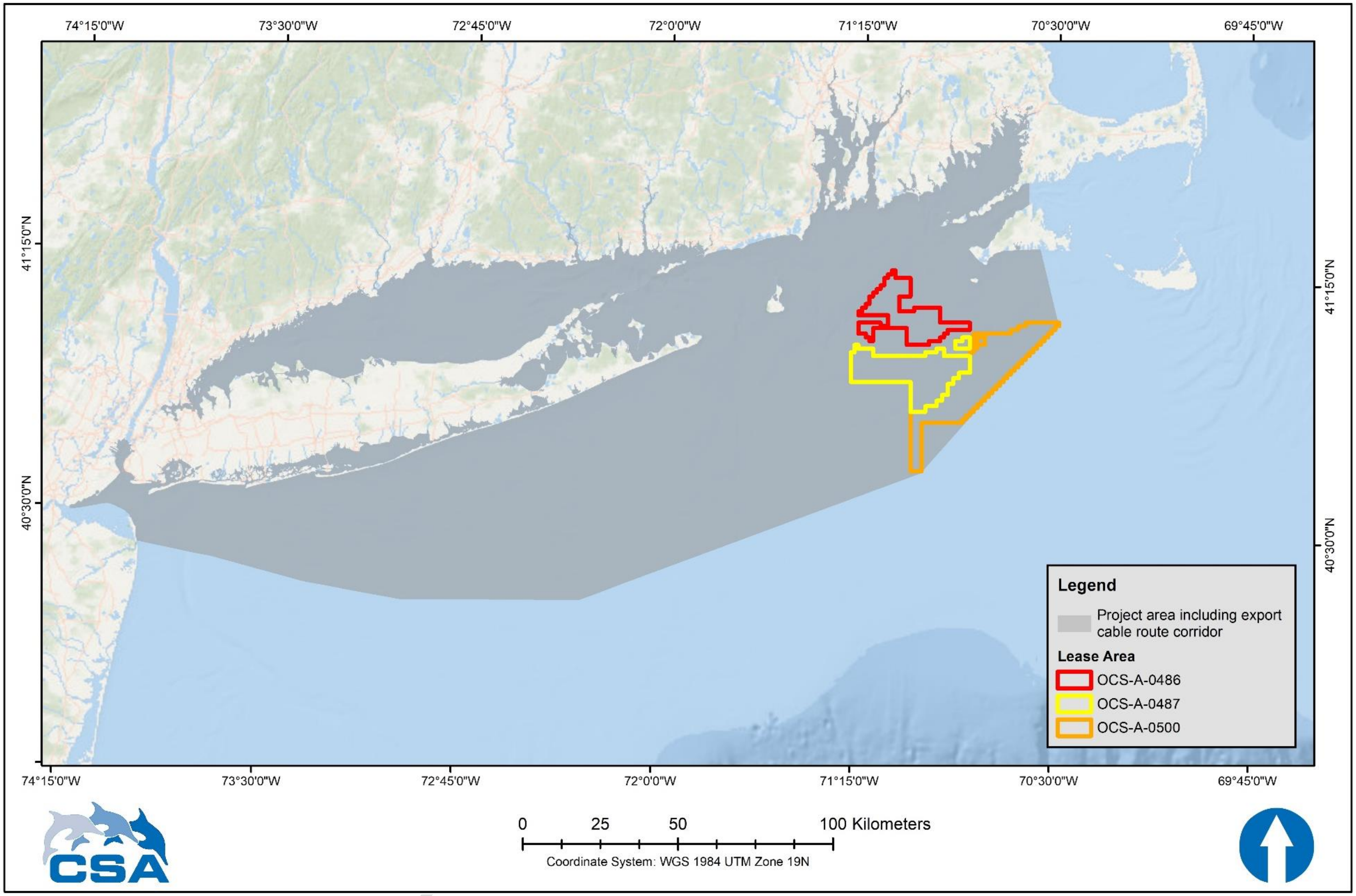

Figure 1. Project Area for the site characterization surveys which includes the Lease Areas and potential export cable route area.

1.2 ACTIVITIES CONSIDERED IN THIS APPLICATION

Site characterization surveys described in this Application will include HRG surveys, using sources with operating frequencies below 180 kHz or which are not included in the list of sources unlikely to result in adverse effects by BOEM in their 2021 Biological Assessment (BA; Baker and Howson, 2021) are considered in this Application. Sources with operating frequencies >180 kHz are outside the general hearing range of most marine mammals (**Section 1.2.1.2**), and other sources produce low sound levels which result in minimal horizontal propagation that no take are expected to occur (Baker and Howson, 2021).

All site characterization activities will utilize one or more of the survey methods and acoustic sources identified below.

1.2.1 Acoustic Analysis of Activities Considered in this Application

1.2.1.1 Acoustic Terminology

This document follows International Organization for Standardization (ISO) 18405:2017 (ISO, 2017) for all acoustic terminology. Underwater acoustic source levels (SLs), exposure levels, and associated measurements are expressed in decibels (dB) referenced to (re) 1 micropascal (µPa). In turn, acoustic metrics can be expressed in several ways depending on the quantity being reported. **Table 1** provides a list of the acoustic units used in this document.

Table 1. Acoustic metric definitions and their units used in this document adapted from International Organization for Standardization (ISO) 18405:2017 (ISO, 2017).

Quantity	Abbreviation	Units
Root-mean-square sound pressure level	SPL	dB re 1 µPa
Zero-to-peak sound pressure level (peak sound pressure level is a synonym)	PK	dB re 1 µPa
Sound exposure level over 24-hours	SEL_{24h}	dB re 1 μPa^2 s
Source level	SL	dB re 1 µPa m

µPa = micropascal dB = decibel; re = referenced to.

1.2.1.2 Regulatory Criteria

The included analysis applies the most recent noise exposure criteria utilized by NMFS Office of Protected Resources (OPR) to estimate acoustic harassment (NMFS, 2018a). The MMPA defines two levels of harassment: 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; Level B harassment is 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, breeding, feeding, or sheltering. In the 2018 acoustic guidance, NMFS establishes acoustic thresholds that, if exceeded, have the potential to cause auditory injury or behavioral disturbance for marine mammals. In 2018, NMFS published a revision to the acoustic guidance for marine mammals for use in impact assessments (NMFS, 2018a).

NMFS recognizes two main types of sound sources: impulsive (e.g., sparkers, boomers) and non-impulsive (e.g., parametric sonars, CHIRPs); sources are further broken down into continuous or intermittent categories. Only impulsive and non-impulsive, intermittent sources are included in the list of equipment analyzed for potential acoustic impacts on marine mammals in this Application. After preliminary acoustic analysis of each equipment type based on its operating frequency, source levels, and operational modes, some sound sources were deemed to not have impact ranges expected to result in Level A or B take and were therefore not carried through to the take assessment of this Application (**Section 6.0**) due to the low likelihood of acoustic impacts from those sources (discussed further in **Section 1.3**). Sound source characteristics and acoustic thresholds are used to establish the ensonified area of received zero-to-peak sound pressure level, (PK), root-mean-square sound pressure level (SPL) or sound exposure level over 24-hours (SEL_{24h}) depending on the source type and marine mammal hearing group. This ensonified area constitutes the harassment zone, within which impacts and takes of marine mammals are considered.

Hearing Groups

Recognizing that marine mammal species do not have equal hearing capabilities, marine mammals are separated into hearing groups (Southall et al., 2007; NMFS, 2018a; Southall et al., 2019). Hearing groups are used in acoustic impact assessment through the application of frequency weighting functions. Frequency weighting functions use physiological parameters to scale a species' sensitivity to a propagated sound source depending on the spectral content of the sound source and the hearing acuity of that animal to that spectral content. Sound energy contained within the hearing range of an animal has the potential to affect hearing while sound energy outside an animal's hearing range is unlikely to affect its hearing.

Marine mammal hearing groups, originally identified by Southall et al., 2007 then later modified by Finneran (2016) and adopted by NMFS (2018a), are categorized as low-frequency (LF) cetaceans, mid-frequency (MF) cetaceans, high-frequency (HF) cetaceans, phocid pinnipeds in water (PW), and otariid pinnipeds in water. Each category has a defined auditory weighting function and estimated acoustic threshold for the onset of temporary and injury-level hearing impacts.

More recently, Southall et al. (2019) conducted a broad, structured assessment of the audiometric, physiological, and acoustic output bases for the categorization of these hearing groups using the best available data at that time. Their assessment revealed several important features and distinctions present within the cetaceans that were not reflected in the less robust assessments used in previous categorizations of hearing groups. However, Southall et al. (2019) acknowledged that there is presently insufficient direct data within several groups to explicitly derive distinct thresholds and weighting functions. They thus proposed retaining the thresholds and functions developed by Finneran (2016) and adopted by NMFS (2018a), but with slightly different categorical identifiers. This results in slightly different grouping nomenclature from the NMFS (2018a) designations, but the overall conclusions of Southall et al. (2019) remain congruent with the current guidance (NMFS, 2018a).

The four hearing groups of marine mammals, based on the NMFS (2018a) nomenclature, that potentially occur in the Project Area include:

- LF cetaceans – mysticetes with a collective generalized hearing range of approximately 7 Hz to 35 kHz;
- MF cetaceans – most dolphins, all toothed whales except for *Kogia* spp., and all beaked and bottlenose whales with a generalized hearing range of approximately 150 Hz to 160 kHz;
- HF cetaceans – all true porpoises and *Kogia* spp. with a generalized hearing range of approximately 275 Hz to 160 kHz; and
- PW – phocid pinnipeds (seals) in water with a generalized hearing range of 50 Hz to 86 kHz.

The 2018 NMFS guidance also defines an otariid seal underwater hearing group; however, species from this group do not occur within the Project Area.

Impact Levels

Level A auditory impacts under the MMPA include a permanent threshold shift (PTS), which is a condition that occurs when sound intensity is very high and/or of such long duration that the result is a permanent loss of hearing sensitivity which is an irreversible auditory tissue injury (Southall et al., 2007). Level A acoustic thresholds are defined as sound exposures that potentially elicit the onset of a PTS in marine mammal hearing. The acoustic thresholds are used to establish the ensonified area of received PK or SEL_{24h} depending on the source type and marine mammal hearing group.

For non-impulsive, intermittent sources, only the SEL_{24h} metric is used to assess potential injury-level impacts. For impulsive sources, both PK and SEL_{24h} criteria are identified to account for the intensity of impulsive sounds and the duration required to elicit PTS.

Level B harassment impacts include temporary threshold shift(s) (TTS) and behavioral responses. Compared to PTS, TTS is a lesser impact to hearing. TTS results when sounds of sufficient loudness cause a transient condition in which an animal's hearing sensitivity over the frequency band of exposure is impaired for a period of time (minutes to days). A TTS does not cause permanent damage and is not considered a tissue injury (Richardson et al., 1995; Southall et al., 2007). Similarly, underwater sound may elicit a behavioral response from marine mammals that may or may not be biologically significant. In principle, behavioral thresholds are lower than TTS thresholds. TTS thresholds are defined in the 2018 criteria; however, TTS thresholds and behavioral response thresholds have not yet been separated within a regulatory framework and are all considered Level B harassment. Currently, the regulatory framework uses interim guidance to define Level B thresholds (NMFS, 2021a) provided as unweighted SPL to assess Level B behavioral impacts (NMFS, 2018a, 2021a).

The corresponding Level A and Level B acoustic threshold criteria are summarized in **Table 2**. While the Level B threshold for non-impulsive sources is an SPL of 120 dB re 1 µPa, an SPL of 160 dB re 1 µPa is considered applicable for intermittent sources such as those assessed in this Application.

Table 2. Summary of National Marine Fisheries Service acoustic criteria for Level A and Level B acoustic exposure from impulsive and non-impulsive intermittent sources.

Hearing Group	Source Type				
	Non-Impulsive		Impulsive		
	Level B[1]	Level A[2]	Level B[1]	Level A[3]	Level A[2]
Low-frequency Cetacean	160	199	160	219	183
Mid-frequency Cetacean		198		230	185
High-frequency Cetacean		173		202	155
Phocid Pinniped (in water)		201		218	185

µPa = micropascal; dB = decibel; re = referenced to; PK = zero-to-peak sound pressure level; SEL_{24h} = sound exposure level over 24-hours; SPL = root-mean-square sound pressure level.
[1]Units expressed as SPL in dB re 1 µPa (unweighted). Level B criteria are the same for all intermittent sources, both non-impulsive and impulsive, which are considered in this Application.
[2]Units expressed as SEL_{24h} in dB re 1 μPa^2 s (weighted).
[3]Units expressed as PK in dB re 1 µPa.

1.3 SURVEY EQUIPMENT

Operational SLs and operational parameters will vary throughout the survey; and therefore, a level of judgment is required to establish appropriate parameters and SLs to estimate the distances to regulatory thresholds. Typically, field-measured data is considered the best available science for HRG sources due to the high site- and result-specific variables that direct frequency content, power, beamwidths, and other user-defined parameters. The same equipment used in a deep-water, clay bottom environment may be operated very differently; and therefore produce different acoustic propagation characteristics than if it were operated in a shallow water, sand bottom environment. Recent communication with NMFS OPR indicates that, due to inconsistencies in field verifications conducted on existing wind leases, Crocker and Fratantonio (2016) measurements are preferable to field measurement results at this time. Additionally, the most recent Biological Assessment (BA) from BOEM (Baker and Howson, 2021), also obtained their information from Crocker and Fratantonio (2016) for the assessment of HRG survey equipment. However, the assessment in the BA assumed the highest source settings were used for all equipment (e.g., 2,400 J for the Applied Acoustics [AA] Dura-spark), whereas the Applicant is proposing lower source settings to meet the needs of their survey (e.g., 500 J for the AA Dura-spark). Therefore, the following hierarchy was used for selecting input to the NMFS User Spreadsheet Tool (NMFS, 2018b) and transmission loss (TL) equations:

1. For equipment that was measured by Crocker and Fratantonio (2016) the reported SL for the most likely operational parameters was selected; and
2. For equipment not measured by Crocker and Fratantonio (2016) and/or not provided in the BOEM BA (Baker and Howson, 2021), the best available manufacturer specifications were selected. Use of manufacturer specifications represent the absolute maximum output of any source and do not adequately represent the operational source. Therefore, they should be considered an overestimate of the sound propagation range for that equipment.

The operational parameters (e.g., operating frequency, SL, pulse duration, ping rate) for each piece of equipment, as well as the output parameters (e.g., SPLs, propagation distance, frequency content) are generally similar within each category; and therefore, the overall magnitude of impact radii can often be predicted based on the equipment category (Crocker and Fratantonio, 2016; Baker and Howson 2021).

The operational characteristics and supplemental source information considered in the analyses for this Application, as well as justification for selected proxy equipment, and categories excluded from analysis, are provided below. Survey equipment is either towed, pole mounted, hull-mounted on the vessel, or equipment mounted on the source itself or on an ROV.

Shallow penetration, non-impulsive, non-parametric SBPs (CHIRPs) are used to map the near-surface stratigraphy (top 0 to 10 m) of sediment below seabed. These systems emit sonar pulses that increase in frequency from approximately 2 to 20 kHz over time. The pulse length frequency range can be adjusted to meet project variables. These shallow penetration SPBs are typically mounted on a pole, either over the side of the vessel or through a moon pool in the bottom of the hull; however, they can be used in several types of towed configurations. The Pangeo Sub-bottom Imager™ (SBI) is also included in this category because although it is typically deployed 3 to 4 m above the seafloor, the acoustic source associated with this equipment is a linear frequency-modulated sweep with output frequencies from 4.5 to 12.5 kHz, and operational beamwidths range from 49° to 120° depending on frequency (Pangeo Subsea, 2019; Spencer, 2021). The sound levels produced by these types of equipment could result in Level B exposures; and therefore, these types of equipment were included in the take analysis of this application (**Section 6.0**). However, the operational configuration and relatively narrow beamwidth of these sources help to reduce the likelihood of the beam intersecting an animal. Additionally, the analysis conducted for the BOEM BA concluded that the ranges to acoustic thresholds for both PTS and behavioral disturbance is small enough (less than 2 and 10 m, respectively) that the consequences of potential exposure would have discountable effects (Baker and Howson, 2021). These equipment types are not likely to result in Level A or B exposures due to the very small disturbance ranges.

Parametric SBPs, also called sediment echosounders, are used for providing high data density in sub-bottom profiles that are typically required for cable routes, very shallow water, and archaeological surveys. There are no relevant information sources or measurement data within the Crocker and Fratantonio (2016) reference for parametric SBPs. Source information is available from the manufacturer; however, no field measurements or propagation characteristics are provided with the manufacturer specifications. Due to the highly specialized nature of these sonars (high frequencies and narrow beamwidths) the source information alone is not sufficient to fully evaluate the expected propagation. Additionally, since the parametric SPBs are typically mounted on a side pole, either over the side of the vessel or through a moon pool in the bottom of the hull; they are typically not towed behind the vessel, the likelihood of the beam intersecting an animal is significantly reduced.

The specific parametric sonar proposed for the HRG work, the Innomar SES-2000 or similar SBP, uses the principle of “parametric” or “nonlinear” acoustics to generate short, very narrow-beam sound pulses at very high frequencies (generally around 85-100 kHz). The transducer projects a beamwidth of approximately 1° to 3.5°. The narrow beamwidth significantly reduces the impact range of the source while the high frequencies of the source are rapidly attenuated in sea water. Neither high frequency sonar nor narrow beamwidth sources are well-captured in the NOAA User Spreadsheets used to calculate Level A isopleths. Therefore, the manufacturer reported SLs expressed as SPL were converted to sound exposure levels over the pulse duration, then exposure distances were calculated for each hearing group following guidance provided by NMFS OPR (NMFS, 2019a) which considers both the beamwidth and frequency absorption as previously mentioned. Because of the high frequency of the source and narrow bandwidth, parametric SBPs do not produce Level A isopleths beyond 2 m and do not produce Level B isopleths beyond 4 m. No Level A or Level B exposures can be reasonably expected from the operation of these sources; therefore, the Innomar parametric SBPs were not carried forward in the take analysis in this Application.

Medium penetration, impulsive SBPs (boomers) are used to map deeper subsurface stratigraphy as needed. A boomer is a broad-band sound source operating in the 3.5 Hz to 10 kHz frequency range. This system is commonly mounted on a sled and towed behind the vessel. The sound levels produced by these types of equipment could result in Level B exposures, and therefore these types of equipment were included in the take analysis of this application (**Section 6.0**).

Medium penetration, impulsive SBPs (sparkers) are used to map deeper subsurface stratigraphy as needed. Sparkers create acoustic pulses from 50 Hz to 4 kHz omnidirectionally from the source. Sparkers are typically towed behind the vessel with adjacent hydrophone arrays to receive the return signals. The sound levels produced by these types of equipment could result in Level B exposures, and therefore these types of equipment were included in the take analysis of this application (**Section 6.0**).

Acoustic cores unlike the other mobile geophysical sources, acoustic corers are stationary and made up of three distinct sound sources comprised of a HF parametric sonar, a HF CHIRP sonar, and a LF CHIRP sonar with each source having its own transducer. The corer is seabed-mounted; therefore, propagation for similar towed equipment are unlikely to be fully comparable.

The beamwidth of the HF parametric sonar on the acoustic corer is narrow (3.5° to 8°) and all three types of sonar are operated roughly 3.5 m above the seabed with the transducer pointed directly downward. This configuration represents the expected operation of the acoustic corer during the survey to maximize the energy channeled into the seabed and subsequently results in nominal horizontal propagation. There are no relevant information sources or measurement data within the Crocker and Fratantonio (2016) reference for acoustic corers; however, an acoustic assessment similar to a sound field verification (SFV) and a modeling assessment were conducted for the acoustic corer by the manufacturer. The modeling assessment showed much larger propagation distances than those that were measured in the field (PanGeo Subsea, 2018), further demonstrating the significant reduction in operational propagation distances for these highly directional, seabed-mounted sources.

Because of the operation close to the seabed and minimal resulting propagation distances, no Level A or Level B exposures can be reasonably expected from the operation of these sources; therefore, the acoustic corers were not carried forward in the take analysis of this Application.

