Dated: August 4, 2020.

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Director, Office of Protected Resources, National Marine Fisheries Service.

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[RTID 0648–XA303]

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Marine Site Characterization Surveys

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed incidental harassment authorization; request for comments on proposed authorization and possible renewal.

SUMMARY: NMFS has received a request from Ørsted Wind Power North America, LLC, (Ørsted) for authorization to take marine mammals incidental to high-resolution geophysical (HRG) survey activities in coastal waters from New York to Massachusetts in certain areas of the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS). These areas are currently being leased by the Applicant's affiliates, Deepwater Wind New England, LLC, and Bay State Wind, LLC, respectively, and are identified as OCS–A 0486/0517, OCS–A 0487, and OCS–A 0500 (collectively referred to herein as the Lease Area). Ørsted is also planning to conduct marine site characterization surveys along one or more potential submarine export cable routes (ECRs) originating from the Lease Area and landing along the shore at locations from New York to Massachusetts, between Raritan Bay (part of the New York Bight) to Falmouth, Massachusetts. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an incidental harassment authorization (IHA) to incidentally take, by Level B harassment only, small numbers of marine mammals during the specified activities. NMFS is also requesting comments on a possible one-time one-year renewal that could be issued under certain circumstances and, if all requirements are met, as described in *Request for Public Comments* at the end of this notice. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorizations and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than September 9, 2020.

ADDRESSES: Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service. Electronic comments should be sent to *ITP.esch@noaa.gov.*

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Comments received electronically, including all attachments, must not exceed a 25-megabyte file size. Attachments to electronic comments will be accepted in Microsoft Word or Excel or Adobe PDF file formats only. All comments received are a part of the public record and will generally be posted online at *www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-other-energy-activities-renewable* without change. All personal identifying information (*e.g.,* name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

FOR FURTHER INFORMATION CONTACT: Carter Esch, Office of Protected Resources, NMFS, (301) 427–8421. Electronic copies of the applications and supporting documents, as well as a list of the references cited in this document, may be obtained by visiting the internet at: *www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-other-energy-activities-renewable.* In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

The MMPA prohibits the "take" of marine mammals, with certain exceptions. Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed incidental take authorization may be provided to the public for review.

Authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for taking for subsistence uses (where relevant). Further, NMFS must prescribe the permissible methods of taking and other "means of effecting the least practicable adverse impact" on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stocks for taking for certain subsistence uses (referred to in shorthand as "mitigation"); and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth.

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216–6A, NMFS must evaluate our proposed action (*i.e.,* the promulgation of regulations and subsequent issuance of incidental take authorization) and alternatives with respect to potential impacts on the human environment.

This action is consistent with categories of activities identified in Categorical Exclusion B4 of the Companion Manual for NAO 216–6A, which do not individually or cumulatively have the potential for significant impacts on the quality of the human environment and for which we have not identified any extraordinary circumstances that would preclude this categorical exclusion. Accordingly, NMFS has preliminarily determined that the proposed action qualifies to be categorically excluded from further NEPA review.

Information in Ørsted's application and this notice collectively provide the environmental information related to proposed issuance of the IHA for public review and comment. We will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the request for incidental take authorization.

Summary of Request

On April 15, 2020, NMFS received a request from Ørsted for authorization to take marine mammals incidental to HRG surveys in the OCS–A 0486/0517, OCS–A 0487, and OCS–A 0500 Lease Areas designated and offered by the Bureau of

Ocean Energy Management (BOEM) as well as along one or more ECRs (ECR Area) between the southern portions of the Lease Areas and shoreline locations from New York to Massachusetts, to support the development of an offshore wind project. The application was considered adequate and complete on July 1, 2020. Ørsted's request is for take, by Level B harassment only, of small numbers of 15 species or stocks of marine mammals. Neither Ørsted nor NMFS expects serious injury or mortality to result from this activity and the activity is expected to last no more than one year; therefore, an IHA is appropriate.

NMFS previously issued an IHA to Ørsted for similar activities (84 FR 52464, October 2, 2019); Ørsted has complied with all the requirements (*e.g.,* mitigation, monitoring, and reporting) of that IHA.

Description of the Proposed Activity

Overview

Ørsted proposes to conduct HRG surveys in support of offshore wind development projects in the Lease Areas and ECR Area. The purpose of the HRG surveys is to obtain a baseline assessment of seabed/sub-surface soil conditions in the Lease Areas and ECR Area to support the siting of potential future offshore wind projects. Underwater sound resulting from Ørsted's proposed site characterization surveys has the potential to result in incidental take of marine mammals in the form of behavioral harassment.

Dates and Duration

HRG surveys, under this IHA, are anticipated to commence in September 2020. Ørsted is proposing to conduct continuous HRG survey operations 12-hours per day (daylight only in shallow, nearshore locations) and 24-hours per day (offshore) using multiple vessels. Ørsted defines a survey day as a 24-hour activity day and assumes a vessel covers 70 kilometers (km) of survey tracks per activity day. A survey day might be the sum of 12-hour daylight only or multiple partial 24-hour operations (if less than 70 km is surveyed in 24 hours). Based on the planned 24-hours operations, the survey activities for all survey segments would require 1,302 vessel days if one vessel were surveying the entire survey line continuously. However, an estimated 5 vessels may be used simultaneously, with a maximum of no more than 9 vessels. Therefore, all the survey effort will be completed in one year. See Table 1 for the estimated number of vessel days for each survey segment. The estimated durations to complete survey activities do not include weather downtime.