Ultra-short baseline (USBL) positioning systems are used to provide high accuracy ranges to survey equipment by measuring the time between the acoustic pulses transmitted by the vessel transceiver and a transponder (or beacon) necessary to produce the acoustic profile. It is a two-component system with a moonpool- or side pole-mounted transceiver and one or several transponders mounted on other survey equipment. There are no relevant information sources or measurement data within the Crocker and Fratantonio (2016) reference for USBLs and only limited manufacturer SL information. However, USBL sound field verifications (SFVs) conducted by the Applicant resulted in no Level A thresholds being met and Level B zones less than 7 m (Marine Acoustics, Inc [MAI], 2018). USBLs have a wide variety of configurations, source levels, and beamwidths but have been shown to produce extremely small acoustic propagation distances in their typical operating configuration. There are numerous options for make and model of USBLs and of combinations pairing USBL transceivers and beacons. Eleven USBL systems have been identified as possible equipment on the site characterization surveys; therefore, the proxy source used was the Sonardyne Ranger 2 operating with an omnidirectional beamwidth is representative of the maximal proxy because it has the highest reported SL at 194 dB re 1 µPa m.

Geophysical sources have been extensively reviewed in the Gulf of Mexico OCS due to the large amount of ongoing and planned oil and gas G&G surveys. A Programmatic Environmental Impact Statement (EIS) was issued for G&G surveys in the Gulf of Mexico in 2017 (BOEM, 2017). Within this EIS, non-airgun HRG sources were considered for potential impacts. USBLs were not considered in the assessment. Additionally, in the recent incidental take regulation published for the Gulf of Mexico USBLs were not considered for take requests by NMFS in the final rule published on 19 January 2021 (86 *FR* 5322) and were considered unlikely to adversely affect marine mammals in the BOEM BA (Baker and Howson, 2021). In both assessments, HRG surveys with equipment comparable to the equipment proposed in these activities were fully evaluated and USBLs were not considered in the take evaluation.

There is; therefore, precedence for not considering USBLs as sound sources likely to propagate sound levels reaching Level A or Level B thresholds. Based on this information, no Level A or Level B exposures can be reasonably expected from the operation of these sources; therefore, the USBLs were not carried forward in the take analysis in this Application.

MBESs are used to determine water depths and general bottom topography. MBES sonar systems project sonar pulses in several angled beams from a transducer mounted to a ship's hull. The beams radiate out from the transducer in a fan-shaped pattern orthogonally to the ship's direction. The proposed MBESs all have operating frequencies >180 kHz; are outside the general hearing range of marine mammals likely to occur in the Project Area and are not likely to affect these species. Therefore, this equipment category will not be discussed further in this Application.

SSS are used for seabed sediment classification purposes and to identify natural and man-made acoustic targets on the seafloor. The 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 column. The acoustic return of the pulses is recorded in a series of cross-track slices, which can be joined to form an image of the sea bottom within the swath of the beam. SSSs are typically towed beside or behind the vessel or from an autonomous vehicle. The proposed SSSs all have operating frequencies >180 kHz; are outside the general hearing range of marine mammals likely to occur in the Project Area and are not likely to affect these species. Therefore, this equipment category will not be discussed further in this Application.

1.3.1 Equipment Summary

The operational parameters for each piece of equipment are typically provided as a range of options that can be specified by the user. The precise settings are often field-specific depending on each contractor's individual survey methodologies and data needs. The selected parameters will affect the impact analysis for each piece of equipment within each category; therefore, the parameters used in the analysis must be as closely aligned as possible with the expected operation at the time of the survey. This information helps determine the expected acoustic output for this Project by selecting the appropriate measurements reported in Crocker and Fratantonio (2016). As mentioned previously, the BOEM BA (Baker and Howson, 2021) also used information from Crocker and Fratantonio (2016), however, the BA assessment used the highest source operational settings which do not match the source settings proposed by the Applicants to meet the needs of their survey. As previously discussed, for equipment that was not measured by Crocker and Fratantonio (2016), manufacturer information was used with the most applicable operational parameters (**Table 3**).

Because there are no standardized field measurements for HRG survey equipment, NMFS recommended that the controlled measurements provided in Crocker and Fratantonio (2016) be the primary reference for equipment SLs with manufacturer information supplementing for equipment that was not measured in the Crocker and Fratantonio (2016) study. Where applicable, SFV measurements are provided in equipment descriptions to supplement the data used in the analysis; however, SFV measurements were not used to define SLs or acoustic threshold distances.

Although the final equipment choices will vary depending on the final survey design, vessel availability, make and model updates, and survey contractor selection, all sources that are representative of those that could be employed during the HRG surveys are provided in **Table 3** along with details of the parameters used in acoustic analyses within this Application.

Table 3. List of all representative geophysical sound sources with operating frequencies below 180 kHz that may be used during the site characterization surveys and were assessed for marine mammal takes. Equipment types not carried through for take analysis are not included in the table. All source information that was used to calculate threshold isopleths are provided in the table[1].

Equipment	Source Type	Frequency used for WFA in User Spreadsheets (kHz)[2]	Reference for SL	Operating Frequency (kHz)	SL (SPL dB re 1 µPa m)	SL (SEL dB re 1 µPa² m² s)	SL (PK dB re 1 µPa m)	Pulse Duration (width) (millisecond)	Repetition Rate (Hz)	Beamwidth (degrees)	Deployment Method
Non-impulsive, Non-parametric, Shallow Sub-bottom Profilers (CHIRP Sonars)											
ET 216 (2000DS or 3200 top unit)	Non-impulsive, mobile, intermittent	N/A[3]	MAN	2–16 2–8	195	178	-	20	6	24	PM/T/EM
ET 424 3200-XS	Non-impulsive, mobile, intermittent	N/A[3]	CF	4–24	176	152	-	3.4	2	71	PM/T/EM
ET 512i	Non-impulsive, mobile, intermittent	N/A[3]	CF	0.7–12	179	158	-	9	8	80	PM/T/EM
GeoPulse 5430A	Non-impulsive, mobile, intermittent	N/A[3]	MAN	2–17	196	183	-	50	10	55	PM/T/EM
Teledyne Benthos Chirp III - TTV 170	Non-impulsive, mobile, intermittent	N/A[3]	MAN	2–7	197	185	-	60	15	100	PM/T/EM
Pangeo SBI	Non-impulsive, mobile, intermittent	N/A[3]	MAN	4.5–12.5	188.2	165	-	4.5	45	120	T/EM
Impulsive, Medium Sub-bottom Profilers (Sparkers & Boomers)											
AA, Dura-spark UHD Sparker (400 tips, 500 J)[4]	Impulsive, mobile	1	CF	0.3–1.2	203	174	211	1.1	4	Omni	T
AA, Dura-spark UHD Sparker Model 400 × 400[4]	Impulsive, mobile	1	CF	0.3–1.2	203	174	211	1.1	4	Omni	T

Table 3. (Continued).

Equipment	Source Type	Frequency used for WFA in User Spreadsheets (kHz)[2]	Reference for SL	Operating Frequency (kHz)	SL (SPL dB re 1 μPa m)	SL (SEL dB re 1 μPa^2 m^2 s)	SL (PK dB re 1 μPa m)	Pulse Duration (width) (millisecond)	Repetition Rate (Hz)	Beamwidth (degrees)	Deployment Method
GeoMarine, Dual 400 Sparker, Model Geo-Source 800[4,5]	Impulsive, mobile	1.5	CF	0.4–5	203	174	211	1.1	2	Omni	T
GeoMarine Sparker, Model Geo-Source 200-400[4,5]	Impulsive, mobile	1	CF	0.3–1.2	203	174	211	1.1	4	Omni	T
GeoMarine Sparker, Model Geo-Source 200 Lightweight[4,5]	Impulsive, mobile	1	CF	0.3–1.2	203	174	211	1.1	4	Omni	T
AA, triple plate S-Boom (700–1,000 J)[6]	Impulsive, mobile	3.4	CF	0.1–5	205	172	211	0.6	4	80	T

μPa = micropascal; AA = Applied Acoustics; CF = Crocker and Fratantonio (2016); CHIRP = compressed high-intensity radiated pulses; dB = decibel; EM = equipment mounted; ET = edgetech; J = joule; Omni = omnidirectional source; re = referenced to; PK = zero-to-peak sound pressure level; PM = pole mounted; SBI = sub-bottom imager; SL = source level; SPL = root-mean-square sound pressure level; T = towed; TB = Teledyne benthos; UHD = ultra-high definition; WFA = weighting factor adjustment.

[1]Operational parameters listed here differ from those listed in the Bureau of Ocean Energy Management Biological Assessment published in February 2021 (Baker and Howson, 2021).

[2]WFAs were selected in the User Spreadsheet were based on estimated hearing sensitivities of marine mammals and the operational frequency of the source.

[3]All CHIRP equipment have operational beamwidths <180° and sweep through a range of frequencies per pulse, so ranges to Level A thresholds were therefore calculated using MATLAB code provided by the National Marine Fisheries Service Office of Protected Resources (NMFS, 2021b).

[4]The Dura-spark measurements and specifications provided in Crocker and Fratantonio (2016) were used for all sparker systems proposed for the survey. The data provided in Crocker and Fratantonio (2016) represent the most applicable data for similar sparker systems with comparable operating methods and settings when manufacturer or other reliable measurements are not available.

[5]The AA Dura-spark (500 J, 400tips) was used as a proxy source.

[6]Crocker and Fratantonio (2016) provide S-Boom measurements using two different power sources (CSP-D700 and CSP-N). The CSP-D700 power source was used in the 700 J measurements but not in the 1,000 J measurements. The CSP-N source was measured for both 700 J and 1,000 J operations but resulted in a lower SL; therefore, the single maximum SL value was used for both operational levels of the S-Boom.

1.4 DISTANCES TO REGULATORY ACOUSTIC THRESHOLDS

Because the impulsive sources included in this analysis use dual metrics (SEL_{24h} and PK) for Level A exposure criteria, the metric resulting in the largest isopleth distance was used for exposure estimation. Weighting factor adjustments (WFAs) for Level A isopleths used to account for differences in marine mammal hearing were determined by examining the frequency range and spectral densities for each source. The selected WFAs were then compared to the Applicable Frequencies Table located in the WFA tab of the NMFS User Spreadsheet Tool (NMFS, 2018b). If the determined frequency was lower than the applicable frequency for all hearing groups, it was entered as the WFA. When the frequency of a source exceeded the applicable frequency for a certain hearing group, an additional worksheet was created that applied the "use" frequency of the exceeded hearing group as indicated by NMFS (NMFS, 2018b). All the non-impulsive sources included in the take assessment of this Application (**Table 3**) have operational beamwidths <180° and sweep through multiple frequencies within a single pulse, so ranges to Level A exposure criteria were therefore calculated using MATLAB code provided by NMFS OPR (NMFS, 2021b).

The User Spreadsheet does not calculate distances to Level B thresholds; the ranges to the Level B thresholds for omnidirectional sources (beamwidths >180°) were instead determined by applying spherical spreading loss to the SL for that equipment. For directional sources with reported beamwidths <180°, operational depth and directionality can greatly influence how the sound propagates and can influence the resulting isopleth distance, so these parameters were considered for sources that had reported beamwidths. Narrow beamwidths allow geophysical equipment to be highly directional, focusing its energy in the vertical direction and minimizing horizontal propagation, which greatly reduces the possibility of direct path exposure to receivers (i.e., marine mammals) from sounds emitted by these sources. Therefore, for directional sources, isopleth distances were calculated following NMFS OPR interim guidance (NMFS, 2019a) to account for the influence of beamwidth and frequency on the horizontal propagation of these sources.

The estimated distances to Level A and Level B isopleths calculated for each marine mammal hearing group are given in **Table 4**.

Table 4. Maximum distance to weighted Level A and unweighted Level B thresholds for each sound source or comparable sound source category for all marine mammal hearing groups[1].

Source	Distance to Level A Threshold (m)					Distance to Level B (m)
	LF (SEL_{24h} threshold)	MF (SEL_{24h} threshold)	HF (SEL_{24h} threshold)	HF (PK threshold)	PW (SEL_{24h} threshold)	All (SPL threshold)
Non-impulsive, non-parametric, shallow SBP (CHIRPs)						
ET 216 CHIRP	<1	<1	1.7	-	<1	12
ET 424 CHIRP	<1	<1	<1	-	<1	4
ET 512i CHIRP	<1	<1	<1	-	<1	6
GeoPulse 5430	<1	<1	18.9	-	<1	29
TB CHIRP III	1.5	<1	11.4	-	<1	54
Pangeo SBI	<1	<1	2.5		<1	22
Impulsive, medium SBP (Boomers and Sparkers)						
AA Triple plate S-Boom (700/1,000 J)	<1	0	0	4.7	0	76
AA, Dura-spark UHD Sparkers	<1	0	0	2.8	0	141
GeoMarine Sparkers	<1	0	0	2.8	0	141

μPa = micropascal; AA = Applied Acoustics; CHIRP = compressed high-intensity radiated pulses; dB = decibel; ET = edgetech; HF = high-frequency; J = joules; LF= low-frequency; MF = mid-frequency; PK = zero to peak sound pressure level in dB re 1 μPa; PW = phocids in water; re= referenced to; SBI = sub-bottom imager; SBP = sub-bottom profiler; SEL_{24h} = cumulative sound exposure level in dB re 1 μPa^2 s; SPL = root-mean-square sound pressure level; TB = Teledyne benthos; UHD = ultra-high definition.

[1]The Level A and B isopleths were calculated to comprehensively assess the potential impacts of the predicted source operations as required for this Application. However, as described in **Section 5.0**, Level A takes are not expected.

[2]Threshold ranges calculated in this Application differ from those listed in the Bureau of Ocean Energy Management Biological Assessment published in February 2021 (Baker and Howson, 2021) because that assessment assumed the maximum source settings for each equipment, whereas lower source settings are proposed for these surveys.

2.0 Survey Dates, Duration, and Specific Geographic Region

2.1 SURVEY ACTIVITY DATES AND DURATION

Site characterization surveys considered under this application are expected to occur between 25 September 2022 through 24 September 2023 with a total of 400 survey days. A survey day is defined here as a 24-hour activity period in which the assumed number of line km are surveyed. The number of anticipated survey days was calculated as the number of days needed to reach the overall level of effort required to meet survey objectives assuming any single vessel covers, on average 70 line km per 24-hour operations. A survey day accounts for multiple vessels such that two vessels operating within one 24-hour period equates to two survey days. A maximum of three vessels would work concurrently in the Project Area in any combination of 24-hour and 12-hour vessels. However, the take assessment in **Section 6.0** assumes all 24-hour vessel operations.

During the one-year period covered by this IHA, 400 vessel survey days are estimated during which HRG sources will be active within Lease Area OCS-A 0486, 0487, 0500 and the associated ECR areas. The number of estimated survey days varies by Lease Area and ECR (**Table 5**).

Table 5. Proposed number of survey days for each of the three Lease Areas as well as the export cable route (ECR) area.

Area	Total Number of Survey days
OCS-A-0486	10
OCA-A-0487	10
OCS-A-0500	200
ECR	180
TOTAL	**400**

2.2 SPECIFIC GEOGRAPHIC REGION

The proposed survey activities will occur within the Project Area in federal waters off the coast of Rhode Island and Massachusetts. Water depths in the Project Area extend out from shoreline to approximately 90 m.

2.3 SURVEY ACTIVITIES

Site characterization survey activities will include multibeam depth sounding, seafloor imaging, and shallow and medium penetration sub-bottom profiling to meet BOEM requirements as set out in the Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585 [March, 2017]; the Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to 30 CFR Part 585 [July, 2015] (BOEM, 2019), as applicable; and to support engineering design and UXO surveys.

Site characterization survey activities considered in this IHA will use combinations of the equipment listed in **Table 3**, or comparable, to collect multiple aspects of geophysical data along each transect. Equipment listed as unlikely to adversely affect marine mammals in the BOEM BA (Baker and Howson, 2021), with operating frequencies above 180 kHz (e.g., SSS, MBES), and that do not have an acoustic output (e.g., magnetometers) will also be used but are not considered in the IHA analysis. Selection of equipment combinations is based on specific survey objectives. Field operation modes of each acoustic equipment source are based on survey parameters and as needed modification due to field conditions and data quality constraints.

3.1 PROTECTED POPULATIONS

All marine mammal species are protected under the MMPA. Some marine mammal stocks, defined as a group of nonspecific individuals that are managed separately (Hayes et al., 2021; NMFS, 2021c), may be designated as strategic under the MMPA.

A stock is considered strategic if:

- Direct human-caused mortality exceeds its Potential Biological Removal (PBR) level (defined as the maximum number of animals, not including natural mortality, that can be removed from the stock while still allowing the stock to reach or maintain its optimum sustainable population level);
- It is listed under the ESA;
- It is declining and likely to be listed under the ESA; or
- It is designated as depleted under the MMPA.

A depleted species or population stock is defined by the MMPA as any case in which:

- The Secretary, after consultation with the Marine Mammal Commission and the Committee of Scientific Advisors on Marine Mammals established under MMPA Title II, determines that a species or population stock is below its optimum sustainable population;
- A State, to which authority for the conservation and management of a species or population stock is transferred under Section 109 of the MMPA, determines that such species or stock is below its optimum sustainable population; or
- A species or population stock is listed as an Endangered species or a Threatened species under the ESA.

Some species are further protected under the ESA. Under the ESA, a species is considered Endangered if it is "in danger of extinction throughout all or a significant portion of its range." A species is considered Threatened if it "is likely to become an Endangered species within the foreseeable future throughout all or a significant portion of its range" (NMFS, 2020).

3.2 MARINE MAMMAL SPECIES

There are 36 species (comprising 37 stocks) of marine mammals in the Western North Atlantic OCS Region that are protected by the MMPA (**Table 5**) (Hayes et al., 2021; NMFS, 2021c). The marine mammal assemblage comprises 31 cetacean species, including 25 members of the suborder Odontoceti (toothed whales, dolphins, and porpoises) and 6 of the suborder Mysticeti (baleen whales). There are five whale species listed as Endangered under the ESA with ranges that include the Project Area:

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

Along with cetaceans, seals are also protected under the MMPA; four species of phocids (true seals) with ranges that include the Project Area include harbor seals (*Phoca vitulina*), gray seals (*Halichoerus grypus*), harp seals (*Pagophilus groenlandicus*), and hooded seals (*Cystiphora cristata*) (Waring et al., 2012; Hayes et al., 2021). Lastly, one species of sirenian, the Florida manatee (*Trichechus manatus latirostris*), is an occasional visitor to the region during summer months (U.S. Fish and Wildlife Service [USFWS], 2021). The manatee is listed as Threatened under the ESA and is protected under the MMPA along with the other marine mammals.

The expected occurrence of each species is based on the following criteria and/or on the habitat models (i.e., Best et al., 2012; Roberts, 2022) for the Project Area and for species available in the model analyses:

- Common – occurring consistently in moderate to large numbers;
- Regular – occurring in low to moderate numbers on a regular basis or seasonally;
- Uncommon – occurring in low numbers or on an irregular basis;
- Rare – records for some years but limited; and
- Not expected – range includes the Project Area but due to habitat preferences and distribution information, species are not expected to occur in the Project Area although records may exist for adjacent waters.

The protection status, stock identification, occurrence, and abundance estimates of the species listed in **Table 6** are discussed in more detail in **Section 4.0**.

Table 6. Marine mammals protected by the Marine Mammal Protection Act with geographic ranges that include the Project Area (Hayes et al., 2021; NMFS, 2021c; Pettis et al., 2021; USFWS, 2021).

Common Name	Scientific Name	Stock	Federal ESA/MMPA Status	Relative Occurrence in the Region	Population (Best Estimate)[1]
Low-frequency Cetaceans					
Fin whale	*Balaenoptera physalus*	Western North Atlantic	ESA Endangered/ Depleted and Strategic	Common	6,802
Minke whale	*Balaenoptera acutorostrata*	Canadian East Coast	Non-strategic	Common	21,968
Humpback whale	*Megaptera novaeangliae*	Gulf of Maine	Non-strategic	Common	1,396
North Atlantic right whale	*Eubalaena glacialis*	Western Atlantic	ESA Endangered/ Depleted and Strategic	Common	368
Sei whale	*Balaenoptera borealis*	Nova Scotia	ESA Endangered/ Depleted and Strategic	Regular	6,292
Blue whale	*Balaenoptera musculus*	Western North Atlantic	ESA Endangered/ Depleted and Strategic	Rare	402
Mid-frequency Cetaceans					
Sperm whale	*Physeter macrocephalus*	North Atlantic	ESA Endangered/ Depleted and Strategic	Common	4,349

Table 6. (Continued).