TABLE 1—SUMMARY OF PROPOSED HRG SURVEY SEGMENTS

Area	Total number of survey days	Maximum number of survey days using medium penetration SBPs (sparkers or boomers) [1]
OCS–A–0486 and OCS–A–0517	217	114
OCA–A–0487	261	97
OCS–A–0500	164	112
ECR Area	661	378
Total	1,302	701

[1] Days with no sparkers operating will use the Innomar parametric sub-bottom profiling equipment, ultra-short baseline positioning device (USBL) and/or other non-impulsive acoustic sources (see *Detailed Description of Specified Activities* section below).

Specific Geographic Region

Ørsted's survey activities would occur in the Lease Area (including OCS–A 0486/0517, OCS–A 0487, and OCS–A 0500), located approximately 14 miles (mi) south of Martha's Vineyard, Massachusetts at its closest point, as well as within potential export cable route corridors off the coast of New York, Connecticut, Rhode Island, and Massachusetts (shown in Figure 1 of the IHA application). In January 2020, Deepwater Wind New England, LLC requested that BOEM assign a portion of Lease Area OCS–A 0486 to Deepwater Wind South Fork, designated OCS–A 0517; the Lease split was approved in April 2020. Water depth in the Lease Area is 25–62 meters (m) and ranges from 1–90 m along potential ECRs to shoreline locations between New York and Massachusetts.

Detailed Description of the Specified Activities

The HRG survey activities would be supported by vessels of sufficient size to accomplish the survey goals in each of the specified survey areas. Surveys within the ECR Area will include 24-hour and 12-hour (daylight only) surveys. Up to nine (24-hour plus 12-hour) vessels may work concurrently throughout the Survey Area considered in this proposal; however, no more than 3 vessels are expected to work concurrently within any single lease area, with an estimated four offshore (24-hour) vessels and two nearshore (12-hour) vessels expected to work concurrently in the ECR Area. Seasonal vessel restrictions are detailed in the Proposed Mitigation section below. HRG equipment will either be deployed from remotely operated vehicles (ROVs) or mounted to or towed behind the survey vessel at a typical survey speed of approximately 4.0 kn (7.4 km) per hour. The geophysical survey activities proposed by Ørsted would include the following:

- Shallow Penetration Sub-bottom Profilers (SBPs; CHIRPs) to map the near-surface stratigraphy (top 0 to 5 m (0 to 16 ft) of sediment below seabed). A CHIRP system emits sonar pulses that increase in frequency over time. The pulse length frequency range can be adjusted to meet project variables. These are typically mounted on the hull of the vessel or from a side pole.
- Medium penetration SBPs (Boomers) 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 typically mounted on a sled and towed behind the vessel.
- Medium penetration SBPs (Sparkers) to map deeper subsurface stratigraphy as needed. A sparker

creates acoustic pulses from 50 Hz to 4 kHz omni-directionally from the source that can penetrate several hundred meters into the seafloor. These are typically towed behind the vessel with adjacent hydrophone arrays to receive the return signals.

- Parametric SBPs, also called sediment echosounders, for providing high density data in sub-bottom profiles that are typically required for cable routes, very shallow water, and archaeological surveys. These are typically mounted on the hull of the vessel or from a side pole.
- Ultra-short Baseline (USBL) Positioning and Global Acoustic Positioning System (GAPS) to provide high accuracy ranges to track the positions of other HRG equipment by measuring the time between the acoustic pulses transmitted by the vessel transceiver and the equipment transponder necessary to produce the acoustic profile. It is a two-component system with a hull or pole mounted transceiver and one to several transponders either on the seabed or on the equipment.
- Multibeam echosounder (MBES) 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.
- Seafloor imaging (sidescan sonar) for seabed sediment classification purposes, to identify natural and man-made acoustic targets resting on the bottom as well as any anomalous features. 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. 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. They are typically towed beside or behind the vessel or from an autonomous vehicle.

Table 2 identifies all the representative survey equipment that operate below 180 kHz that may be used in support of planned geophysical survey activities, some of which have the potential to be detected by marine mammals. The make and model of the listed geophysical equipment may vary depending on availability and the final equipment choices will vary depending upon the final survey design, vessel availability, and survey contractor selection. Geophysical surveys are expected to use several equipment types concurrently in order to collect multiple aspects of geophysical data along one transect, thereby reducing the duration of total survey activities. Selection of equipment combinations is based on specific survey objectives.

The operational frequencies for MBES and Sidescan Sonar that would be used for these surveys are greater than 180 kHz, outside the general hearing range of marine mammals likely to occur in the Survey Area. These equipment types are, therefore, not considered further in this notice.

Sparker and boomer systems, which produce the largest estimated Level B harassment isopleths (see Estimated Take section, Table 5), would be used for only a portion of the surveys days within the Survey Area. Surveys days that do not utilize sparkers or boomers would use Innomar parametric sonar systems combined with a USBL system or other intermittent non-impulsive sources, which produce smaller estimated Level B harassment zones (Table 5). A conservative estimate of the number of days using sparkers or boomers is provided in Table 1.