Common Name	Scientific Name	Stock	Federal ESA/MMPA Status	Relative Occurrence in the Region	Population (Best Estimate)[1]
Risso's dolphin	*Grampus griseus*	Western North Atlantic	Non-strategic	Common	35,215
Long-finned pilot whale	*Globicephala melas*	Western North Atlantic	Strategic	Common	39,215
Short-finned pilot whale	*Globicephala macrorhynchus*	Western North Atlantic	Strategic	Rare	28,924
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Western North Atlantic	Non-strategic	Common	93,233
Common dolphin	*Delphinus delphis*	Western North Atlantic	Non-strategic	Common	172,974
Atlantic spotted dolphin	*Stenella frontalis*	Western North Atlantic	Non-strategic	Uncommon	39,921
Common bottlenose dolphin[3]	*Tursiops truncatus*	Western North Atlantic, Offshore	Non-strategic	Common	62,851
Common bottlenose dolphin[3]	*Tursiops truncatus*	Western North Atlantic, northern migratory coastal	Strategic	Rare	6,639
Dwarf sperm whale	*Kogia sima*	Western North Atlantic	Non-strategic	Rare	7,750
Pygmy sperm whale	*Kogia breviceps*	Western North Atlantic	Non-strategic	Rare	7,750
Killer whale	*Orcinus orca*	Western North Atlantic	Non-strategic	Rare	Unknown
Pygmy killer whale	*Feresa attenuata*	Western North Atlantic	Non-strategic	Not Expected	Unknown
False killer whale	*Pseudorca crassidens*	Western North Atlantic	Non-strategic	Rare	1,791
Northern bottlenose whale	*Hyperoodon ampullatus*	Western North Atlantic	Non-strategic	Not Expected	Unknown
Cuvier's beaked whale	*Ziphius cavirostris*	Western North Atlantic	Non-strategic	Rare	5,744
Mesoplodon beaked whales	*Mesoplodon* spp.	Western North Atlantic	Depleted	Rare	10,107
Melon-headed whale	*Peponocephala electra*	Western North Atlantic	Non-strategic	Not Expected	Unknown
White-beaked dolphin	*Lagenorhynchus albirostris*	Western North Atlantic	Non-strategic	Rare	536,016
Pantropical spotted dolphin	*Stenella attenuata*	Western North Atlantic	Non-strategic	Rare	6,593
Striped dolphin	*Stenella coeruleoalba*	Western North Atlantic	Non-strategic	Uncommon	67,036
Fraser's dolphin	*Lagenodelphis hosei*	Western North Atlantic	Non-strategic	Rare	Unknown
Rough toothed dolphin	*Steno bredanensis*	Western North Atlantic	Non-strategic	Rare	136
Clymene dolphin	*Stenella clymene*	Western North Atlantic	Non-strategic	Not Expected	4,237
Spinner dolphin	*Stenella longirostris*	Western North Atlantic	Non-strategic	Rare	4,102

Table 6. (Continued).

Common Name	Scientific Name	Stock	Federal ESA/MMPA Status	Relative Occurrence in the Region	Population (Best Estimate)[1]
High-frequency Cetaceans					
Harbor porpoise	*Phocoena phocoena*	Gulf of Maine/Bay of Fundy	Non-strategic	Common	95,543
Phocid Pinnipeds in Water					
Harbor seal	*Phoca vitulina*	Western North Atlantic	Non-strategic	Regular	61,336
Gray seal	*Halichoerus grypus*	Western North Atlantic	Non-strategic	Regular	27,300
Harp seal	*Pagophilus groenlandica*	Western North Atlantic	Non-strategic	Rare	7,600,000
Hooded seal	*Cystophora cristata*	Western North Atlantic	Non-strategic	Rare	Unknown
Sirenians					
Florida manatee	*Trichechus manatus latirostris*	-	ESA Threatened/ Depleted and Strategic	Rare	13,000[3]

- = not applicable for this species; ESA = Endangered Species Act; MMPA = Marine Mammal Protection Act; NMFS = National Marine Fisheries Service; USFWS = U.S. Fish and Wildlife Service.
[1]Best abundance estimate from the most recently published National Oceanic and Atmospheric Administration Stock Assessment Reports (Hayes et al., 2021) or draft Stock Assessment Report (NMFS, 2021c) were used.
[2]Common bottlenose dolphins likely to occur in this area belong to two distinct stocks.
[3]Current range-wide estimate from the USFWS (2021).

4.0 Affected Species Status and Distribution

Of the 36 marine mammal species with geographic ranges that include the Project Area (**Table 5**), 16 species can be reasonably expected to reside, traverse, or occasionally visit the Project Area and may be considered affected. Species information is based on NMFS stock assessment reports (SARs) (Hayes et al., 2017, 2019, 2020, 2021; NMFS, 2021c; Waring et al., 2014, 2015, 2016), and regional survey records (e.g., Cetacean and Turtle Assessment Program [CETAP], 1982; Atlantic Marine Assessment Program for Protected Species [AMAPPS], 2010 to 2014 [Palka et al., 2017]; North Atlantic Right Whale Sighting Survey and Right Whale Sighting Advisory System [RWSAS]; BOEM Mid-Atlantic EA [BOEM, 2012]; the 2021 BOEM BA (Baker and Howson, 2021); the Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles [Kraus et al., 2016]); modeling studies (Pace, 2021); species working group reports (Pettis et al., 2021); and results (unpublished) of PSO/PAM mitigation surveys conducted by the Applicant during site investigation surveys in 2017 and 2018, and 2020 PSO data from a monitoring report from surveys not conducted by the Applicant posted under supporting materials for 86 *FR* 21289.

Affected species are those that have a common, regular, or uncommon relative occurrence in Project Area (**Table 5**) and include those species regularly observed around the Project Area or have a very wide distribution with limited distribution or abundance details. Species that are rare or not expected are not carried forward in this application. Therefore, the Applicant requests an IHA for Level B disturbance for the 16 species listed below and described in the following sections.

- North Atlantic right whale (*Eubalaena glacialis*)
- Humpback whale (*Megaptera novaeangliae*)
- Fin whale (*Balaenoptera physalus*)
- Sei whale (*Balaenoptera borealis*)
- Minke whale (*Balaenoptera acutorostrata*)
- Sperm whale (*Physeter microcephalus*)
- Risso’s dolphin (*Grampus griseus*)
- Long-finned pilot whale (*Globicephala melas*)
- Atlantic white-sided dolphin (*Lagenorhynchus acutus*)
- Common dolphin (*Delphinus delphis*)
- Atlantic spotted dolphin (*Stenella frontalis*)
- Common bottlenose dolphin (*Tursiops truncatus*) – Western North Atlantic offshore stock
- Striped dolphin (*Stenella coeruleoalba*)
- Harbor porpoise (*Phocoena phocoena*)
- Harbor seal (*Phoca vitulina*)
- Gray seal (*Halichoerus grypus*)

Species will not be equally affected by the proposed activities due to individual exposure patterns, the context in which noise is received, and, most prominently, individual hearing sensitivities. To account for acoustic sensitivity, marine mammal species are categorized into hearing groups that are designated to better predict and quantify impacts of noise (NMFS, 2018a; Southall et al., 2007, 2019). These functional hearing groups are described below with associated reference frequencies. While all these species likely hear beyond these bounds, primary sensitivities fall within the listed frequencies (**Section 1.2.1.1**).

The following information summarizes data on the status and trends, distribution and habitat preferences, behavior and life history, and auditory capabilities of marine mammals found in the Project Area as available in published literature and reports, including NMFS marine mammal SARs (Hayes et al., 2017, 2019, 2020, 2021; NMFS; 2021c; Waring et al., 2014, 2015, 2016).

4.1 MYSTICETES

4.1.1 North Atlantic Right Whale

The North Atlantic right whale (NARW) is the only member of the mysticete family Balaenidae found in North Atlantic waters. They are skim feeders that primarily consume zooplankton including copepods, euphausiids, and cyprids. The NARW is listed as Endangered and is considered one of the most endangered large whale species in the world (Jefferson et al., 2011; NMFS, 2021c; Pettis et al., 2021). The most recent draft NMFS SAR estimated a population size for the Western North Atlantic stock of only 368 individuals based on a published state-space model of the sighting histories of individual whales using photo identification techniques which included information up through November 2019 (NMFS, 2021c).

The most recent draft NMFS SAR (NMFS, 2021c) identified seven discrete areas where Western Atlantic NARWs aggregate seasonally: the coastal waters of the southeast U.S., the Great South Channel, Jordan Basin, Georges Basin along the northeastern edge of Georges Bank, Cape Cod and Massachusetts Bays, the Bay of Fundy, and the Roseway Basin on the Scotian Shelf (Brown et al., 2001; Cole et al., 2013). Several of these congregation areas correlate with seasonally high copepod concentrations (Pendleton et al., 2009). New England waters are a primary feeding habitat for NARWs during late winter through spring, with feeding moving into deeper and more northerly waters during summer and fall. It is understood that some individuals migrate from the northern feeding grounds to their calving grounds in shallow coastal waters off the southeast U.S. during fall/winter. However, movement and migration patterns vary and less overall is known regarding winter distributions.

Recent passive acoustic studies of NARWs have demonstrated they may also be present year-round in the Gulf of Maine (Morano et al., 2012; Bort et al., 2015), Rhode Island (Kraus et al., 2016), New Jersey (Whitt et al., 2013), and Virginia (Salisbury et al., 2016). Additionally, NARWs were acoustically detected off Georgia and North Carolina during 7 of the 11 months monitored (Hodge et al., 2015). All of this work further demonstrates the highly mobile nature of NARWs. Movements within and between habitats are extensive and the area off the coasts of Rhode Island and Massachusetts is an important migratory corridor. Critical foraging habitat for this species has been designated to the north of the Project Area in the Gulf of Maine and Georges Bank region (81 *FR* 4837). Davis et al. (2017) recently examined detections from passive acoustic monitoring devices and documented a broad-scale use of much more of the U.S. Eastern Seaboard than was previously believed, and an apparent shift in habitat use patterns to the south of traditionally identified NARW congregations. Increased use of Cape Cod Bay and decreased use of the Great South Channel were also observed (Davis et al., 2017).

Around the Project Area NARWs were predominantly observed during the winter and spring during visual surveys (Kraus et al., 2016; NOAA, 2022). Sighting data from the RWSAS indicate approximately 998 detections of NARWs have been seen in waters around the Project Area between 2015 and 2022 between January and March (NOAA, 2022).

The major threat to the NARW stock is human-caused mortality through incidental fishery entanglement that averaged 5.7 incidents per year and ship strikes that averaged 2.0 incident records per year based on data from 2015 through 2019 (NMFS, 2021c). In June 2017, NMFS declared an Unusual Mortality Event (UME) following an increase in NARW mortalities in the U.S. and Canada. As of 3 September 2021, a total of 34 dead stranded whales have been reported, including 21 in Canada, and 13 in the U.S. The preliminary cause of death for most of these cases was determined to be due to vessel strike or entanglement (NMFS, 2021d). The draft SAR for NARW sets the PBR level at 0.7; therefore, any mortality or serious injury for this stock can be considered significant (NMFS, 2021c). The Western Atlantic stock is considered strategic by NMFS because the average annual human-related mortality and serious injury exceeds PBR, and because the NARW is an Endangered species.

Seasonal Management Areas (SMAs) for reducing ship strikes of the NARW have also been designated in the U.S. and Canada. All vessels greater than 19.8 m in overall length must operate at speeds of 10 knots or less within these areas during specified time periods (NMFS, 2021e). The closest SMAs to the Project Area are at the ports of New York and New Jersey and the entrance to Delaware Bay, which are in effect seasonally from1 November to 30 April (**Figure 2**).

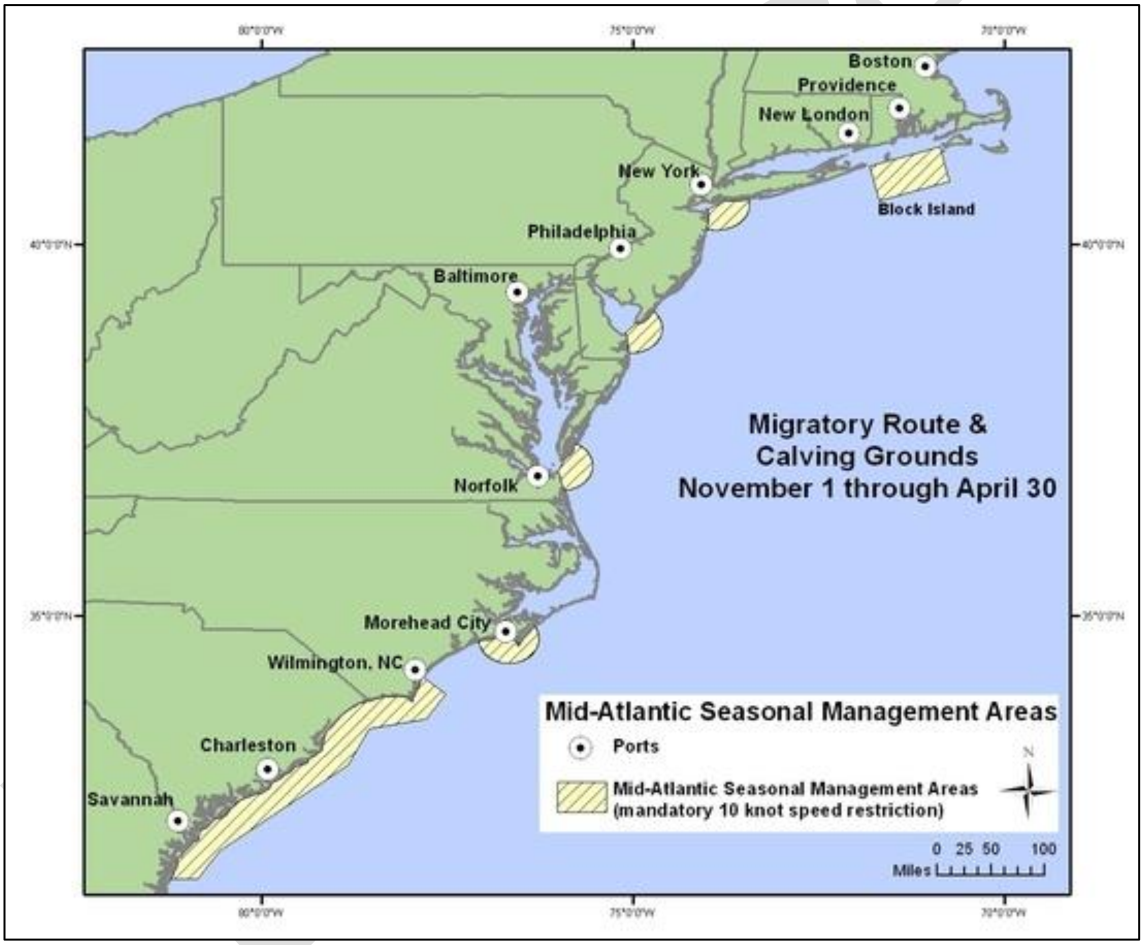

Figure 2. Mid-Atlantic Seasonal Management Areas for North Atlantic right whales (*Eubalaena glacialis*). (NMFS, 2021e).

The NARW underwent a NMFS 5-year review in 2017, which resulted in no change to its listing status. In 2009, NMFS received a petition to expand the critical habitat, and the agency considered this petition in the rulemaking process. In January 2016, two additional units comprising over 102,000 km^2 of marine habitat were designated as critical habitat to encompass the northeast feeding area in the Gulf of Maine/ Georges Bank and the southeast calving grounds from North Carolina to Florida. The Project Area does not fall in any NARW critical habitat designations.

The following final rules notices are associated with the NARW:

- Critical Habitat Designation: 59 *FR* 28805, June 3, 1994;
- Atlantic Large Whale Take Reduction Plan: 62 *FR* 39157, July 22, 1997;
- Federal Regulations Governing the Approach to North Atlantic right whales: 69 *FR* 69536, November 30, 2004;
- Final Rule to Implement Speed Restrictions to Reduce the Threat of Ship Collisions with North Atlantic right whales: 73 *FR* 60173, October 10, 2008;
- Findings on Petition to Revise Critical Habitat: 75 *FR* 61690, October 6, 2010;
- Final Rule to Remove the Sunset Provision of the Final Rule Implementing Vessel Speed Restrictions to Reduce the Threat of Ship Collisions with North Atlantic right whales 78 *FR* 73726 December 9, 2013; and
- Final Rule for North Atlantic right whale (*Eubalaena glacialis*) Critical Habitat 81 *FR* 4838, January 27, 2016.

NARWs are LF cetaceans that vocalize using a number of distinctive call types, most of which have peak acoustic energy below 500 Hz. Most vocalizations do not go above 4 kHz (Matthews et al., 2014). One typical NARW vocalization is the “up call”; a short sweep that rises from roughly 50 to 440 Hz over a period of 2 seconds. These up calls are characteristic of NARWs and are used by research and monitoring programs for indication of species presence. A characteristic “gunshot” call is believed to be produced by male NARWs. These pulses can have SLs of 174 to 192 dB re 1 µPa m with frequency range from 50 to 2,000 Hz (Parks and Tyack, 2005; Parks et al., 2005). Other tonal calls range from 20 to 1,000 Hz and have SLs between 137 and 162 dB re 1 µPa m.

4.1.2 Humpback Whale

The humpback whale is a robust and medium-sized mysticete. It is distinguished from all other cetaceans by its long pectoral flippers, which are approximately one-third the length of the body (Jefferson et al., 2008). One species of the humpback whale is currently recognized (Committee on Taxonomy, 2021). Humpback whales are largely piscivorous, feeding primarily on herring (*Clupea* spp.), sand lance (*Ammodytes* spp.), and other small fishes as well as euphausiids in the Gulf of Maine (Hayes et al., 2019). Humpbacks show fidelity to feeding sites; however, local distribution is driven by prey availability and bathymetry, resulting in the whales transiting widely throughout their feeding habitat between spring and fall in search of prey. Feeding is the principal activity of humpback whales in New England waters, and their distribution in this region has been largely correlated to prey species and abundance (Payne et al., 1986, 1990).

The humpback whales occurring within the Project Area are believed to be mainly part of the Gulf of Maine stock (Hayes et al., 2021). Humpback whales have a global distribution and follow a migratory pattern of feeding in the high latitudes during summers and spending winters in the lower latitudes for calving and mating. The Gulf of Maine stock follows this pattern with winters spent in the Caribbean and West Indies, although acoustic recordings show a small number of males persisting in Stellwagen Bank throughout the year (Vu et al., 2012). The Gulf of Maine stock is comprised of an estimated 1,396 individuals (Hayes et al., 2021).

Sightings of humpback whales in the northeast are common (Kenney and Vigness-Raposa, 2010; Kraus et al., 2016). Surveys in the RI – MA WEA reported humpback whale sightings in all seasons with peak abundance during the spring and summer, but their presence within the region varies between years (Kraus et al., 2016). Stocks of sand lance appear to correlate with the years in which the most abundant whales are observed, suggesting that humpback whale distribution and occurrences could largely be influenced by prey availability (Kenney and Vigness-Raposa, 2010). The greatest number of sightings of humpbacks in the WEA occurred during April (33 sightings); their presence increased starting in March and continuing through July. Acoustic detections within the WEA were also primarily during the summer months (Kraus et al., 2016).

Primary threats to humpback whales are fishing gear entanglements and ship strikes. Mortality and serious injury records for large whales in the Western North Atlantic over a 40-year period (1970 to 2009) were reviewed to assess the magnitude of human related mortalities (van der Hoop et al., 2013). Results showed that roughly 27% of large whale mortalities and serious injuries were humpback whale records. Of the humpback records where a cause could be determined (203 records), 57% of mortalities were caused by entanglements in fishing gear and 15% were attributable to vessel strikes. Glass et al. (2009) reported that between 2002 and 2006, humpback whales belonging to the Gulf of Maine stock were involved in 77 confirmed fishing gear entanglements and nine confirmed ship strikes. Records assessed between 2014 and 2018 resulted in a minimum annual rate of human-caused mortality and serious injury to the Gulf of Maine stock of 15.25 animals per year (Hayes et al., 2021). This value includes an annual rate of incidental fishery interactions (9.45) and vessel strikes (5.8) (Hayes et al., 2021). In 2016, a high number of humpback mortalities prompted NMFS to declare a UME starting in January (NMFS, 2021e). As of 3 September 2021, a total of 152 humpback whales have been found dead between Maine and Florida. Of these mortalities, eight occurred in Delaware, three in Maryland, 16 in New Jersey, and 31 in New York. Of the carcasses examined, approximately 50% had evidence of human interaction such as vessel strike or entanglement (NMFS, 2021e).