TABLE 2—SUMMARY OF REPRESENTATIVE HRG SURVEY EQUIPMENT

HRG equipment category	Specific HRG equipment	Operating frequency range(kHz)	Source level (dB rms)	Source level (dB 0-peak)	Beamwidth (degrees)	Typical pulse duration (ms)	Pulse repetition rate
Shallow Sub-bottom Profilers.	ET 216 (2000DS or 3200 top unit).	2–16; 2–8	195	-	24	20	6
	ET 424	4–24	176	-	71	3.4	2
	ET 512	0.7–12	179	-	80	9	8
	GeoPulse 5430A	2–17	196	-	55	50	10
	TB Chirp III—TTV 170.	2–7	197	-	100	60	15
Parametric Sub-bottom Profilers.	Innomar, SES-2000 compact.	85–115	222	-	4	1	40
	Innomar, SES-2000 Light & Light Plus.	85–115	222	-	4	1	50
	Innomar, SES-2000 Medium-70.	60–80	231	-	3	5	40
	Innomar, SES-2000 Medium-100.	85–115	232	-	2	3.5	40
	Innomar, SES-2000 Quattro.	85–115	220	-	3–5	1	60
	Innomar, SES-2000 Smart.	90–110	220	-	5	0.5	40
	Innomar, SES-2000 Standard & Standard Plus.	85–115	225	-	1–3.5	1.5	60
Medium Sub-bottom Profilers.	AA, Dura-spark UHD (400 tips, 500 J) [1].	0.3–1.2	203	211	Omni	1.1	4

TABLE 2—SUMMARY OF REPRESENTATIVE HRG SURVEY EQUIPMENT—Continued

HRG equipment category	Specific HRG equipment	Operating frequency range(kHz)	Source level (dB rms)	Source level (dB 0-peak)	Beamwidth (degrees)	Typical pulse duration (ms)	Pulse repetition rate
	AA, Dura-spark UHD (400+400) [1].	0.3–1.2	203	211	Omni	1.1	4
	GeoMarine, Geo-Source or similar dual 400 tip sparker (≤800 J) [1].	0.4–5	203	211	Omni	1.1	2
	GeoMarine Geo-Source 200 tip light weight sparker (400 J) [1].	0.3–1.2	203	211	Omni	1.1	4
	GeoMarine Geo-Source 200–400 tip freshwater sparker (400 J) [1].	0.3–1.2	203	211	Omni	1.1	4
	AA, triple plate S-Boom (700–1,000 J) [2].	0.1–5	205	211	80	0.6	4
Acoustic Cores	PanGeo (LF CHIRP).	2–6.5	177.5	-	73	4.5	0.06
	PanGeo (HF CHIRP).	4.5–12.5	177.5	-	73	4.5	0.06
Acoustic Positioning System (USBL).	Advances Navigation, Subsonus.	30	NR	176	Up to 300	90	5
	AA, Easytrak Alpha.	18–24	189	192	Up to 180	10	0.125–1
	AA, Easytrak Nexus 2.	18–24	192	193	150–180	10	2
	AA, Easytrak Nexus Lite.	18–24	190	192	180	10	2
	ET, BATS II	16–21	NR	NR	90	1–15	0.05–1.67
	EvoLogics, S2C	18–78	NR	NR	100-omni	NR	NR
	iXblue, IxSea GAPS Beacon System.	8–16	188	-	Omni	10	1
	Kongsberg HiPAP 501/502.	20.5–29.6	NR	207	15	30	0.8–30
	Sonardyne Ranger 2 and Mini Ranger 2 USBL HPT 3000/5/7000.	19–34	194	NR	NR	5	1
	Sonardyne Scout Pro.	35–50	188	NR	5	5	3
	Tritech, MicroNav	20–28	NR	169	NR	NR	0.1–2

- = not applicable; NR = not reported; µPa = micropascal; AA = Applied Acoustics; BATS = Broadband Acoustic Tracking System; dB = decibel; ET = EdgeTech; GAPS = Global Acoustic Positioning System; HF = high-frequency; HiPAP = high-precision acoustic positioning system; J = joule; LF = low-frequency; Omni = omnidirectional source; re = referenced to; SL = source level; $SL_{0\text{-}pk}$ = zero to peak source level; SL_{rms} = root-mean-square source level; UHD = ultra-high definition. For discussion of acoustic terminology, please see Potential Effects of Specified Activities on Marine Mammals and their Habitat and Estimated Take sections.

[1] 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.

[2] 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.

The deployment of certain types of HRG survey equipment, including some of the equipment planned for use during Ørsted's proposed activity, produces sound in the marine environment that has the potential to result in harassment of marine mammals. Proposed mitigation, monitoring, and reporting measures are described in detail later in this document (please see Proposed Mitigation and Proposed Monitoring and Reporting).

Description of Marine Mammals in the Area of Specified Activity

Sections 3 and 4 of the IHA application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history, of the potentially affected species. Additional information regarding population trends and threats may be found in NMFS' Stock Assessment Reports (SARs; *www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*) and more general information about these species (*e.g.,* physical and behavioral descriptions) may be found on NMFS' website (*www.fisheries.noaa.gov/find-species*).