On 8 September 2016 NMFS published a final decision changing the status of humpback whales under the ESA (81 *FR* 62259), effective as of 11 October 2016. Previously, humpback whales were listed under the ESA as an Endangered species worldwide. In the 2016 decision, NMFS recognized the existence of 14 distinct population segments (DPSs), of which four were listed as Endangered, one was listed as Threatened, and the remaining nine did not warrant protection under the ESA. A status review of the humpback whale was undertaken by NMFS in 2015 (Bettridge et al., 2015) to identify taxonomic units such as DPSs and assess the extinction risk of these units. To be considered a DPS, a population or group of populations must be "discrete" from the remainder of the taxon to which it belongs, and "significant" to the taxon to which it belongs. Information on distribution, ecological situation, genetics, and other factors is used to evaluate a population's discreteness and significance. This review process resulted in the identification of a West Indies DPS, which includes the Gulf of Maine stock. The West Indies DPS was considered not to be at risk of extinction. Subsequently, the Gulf of Maine stock is not a strategic stock, and no critical habitat has been designated for the humpback whale (Hayes et al., 2021).

Like other large whales, increases in noise levels may affect this species' ability to transmit and access acoustic cues in the environment. For example, Clark et al. (2009) predicted an 8% reduction in communication space due to shipping for singing humpback whales in the northeast. Humpbacks are an LF species, but have one of the most varied vocal repertoires of the baleen whales. Male humpbacks will arrange vocalizations into a complex, repetitive sequence to produce a characteristic "song." Songs are variable, but typically occupy in frequency bands between 300 and 3,000 Hz and last upwards of 10 minutes. Songs are predominately produced while on breeding grounds; however, they have been recorded on feeding grounds throughout the year (Clark and Clapham, 2004; Vu et al., 2012). Typical feeding calls are centered at 500 Hz with some other calls and songs reaching 20 kHz. Common humpback calls also contain series of grunts between 25 and 1,900 Hz as well as strong, LF pulses (with SLs up to 176 dB re 1 µPa m) between 25 and 90 Hz (Clark and Clapham, 2004; Vu et al., 2012).

4.1.3 Fin Whale

Fin whales are a widely distributed species found in all oceans of the world. The fin whale is listed as Endangered under the ESA and a Final Recovery Plan for fin whales is available (NMFS, 2010). Fin whales transit between summer feeding grounds in the high latitudes and their wintering, calving, or mating habitats in low latitudes or offshore. However, acoustic records indicate that fin whale populations may be less migratory than other mysticetes whose populations make distinct annual migrations (Watkins et al., 2000). Fin whales typically feed on sand lance, capelin (*Mallotus villosus*), euphausiids, herring, copepods, and cephalopods (i.e., squid) in deeper waters near the edge of the continental shelf (90 to 180 m) but will migrate towards coastal areas following prey distribution.

The fin whales that occur within the Project Area are part of the Western North Atlantic stock of fin whales. This is considered a strategic stock because fin whales are listed as Endangered throughout their range. In February 2019, NMFS undertook a 5-year status review (NMFS, 2019b) of the fin whale and determined that there should be no change in its listing status. The best population abundance estimate is 6,802 individuals (NMFS, 2021c).

Along the U.S. Atlantic seaboard they are mainly found from Cape Hatteras northward with a distribution in both continental shelf and deep water habitats (Hayes et al., 2019). The Northern fin whale subspecies is found within the Project Area. Fin whales accounted for 46% of the large whales sighted during aerial surveys along the continental shelf (CETAP, 1982) between Cape Hatteras and Nova Scotia from 1978 to 1982. Two well-known feeding grounds for fin whales are present near the Project Area in the Great South Channel and Jeffrey's Ledge and in waters directly east of Montauk, New York (Hayes et al., 2019; Kenney and Vigness-Raposa, 2010). The highest occurrences are identified south of Montauk Point to south of Nantucket (Kenney and Vigness-Raposa, 2010). Surveys conducted in the RI – MA WEA indicate fin whales may be present year-round, but sightings were the highest during the spring and summer (Kraus et al., 2019).

Threats to fin whales are entanglements in fishing gear and ship strikes. For the period between 2015 through 2019, the minimum annual rate of human-caused mortality and serious injury to fin whales was 1.85 individuals per year. This value includes 1.45 fishery interaction records per year and 0.4 vessel strike records per year (NMFS, 2021c). The total human-caused mortality and serious injury is less than the calculated PBR; however, it cannot be considered insignificant due to uncertainties regarding these estimates and the current Endangered status of this population which make this a strategic stock under the MMPA. There is no designated critical habitat for this stock (NMFS, 2021c).

Fin whales are LF cetaceans that produce short-duration, down sweep calls between 15 and 30 Hz, typically termed "20-Hz pulses" as well as tonal calls up to 150 Hz. The SL of the fin whale vocalizations can reach 186 dB re1 µPa m, making it one of the most powerful biological sounds in the ocean (Charif et al., 2002).

4.1.4 Sei Whale

Sei whales are a widespread species throughout the world's temperate, subpolar, subtropical, and tropical oceans (Waring et al., 2015). They are very similar in appearance to fin and Bryde's whales (*Balaenoptera edeni*). Two subspecies of sei whales are currently recognized (Committee on Taxonomy, 2018) one of which, the Northern sei whale (*B. b. borealis*) is known to occur within the Project Area. The sei whales occurring in the Project Area are part of the Nova Scotia stock (formerly the Western North Atlantic stock). Sei whales are most common in deeper waters along the continental shelf edge

(NMFS, 2021c) but will forage occasionally in shallower, inshore waters. The average spring abundance estimate for surveys conducted between 2010 and 2013 is 6,292 individuals, which is considered the best available abundance estimate for the Nova Scotia stock since these surveys covered the largest portion of its range (NMFS, 2021c).

Sei whales are most abundant in Northeastern U.S. waters during the spring, with sightings concentrated along the eastern and southwestern margins of Georges Bank in the area of Hydrographer Canyon (CETAP, 1982). Small groups of sei whales have also been reported south of Montauk Point, New York and Block Island, Rhode Island (Kenney and Vigness-Raposa, 2010). The sei whale feeds primarily on euphausiids and copepods, but will also prey upon fish, and local abundance is largely driven by prey availability. The occurrence and abundance of sei whales on feeding grounds may shift dramatically from one year to the next. CETAP surveys observed sei whales along the continental shelf edge only during the spring and summer (CETAP, 1982). This agrees with sightings in the RI – MA WEA where sei whales were also only observed during the spring (eight sightings) and summer (13 sightings). No sightings were reported in the WEA during the fall and winter (Kraus et al., 2016).

From 2015 through 2019, the minimum rate of confirmed human-caused serious injury and mortality to the Nova Scotia stock was 0.8 individuals per year, which was attributed to fisheries interactions (0.4), vessel strikes (0.2), and other human-caused mortality (0.2) (NMFS, 2021c). The Nova Scotia stock is strategic because the species is listed as Endangered under the ESA and the average human-related mortality and serious injury exceeds the PBR. There is no designated critical habitat for this species (NMFS, 2021c).

There are limited confirmed sei whale vocalizations; however, studies indicate that this species produces several, mainly LF (<1,000 Hz) vocalizations. Several calls attributed to sei whales include pulse trains up to 3 kHz, broadband "growl" and "whoosh" sounds between 100 and 600 Hz, tonal calls and upsweeps between 200 and 600 Hz, and down sweeps between 34 and 100 Hz (Baumgartner et al., 2008; McDonald et al., 2005; Rankin and Barlow, 2007).

4.1.5 Minke Whale

The minke whale is a small mysticete that is divided into two species: the common minke whale and the Antarctic minke whale. The common minke whale is further divided into three subspecies (Committee on Taxonomy, 2021). The subspecies *B. a. acutorostrata* occurs throughout the North Atlantic. Generally, minke whales occupy warmer waters during the winter and travel north to colder regions in the summer, with some animals migrating as far as the ice edge. Minke whales are frequently observed in coastal or shelf waters along with humpback and fin whales owing to their piscivorous feeding habitats where prey includes sand lance and herring (Hayes et al., 2019). The current best abundance estimate for the Canadian East Coast stock is 21,968 individuals (NMFS, 2021c).

The minke whales that occur within the Project Area are part of the Canadian East Coast stock, which is one of four stocks in the North Atlantic. Little is known about their specific migratory behavior compared to other large whale species; however, acoustic detections show that minke whales migrate south in mid-October to early November and return from wintering grounds starting in March through early April (Risch et al., 2014). Northward migration appears to track the warmer waters of the Gulf Stream along the continental shelf, while southward migration is made farther offshore (Risch et al., 2014). Surveys conducted in the RI – MA WEA, reported 103 minke whale sightings within the area, predominantly in the spring (76) followed by summer (26) and fall (1) (Kraus et al., 2016).

Like other baleen whales, threats to minke whales include ship strikes and fisheries interactions. However, unlike the larger whales, minke whales are more susceptible to bycatch threats from bottom trawls, lobster trap/pot, gillnet, and purse seine fisheries. During the period from 2015 to 2019, the average annual minimum detected human-caused mortality and serious injury was 10.55 minke whales per year. This number was composed of 9.55 whales per year from unobserved U.S. fisheries bycatch, 0.2 from U.S. fisheries based on observer data, and 0.8 whale per year from ship strikes (NMFS, 2021c). Estimated rates of serious injury and mortality are less than the calculated PBR, but it cannot be considered insignificant or approaching zero (NMFS, 2021c). Vessel strikes have been documented from Maine to South Carolina (NMFS, 2021c). Since January 2017, a UME has been declared due to minke whale mortalities occurring between Maine and South Carolina. As of 3 September 2021, a total of 114 strandings have been reported with 17 of those occurring in New York and 11 in New Jersey. Examinations for several of the whales showed evidence of human interactions such as vessel strike or entanglement, or infectious disease (NMFS, 2021g). Additionally, minke whales continue to be hunted as part of an ongoing whaling industry in the northeastern North Atlantic, the North Pacific, and Antarctic (Reeves et al., 2012; NMFS, 2021h).

Minke whale recordings have resulted in some of the most variable and unique vocalizations of any marine mammal. Common calls for minke whales found in the North Atlantic include repetitive, LF (100 to 500 Hz) pulse trains that may consist of either grunt-like pulses or thump-like pulses. The thumps are very short in duration (50 to 70 milliseconds) with peak energy between 100 and 200 Hz. The grunts are slightly longer in duration (165 to 320 milliseconds) with most energy between 80 and 140 Hz. In addition, minke whales will repeat a 6 to 14-minute pattern of 40 to 60 second pulse trains over several hours (Risch et al., 2014). Minke whales produce a unique sound called the “boing” which consists of a short pulse at 1.3 kHz followed by an undulating tonal call around 1.4 kHz. This call was widely recorded but remained unidentified for many years and scientists widely speculated as to its source (Rankin and Barlow, 2005). The call frequency of minke whales suggests a hearing sensitivity higher than that of other baleen whales.

4.2 ODONTOCETES

4.2.1 Sperm Whale

Sperm whales can easily be distinguished in visual surveys by their large, blunt head; narrow underslung jaw; and characteristic blow shape resulting from the S-shaped blowhole set at the front-left of the head (Jefferson et al., 2008). They can be found throughout the world’s oceans; they have been observed near the edge of the ice packs in both hemispheres and are also common along the equator. The North Atlantic stock is distributed mainly along the continental shelf edge, over the continental slope, and mid-ocean regions, where they prefer water depths of 600 m or more. Sperm whales are uncommon, but have been detected, in waters <300 m deep (Waring et al., 2015). Sperm whales are listed as Endangered under the ESA and are considered a strategic stock by NMFS (Waring et al., 2015). Data are insufficient to assess population trends and the current abundance estimate was based on only a fraction of the known stock range (Waring et al., 2015). The best recent abundance estimate for sperm whales is the sum of the estimates from 2016 surveys totaling 4,349 (Hayes et al., 2020).

In winter, sperm whales concentrate east and northeast of Cape Hatteras. In spring, distribution shifts northward to east of Delaware and Virginia, and is widespread throughout the central Mid-Atlantic Bight and the southern part of Georges Bank. In the fall, sperm whale occurrence on the continental shelf south of New England reaches peak levels (Waring et al., 2015). Sperm whales were the fifth most commonly sighted large whale in the CETAP study area and were observed in all four seasons. CETAP and NMFS Northeast Fisheries Science Center sightings in shelf-edge and off-shelf waters included many social groups with calves/juveniles (CETAP, 1982). Sperm whales were usually seen at locations corresponding to the tops of the seamounts and rises and did not generally occur over the slopes. Sperm whales were recorded at the surface over depths varying from 800 to 3,500 m. Kraus et al. (2016) reported sightings of sperm whales in the RI – MA WEA during the summer and fall months, with five individuals in August, one in September, and three in June. There have also been occasional strandings in Massachusetts and Long Island (Kenney and Vigness-Raposa, 2010). Although the likelihood of occurrence within the Project Area remains very low, the sperm whale was included as an affected species because of its high seasonal densities east of the Project Area.

Historically, thousands of sperm whales were killed during the early 18th Century. Presently, no hunting is allowed for any purposes in the North Atlantic. Occasionally, sperm whales become entangled in fishing gear or struck by ships off the east coast of the U.S. However, this rate of mortality is not believed to have biologically significant impacts. The annual average human-caused mortality for 2008 to 2012 was estimated to be 0.8 individuals due to entanglement and vessel strikes. During this same period, a total of 14 sperm whale strandings were reported in the U.S.; while the reasons for stranding could not be determined for all these cases, possible causes include vessel strikes, entanglement, pollution, and changes to their environment (Waring et al., 2015). However, there were no documented reports of human-caused mortality or serious injury for the period between 2013 and 2017 (Hayes et al., 2020). This stock is considered strategic under the MMPA due to its Endangered status, but since human-caused mortality and serious injury is less than PBR, it is not considered significant (Hayes et al., 2020).

Sperm whales are in the MF hearing group with an estimated auditory range of 150 Hz to 160 kHz (Southall et al., 2007). Sperm whales produce short-duration, repetitive broadband clicks used for communication and echolocation. These clicks range in frequency from 0.1 to 30 kHz, with dominant frequencies between the 2 to 4 kHz and 10 to 16 kHz ranges (Department of the Navy [DoN], 2008). Echolocation clicks from adult sperm whales are highly directional and have an estimated SL of up to 236 dB re 1 µPa m.

4.2.2 Risso’s Dolphin

Risso’s dolphins are large dolphins with a characteristic blunt head and light coloration, often with extensive scarring. They are widely distributed in tropical and temperate seas. In the Western North Atlantic they occur from Florida to eastern Newfoundland (Baird and Stacey, 1991; Leatherwood et al., 1976). Off the U.S. Northeast Coast, Risso’s dolphins are primarily distributed along the continental shelf, but can also be found swimming in shallower waters to the mid-shelf (Waring et al., 2016).

The status of the Western North Atlantic stock of the Risso’s dolphin in the U.S. Atlantic Exclusive Economic Zone is not well documented. An abundance estimate of 35,215 individuals in this stock was generated from a shipboard and aerial survey conducted between Florida and Newfoundland during 2016 (NMFS, 2021c). Risso’s dolphins are not listed as Threatened or Endangered under the ESA and the Western North Atlantic stock is not considered strategic under the MMPA.

Risso’s dolphins are widely distributed in tropical and temperate seas. In the Western North Atlantic they occur from Florida to eastern Newfoundland (Leatherwood et al., 1976; Baird and Stacey, 1991). Risso’s dolphins occur along the continental shelf edge from Cape Hatteras to Georges Bank during spring, summer, and autumn. In winter, they occur in continental shelf slope waters within the Mid-Atlantic Bight (Waring et al., 2014). The majority of sightings during 2011 AMAPPS surveys occurred along the continental shelf break with generally lower sighting rates over the continental slope (Palka, 2012). Offshore Rhode Island, Risso’s dolphin have been observed year-round, with a peak abundance during the summer. This species is primarily observed along the continental shelf break, with few individuals seen in waters shallower than 100 m (Kenney and Vigness-Raposa, 2010). Only two Risso’s dolphins were observed in the RI – MA WEA during spring (Kraus et al., 2016).

Entanglement and fisheries interactions are the primary threats to Risso's dolphins in the U.S. Atlantic. Estimated annual rates of serious injury and mortality from 2015 to 2019 were 34 mortalities in observed fisheries and no mortalities from non-fishery-related strandings (NMFS, 2021c). There were 31 strandings were reported during this period, none of which had confirmed evidence of human interactions (NMFS,2021c). Total human-related mortality does not exceed the calculated PBR but is not considered to be insignificant or approaching zero for this population (NMFS, 2021c).

Risso's dolphins are in the MF functional hearing group, with an estimated auditory bandwidth of 150 Hz to 160 kHz (Southall et al., 2007). Vocalizations range from 400 Hz to 65 kHz (DoN, 2008).

4.2.3 Long-finned Pilot Whale

There are two species of pilot whale in the Western North Atlantic: long-finned (*G. melas*) and short-finned (*G. macrorhynchus*). The species overlap, are difficult to tell apart, and parameters that define their distributions are not well differentiated. The best distinguishing characteristic of the long-finned pilot whale are the long, slender flippers, which are typically not visible during aerial or shipboard surveys (Jefferson et al., 2011). However, it is generally accepted that pilot whale sightings above approximately 42° N are most likely long-finned pilot whales (Waring et al., 2015). Short-finned pilot whales prefer warmer or tropical waters and are considered rare in New England. In the Northeastern U.S., they are typically sighted in deeper waters offshore near the Gulf Stream, but given the limited observations of this species in New England, they are not expected to occur in the Project Area and will not be discussed further (Kenney and Vigness-Raposa, 2010; NMFS, 2021c).

Long-finned pilot whales occur over the continental slope in high densities during winter and spring then move inshore and into shelf waters during summer and autumn following prey populations of cephalopods (i.e., squid) and mackerel (*Scomber* spp.) (Reeves et al., 2012). They will also readily feed on other fish, cephalopods, and crustaceans. Pilot whales are common in central and northern Georges Bank, Great South Channel, Stellwagen Bank, and Gulf of Maine during the summer and early fall (May and October) (NMFS, 2021c). Long-finned pilot whales are highly social and vocal and are typically observed in groups of 10 to 20 surface-active individuals. Long-finned pilot whales are not listed as threatened or endangered, and the Western North Atlantic stock is not considered strategic under the MMPA. The best population estimate for the Western North Atlantic stock of long-finned pilot whales is 39,215 individuals (NMFS, 2021c).

Pilot whales are distributed along the continental shelf waters off the Northeastern U.S. coast in the winter and early spring. By late spring, pilot whales migrate into more northern waters including Georges Bank and the Gulf of Maine and will remain there until fall (NMFS, 2021c). Long-finned pilot whales concentrate along the Northeast U.S. shelf edge between the 100 m and 1,000 m isobaths during mid-winter and early spring (CETAP, 1982). In late spring, pilot whales move from the mid-Atlantic region onto Georges Bank and the Scotian Shelf, and into the Gulf of Mexico, where they remain through late autumn (CETAP, 1982). Pilot whales generally occur in areas of high relief or submerged banks and are also associated with the Gulf Stream wall and thermal fronts along the continental shelf edge (Hamazaki, 2002). Pilot whales are highly social and vocal and are typically observed in groups of 10 to 20. Pilot whales are highly social and vocal and are typically observed in groups of 10 to 20 surface-active individuals. Within the RI – MA WEA, no sightings of pilot whales were observed during the summer, fall, or winter (Kraus et al., 2016).

A source of mortality and injury to long-finned pilot whales is bycatch during gillnet fishing, pelagic trawling, longline fishing, and purse seine fishing. For the period between 2015 and 2019, the observed average fishery-related mortality or serious injury was 9 long-finned pilot whales per year (NMFS, 2021c). The highest observed bycatch rate for all pilot whales occurred in the pelagic longline fishery, with peak bycatch occurring during September and October along the Mid-Atlantic coast. However, based on biopsy data, the majority, if not all, of the bycatch whales were short-finned. Other fisheries mortalities (e.g., bottom trawls, mid-water trawls, gillnets) are more frequently observed north of 40° N; therefore, these fisheries likely have a higher proportional impact on long-finned pilot whales. Mean human-caused annual mortality and serious injury does not exceed the calculated PBR for this stock; however, it is not considered insignificant or approaching zero. There is no designated critical habitat for this species (NMFS, 2021c).

Long-finned pilot whales also demonstrate a propensity to mass strand; however, the role that human activities play in these strandings is not known. From 2015 to 2019, 7 long-finned pilot whales stranded between Maine and Florida, none of which showed any signs of human interaction (NMFS, 2021c). Bioaccumulated toxins are also a potential source of human-caused mortality in pilot whales. Polychlorinated biphenyls and chlorinated pesticides (e.g., DDT, DDE, dieldrin) have been found in pilot whale blubber (Muir et al., 1988; Weisbrod et al., 2000) and bioaccumulation levels of these toxins were more similar in whales from the same stranding group than from animals within the same sex or age category (Weisbrod et al., 2000).

Long-finned pilot whales are part of the MF hearing group with an estimated auditory bandwidth of 150 Hz to 160 kHz (Southall et al., 2007). All pilot whales echolocate and produce tonal calls. Long-finned pilot whales produce burst-pulses which ranged from 100 to 22,000 Hz. The primary tonal calls of the long-finned pilot whale range from 1 to 8 kHz with a mean duration of about 1 second. The calls can be varied with seven categories identified (level, falling, rising, up-down, down-up, waver, and multi-hump) and are likely associated with specific social activities (Vester et al., 2014).

4.2.4 Atlantic White-Sided Dolphin

The Atlantic white-sided (AWS) dolphin is a robust animal characterized by a strongly "keeled" tail stock and distinctive color pattern (Jefferson et al., 2008; Waring et al., 2015). The AWS dolphin occurs primarily along the 100-m depth contour within temperate and subpolar waters of the North Atlantic. Seasonally, AWS dolphins occupy northern, inshore waters during summer and southern, offshore waters in the winter. AWS dolphins that potentially occur in the Project Area are all part of the Western North Atlantic stock, which inhabit waters from central West Greenland to North Carolina (about 35° N) (Waring et al., 2015). There is some evidence supporting the division of the Western Atlantic population into three separate stocks; however, this has not been clearly established (NMFS, 2021c). The estimated average annual human-related mortality does not exceed the PBR for this stock and the AWS dolphin is not listed as Threatened or Endangered; therefore, the stock is not considered strategic under the MMPA. The best abundance estimate for the Western North Atlantic AWS dolphin stock is 93,233 individuals (NMFS, 2021c).

AWS dolphins feed on a variety of fish such as herring, hake (*Merluccius* spp.), smelt (*Osmerus* spp.), capelin, and cod (*Gadus* spp.) as well as cephalopods and crustaceans (i.e., shrimp). Like many dolphins, this species is highly gregarious and will often travel in groups of 100 or more and are highly vocal when in these aggregations. Breeding takes place between May and August with most calves born in June and July (Rasmussen and Miller, 2002).

Prior to the 1970s, AWS dolphins in U.S. waters were found primarily offshore on the continental slope, while white-beaked dolphins (*L. albirostris*) were found on the continental shelf. During the 1970s, there was an apparent switch in habitat use between these two species. This shift may have been a result of the decrease in herring and increase in sand lance in the continental shelf waters (Katona et al., 1993; Kenney et al., 1996). AWS dolphins are opportunistic feeders and their diet is based on available prey (Craddock et al., 2009). AWS dolphins primarily inhabit continental shelf waters, shoreward of the

100-m depth contour (CETAP, 1982; NMFS, 2021c). Most of the sightings during CETAP surveys were seen in depths ranging from approximately 38 to 271 m. Sightings were concentrated in coastal waters near Cape May and in shallow waters within the Gulf of Maine (CETAP, 1982). The Gulf of Maine population is commonly seen from the Hudson Canyon to Georges Bank. Sightings south of Georges Bank and Hudson Canyon occur year-round; however, at lower densities (Hayes et al., 2019). Offshore Rhode Island, AWS dolphins were common in continental shelf waters, with a slight tendency to occur in shallower waters in the spring (Kenney and Vigness-Raposa, 2010). Records indicate that there is an aggregation of sightings southeast of Montauk Point during the spring and summer. In the RI – MA WEA, 185 individual AWS dolphins were sighted primarily during summer (112 individuals) followed by fall (70 individuals) (Kraus et al., 2016).

Mortality to AWS dolphins resulting from fisheries interactions averaged 27 dolphins per year between 2015 and 2019. This number was comprised of recorded mortality or serious injury from fisheries observer data (27 per year), and possible non-fishery human-caused mortalities (0.2 per year) (NMFS, 2021c). There was a total of 204 documented strandings of this species in both the U.S. and Canada during this period, 16 of which were released alive; human interaction, such as pollution, was indicated for four of these cases (NMFS, 2021c). The total human-caused annual mortality and serious injury is less than the calculated PBR but is not considered insignificant or approaching zero (NMFS, 2021c).

AWS dolphins are in the MF hearing group with an estimated auditory bandwidth of 150 Hz to 160 kHz (Southall et al., 2007). Their vocalizations range from 6 to 15 kHz (DoN, 2008).

4.2.5 Common Dolphin

The common dolphin may be one of the most widely distributed species of cetaceans, as it is found worldwide in temperate, tropical, and subtropical seas (Waring et al., 2015). Two species were previously recognized: the long-beaked common dolphin (*D. capensis*) and the short-beaked common dolphin; however, Cunha et al. (2015) summarized the relevant data and analyses, along with additional molecular data and analysis, and recommended that the long-beaked common dolphin not be further used for the Atlantic stock. This taxonomic convention is used by the Society for Marine Mammalogy. The best population estimate for this stock is 172,947 individuals. The species is not listed as Threatened or Endangered under the ESA, and the stock is not classified as a strategic or depleted stock (NMFS, 2021c).

Common dolphins are distributed in waters off the U.S. East Coast from Cape Hatteras to Georges Bank (35° N to 42° N) during mid-January to May and move as far north as the Scotian Shelf from mid-summer to autumn (CETAP, 1982; Hamazaki, 2002; Hayes et al., 2019; Selzer and Payne, 1988). Common dolphins are primarily found at the shelf and shelf break along the Gulf Stream; however, common dolphins are known to occur in both nearshore and deep offshore waters (Perrin, 2002). Common dolphins aggregate in large schools numbering in the hundreds, although the typical group size is 30 or fewer (Reeves et al., 2012).

Kraus et al. (2016) observed 3,896 individual common dolphins within the RI – MA WEA. Summer surveys observed the most individuals (1,964) followed by fall (725), winter (132), then spring (75).

The common dolphin feeds on small schooling fish and squid; as such, common dolphins are subject to bycatch in gillnets, pelagic trawls, and longline fisheries (Hayes et al., 2021; Reeves et al., 2012). During 2015 to 2019, an estimated average of 390 common dolphins were taken each year in fisheries activities, plus 0.2 individuals per year from research takes and 0.2 individuals per year from non-fishery stranding mortalities (NMFS, 2021c). During this period, 546 common dolphins were reported stranded between Maine and Florida, 124 of which were either released or last seen alive. Signs if human interaction were detected in 28 of these cases from activities such as fishery interaction, vessel strike, or public harassment

(NMFS, 2021c). The total annual mortality and serious injury does not exceed the calculated PBR, but it cannot be considered insignificant or approaching zero for this population. There is no designated critical habitat for this species (NMFS, 2021c).

Common dolphins are in the MF hearing group with an estimated auditory bandwidth of 150 Hz to 160 kHz (Southall et al., 2007). Their vocalizations range widely from 200 Hz to 150 kHz (DoN, 2008).

4.2.6 Atlantic Spotted Dolphin

Atlantic spotted dolphins are widely distributed in tropical and warm temperate waters of the Western North Atlantic (Leatherwood et al., 1976). They range from southern New England south through the Gulf of Mexico, and from the Caribbean to Venezuela (Leatherwood et al., 1976; Perrin et al., 1994). Atlantic spotted dolphins are not listed as Threatened or Endangered under the ESA. Atlantic species of spotted dolphins were not differentiated during surveys, resulting in insufficient data to determine the population trends. The stock status is also unknown (Waring et al., 2014). The best estimate of abundance derived from 2016 surveys for the Western North Atlantic stock of Atlantic spotted dolphins is 39,921 individuals (Hayes et al., 2020).

There are few reported occurrences of spotted dolphins (*Stenella* spp.) in the Project Area. CETAP reported 126 spotted dolphin sightings over the course of 3-year study. The CETAP data for 1982 observed 40 individuals south of Block Island (CETAP, 1982). NMFS shipboard surveys conducted during June-August between central Virginia and the Lower Bay of Fundy reported 542 to 860 individual sightings from two separate visual teams (Palka et al., 2017).

Between 2013 and 2017, 21 Atlantic spotted dolphins were reported stranded in the U.S. Atlantic. None showed definitive signs of human interaction (Hayes et al., 2020). There were also no reports of injury or mortality due to fisheries interactions during this period; therefore, fisheries interactions are considered insignificant for this population. There is no designated critical habitat for this population (Hayes et al., 2020).

Atlantic spotted dolphins are in the MF hearing group with an estimated auditory bandwidth of 150 Hz to 160 kHz (Southall et al., 2007). Vocalizations typically range from 100 Hz to 130 kHz (DoN, 2008).

4.2.7 Common Bottlenose Dolphin

The common bottlenose dolphin occupies a wide variety of habitats, occurring in both peripheral seas and oceans in tropical and temperate climates (Stewart et al., 2002). They are common all along the U.S. East Coast year-round (Hayes et al., 2020, 2021). Within the Western North Atlantic, there are two distinct common bottlenose dolphin forms: coastal and offshore. The two forms are genetically and morphologically distinct although regionally variable (Jefferson et al., 2008; Waring et al., 2015). Both inhabit waters in the Western North Atlantic Ocean (Curry and Smith, 1997; Hersh and Duffield, 1989; Mead and Potter, 1995) along the U.S. Atlantic Coast. The common bottlenose dolphin is not listed as Threatened or Endangered under the ESA.

The Western North Atlantic offshore stock expected to occur in the Project Area is not listed as depleted under the MMPA. The offshore stock is distributed primarily along the outer continental shelf and slope, from Georges Bank to Cape Hatteras during the spring and summer (CETAP, 1982; Kenney, 1990). Stock status within U.S. Atlantic waters is unknown and data are insufficient to determine population trends. The best available abundance estimate for the offshore morphotype of common bottlenose dolphins in the Western North Atlantic is 62,851 individuals (Hayes et al., 2020).

Spatial distribution data and genetic studies indicate the coastal morphotype comprises multiple stocks distributed throughout coastal and estuarine waters of the U.S. East Coast. The northern migratory coastal stock ranges from North Carolina to New York (Hayes et al., 2018). All coastal stocks are listed as depleted (Waring et al., 2010). The best abundance estimates for the northern migratory coastal stock of common bottlenose dolphin is 6,639 (NMFS, 2019b). The northern migratory coastal stock's summer range has been identified between upper New Jersey and Virginia (Hayes et al., 2018). During winter months, bottlenose dolphins are rarely observed north of the North Carolina-Virginia border, and their northern distribution appears to be limited by water temperatures <9.5°C (Garrison et al., 2003).

Common bottlenose dolphins were observed in the RI – MA WEA in all seasons with the highest seasonal abundance estimates during the fall, summer, and spring. The greatest concentrations of bottlenose dolphins were observed in the southernmost portion of the RI – MA WEA (Kraus et al., 2016). Common bottlenose dolphins occurring within the Project Area are likely to come from the offshore population, as the seasonal stranding records match the temporal patterns of the offshore stock than the coastal stock (Kenney and Vigness-Raposa, 2010). Therefore, the northern migratory coastal stock is not likely to occur in the Project Area and will not be discussed further.

Total U.S. fishery-related mortality and serious injury for coastal stocks cannot be directly estimated due to the spatial overlap of several stocks in North Carolina. Best estimates of fishery-related annual average mortality and serious injury for the northern migratory coastal stock for 2014 through 2018 range from 12.2 to 21.5 individuals per year (Hayes et al., 2021). During this period, 692 common bottlenose dolphins determined to be part of the northern migratory coastal stock were reported stranded between North Carolina and New York. Evidence of human interaction was found for 80 of these cases, including 51 due to fisheries interactions and 4 due to vessel strikes (Hayes et al., 2021). This stock has also been impacted by a UME from 2013 to 2015 which was attributed to a morbillivirus epidemic that caused 1,614 strandings between New York and Florida (Hayes et al., 2021). Because overlap in coastal stocks makes population trends difficult, the precise impact of these strandings on this population is uncertain, but the majority of the animals found were thought to belong to the northern migratory coastal stock. PBR due to human-caused mortality and serious injury, although not the primary cause of strandings for this stock, are not considered insignificant or approaching zero (Hayes et al., 2021).

For the offshore stock, annual fishery-caused mortality and serious injury for the offshore stock of common bottlenose dolphin from 2013 to 2017 was estimated to be 28 individuals due to interactions with sink gillnet and bottom trawl fisheries (Hayes et al., 2020). Total human-caused mortality and serious injury for this stock is considered insignificant, and this stock is not strategic under the MMPA. There is no designated critical habitat for this species (Hayes et al., 2020).

Coastal and offshore stocks of bottlenose dolphins are in the MF hearing group, with an estimated auditory bandwidth of 150 Hz to 160 kHz (Southall et al., 2007). Bottlenose dolphin vocalization frequencies range from 3.4 to 130 kHz (DoN, 2008).

4.2.8 Striped Dolphin

Striped dolphins are widely distributed in tropical and warm temperate waters of the Western North Atlantic ranging from Nova Scotia to the Caribbean and Gulf of Mexico (Hayes et al., 2020). Striped dolphins prefer offshore waters from the continental slope to the Gulf Stream although there is limited information regarding the stock structure (Hayes et al., 2020). Western North Atlantic striped dolphins are not a strategic stock and are not listed as Threatened or Endangered under the ESA. The best estimate of abundance derived from 2016 surveys for the Western North Atlantic stock of striped dolphins is 67,036 individuals (Hayes et al., 2020).

There are few reported occurrences of striped dolphins in the Project Area. All CETAP records reported striped dolphins in waters greater than 900m; although it was noted that the most northern sightings aligned with warm core rings of the Gulf Stream (Hayes et al., 2020). Striped dolphins would not typically be associated with shelf waters off New York and Massachusetts; however, preliminary data from site investigation surveys for offshore wind have a very small number of probable striped dolphin sightings; therefore, they have been included in this assessment. Between 2013 and 2017, strandings of striped dolphins were reported from New York (5); Massachusetts (2); and New Jersey (7) (Hayes et al., 2020). None showed definitive signs of human interaction (Hayes et al., 2020). There were also no reports of injury or mortality due to fisheries interactions during this period; therefore, fisheries interactions are considered insignificant for this population. There is no designated critical habitat for this population (Hayes et al., 2020).

Striped dolphins are in the MF hearing group with an estimated auditory bandwidth of 150 Hz to 160 kHz (Southall et al., 2007). Vocalizations typically range from 100 Hz to 130 kHz (DoN, 2008).

4.2.9 Harbor Porpoise

The harbor porpoise is the only porpoise species found in the Atlantic. It is a small, stocky cetacean with a blunt, short-beaked head. There are four subspecies, with *P. phocoena* residing in the North Atlantic (Committee on Taxonomy, 2021). The harbor porpoises that occur in the Project Area comprise the Gulf of Maine/Bay of Fundy stock. This stock is not considered strategic under the MMPA because they are not listed as Threatened or Endangered. In 2001, NMFS conducted a status review for the stock, mainly due to the level of bycatch in fisheries (66 *FR* 53195). The determination from the review was that listing the harbor porpoise under the ESA was not warranted and the species was removed from the candidate list. Population trends for this species are unknown. The best, and most recent, abundance estimate for harbor porpoise in the Gulf of Maine/Bay of Fundy stock is 95,543 individuals (NMFS, 2021c).

Harbor porpoises commonly occur throughout Massachusetts Bay from September through April. During the fall and spring, harbor porpoises are widely distributed along the U.S. East Coast from New Jersey to Maine. During the summer, the porpoises are concentrated in the Northern Gulf of Maine and Southern Bay of Fundy in water depths <150 m. In winter, densities increase in waters off New Jersey to North Carolina and decrease in the waters from New York to New Brunswick; however, specific migratory timing or routes are not apparent (Wingfield et al., 2017; NMFS, 2021c).

Harbor porpoise occurrence offshore Rhode Island is highly seasonal with most sightings occurring predominantly in winter and spring and relatively few in summer and fall (Kenney and Vigness-Raposa, 2010). They are most commonly reported in eastern Long Island Sound, Gardiner's Bay, and Peconic Bay during the winter. They have the greatest abundance on the continental shelf offshore Rhode Island during the spring when they are known to migrate from their offshore wintering habitat in the mid-Atlantic to their summer feeding grounds in the Gulf of Maine (Kenney and Vigness-Raposa, 2010). Within the RI – MA WEA, Kraus et al. (2016) observed 121 individual harbor porpoises throughout the course of the study. Fall observations included the most individuals (49) followed by winter (35), spring (36), and summer (1). Vertical camera detections of all small cetaceans showed that the most commonly detected species over time was the harbor porpoise (Kraus et al., 2016).

Harbor porpoises feed on small schooling fish such as mackerel, herring, and cod, as well as worms, cephalopods, and sand eels (*Hyperoplus* spp.). Their foraging habits and habitats make this species particularly susceptible to mortality in bottom-set gill nets (Waring et al., 2015). The average estimated human-caused mortality or serious injury for this stock for the period between 2015 and 2019 was 164 harbor porpoises per year, from U.S. fisheries observer data (163 per year) and non-fishery caused stranding mortalities (0.6 per year) (NMFS, 2021c). In 2010, a final rule was published for the existing Harbor Porpoise Take Reduction Plan in the Federal Register (75 *FR* 7383) to address closure areas and timing based on bycatch rates. A total of 417 harbor porpoises were stranded in the U.S. between 2015 and 2019, 17 of which showed evidence for human interaction such as entanglement or fishery interaction, vessel strike, or public harassment (NMFS, 2021c). The total annual human-related mortality rates do not exceed the PBR but cannot be considered insignificant or approaching zero. There is no designated critical habitat for this species (NMFS, 2021c).

The harbor porpoise is the only potentially affected species in the Project Area within the HF hearing group that uses ultrasonic echolocation clicks to navigate and hunt prey. The click frequency is between 110 and 150 kHz, which is consistent with harbor porpoise hearing sensitivity centered between 100 and 120 kHz (Thompson et al., 2013). Click trains can have very short inter-click intervals when close to a prey item, which results in a "feeding buzz" due to the rapid succession of individual clicks, making them highly identifiable in acoustic surveys.

4.3 PHOCIDS

4.3.1 Harbor Seal

The harbor seal is found in all nearshore waters of the Atlantic Ocean and adjoining seas north of 30° N (NMFS, 2021c). In the Western North Atlantic, they are distributed from Eastern Canada to southern New England and New York, and occasionally to the Carolinas (Payne and Selzer, 1989). Harbor seals are the most abundant seals in the Eastern U.S.; they are not listed as Threatened or Endangered. The harbor seals within the Project Area are part of the single Western North Atlantic stock, which is not considered strategic under the MMPA. The best population estimate of harbor seals for this stock is 61,336 (NMFS, 2021c).

Harbor seals exploit a variety of available food sources and feed both in shallow coastal habitats and offshore (Waring, 2015). Typical prey items include cephalopods and small schooling fish (i.e., herring, alewife [*Alosa pseudoharengus*], flounder [*Paralichthys* spp. and *Pseudopleuronectes* spp.], redfish [*Sciaenops ocellatus*], cod, yellowtail flounder [*Pleuronectes ferruginea*], sand eel, hake) and spend up to 85% of the day diving, presumably foraging.