All species that could potentially occur in the proposed survey areas are included in Table 6 of the IHA application. However, the temporal and/or spatial occurrence of several species listed in Table 6 of the IHA application is such that take of these species is not expected to occur, either because they have very low densities in the Survey Area or are known to occur further offshore than the Survey Area. These are: the blue whale (*Balaenoptera musculus*), Cuvier's beaked whale (*Ziphius cavirostris*), four species of Mesoplodont beaked whale (*Mesoplodon* spp.), dwarf and pygmy sperm whale (*Kogia sima* and *Kogia breviceps*), short-finned pilot whale (*Globicephala macrorhynchus*), northern bottlenose whale (*Hyperoodon ampullatus*), killer whale (*Orcinus orca*), pygmy killer whale (*Feresa attenuata*), false killer whale (*Pseudorca crassidens*), melon-headed whale (*Peponocephala electra*), striped dolphin (*Stenella coeruleoalba*), white-beaked dolphin (*Lagenorhynchus albirostris*), pantropical spotted dolphin (*Stenella attenuata*), Fraser's dolphin (*Lagenodelphis hosei*), rough-toothed dolphin (*Steno bredanensis*), Clymene dolphin (*Stenella clymene*), spinner dolphin (*Stenella longirostris*), hooded seal (*Cystophora cristata*), and harp seal (*Pagophilus groenlandicus*). As take of these species is not anticipated as a result of the proposed activities, these species are not analyzed further. In addition, the Florida manatee (*Trichechus manatus*) may be found in the coastal waters of the survey area. However, Florida manatees are managed by the U.S. Fish and Wildlife Service and are not considered further in this document.

Table 3 lists all species or stocks for which take is expected and proposed to be authorized for this action, and summarizes information related to the population or stock, including regulatory status under the MMPA and ESA and potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2020). PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (as described in NMFS' SARs). While no mortality is anticipated or proposed for authorization, PBR and serious injury or mortality from anthropogenic sources are included here as a gross indicator of the status of the species and other threats.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS' stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. All managed stocks in this region are assessed in NMFS' Atlantic SARs (*e.g.,* Hayes *et al.,* 2020). All values presented in Table 3 are the most recent available at the time of publication and are available online at: *www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region.*

TABLE 3—MARINE MAMMALS KNOWN TO OCCUR IN THE SURVEY AREA THAT MAY BE AFFECTED BY ØRSTED'S PROPOSED ACTIVITY

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	PBR [3]	Annual M/SI [3]
Order Cetartiodactyla—Cetacea—Superfamily Mysticeti (baleen whales)						
Family Balaenidae:						
North Atlantic right whale	*Eubalaena glacialis*	Western North Atlantic	E/D; Y	428 (0; 418; n/a)	0.8	6.85
Family Balaenopteridae (rorquals):						
Humpback whale	*Megaptera novaeangliae*	Gulf of Maine	-/-; N	1,396 (0; 1,380; See SAR)	22	12.15
Fin whale	*Balaenoptera physalus*	Western North Atlantic	E/D; Y	7,418 (0.25; 6,029; See SAR)	12	2.35
Sei whale	*Balaenoptera borealis*	Nova Scotia	E/D; Y	6,292 (1.015; 3,098; see SAR).	6.2	1
Minke whale	*Balaenoptera acutorostrata*	Canadian East Coast	-/-; N	24,202 (0.3; 18,902; See SAR).	189	8.2
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Physeteridae:						
Sperm whale	*Physeter macrocephalus*	NA	E; Y	4,349 (0.28; 3,451; See SAR)	3.9	0
Family Delphinidae:						
Long-finned pilot whale	*Globicephala melas*	Western North Atlantic	-/-; Y	39,215 (0.30; 30,627)	306	21
Bottlenose dolphin	*Tursiops truncatus*	Western North Atlantic Offshore.	-/-; N	62,851 (0.23; 51,914; See SAR).	519	28
Common dolphin	*Delphinus delphis*	Western North Atlantic	-/-; N	172,825 (0.21; 145,216; See SAR).	1,452	419
Atlantic white-sided dolphin.	*Lagenorhynchus acutus*	Western North Atlantic	-/-; N	93,233 (0.71; 54,443; See SAR).	544	26
Atlantic spotted dolphin	*Stenella frontalis*	Western North Atlantic	-/-; N	39,921 (0.27; 32,032; 2012)	320	0
Risso's dolphin	*Grampus griseus*	Western North Atlantic	-/-; N	35,493 (0.19; 30,289; See SAR).	303	54.3
Family Phocoenidae (porpoises):						
Harbor porpoise	*Phocoena phocoena*	Gulf of Maine/Bay of Fundy	-/-; N	95,543 (0.31; 74,034; See SAR).	851	217
Order Carnivora—Superfamily Pinnipedia						
Family Phocidae (earless seals):						

TABLE 3—MARINE MAMMALS KNOWN TO OCCUR IN THE SURVEY AREA THAT MAY BE AFFECTED BY ØRSTED'S PROPOSED ACTIVITY—Continued

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	PBR [3]	Annual M/SI [3]
Gray seal [4]	*Halichoerus grypus*	Western North Atlantic	-/-; N	27,131 (0.19; 23,158, 2016)	1,389	5,410
Harbor seal	*Phoca vitulina*	Western North Atlantic	-/-; N	75,834 (0.15; 66,884, 2018)	2,006	350

1—Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

2—NMFS marine mammal stock assessment reports online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region/*. CV is coefficient of variation; Nmin is the minimum estimate of stock abundance. In some cases, CV is not applicable.

3—Potential biological removal, defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population size (OSP). Annual M/SI, found in NMFS' SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.,* commercial fisheries, subsistence hunting, ship strike). Annual M/SI values often cannot be determined precisely and is in some cases presented as a minimum value. All M/SI values are as presented in the 2020 SARs (Hayes *et al.,* 2020).