Harbor seals are the most abundant seals in the Northeastern U.S. They can be found year-round in the coastal waters of Eastern Canada and Maine (NMFS, 2021c). Harbor seals occur seasonally along the southern New England and New York coasts from September through late May although evidence suggests they may remain in this region over longer time period (Schneider and Payne, 1983; Barlas, 1999; deHart, 2002). Survey data collected from NMFS and the Provincetown Center for Coastal Research reported 151 harbor seal sightings in this region, a large concentration of which were observed near the coast from eastern Long Island to Buzzards Bay and Vineyard Sound. There were occurrences of harbor seals offshore; however, abundances offshore were lower than what was observed near haul-out sites (Kenney and Vigness-Raposa, 2010). No pupping areas have been identified in southern New England, but there are several haul-out sites on Block Island and six haul-out sites have been identified in Narragansett Bay (Barlas, 1999; Kenney and Vigness-Raposa, 2010). They are most commonly observed at the Dumplings off Jamestown at Rome Point in North Kingstown. Nearly all the haul-outs within Narragansett Bay are rocky ledges or isolated rocks with the exception of Spar Island which is a man-made dredge spoil (Kenney and Vigness-Raposa, 2010).

Fisheries interactions are common, and harbor seals are legally killed in Canada, Norway, and the United Kingdom to protect fish farms or local fisheries (Reeves et al., 2013). Harbor seals are also susceptible to bycatch in gillnets, trawls, and purse seines. For the period from 2015 to 2019, the average human-caused mortality and serious injury to harbor seals was 339 individuals per year, of which 334 occurred in fisheries interactions. Other causes of mortality for this population include human interactions such as vessel strikes, pollution, and harassment; storms; abandonment by the mother; disease; and predation (NMFS, 2021c). In July 2018, a UME was declared for both the harbor seal and gray seal due to mortalities throughout the Northeast U.S. Based on results of preliminary examinations, the 3,152 strandings (which include both species) reported through 13 March 2020 were determined to be the result of phocine distemper virus (NMFS, 2021i). This UME is currently inactive and pending closure by NMFS (2021i). The total human-caused mortality and serious injury does not exceed the PBR but cannot be considered insignificant for this population (NMFS, 2021c).

Harbor seals are part of the PW hearing group. Male harbor seals produce underwater vocalizations during mating season to attract females and defend territories (Sabinsky et al., 2012). These calls are comprised of "growls" or "roars" with a peak energy at 1.2 kHz (Sabinsky et al., 2012). Captive studies have shown that harbor seals have good (>50%) sound detection thresholds between 0.1 and 80 kHz, with primary sound detection between 0.5 and 40 kHz (Kastelein et al., 2009).

4.3.2 Gray Seal

Gray seals within the Project Area are part of the Western North Atlantic stock. They are not listed as Threatened or Endangered and the stock is not considered strategic under the MMPA. The best population estimate of gray seals for this stock is 27,300 individuals (NMFS, 2021c). A U.S. population estimate for this species is not available; however, the Canadian gray seal population was estimated to be 424,300 individuals in 2016 (NMFS, 2021c). Gray seals will aggregate in large numbers to breed, molt, and rest. Gray seals will exploit a variety of available food sources and will feed both in shallow coastal habitats and offshore (Waring, 2015). Typical prey items include cephalopods, sessile organisms, small schooling fish (i.e., herring, alewife, flounder, redfish, cod, yellowtail flounder, sand eel, hake), and crustaceans. Gray seals will go on extensive dives to depths of up to 475 m to capture food (Waring, 2015).

The gray seal has a year-round range from Canada to Massachusetts and may seasonally migrate further south to northern parts of New Jersey between September and May (NMFS, 2021c). Stranding records extend as far south as Cape Hatteras, North Carolina (Gilbert et al., 2005). Historically, gray seals were relatively absent from Rhode Island and nearby waters. However, with the recent recovery of the Massachusetts and Canadian populations, their occurrence has increased in southern New England waters (Kenney and Vigness-Raposa, 2010). In New York, gray seals are typically seen alongside harbor seal haul-outs. Two frequent sighting locations include Great Gull Island and Fisher's Island (Kenney and Vigness-Raposa, 2010). Two breeding and pupping grounds have also been identified near the Project Area in Nantucket Sound at Monomoy and Muskeget Island (NMFS, 2021c). Gray seals have been observed using the historic pupping site on Muskeget Island in Massachusetts since 1990 (Wood LaFond, 2009).

Gray seals are susceptible to bycatch and fisheries interactions and, like the harbor seal, are legally killed in some countries to protect fisheries resources. The gray seal is also taken commercially outside the U.S. The average estimated human-caused mortality and serious injury of gray seals between 2015 and 2019 was 4,453 seals per year for both the U.S. and Canada (NMFS, 2021c). As discussed in **Section 4.3.1**, there was a UME declared for this population likely due to viral infection which is currently pending closure (NMFS, 2021i). As with the harbor seal, the total annual human-caused mortality and serious injury does not exceed the PBR, but it cannot be considered insignificant (NMFS, 2021c).

Gray seals, like harbor seals, belong to the PW hearing group. As with all pinnipeds, they are assigned to hearing groups based on the medium (air or water) through which they are detecting the sounds, for an estimated underwater auditory bandwidth of 75 Hz to 75 kHz (Southall et al., 2007). Vocalizations range from 100 Hz to 3 kHz (DoN, 2008).

5.0 Type of Incidental Take Requested

The Applicant requests an IHA pursuant to Section 101 (a)(5)(D) of the MMPA for incidental take of small numbers of marine mammals by Level B harassment during geophysical surveys conducted as part of site characterization activities within the Project Area. Proposed activities, as outlined in **Section 1.0**, have the potential to impact marine mammals within the Project Area from sounds generated by survey equipment.

For impulsive intermittent sources, the maximum range to a Level A threshold is <19 m and Level A take is not anticipated during HRG surveys. The take calculations assumed that all 400 days of geophysical surveys conducted during the survey window will use the source producing the largest Level B acoustic isopleths of 141 m (i.e., the Dura-sparks and GeoMarine sparkers, **Table 4**). This assumption provides a conservative approach to predicting potential impact on marine mammal species from active survey operations while also providing a more realistic representation of anticipated survey effort.

The most likely Level B take is expected to result from minor behavioral reactions such as avoidance and temporary displacement for some individuals or groups of marine mammals near the proposed activities. It is expected that the severity of behavioral effects will vary with the duration of operations, the behavior of the animal at the time of reception of the sound, and the distance and received SPL of the sound. The Level B take is unlikely to manifest as TTS (Southall et al., 2007) but has the potential in the immediate vicinity (several meters) of the sound source where the received SPL might be high enough to cause a temporary loss of hearing sensitivity (Holt, 2008). No PTS, physiological damage, or injury is expected to occur to marine mammals from the noise generated by the survey equipment or vessels during proposed surveys.

Potential impacts will be mitigated through a visual monitoring program and associated vessel activity management program, both of which are described in **Section 11.0**.

6.0 Take Estimates for Marine Mammals

The Applicant is seeking authorization for potential “taking” of small numbers of marine mammals under the jurisdiction of NMFS in the proposed region of activity, as described in **Section 2.0**. The 16 species listed below are described further in **Section 4.0**. Each species has a geographic distribution that encompasses the Project Area and has at least a minimal potential to be “taken” during the proposed surveys.

Authorization for Level B harassment is sought for the following 16 species:

- North Atlantic right whale;
- Humpback whale;
- Fin whale;
- Sei whale;
- Minke whale;
- Sperm whale;
- Risso’s dolphin;
- Long-finned pilot whale;
- Atlantic white-sided dolphin;
- Common dolphin;
- Atlantic spotted dolphin;
- Common bottlenose dolphin;
- Striped dolphin;
- Harbor porpoise;
- Harbor seal; and
- Gray seal.

The only anticipated impacts to marine mammals are associated with noise and are limited to the use of HRG survey equipment operating sources less than 180 kHz. The potential activities are not expected to take more than a small number of marine mammals or have more than a negligible effect on their populations based on their seasonal density and distribution and known reactions to underwater sound exposure. The source activity is described in **Section 1.2**, survey equipment is listed in **Section 1.3**, and species status and distributions are discussed in **Section 4.0**.

6.1 BASIS FOR ESTIMATING NUMBERS OF MARINE MAMMALS THAT MIGHT BE TAKEN BY HARASSMENT

Estimating exposures of marine mammal species assumes that exposure of an animal to a specified noise level within a region of ensonification will result in a take of that animal. The ensonified area is calculated based on the SL and operational mode of the equipment (**Table 3**). Potential Level B take exposures are estimated within the ensonified area as an SPL exceeding 160 dB re 1 µPa for impulsive sources (e.g., sparkers, boomers) within an average day of activity. The potential number of exposed animals is estimated from the mean monthly densities (animals km^{-2}) of a given species expected within the Project Area. These densities are then multiplied by the maximum number of survey days. These calculations result in unmitigated take estimates for each affected species over the entire survey period.

6.1.1 Harassment Zone Calculations

The harassment zone is a representation of the maximum extent of the ensonified area around a sound source over a 24-hour period. The harassment zone for each piece of equipment operating below 180 kHz was calculated per the following formulae:

Stationary Source: Harassment Zone = πr^2

Mobile Source: Harassment Zone = (Distance/day × 2r) + πr^2

Where r is the linear distance from the source to the isopleth for Level A or Level B thresholds and day = 1 (i.e., 24 hours).

The estimated potential daily active survey distance of 70 km was used as the estimated areal coverage over a 24-hour period. This distance accounts for the vessel traveling at roughly 4 knots and only for periods during which equipment <180 kHz is in operation. A vessel traveling 4 knots can cover approximately 110 km per day; however, based on data from surveys conducted since 2017, survey coverage over a 24-hour period is closer to 70 km per day. For daylight only vessels, the distance is reduced to 30 km per day; however, to maintain the potential for 24-hour surveys, the corresponding Level A and Level B ZOIs provided in **Table 7** were calculated for each source based on the Level A and Level B threshold distances in **Table 4** with a 24-hour (70 km) operational period.

Table 7. Calculated harassment zones encompassing Level A and Level B thresholds[1] for each sound source or comparable sound source category.

Source	Level A Harassment Zone (km^2)[2]				Level B Harassment Zone (km^2)[3]
Hearing Group[4]	LF	MF	HF	PW	All
Non-impulsive, non-parametric, shallow SBP (CHIRPs)					
ET 216 CHIRP	0.0	0.0	0.4	0.0	1.3
ET 424 CHIRP	0.1	0.1	0.1	0.1	0.6
ET 512i CHIRP	0.1	0.1	0.1	0.1	0.8
GeoPulse 5430	0.1	0.1	2.9	0.1	2.9
TB CHIRP III	0.2	0.1	2.5	0.1	6.7
Pangeo SBI	0.1	0.1	0.5	0.1	3.1
Impulsive, medium SBP (Boomers and Sparkers)					
AA Triple plate S-Boom (700–1,000 J)	0.1	0	0.7	0	4.8
AA, Dura-spark UHD Sparkers	0.1	0	0.4	0	19.8
GeoMarine Sparkers	0.1	0	0.4	0	19.8

AA = Applied Acoustics; CHIRP = compressed high-intensity radiated pulses; ET = edgetech; HF = high-frequency; J = joules; LF = low-frequency; MF = mid-frequency; PW = phocid pinnipeds in water; SBI = sub-bottom imager; SBP = sub-bottom profiler; TB = Teledyne benthos UHD = ultra-high definition.

[1]The Level A and B isopleths were calculated to comprehensively assess the potential impacts of the predicted source operations as required for this Application. However, as described in **Section 5.0**, Level A takes are not expected.

[2]Based on maximum distances in **Table 4**. For consistency, the metric producing the largest distance to the Level A thresholds (either cumulative sound exposure level or zero to peak sound pressure level) was used to calculate the harassment zones for each hearing group.

[3]Based on maximum distances in **Table 4** calculated for Level B root-mean-square sound pressure level thresholds.

[4]As defined by the National Marine Fisheries Service.

For sources that have operating beamwidths that are less than 180°, the harassment zone will be conical below the source with maximum radial propagation widths dependent upon the water depth and absorption. For these equipment cases (CHIRPs, boomers), the radial distance to the Level A thresholds were calculated using a MATLAB code provided by NMFS (2021b), and the distances to the Level B thresholds were calculated using interim recommendations provided from NMFS (2019a) and provided as part of the User Spreadsheet submitted with this application.

The Level A and Level B threshold isopleths were calculated to comprehensively assess the potential impacts of the predicted maximum practicable source operations as required for this Application. However, as described in **Section 5.0**, Level A takes are not expected. A conservative approach to estimating the potential Level B exposures for the survey was applied by using the equipment that produced the greatest Level B isopleth distance from apparent or measured SL to define the impact radii of all proposed equipment within that group. The maximum estimated distance from a geophysical source to the Level B threshold (SPL of 160 dB re 1 µPa) were for the sparkers (the Dura-sparks and GeoMarine sparkers), all of which are estimated to produce a 141 m threshold range at the operating modes used during the survey (**Table 4**).

6.1.2 Marine Mammal Density Calculation

The density calculation methodology applied to take estimates for this application is derived from the model results produced by Roberts (2022) for the entire U.S. East Coast region. To determine cetacean densities for take estimates, only those density blocks which overlapped with any portion of the Project Area were selected for this assessment (**Figure 3**). These estimates are considered the best information currently available for calculating marine mammal densities in the U.S. Atlantic by NMFS.

Given their size and behavior when in the water, seals are difficult to identify during shipboard visual surveys and limited information is currently available on their distribution. Therefore, data used to establish the density estimates from Roberts (2022) are based on information for all seal species that may occur in the Western North Atlantic (i.e., harbor, gray, hooded, harp). However, only the harbor seal and gray seal are reasonably expected to occur in the Project Area, and the densities were split evenly between both species.

Given the variability in level of effort between the Lease Areas and the ECR area, densities were separated for the three Lease Areas (OCS-A 0486, 0487, and 0500) and the ECR area. All density squares intersecting each area were isolated and the average monthly and annual densities were estimated from this value (**Tables 8** to **11**).

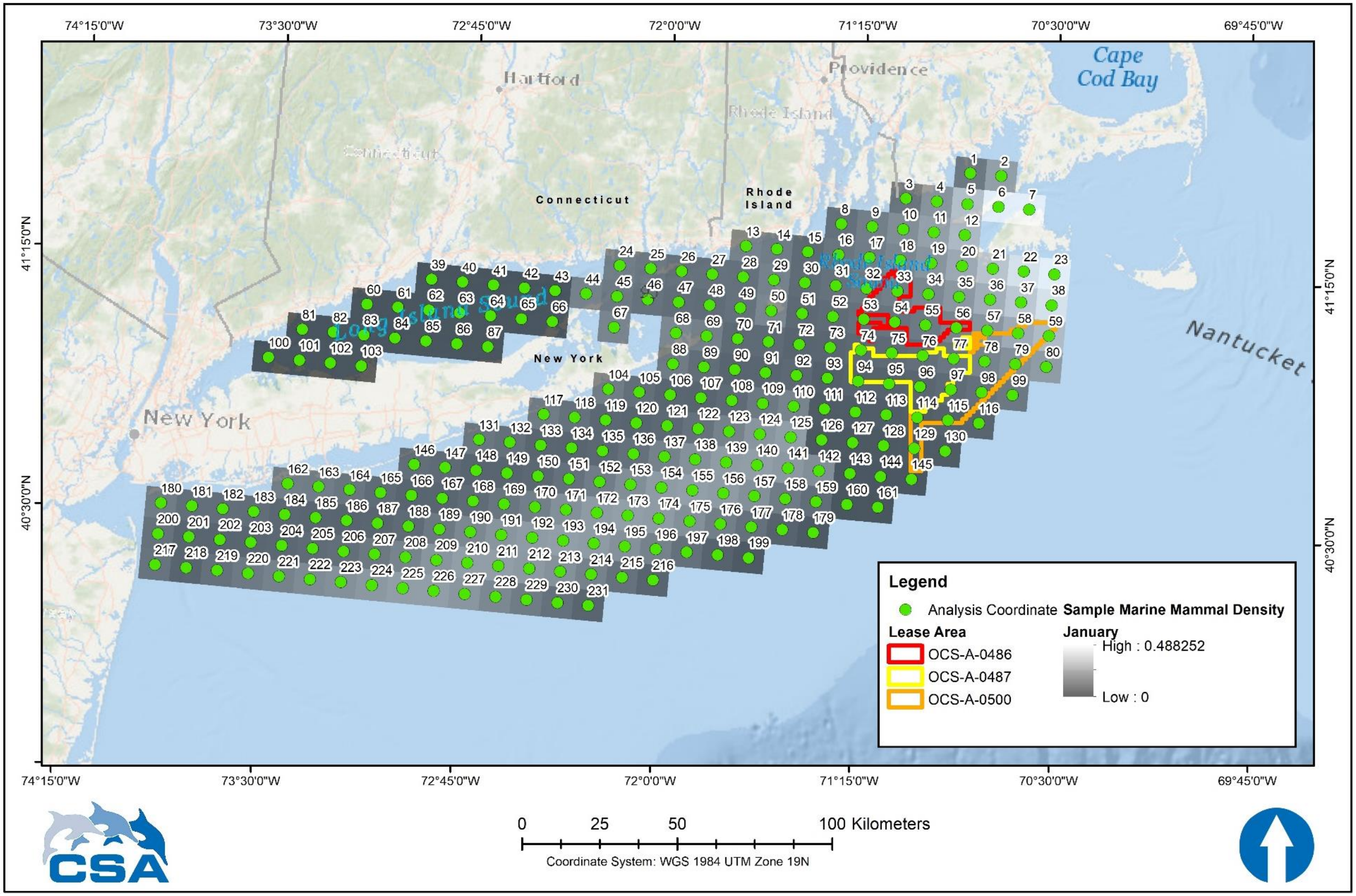

Figure 3. Sample density blocks (Roberts, 2022) from models used to determine monthly marine mammal densities within the Project Area.

Table 8. Estimated monthly and average annual density (animals km^{-2}) of potentially affected marine mammals within Lease Areas OCS-A 0486 based on monthly habitat density models (Roberts, 2022).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average Annual Density (km^{-2})
Low-frequency Cetaceans													
Fin whale	0.0011	0.0009	0.0011	0.0019	0.0013	0.0015	0.0019	0.0019	0.0015	0.0013	0.0008	0.0008	**0.0013**
Sei whale	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**
Minke whale	0.0004	0.0004	0.0005	0.0009	0.0011	0.0010	0.0003	0.0001	0.0001	0.0003	0.0002	0.0003	**0.0005**
Humpback whale	0.0006	0.0004	0.0003	0.0013	0.0011	0.0013	0.0007	0.0014	0.0040	0.0019	0.0004	0.0007	**0.0012**
North Atlantic right whale	0.0075	0.0100	0.0104	0.0089	0.0036	0.0007	0.0003	0.0003	0.0005	0.0008	0.0013	0.0041	**0.0040**
Mid-frequency Cetaceans													
Sperm whale	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0003	0.0002	0.0001	0.0001	0.0001	0.0000	**0.0001**
Atlantic white sided dolphin	0.0084	0.0039	0.0054	0.0114	0.0134	0.0129	0.0097	0.0060	0.0062	0.0107	0.0086	0.0135	**0.0092**
Atlantic spotted dolphin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0002	0.0002	0.0003	0.0002	0.0000	**0.0001**
Common bottlenose dolphin	0.0045	0.0001	0.0000	0.0020	0.0044	0.0188	0.0379	0.0413	0.0404	0.0153	0.0075	0.0093	**0.0151**
Long-finned pilot whale	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	**0.0020**
Risso's dolphin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0001	**0.0000**
Common dolphin	0.0618	0.0093	0.0046	0.0121	0.0309	0.0329	0.0265	0.0330	0.0559	0.0757	0.0601	0.1452	**0.0457**
Striped dolphin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**
High-frequency Cetaceans													
Harbor porpoise	0.0366	0.1061	0.1313	0.0446	0.0349	0.0019	0.0013	0.0013	0.0014	0.0030	0.0192	0.0203	**0.0335**
Pinnipeds in-water[1]													
Gray seal	0.0109	0.0470	0.0286	0.0096	0.0138	0.0037	0.0011	0.0005	0.0010	0.0017	0.0014	0.0061	**0.0104**
Harbor seal	0.0109	0.0470	0.0286	0.0096	0.0138	0.0037	0.0011	0.0005	0.0010	0.0017	0.0014	0.0061	**0.0104**

[1]Seal species are not separated in the Roberts (2022) data therefore densities were evenly split between the two species expected to occur in the Project Area.

Table 9. Estimated monthly and average annual density (animals km^{-2}) of potentially affected marine mammals within Lease Areas OCS-A 0487 based on monthly habitat density models (Roberts, 2022).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average Annual Density (km^{-2})
Low-frequency Cetaceans													
Fin whale	0.0016	0.0016	0.0016	0.0029	0.0023	0.0026	0.0032	0.0031	0.0024	0.0017	0.0012	0.0012	**0.0021**
Sei whale	0.0000	0.0000	0.0000	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0001**
Minke whale	0.0005	0.0006	0.0007	0.0016	0.0021	0.0019	0.0006	0.0004	0.0004	0.0007	0.0003	0.0004	**0.0008**
Humpback whale	0.0003	0.0002	0.0003	0.0019	0.0019	0.0023	0.0007	0.0011	0.0047	0.0016	0.0005	0.0003	**0.0013**
North Atlantic right whale	0.0035	0.0048	0.0047	0.0048	0.0022	0.0004	0.0002	0.0002	0.0003	0.0004	0.0006	0.0015	**0.0020**
Mid-frequency Cetaceans													
Sperm whale	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0004	0.0003	0.0001	0.0000	0.0001	0.0000	**0.0001**
Atlantic white sided dolphin	0.0222	0.0107	0.0126	0.0278	0.0392	0.0367	0.0261	0.0144	0.0151	0.0234	0.0218	0.0304	**0.0234**
Atlantic spotted dolphin	0.0000	0.0000	0.0000	0.0001	0.0001	0.0002	0.0005	0.0005	0.0006	0.0007	0.0005	0.0001	**0.0003**
Common bottlenose dolphin	0.0051	0.0003	0.0001	0.0016	0.0025	0.0071	0.0125	0.0149	0.0217	0.0151	0.0071	0.0058	**0.0078**
Long-finned pilot whale	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	**0.0074**
Risso’s dolphin	0.0001	0.0000	0.0000	0.0000	0.0001	0.0001	0.0002	0.0003	0.0002	0.0001	0.0001	0.0002	**0.0001**
Common dolphin	0.1495	0.0255	0.0100	0.0248	0.0553	0.0592	0.0560	0.0743	0.1244	0.1563	0.1188	0.2547	**0.0924**
Striped dolphin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**
High-frequency Cetaceans													
Harbor porpoise	0.0355	0.1108	0.1669	0.0786	0.0475	0.0022	0.0015	0.0016	0.0015	0.0027	0.0128	0.0170	**0.0399**
Pinnipeds in-water[1]													
Gray seal	0.0136	0.0468	0.0294	0.0099	0.0125	0.0045	0.0015	0.0006	0.0012	0.0021	0.0016	0.0082	**0.0110**
Harbor seal	0.0136	0.0468	0.0294	0.0099	0.0125	0.0045	0.0015	0.0006	0.0012	0.0021	0.0016	0.0082	**0.0110**

[1]Seal species are not separated in the Roberts (2022) data therefore densities were evenly split between the two species expected to occur in the Project Area.

Table 10. Estimated monthly and average annual density (animals km^{-2}) of potentially affected marine mammals within Lease Areas OCS-A 0500 based on monthly habitat density models (Roberts, 2022).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average Annual Density (km^{-2})
Low-frequency Cetaceans													
Fin whale	0.0019	0.0017	0.0017	0.0031	0.0030	0.0029	0.0035	0.0032	0.0025	0.0017	0.0014	0.0014	**0.0023**
Sei whale	0.0000	0.0000	0.0000	0.0003	0.0003	0.0002	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	**0.0001**
Minke whale	0.0006	0.0007	0.0007	0.0016	0.0023	0.0020	0.0007	0.0004	0.0004	0.0006	0.0003	0.0004	**0.0009**
Humpback whale	0.0003	0.0002	0.0003	0.0023	0.0020	0.0018	0.0013	0.0012	0.0052	0.0025	0.0006	0.0003	**0.0015**
North Atlantic right whale	0.0063	0.0077	0.0078	0.0080	0.0041	0.0007	0.0003	0.0003	0.0004	0.0008	0.0011	0.0031	**0.0034**
Mid-frequency Cetaceans													
Sperm whale	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0003	0.0003	0.0001	0.0001	0.0001	0.0000	**0.0001**
Atlantic white sided dolphin	0.0311	0.0166	0.0182	0.0389	0.0659	0.0635	0.0420	0.0240	0.0256	0.0351	0.0343	0.0453	**0.0367**
Atlantic spotted dolphin	0.0000	0.0000	0.0000	0.0001	0.0002	0.0003	0.0007	0.0008	0.0009	0.0010	0.0005	0.0001	**0.0004**
Common bottlenose dolphin	0.0052	0.0004	0.0001	0.0026	0.0034	0.0074	0.0159	0.0154	0.0266	0.0231	0.0103	0.0064	**0.0097**
Long-finned pilot whale	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	**0.0090**
Risso’s dolphin	0.0001	0.0000	0.0000	0.0000	0.0001	0.0001	0.0002	0.0004	0.0002	0.0001	0.0001	0.0003	**0.0001**
Common dolphin	0.1456	0.0247	0.0098	0.0253	0.0531	0.0514	0.0518	0.0823	0.1386	0.1722	0.1296	0.2492	**0.0945**
Striped dolphin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**
High-frequency Cetaceans													
Harbor porpoise	0.0426	0.0844	0.1548	0.0861	0.0469	0.0041	0.0030	0.0028	0.0024	0.0032	0.0113	0.0194	**0.0384**
Pinnipeds in-water[1]													
Gray seal	0.0134	0.0381	0.0289	0.0202	0.0277	0.0067	0.0015	0.0008	0.0015	0.0023	0.0010	0.0070	**0.0124**
Harbor seal	0.0134	0.0381	0.0289	0.0202	0.0277	0.0067	0.0015	0.0008	0.0015	0.0023	0.0010	0.0070	**0.0124**

[1]Seal species are not separated in the Roberts (2022) data therefore densities were evenly split between the two species expected to occur in the Project Area.

Table 11. Estimated monthly and average annual density (animals km^{-2}) of potentially affected marine mammals within the export cable route area based on monthly habitat density models (Roberts, 2022).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average Annual Density (km^{-2})
Low-frequency Cetaceans													
Fin whale	0.0010	0.0010	0.0011	0.0021	0.0018	0.0020	0.0023	0.0021	0.0021	0.0013	0.0008	0.0008	**0.0015**
Sei whale	0.0000	0.0000	0.0000	0.0002	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**
Minke whale	0.0003	0.0004	0.0004	0.0011	0.0014	0.0010	0.0003	0.0002	0.0002	0.0004	0.0002	0.0002	**0.0005**
Humpback whale	0.0004	0.0002	0.0002	0.0010	0.0008	0.0009	0.0004	0.0003	0.0010	0.0010	0.0007	0.0006	**0.0006**
North Atlantic right whale	0.0015	0.0020	0.0019	0.0017	0.0007	0.0001	0.0001	0.0001	0.0001	0.0002	0.0003	0.0008	**0.0008**
Mid-frequency Cetaceans													
Sperm whale	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0003	0.0002	0.0001	0.0001	0.0001	0.0000	**0.0001**
Atlantic white sided dolphin	0.0156	0.0084	0.0087	0.0227	0.0318	0.0264	0.0132	0.0061	0.0093	0.0160	0.0168	0.0203	**0.0163**
Atlantic spotted dolphin	0.0000	0.0000	0.0000	0.0000	0.0001	0.0002	0.0006	0.0006	0.0006	0.0007	0.0006	0.0001	**0.0003**
Common bottlenose dolphin	0.0068	0.0009	0.0003	0.0060	0.0125	0.0433	0.0722	0.0732	0.0529	0.0230	0.0140	0.0135	**0.0266**
Long-finned pilot whale	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	**0.0043**
Risso's dolphin	0.0001	0.0001	0.0000	0.0000	0.0001	0.0001	0.0003	0.0005	0.0002	0.0001	0.0001	0.0002	**0.0001**
Common dolphin	0.1188	0.0277	0.0098	0.0169	0.0274	0.0345	0.0335	0.0479	0.0623	0.0791	0.0678	0.1490	**0.0562**
Striped dolphin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**
High-frequency Cetaceans													
Harbor porpoise	0.0459	0.0728	0.0878	0.0512	0.0249	0.0017	0.0014	0.0020	0.0011	0.0023	0.0245	0.0885	**0.0337**
Pinnipeds in-water[1]													
Gray seal	0.0488	0.0518	0.0284	0.0160	0.0227	0.0095	0.0037	0.0015	0.0016	0.0035	0.0045	0.0263	**0.0182**
Harbor seal	0.0488	0.0518	0.0284	0.0160	0.0227	0.0095	0.0037	0.0015	0.0016	0.0035	0.0045	0.0263	**0.0182**

[1]Seal species are not separated in the Roberts (2022) data therefore densities were evenly split between the two species expected to occur in the Project Area.

6.1.3 Take Calculation

Based on the average annual densities for each species (**bolded** numbers in **Tables 8** through **11**) and the harassment zones (**Table 7**), the estimated number of Level A takes per equipment type was determined, and the estimated number of Level B takes for the sparker sources was determined. Calculations were based on vessel-towed or mounted geophysical survey equipment operating between 10 and 200 vessel days in each Lease Area and 180 days in the ECR area, with the sources producing the largest threshold distances (i.e., sparkers) operating during 100% of vessel days.

Estimates of take are calculated according to the following formula:

Estimated Take = D × Harassment Zone × # of Survey Days

Where: D = average species density (km^{-2}); and Harassment Zone = maximum ensonified area that equates to NMFS thresholds for noise impact criteria. To estimate take, the density of marine mammals within the Project Area (animals km^{-2}) was multiplied by the daily ensonified harassment zone (km^{2}). That result is then multiplied by the number of survey days (rounded to the nearest whole number) to arrive at the estimated take. This final number equals the instances of take for the entire operational period. The result is an estimate of the maximum potential number of instances that marine mammals could be exposed to sounds above the Level A or Level B harassment thresholds over the duration of survey activities. The Applicant has proposed mitigation measures to reduce potential Level B harassment and eliminate the possibility of any Level A harassment (**Section 11.0**).

6.2 ESTIMATED NUMBERS OF MARINE MAMMALS THAT MIGHT BE TAKEN BY HARASSMENT

The Applicant is requesting approval for Level B incidental harassment takes of marine mammals associated with geophysical surveys. Take estimates were projected based on marine mammal presence, calculated density estimates, and activity-specific noise source propagation characteristics. No Level A harassment takes are expected and therefore no Level A takes are calculated.

6.2.1 Estimated Level B Harassment of Marine Mammals

Level B exposures were estimated by multiplying the average annual density of each species (**Tables 8** through **11**) (Roberts, 2022) by the daily harassment zone that was estimated to be ensonified to an SPL exceeding 160 dB re 1 µPa (**Table 7**), times the number of operating days expected for the survey in each area assessed. In this Application, it was assumed the sparker systems were operating all 400 survey days as it is the sound source expected to produce the largest harassment zone.

Table 12 summarizes the Level B take estimates for the Project Area for all species occurring in the Project Area that are considered common, uncommon, or regular (**Section 3.0**).

Table 12. Summary of maximum potential Level B exposures resulting from 100% usage of the sparker systems during all 400 days of surveys in the Project Area.

Species		Abundance	Maximum Level B Takes	Max % Population
Low-frequency Cetaceans				
Fin whale		6,802	14	0.21%
Sei whale		6,292	0	0.00%
Minke whale		21,968	6	0.03%
Humpback whale		1,396	8	0.57%
North Atlantic right whale		368	17	4.62%
Mid-frequency Cetaceans				
Sperm whale		4,349	0	0.00%
Atlantic white-sided dolphin		93,233	210	0.23%
Atlantic spotted dolphin		39,921	3	0.01%
Common bottlenose dolphin[1]		62,851	139	0.22%
Long-finned pilot whale		39,215	52	0.13%
Risso's dolphin		35,215	1	0.00%
Common dolphin		172,974	601	0.35%
Striped dolphin		67,036	0	0.00%
High-frequency Cetaceans				
Harbor porpoise		95,543	287	0.30%
Pinnipeds				
Seals[1]	Gray seal	27,300	118	0.43%
	Harbor seal	61,336	118	0.19%

[1]Roberts (2022) only provides density estimates for "generic" seals; therefore, densities were split evenly between the two species.

6.2.2 Requested Level B Takes

The estimated Level B exposures in **Table 12** are based on the operation of the sparker sources that produced the largest threshold isopleth (141 m) during 100% of the proposed vessel days. All non-sparker sources were estimated to produce Level B isopleths less than 54 m. This method provides a conservative estimate of Level B exposures to any of the marine mammal species or stocks expected to occur within the Project Area because maximum isopleths for each of the equipment groups were used.

There are a number of other factors that reduce the overall number of takes expected to occur during this Project.

1. It is assumed that an animal will only be taken once over a 24-hour period and that the maximum number of calculated takes represents different individuals from a population. In actuality, an activity may result in multiple exposures of the same animal over a period of time and only a limited number of individuals within a single population may experience behavioral modification. Both the estimated number of takes and the percentage of the population potentially affected represent the maximum potential take numbers that do not account for species behavior or the context within which a behavioral disturbance may occur.

2. The Level B calculations assumed the sparker systems will be used during 100% of the survey days. However, it is likely that lower-power equipment and equipment operating at frequencies >180 kHz (e.g., SSS or MBES) or surveys with only a USBL active, will be conducted during the allocated 400 days, although the exact number of days these surveys would comprise has not yet been determined. Bathymetric surveys may also be performed at any point throughout the survey period, with a vessel using only a hull-mounted USBL and MBES. Regardless of these periods where lower-powered sources or only USBLs may be used, all 400 survey days assumed use of the sparker sources that produce the largest threshold isopleths when calculating Level B exposures.

Preliminary protected species observer (PSO) data from the ongoing site characterization surveys being conducted under previous and existing IHAs were reviewed to provide an overview of the most recent species detections. While detections within the Level B zone in the PSO reports are still very low, higher numbers of several species are being reported in the area which present an increased potential for take. Based on the PSO data from May 2020 through December 2021 (**Table 13**). A key evaluation component of the requested takes was how many of individuals were visually detected within 500 m of any active source. While 500 m is outside the Level B zone, it represents a pool of detections that are more likely to be representative of individuals entering a Level B zone. Notably, these draft data represent more survey effort than planned for the project survey and include both geotechnical and geophysical surveys.

Table 13. Draft Protected Species Observer (PSO) visual detection records from geophysical and geotechnical surveys conducted in the project lease areas and export cable routes between May 2020 and December 2021. Species in **Bold** are candidates for increased take request for this Application.

Species Common Name	Total Visual Detections	Total Recorded Individuals	Mean CPA (m) to active source	Number of Individual within 500 m of an active source
Atlantic spotted dolphin	3	28	N/A	0
Atlantic white-sided dolphin	1	18	N/A	0
Bottlenose dolphin	**90**	**1,541**	**368**	**15**
Fin whale	**81**	**150**	**1,059**	**15**
Gray seal	50	52	211	3
Harbor porpoise	2	6	545	0
Harbor seal	18	20	118	3
Humpback whale	**250**	**465**	**1,253**	**34**
Long-finned pilot whale	1	1	830	0
Minke whale	**59**	**66**	**635**	**13**
North Atlantic right whale	5	5	1,563	1
Risso's dolphin	2	14	200	1
Sei whale	3	3	3,099	0
Common Dolphin	**927**	**14,250**	**246**	**271**
Sperm whale	**4**	**4**	**532**	**1**
Striped dolphin	**1**	**30**	**N/A**	**0**

CPA=closest point of approach; m=meters; N/A= not applicable (i.e., no detections with sources active).

The following adjustments were made to the estimated takes (**Table 12**) to calculate the requested takes in **Table 14**.

- Risso's dolphin: only one take was estimated but based on their occurrence in PSO data, 1 group of 30 (Kenney and Vigness-Raposa, 2010) was added to the requested takes.
- Striped dolphin: no takes were estimated but based on their occurrence in PSO data, 1 group of 20 (Kenney and Vigness-Raposa, 2010) was added to the requested takes.
- Sperm whale: no takes were estimated but based on their occurrence in PSO data, 1 group of 2 (Barkaszi and Kelly, 2019) was added to the requested takes.
- Sei whale: no takes were estimated but based on their occurrence in the Project Area, but requested takes were increased to 3 based on the most common group size reported in Kenney and Vigness-Raposa (2010).
- Minke whale: requested takes were increased to the number recorded within 500 m of an active source based on draft PSO data in **Table 13**.
- Humpback whale: requested takes were increased to the number recorded within 500 m of an active source based on draft PSO data in **Table 13**.
- Common dolphin: requested takes were increased to 9,015. This is based on the average group size of 15 from the PSO data (calculated by dividing the total number of individuals [14,250] by the total number of detections [927] in **Table 13**) multiplied by the calculated Level B exposures in **Table 12**.
- Common bottlenose dolphin: requested takes were increased to 2,363. This is based on the average group size of 17 from the PSO data (calculated by dividing the total number of individuals [1,541] by the total number of detections [90] in **Table 13**) multiplied by the calculated Level B exposures in **Table 12**.

Table 14. Summary of requested Level B takes for this Project.

Species		Abundance	Requested Level B Takes[1]	Max % Population
Low-frequency Cetaceans				
Fin whale		6,802	14	0.21%
Sei whale		6,292	0 (3)	0.05%
Minke whale		21,968	6 (13)	0.06%
Humpback whale		1,396	8 (34)	2.44%
North Atlantic right whale		368	17	4.62%
Mid-frequency Cetaceans				
Sperm whale		4,349	0 (2)	0.05%
Atlantic white-sided dolphin		93,233	210	0.23%
Atlantic spotted dolphin		39,921	3	0.01%
Common bottlenose dolphin		62,851	139 (2,363)	3.76%
Pilot Whales		39,215	52	0.13%
Risso's dolphin		35,215	1 (30)	0.09%
Common dolphin		172,974	601 (9,015)	5.21%
Striped dolphin		67,036	0 (20)	0.03%
High-frequency Cetaceans				
Harbor porpoise		95,543	287	0.30%
Pinnipeds				
Seals[2]	Gray seal	27,300	118	0.43%
	Harbor seal	61,336	118	0.19%

[1]Parenthesis denote changes from calculated take estimates.

- For species with no modeled exposures, requested takes for HRG surveys are based on mean group sizes derived from the following references:
  - Sperm whale: Barkaszi and Kelly, 2019;
  - Sei whale: Kenney and Vigness-Raposa, 2010
  - Risso's dolphin: Kenney and Vigness-Raposa, 2010;
  - Striped dolphin: Kenney and Vigness-Raposa, 2010;
- For minke whale and humpback whale, requested takes were revised based the number recorded within 500 m of an active source based on draft PSO data.
- For common dolphins and common bottlenose dolphins, the average group size was estimated from the PSO data by dividing the total number of detections from the total number of individuals and multiplying the group size by the calculated Level B exposures.

[2]Roberts (2022) only provides density estimates for "generic" seals; therefore, densities were split evenly between the two species and used to estimated potential take.

7.0 Effects on Marine Mammal Species or Stocks

Marine mammals exposed to natural or man-made sound may experience non-auditory and auditory impacts which range in severity (Southall et al., 2007, 2019; NMFS, 2018a; Wood et al., 2012). The potential exists for small numbers of marine mammals to be exposed to underwater sound associated with survey activities. These impacts are likely to affect individual species but have only negligible effects on the marine mammal stocks; and therefore, will not adversely affect the population of any species.