4—NMFS stock abundance estimate applies to U.S. population only, actual stock abundance is approximately 505,000.

As indicated below, 15 species (with 15 managed stocks) temporally and spatially co-occur with the survey activities to the degree that take is reasonably likely to occur, and we have proposed authorizing it. The following subsections provide additional information on the biology, habitat use, abundance, distribution, and the existing threats to the non-ESA-listed and ESA-listed marine mammals that are both common in the waters of the outer continental shelf (OCS) of Southern New England, and have the likelihood of occurring, at least seasonally, in the Survey Area. These species include the North Atlantic right, humpback, fin, sei, minke, sperm, and long-finned pilot whale, bottlenose, common, Atlantic white-sided, Atlantic spotted, and Risso's dolphins, harbor porpoise, and gray and harbor seals. Although the potential for interactions with long-finned pilot whales and Atlantic spotted and Risso's dolphins is minimal, small numbers of these species may transit the Survey Area and are included in this analysis.

Cetaceans

North Atlantic Right Whale

The North Atlantic right whale ranges from calving grounds in the southeastern United States to feeding grounds in New England waters and into Canadian waters (Waring *et al.,* 2017). Right whales have been observed in or near southern New England during all four seasons; however, they are most common in the spring when they are migrating north and in the fall during their southbound migration (Kenney and Vigness-Raposa 2009). Surveys have demonstrated the existence of seven areas where North Atlantic right whales congregate seasonally: The coastal waters of the southeastern 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 (Hayes *et al.,* 2018). In addition, modest late winter use of a region south of Martha's Vineyard and Nantucket Islands was recently described (Stone *et al.,* 2017). NOAA Fisheries has designated two critical habitat areas for the NARW under the ESA: The Gulf of Maine/Georges Bank region, and the southeast calving grounds from North Carolina to Florida.

In the late fall months (*e.g.,* October), right whales are generally thought to depart from the feeding grounds in the North Atlantic and move south to their calving grounds off Georgia and Florida. However, recent research indicates our understanding of their movement patterns remains incomplete (Davis *et al.,* 2017). A review of passive acoustic monitoring data from 2004 to 2014 throughout the western North Atlantic demonstrated nearly continuous year-round right whale presence across their entire habitat range, including in locations previously thought of as migratory corridors, suggesting that not all of the population undergoes a consistent annual migration (Davis *et al.,* 2017). North Atlantic right whales are expected to be present in the proposed survey area during the proposed survey, especially summer months, with numbers possibly lower in the fall. The proposed survey area is part of a Biologically Important Area (BIA) for North Atlantic right whales; this important migratory area is comprised of the waters of the continental shelf offshore the East Coast of the United States and extends from Florida through Massachusetts. A map showing designated BIAs is available at: *https://cetsound.noaa.gov/biologically-important-area-map.*

NMFS' regulations at 50 CFR part 224.105 designated nearshore waters of the Mid-Atlantic Bight as Mid-Atlantic U.S. Seasonal Management Areas (SMA) for right whales in 2008. SMAs were developed to reduce the threat of collisions between ships and right whales around their migratory route and calving grounds. A portion of one SMA overlaps spatially with a section of the proposed Survey Area. The SMA is active from November 1 through April 30 of each year.

The western North Atlantic population demonstrated overall growth of 2.8 percent per year between 1990 to 2010, despite a decline in 1993 and no growth between 1997 and 2000 (Pace *et al.,* 2017). However, since 2010 the population has been in decline, with a 99.99 percent probability of a decline of just under 1 percent per year (Pace *et al.,* 2017). Between 1990 and 2015, calving rates varied substantially, with low calving rates coinciding with all three periods of decline or no growth (Pace *et al.,* 2017). On average, North Atlantic right whale calving rates are estimated to be roughly half that of southern right whales (*Eubalaena australis*) (Pace *et al.,* 2017), which are increasing in abundance (NMFS' SAR 2015). In 2018, no new North Atlantic right whale calves were documented in their calving grounds; this represented the first time since annual NOAA aerial surveys began in 1989 that no new right whale calves were observed. Data indicated that the number of adult females fell from 200 in 2010 to 186 in 2015, while the number of males fell from 283 to 272 in the same time frame (Pace *et al.,* 2017). In addition, elevated North Atlantic right whale mortalities have occurred since June 7, 2017 along the U.S. and Canadian coast. As of July 2020, a total of 31 confirmed dead stranded whales (21 in Canada; 10 in the United States) have been documented. This event has been declared an Unusual Mortality Event

(UME), with human interactions, including entanglement in fixed fishing gear and vessel strikes, implicated in at least 16 of the mortalities thus far. More information is available online at: *www.fisheries.noaa.gov/national/marine-life-distress/2017-2019-north-atlantic-right-whale-unusual-mortality-event.*

Humpback Whale

Humpback whales are found worldwide in all oceans. Humpback whales were listed as endangered under the Endangered Species Conservation Act (ESCA) in June 1970. In 1973, the ESA replaced the ESCA, and humpbacks continued to be listed as endangered. On September 8, 2016, NMFS divided the species into 14 distinct population segments (DPS), removed the current species-level listing, and in its place listed four DPSs as endangered and one DPS as threatened (81 FR 62259; September 8, 2016). The remaining nine DPSs were not listed. The West Indies DPS, which is not listed under the ESA, is the only DPS of humpback whale that is expected to occur in the Survey Area. The best estimate of population abundance for the West Indies DPS is 12,312 individuals, as described in the NMFS Status Review of the Humpback Whale under the Endangered Species Act (Bettridge *et al.,* 2015).

In New England waters, feeding is the principal activity of humpback whales, and their distribution in this region has been largely correlated to abundance of prey species, although behavior and bathymetry are factors influencing foraging strategy (Payne *et al.,* 1986, 1990). Humpback whales are frequently piscivorous when in New England waters, feeding on Herring (*Clupea harengus*), sand lance (*Ammodytes spp.*), and other small fishes, as well as euphausiids in the northern Gulf of Maine (Paquet *et al.,* 1997). During winter, the majority of humpback whales from the North Atlantic feeding area (including the Gulf of Maine) mate and calve in the West Indies, where spatial and genetic mixing among feeding groups occurs, though significant numbers of animals are found in mid- and high-latitude regions at this time and some individuals have been sighted repeatedly within the same winter season, indicating that not all humpback whales migrate south every winter (Waring *et al.,* 2017).

Kraus *et al.* (2016) observed humpbacks in the RI/MA & MA Wind Energy Areas (WEAs) and surrounding areas during all seasons. Humpback whales were observed most often during spring and summer months, with a peak from April to June. Calves were observed 10 times and feeding was observed 10 times during the Kraus *et al.* study (2016). That study also observed one instance of courtship behavior. Although humpback whales were rarely seen during fall and winter surveys, acoustic data indicate that this species may be present within the MA WEA year-round, with the highest rates of acoustic detections in the winter and spring (Kraus *et al.,* 2016). Other sightings of note include 46 sightings of humpback whales in the New York-New Jersey Harbor Estuary documented between 2011–2016 (Brown *et al.,* 2017).

Since January 2016, elevated humpback whale mortalities have occurred along the Atlantic coast from Maine to Florida. The event has been declared a UME. As of July 2020, partial or full necropsy examinations have been conducted on approximately half of the 126 known cases. Of the whales examined, about 50 percent had evidence of human interaction, either ship strike or entanglement. While a portion of the whales have shown evidence of pre-mortem vessel strike, this finding is not consistent across all whales examined and more research is needed. NOAA is consulting with researchers that are conducting studies on the humpback whale populations, and these efforts may provide information on changes in whale distribution and habitat use that could provide additional insight into how these vessel interactions occurred. Three previous UMEs involving humpback whales have occurred since 2000 (in 2003, 2005, and 2006). More information is available at: *www.fisheries.noaa.gov/national/marine-life-distress/2016-2019-humpback-whale-unusual-mortality-event-along-atlantic-coast.* A BIA for humpback whales for feeding has been designated northeast of the lease areas from March through December (LeBreque *et al.,* 2015).

Fin Whale

Fin whales are common in waters of the U.S. Atlantic Exclusive Economic Zone (EEZ), principally from Cape Hatteras northward (Waring *et al.,* 2016). Fin whales are present north of 35-degree latitude in every season and are broadly distributed throughout the western North Atlantic for most of the year (Waring *et al.,* 2016). They are typically found in small groups of up to five individuals (Brueggeman *et al.,* 1987). The main threats to fin whales are fishery interactions and vessel collisions (Waring *et al.,* 2016).

Sei Whale

The Nova Scotia stock of sei whales can be found in deeper waters of the continental shelf edge waters of the northeastern U.S. and northeastward to south of Newfoundland. The southern portion of the stock's range during spring and summer includes the Gulf of Maine and Georges Bank. Spring is the period of greatest abundance in U.S. waters, with sightings concentrated along the eastern margin of Georges Bank and into the Northeast Channel area, and along the southwestern edge of Georges Bank in the area of Hydrographer Canyon (Waring *et al.,* 2015). Sei whales occur in shallower waters to feed. The main threats to this stock are interactions with fisheries and vessel collisions.

Minke Whale

Minke whales can be found in temperate, tropical, and high-latitude waters. The Canadian East Coast stock can be found in the area from the western half of the Davis Strait (45°W) to the Gulf of Mexico (Waring *et al.,* 2016). This species generally occupies waters less than 100 m deep on the continental shelf. There appears to be a strong seasonal component to minke whale distribution in the survey areas, in which spring to fall are times of relatively widespread and common occurrence while during winter the species appears to be largely absent (Waring *et al.,* 2016).

Since January 2017, elevated minke whale mortalities have occurred along the Atlantic coast from Maine through South Carolina. This event has been declared a UME. As of July 2020, partial or full necropsy examinations have been conducted on approximately 60 percent of the 92 known cases. Preliminary findings in several of the whales have shown evidence of human interactions or infectious disease, but these findings are not consistent across all the whales examined, so more research is needed. More information is available at: *www.fisheries.noaa.gov/national/marine-life-distress/2017-2019-minke-whale-unusual-mortality-event-along-atlantic-coast.*

Sperm Whale

The distribution of the sperm whale in the U.S. EEZ occurs on the continental shelf edge, over the continental slope, and into mid-ocean regions (Waring *et al.,* 2014). The basic social unit of the sperm whale appears to be the mixed school of adult females plus their calves and some juveniles of both sexes, normally numbering 20–40 animals in all. There is evidence that some social bonds persist for many years (Christal *et al.,* 1998). This species forms stable social groups, site fidelity, and latitudinal range limitations in groups of females and juveniles (Whitehead, 2002). In summer, the distribution of sperm whales includes the area east and north of Georges Bank and into the Northeast Channel region, as well as the continental shelf (inshore of the 100 m isobath) south of New England. In the fall, sperm whale occurrence south of New England on the continental shelf is at its highest level, and there remains a continental shelf edge occurrence in the mid-Atlantic bight. In winter, sperm whales are concentrated east and northeast of Cape Hatteras.