7.1 MITIGATION AND AVERSION

Mitigation is not considered in the take estimates; the inclusion of mitigation would reduce the take estimates. Although the proposed mitigation (**Section 11.0**) is implemented to eliminate the potential for Level A takes, it will also serve to reduce the exposure of animals to SLs that could constitute Level B takes. NMFS determined that with the RPMs, (e.g., mitigation measures such as clearance periods, ramp ups, and shutdowns when an animal is detected within a shutdown zone) the proposed geophysical surveys may adversely affect, but are not likely to jeopardize, the continued existence of NARW, humpback, fin, sei, or sperm whales. This suggests that geophysical survey operations would not jeopardize the sustainability of other cetaceans, particularly other LF and MF species that occupy the same acoustic habitat.

7.2 MULTIPLE EXPOSURES AND SEASONALITY

Level B exposures likely include the same individuals across multiple days and not exposures to the entire stock; therefore, they can be considered instances of exposure rather than a discrete count of individuals that have received regulatory-level sound exposures. The acoustic metric used to establish Level B isopleths (SPL) does not consider a duration of exposure (SEL_{24h}) in its calculations. The SPL assumes that an animal within the Level B isopleth, regardless of the length of time, is taken by exposure. The take estimates assume that an animal will only be taken once over a 24-hour period; however, an activity may result in multiple takes of the same animal during this period resulting in an inflated percent of the population taken which is not realized during actual events.

Additionally, estimates using the habitat density data (Roberts, 2022) may not fully reflect the actual observations in the field. In the case of the NARW, seasonal, patchy densities increase the average annual densities across an entire project area for only a short period of time, resulting in much fewer detections during the surveys when compared to the calculated exposure estimates. Population percentages represent the maximum potential take numbers, whereas in actuality, a limited number of marine mammals may realize behavioral modification.

7.3 NEGLIGIBLE IMPACTS

Animals in an area of exposure may move location depending on their acoustic sensitivity, life stage, and acclimation (Wood et al., 2012), and may or may not demonstrate behavioral responses. Therefore, while the number of takes and the affected population percentages represent the maximum potential take numbers, in actuality, a limited number of marine mammals may realize behavioral modification.

Under the requirements of 50 CFR § 216.104, NMFS has defined negligible impact as an impact that is not reasonably expected to adversely affect a species or stock through effects on annual rates of recruitment or survival. The negligible impacts determination is not based on take estimates alone; rather, for NMFS to make a negligible impact determination, small numbers must denote that the portion of a marine mammal species or stock in the take estimates will have a negligible impact on that species or stock.

As discussed in **Sections 9.0** and **10.0**, physical auditory effects, vessel strikes, PTS or TTS, and long-term impacts to habitat or prey species are not expected to occur. Temporary masking may occur in localized areas for short periods of time when an animal is in proximity to the survey. Masking occurs when an animal's acoustic "space" (i.e., auditory perception and discrimination) is covered up by noise of similar frequency, but at higher amplitudes of biologically important sounds. However, due to movement of the sources, masking effects are expected to be negligible and will not contribute significantly to other noise sources operating in the region.

The primary potential impact on marine mammals from exposure to survey-related underwater sound is behavioral response, which will not necessarily constitute significant changes in biologically important behaviors. The National Research Council (2005) noted that an action or activity becomes biologically significant to an individual animal when it affects the ability of the animal to grow, survive, and reproduce, wherein an impact on individuals can lead to population-level consequences and affect the viability of the species. The reasonably expected impacts from the proposed activities are based on noise exposure thresholds that can potentially elicit a behavioral response and are categorized as Level B takes under the MMPA. Here, due to the variability in species reaction to sound sources, short time period of the survey operations, and use of mitigation measures, any behavioral reactions are expected to be minor, localized, short-term, and have negligible effects on individuals and stocks. It is expected that behavioral reactions will mainly comprise a temporary shift in spatial use. No long-term or population effects are expected from the behavioral reactions to the proposed surveys.

8.0 Minimization of Adverse Effects to Subsistence Uses

This section addresses NFMS' requirement to identify methods to minimize adverse effects of the proposed activity on subsistence uses.

There are no current subsistence hunting areas in the vicinity of the proposed Project Area and there are no activities related to the proposed surveys that may affect the availability of a species or stock of marine mammals for subsistence uses. Consequently, there are no available methods to minimize potentially adverse effects to subsistence uses.

9.0 Anticipated Impacts on 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. Anticipated impacts to marine mammal habitat have been summarized in the following sections and are further discussed in **Section 10**.

9.1 SHORT-TERM IMPACTS

The proposed activity has the potential to affect marine mammal habitat primarily through short-term impacts from increases in ambient noise levels from survey equipment. The expected short-term impacts to the acoustic habitat are highly localized and transient during the survey; and therefore, have the potential to only temporarily affect marine mammal prey availability.

9.2 LONG-TERM IMPACTS

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

10.0 Anticipated Effects of Habitat Impacts on Marine Mammals

This section addresses NFMS' requirement to characterize the short- and long-term impacts of the proposed activity on predicted habitat loss or modification. The predicted impacts to marine mammal habitat have been summarized in **Sections 10.1** and **10.2**.

10.1 SHORT-TERM IMPACTS

Marine mammals use sound to navigate, communicate, find open water, avoid predators, and find food. Acoustic acuity within the habitat must be available for species to conduct these ecological processes. If noise levels within critical frequency bands preclude animals from accessing the acoustic properties of that habitat, then availability and quality of that habitat has been diminished. The sounds that marine mammals hear and generate will vary in terms of dominant frequency, bandwidth, energy, temporal pattern, and directionality. The same variables in ambient noise will; therefore, determine a marine mammal's acoustic resource availability. In the case of marine mammals, anthropogenic noise can be viewed as a form of habitat fragmentation resulting in a loss of acoustic space that could otherwise be occupied by vocalizations or other acoustic cues (Rice et al., 2014). Primary acoustic habitat for a species will be focused within the vocal ranges for that species; therefore, habitat impact assessment should be conducted within those vocal ranges. The functional extent of the ensonified space around operations employing HRG sources will require an understanding of the distribution of SPLs by their spectral probability density and knowledge of received exposure levels with coordinated species densities. Therefore, marine mammals may experience some short-term loss of acoustic habitat, but the nature and duration of this loss is not expected to represent a significant loss of habitat.

Reduction of prey availability might indirectly affect marine mammals by altering prey abundance, behavior, and distribution. Rising sound levels could affect fish populations (McCauley et al., 2003; Popper and Hastings, 2009; Slabbekoorn et al., 2010). Marine fish are typically sensitive to the 100 to 500 Hz range, which is below the primary operating frequencies of most HRG survey sources. However, several studies have demonstrated that seismic airguns and other impulsive sources might affect the behavior of at least some species of fish. For example, field studies by Engås et al. (1996) and Whitlock and Schluter (2009) showed that the catch rate of haddock (*Melanogrammus aeglefinus*) and Atlantic cod (*Gadus morhua*) significantly declined over the five days following seismic airgun operation, after which the catch rate returned to normal. Other studies found only minor responses by fish to seismic surveys, such as a small decline in lesser sand eel (*Ammodytes marinus*) abundance that quickly returned to pre-seismic levels (Hassel et al., 2004) or no permanent changes in the behavior of marine reef fishes (Wardle et al., 2001). Southern reef squid (*Sepioteuthis australis*) are an extremely important food chain component for many higher order marine predators, including sperm whales. McCauley et al. (2000) recorded caged squid responding to airgun signals. Given the generally low SPLs produced by the HRG sources used in this activity compared to sources such as airguns, no short-term impacts to potential prey items (i.e., fishes, cephalopods, crustaceans) are expected from the proposed survey activities.

10.2 LONG-TERM IMPACTS

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

This section addresses NMFS' IHA requirement to assess the availability and feasibility (economic and technological), methods, and manner of conducting this survey activity that has the least practicable impact upon affected species or stock, its habitat, and its availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.

The Applicant has demonstrated a commitment to minimizing impacts to marine mammal species through a comprehensive and progressive mitigation and monitoring program, described here. The Applicant has committed to engaging in ongoing consultations with NMFS and following a comprehensive set of mitigation measures during site characterization surveys. These measures include the following components which are described in detail below:

- Project personnel training;
- Vessel strike avoidance procedures;
- Use of right whale reporting systems;
- Establishment of pre-start clearance and shutdown zones;
- Visual monitoring, including low visibility monitoring tools;
- Ramp-up procedures;
- Operational shutdowns and delays; and
- Communication of sightings between vessels.

The mitigation protocols have been designed to provide protection to marine mammals, both individuals and, by extension, species' stocks where designated, by minimizing exposure to potentially disruptive noise levels during site characterization activities. The mitigation measures will also reduce the likelihood of ship strikes to large whales in the area.

11.1 PROJECT PERSONNEL TRAINING

Project-specific training will be conducted for all vessel crew prior to the start of a survey and during any changes in crew such that all survey personnel are fully aware and understand the mitigation, monitoring, and reporting requirements. Confirmation of the training and understanding of the requirements will be documented on a training course log sheet. Signing the log sheet will certify that the crew member understands and will comply with the necessary requirements throughout the survey activities.

11.2 VESSEL STRIKE AVOIDANCE PROCEDURES

The Applicant will ensure that vessel operators and crew maintain a vigilant watch for cetaceans and pinnipeds, and change course, slow down, or switch the engines to neutral, as safely as applicable, to avoid striking marine mammals. 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, or if the vessel is restricted in its ability to maneuver:

- All vessel operators and crew will maintain vigilant watch for cetaceans and pinnipeds, and will change course, slow down, or switch engines to neutral to avoid striking an animal;

- The vessel will maintain a 500-m separation distance from all ESA-listed whales;
    - If an ESA-listed whale or unidentified whale is observed within 500 m of the forward path of the vessel, the vessel operator must steer a course away from the whale at 10 knots or less until the 500-m separation distance has been established.

- The vessel will maintain a 100-m separation distance from all other large whales;
- If any large whale is observed within 200 m of the forward path of the vessel, the vessel must reduce speed and shift into neutral. Engines may not be engaged until the whale has moved outside the vessel's forward path and beyond 500 m;
- All vessel operators will comply with 10 knot speed restrictions in any SMA or visually triggered DMA or slow zone where NARW are expected to occur;
- All vessels 19.8 m or greater operating from November 1 through April 30 will operate at speeds of 10 knots or less; and
- All vessel operators will reduce vessel speed to 10 knots or less when mother/calf pairs, pods, or larger assemblages of non-delphinid cetaceans are observed near an underway vessel.

11.3 RIGHT WHALE OPERATING REQUIREMENTS

Members of the monitoring team will consult NMFS and US Coast Guard right whale reporting systems (e.g., Whale Alert, WhaleMap, Notices to Mariners) as able, for the presence of NARWs throughout survey operations, and for the establishment of a DMA. If NMFS should establish a DMA in the Project Area during the survey, the vessels will abide by speed restrictions in the DMA per the permit conditions.

11.4 MONITORING, PRE-START, AND EXCLUSION ZONES

Three distinct zones are defined to better describe the monitoring activities and mitigation actions associated with the detection of a marine mammals during the survey. The Applicant will employ the following zones and conditions during all site characterization survey activities using sparkers or boomers:

Monitoring zone:
- Includes waters surrounding the sound sources and the vessel;
- Encompasses all other zones (pre-start clearance, shutdown); and
- All marine mammals detected will be recorded.

Pre-start Clearance Zones:
- 500 m for ESA-listed whales including NARWs;
- 100 m for all other whales; and
- 50 m for dolphins, seals, and porpoises.

Shutdown Zones:
- 500 m for NARWs and unidentified large whales;
- 100 m for all other whales; and
- The shutdown zone may or may not encompass the Level B zone. A marine mammal's entry into the shutdown zone does not necessarily represent a take.

11.5 VISUAL MONITORING

Visual monitoring of the established zones will be performed by the NMFS-approved PSOs.

PSOs will be stationed on all survey vessels and will work in shifts such that observers obtain adequate rest periods between active watch periods. For all HRG survey activities, PSOs will work in shifts such that one PSO will be on watch during all daylight hours and two PSOs equipped with nighttime monitoring devices will be on watch during all hours of reduced visibility, including hours of darkness. On a case-by-case basis, and upon approval from NMFS, changes in the PSO numbers, schedule, or 3rd party status may be adjusted during the project. During PSO observations the following guidelines shall be followed:

- Other than brief alerts to bridge personnel of maritime hazards and the collection of ancillary wildlife data, no additional duties may be assigned to the PSO during his/her visual observation watch.
- No PSO will be allowed more than four consecutive hours on watch before being allocated a break from visual watch.
- No PSO will be assigned a combined watch schedule of more than 12 hours in a 24-hour period.
- The PSOs will stand watch in a suitable location that will not interfere with the navigation or operation of the vessel and affords an optimal view of the sea surface.
- The PSOs will be responsible for visually monitoring and identifying marine mammals approaching or entering the established zones during survey activities. It will be the responsibility of the Lead PSO on duty to communicate to the vessel operator 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.
- PSOs will share sighting data between Project survey vessels, as able, in near real-time via computer, radio, phone, or other methods.

11.5.1 Nighttime Monitoring

During night operations, night vision equipment (night vision goggles with thermal clip-ons) and/or infrared/thermal imaging technology will be used. Recent studies have concluded that the use of infrared/thermal imaging technology allows for the detection of marine mammals at night (Verfuss et al., 2018; Guazzo et al., 2019). Guazzo et al (2019) showed that the probability of detecting a large whale blow by a commercially available infrared camera was similar at night to during the day; camera monitoring distance was 2.1 km from an elevated vantage point at night versus 3 km for daylight visual monitoring from the same location. The maximum monitoring distance required for the proposed activities would be up to 500 m (**Section 11.3**). The Applicant presents that the use of thermal camera systems for mitigation purposes warrants additional application in the field as both a standalone tool and in conjunction with other alternative monitoring methods (e.g., night vision binoculars).

11.5.2 Data Recording

PSOs will record all sightings of marine mammals while monitoring during day or night. Data on all 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 behavioral disturbances or injury/mortality. Visual detections will be shared between vessels in near-real time, to the extent possible via computer, radio, phone, or other methods, thus increasing situational awareness.

11.6 PRE-START CLEARANCE DURATION OF THE EXCLUSION ZONE

The Applicant will implement a 30-minute clearance period of the pre-start clearance zones prior to the initiation of HRG activities. If any marine mammal has entered their respective clearance zone, ramp-up will not be initiated until the animal is confirmed outside the clearance zone or until the following time has elapsed since the last sighting of the animal in their respective clearance zone:

- 30 minutes for whales, including the NARW; and
- 15 minutes for dolphins, porpoises, and seals.

After the clearance period survey activities may commence, unless a marine mammal is detected within or entering the applicable shutdown zone. After the clearance period and once surveys have commenced, surveys can continue into darkness or inclement weather even if the shutdown zones, Level B Zones, and/or monitoring zone are not fully visible to PSOs.

11.7 RAMP-UP PROCEDURES

A ramp-up procedure will be used, to the extent practicable, at the beginning of HRG survey activities in order to provide additional protection to marine mammals near the survey by allowing them to vacate the area prior to the commencement of survey equipment use. Where technically feasible, a ramp-up procedure will be used for HRG survey equipment capable of adjusting energy levels at the start or restart of HRG survey activities. A ramp-up would begin with powering up of the HRG equipment that has the lowest source level output and starting it at its lowest practical power appropriate for the survey. The ramp-up will proceed by either adding equipment with higher source levels, increasing the power output of the operating equipment, or a combination of both.

The ramp-up procedure will not be initiated (i.e., equipment will not be started) during periods of inclement conditions when the marine mammal pre-start clearance zone cannot be adequately monitored by the PSOs for a 30-minute period using the appropriate visual technology. If any marine mammal enters the clearance zone, ramp-up will not be initiated until the animal is confirmed outside the marine mammal EZ, or until the appropriate time (30 minutes for whales, 15 minutes for dolphins, porpoises, and seals) has elapsed since the last sighting of the animal in the clearance zone.

11.8 SHUTDOWN PROCEDURES

An immediate shutdown of impulsive HRG survey equipment will be required if a whale is sighted at or within the corresponding marine mammal shutdown zones (**Section 11.4**). Survey equipment will not be shut down for dolphins, porpoises, or seals. The vessel operator must comply immediately with any call for shutdown by the Lead PSO. Any disagreement between the Lead PSO and vessel operator should be discussed only after shutdown has occurred. Subsequent restart of the survey equipment can be initiated if the animal has been observed exiting its respective shutdown zones or has not been re-sighted within their respective shutdown zone for the appropriate time period (30 minutes for whales, 15 minutes for dolphins, porpoises, and seals). The PSOs will determine if the marine mammal is inside or outside the respective shutdown zone.

There is no shutdown requirement for categorical sources not listed in **Table 3** (i.e., Parametric SBPs [Innomars], acoustic corers, USBL, MBES, SSS).

If a marine mammal enters the respective clearance or shutdown zone during a shutdown period, the equipment may not restart until that animal is confirmed outside the clearance zone as stated previously in the pre-start clearance procedures (**Section 11.5**), or until the appropriate time listed above has elapsed since the last sighting of the animal within the zone.

11.9 SURVEY COMMUNICATION AND COORDINATION FOR SIGHTINGS

The Applicant will utilize radios and available software to communicate sightings between all vessels. This will allow all PSOs and vessel crew to maintain awareness of marine mammal observations and adjust activities accordingly. The Applicant will also utilize the Whale Alert application to report all NARW detections and monitor for DMAs. Whale Alert will be checked at least once every 4 hours by the PSOs on the vessel while underway.

12.0 Arctic Plan of Cooperation

This requirement is applicable only for activities that occur in Alaskan waters north of 60° N latitude. The proposed survey activities will not take place within the designated region and, therefore, will not have an adverse effect on the availability of marine mammals for subsistence uses. As such, there is no need to form such a plan.

The Applicant will comply with the marine mammal reporting requirements for site characterization activities detailed below.

Reporting Injured or Dead Species. The Applicant will ensure that sightings of any injured or dead marine mammals are reported to the Greater Atlantic (Northeast) Region Marine Mammal and Sea Turtle Stranding & Entanglement Hotline (866-755-NOAA [6622]) within 24 hours of a sighting, regardless of whether the injury or death is caused by a vessel.

Reporting of Observed Impacts to Species. The observers will report any observations concerning impacts on marine mammals to NMFS within 48 hours. Any observed takes of listed marine mammals resulting in injury or mortality must be reported within 24 hours to NMFS.

Final Report. The Applicant will provide d NMFS with a report within 90 calendar days following the completion of survey activities, including a summary of the survey activities and an estimate of the number of marine mammals taken during these survey activities. Data on all marine mammal observations will be recorded and based on standards of observer collection data by the PSOs. This information will include dates, times, and locations of survey operations; time of observation, location, and weather; details of marine mammal sightings (e.g., species, numbers, behavior); and details of any observed taking (e.g., behavioral disturbances, injury/mortality).

14.0 Suggested Means of Coordinated Research

This section addresses the IHA requirement to suggest means of learning, encouraging, and coordinating research opportunities, plans, and activities related to reducing incidental take and evaluating its effects.

While no direct research on marine mammals or marine mammal stocks is expected from the Project, there is the opportunity for the proposed activity to contribute greatly to the noise characterization in the region and to specific sound source measurements.

Data acquired during the mitigation and monitoring 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.

The applicant commits to sharing all NARW sightings with NMFS as quickly as practicable. At all times, the PSOs will maintain primary responsibility to observe and facilitate mitigations as needed when marine mammals are sighted.

All marine mammal data collected by the Applicant during marine characterization survey activities will be provided to NMFS through the reporting processes. In addition, the data may be made available to educational institutions and environmental groups upon request.

15.0 List of Preparers

CSA Ocean Sciences Inc.

- Mary Jo Barkaszi, Marine Mammal Programs Manager
- Kayla Hartigan, Project Scientist
- Tara Stevens, Project Scientist
- Kim Olsen, Science Reviewer
- John Tiggelaar, Technical Editor

PSEG

- Brandi Bartolomeo, Manager of Major Permits and Field Services
- David Hinchey, Manager of Major Permits and Field Services

Orsted

- Stephanie Wilson, Head of Permitting
- Laura Morse, Senior Environmental and Permitting Specialist
- Brita Woeck, Lead Environmental and Permitting Specialist
- Thomas Bojer Kristensen, Lead Geophysicist, Geophysics and Seabed Surveys
- Elizabeth Andrews, Senior Geophysicist, Geophysics and Seabed Surveys

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