Long-Finned Pilot Whale

Long-finned pilot whales are found from North Carolina north to Iceland, Greenland, and the Barents Sea (Waring *et al.,* 2016). In U.S. Atlantic waters, the species is distributed principally along the continental shelf edge off the northeastern U.S. coast in winter and early spring and in late spring, pilot whales move onto Georges Bank and into the Gulf of Maine and more northern waters and remain in these areas through late autumn (Waring *et al.,* 2016).

Atlantic White-Sided Dolphin

White-sided dolphins are found in temperate and sub-polar waters of the North Atlantic, primarily in continental shelf waters to the 100-m depth contour from central West Greenland to North Carolina (Waring *et al.,* 2016). The Gulf of Maine stock is most common in continental shelf waters from Hudson Canyon to Georges Bank, and in the Gulf of Maine and lower Bay of Fundy. Sighting data indicate seasonal shifts in distribution (Northridge *et al.,* 1997). During January to May, low numbers of white-sided dolphins are found from Georges Bank to Jeffreys Ledge (off New Hampshire), with even lower numbers south of Georges Bank, as documented by a few strandings on beaches of Virginia to South Carolina. From June through September, large numbers of white-sided dolphins are found from Georges Bank to the lower Bay of Fundy. From October to December, white-sided dolphins occur at intermediate densities from southern Georges Bank to southern Gulf of Maine (Payne and Heinemann 1990). Sightings south of Georges Bank, particularly around Hudson Canyon, occur year-round, but at low densities.

Atlantic Spotted Dolphin

Atlantic spotted dolphins are found in tropical and warm temperate waters ranging from southern New England south to Gulf of Mexico and the Caribbean to Venezuela (Waring *et al.,* 2014). This stock regularly occurs in continental shelf waters south of Cape Hatteras and in continental shelf edge and continental slope waters north of this region (Waring *et al.,* 2014). There are two forms of this species, with the larger ecotype inhabiting the continental shelf, usually found inside or near the 200 m isobaths (Waring *et al.,* 2014).

Common Dolphin

The common dolphin is found world-wide in temperate to subtropical seas. In the North Atlantic, common dolphins are commonly found over the continental shelf between the 100 m and 2,000 m isobaths and over prominent underwater topography and east to the mid-Atlantic Ridge (Waring *et al.,* 2016).

Bottlenose Dolphin

There are two distinct bottlenose dolphin morphotypes in the western North Atlantic: The coastal and offshore forms (Waring *et al.,* 2016). The migratory coastal morphotype resides in waters typically less than 20 m deep, along the inner continental shelf (within 7.5 km (4.6 miles) of shore), around islands, and is continuously distributed south of Long Island, New York into the Gulf of Mexico. This migratory coastal population is subdivided into 7 stocks based largely upon spatial distribution (Waring *et al.,* 2015). Of these 7 coastal stocks, the Western North Atlantic Migratory Coastal Stock is common in the coastal continental shelf waters off the coastal of New Jersey (Waring *et al.,* 2017). Generally, the offshore migratory morphotype is found exclusively seaward of 34 km (21 miles) and in waters deeper than 34 m (111.5 feet). This morphotype is primarily expected in waters north of Long Island, New York (Waring *et al.,* 2017; Hayes *et al.,* 2017; 2018). The offshore form is distributed primarily along the outer continental shelf and continental slope in the Northwest Atlantic Ocean from Georges Bank to the Florida Keys and is the only type that may be present in the survey area as the survey area is north of the northern extent of the Western North Atlantic Migratory Coastal Stock.

Harbor Porpoise

In the Lease Area, only the Gulf of Maine/Bay of Fundy stock may be present. This stock is found in U.S. and Canadian Atlantic waters and is concentrated in the northern Gulf of Maine and southern Bay of Fundy region, generally in waters less than 150 m deep (Waring *et al.,* 2016). They are seen from the coastline to deep waters (≤1800 m; Westgate and Read 1998), although the majority of the population is found over the continental shelf (Waring *et al.,* 2016). The main threat to the species is interactions with fisheries, with documented take in the U.S. northeast sink gillnet, mid-Atlantic gillnet, and northeast bottom trawl fisheries and in the Canadian herring weir fisheries (Waring *et al.,* 2016).

Pinnipeds

Harbor Seal

The harbor seal is found in all nearshore waters of the North Atlantic and North Pacific Oceans and adjoining seas above about 30° N (Burns, 2009). In the western North Atlantic, harbor seals are distributed from the eastern Canadian Arctic and Greenland south to southern New England and New York, and occasionally to the Carolinas (Waring *et al.,* 2016). Haulout and pupping sites are located off Manomet, MA and the Isles of Shoals, ME, but generally do not occur in areas in southern New England (Waring *et al.,* 2016).

Since July 2018, elevated numbers of harbor seal and gray seal mortalities have occurred across Maine, New Hampshire, and Massachusetts. This event has been declared a UME. Additionally, stranded seals have shown clinical signs as far south as Virginia, although not in elevated numbers; therefore, the UME investigation now encompasses all seal strandings from Maine to Virginia. Lastly, ice seals (harp and hooded seals) have also started stranding with clinical signs, again not in elevated numbers, and those two seal species have also been added to the UME investigation. As of March 2020, a total of 3,152 reported strandings (of all species) had occurred. Full or partial necropsy examinations have been conducted on some of the seals and samples have been collected for testing. Based on tests conducted thus far, the main pathogen found in the seals is phocine distemper virus. NMFS is performing additional testing to identify any other factors that may be involved in this UME. Information on this UME is available online at: *www.fisheries.noaa.gov/new-england-mid-atlantic/marine-life-distress/2018-2019-pinniped-unusual-mortality-event-along.*

Gray Seal

There are three major populations of gray seals found in the world: eastern Canada (western North Atlantic stock), northwestern Europe and the Baltic Sea. Gray seals in the survey area belong to the western North Atlantic stock. The range for this stock is thought to be from New Jersey to Labrador. Current population trends show that gray seal abundance is likely increasing in the U.S. Atlantic EEZ (Waring *et al.,* 2016). Although the rate of increase is unknown, surveys conducted since their arrival in the 1980s indicate a steady increase in abundance in both Maine and Massachusetts (Waring *et al.,* 2016). It is believed that recolonization by Canadian gray seals is the source of the U.S. population (Waring *et al.,* 2016).

As described above, elevated seal mortalities, including gray seals, have occurred from Maine to Virginia since July 2018. This event has been declared a UME, with phocine distemper virus identified as the main pathogen found in the seals. NMFS is performing additional testing to identify any other factors that may be involved in this UME. Information on this UME is available online at: *www.fisheries.noaa.gov/new-england-mid-atlantic/marine-life-distress/2018-2019-pinniped-unusual-mortality-event-along.*

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.,* Richardson *et al.,* 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.,* low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 decibel (dB) threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. The functional groups and the associated frequencies are indicated below (note that these frequency ranges correspond to the range for the composite group, with the entire range not necessarily reflecting the capabilities of every species within that group):

- *Low-frequency cetaceans (mysticetes):* Generalized hearing is estimated to occur between approximately 7 Hertz (Hz) and 35 kHz;
- *Mid-frequency cetaceans (larger toothed whales, beaked whales, and most delphinids):* Generalized hearing is estimated to occur between approximately 150 Hz and 160 kHz;
- *High-frequency cetaceans (porpoises, river dolphins, and members of the genera Kogia and Cephalorhynchus; including two members of the genus Lagenorhynchus, on the basis of recent echolocation data and genetic data):* Generalized hearing is estimated to occur between approximately 275 Hz and 160 kHz; and
- *Pinnipeds in water; Phocidae (true seals):* Generalized hearing is estimated to occur between approximately 50 Hz to 86 kHz.

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Kastelein *et al.,* 2009; Reichmuth and Holt, 2013).

For more detail concerning these groups and associated frequency ranges, please see NMFS Technical Guidance (2018) for a review of available information. Fifteen marine mammal species (thirteen cetacean and two pinnipeds (both phocid) species) have the reasonable potential to co-occur with the proposed survey activities (see Table 3). Of the cetacean species that may be present, five are classified as low-frequency cetaceans (*i.e.,* all mysticete species), seven are classified as mid-frequency cetaceans (*i.e.,* all delphinid species and the sperm whale), and one is classified as a high-frequency cetacean (*i.e.,* harbor porpoise).

Potential Effects of Specified Activities on Marine Mammals and Their Habitat

This section includes a summary and discussion of the ways that components of the specified activity may impact marine mammals and their habitat. The Estimated Take section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The Negligible Impact Analysis and Determination section considers the content of this section, the Estimated Take section, and the Proposed Mitigation section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks.

Background on Sound

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air or water, and is generally characterized by several variables. Frequency describes the sound's pitch and is measured in Hz or kHz, while sound level describes the sound's intensity and is measured in dB. Sound level increases or decreases exponentially with each dB of change. The logarithmic nature of the scale means that each 10-dB increase is a 10-fold increase in acoustic power (and a 20-dB increase is then a 100-fold increase in power). A 10-fold increase in acoustic power does not mean that the sound is perceived as being 10 times louder, however. Sound levels are compared to a reference sound pressure (micro-Pascal) to identify the medium. For air and water, these reference pressures are ''re: 20 micro Pascals (µPa)'' and ''re: 1 µPa,'' respectively. Root mean square (RMS) is the quadratic mean sound pressure over the duration of an impulse. RMS is calculated by squaring all the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick 1975). RMS accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels. This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units rather than by peak pressures.

When sound travels (propagates) from its source, its loudness decreases as the distance traveled by the sound increases. Thus, the loudness of a sound at its source is higher than the loudness of that same sound one km away. Acousticians often refer to the loudness of a sound at its source (typically referenced to one meter from the source) as the source level and the loudness of sound elsewhere as the received level (*i.e.,* typically the receiver). For example, a humpback whale 3 km from a device that has a source level of 230 dB may only be exposed to sound that is 160 dB loud, depending on how the sound travels through water (*e.g.,* spherical spreading (6 dB reduction with doubling of distance) was used in this example). As a result, it is important to understand the difference between source levels and received levels when discussing the loudness of sound in the ocean or its impacts on the marine environment.

As sound travels from a source, its propagation in water is influenced by various physical characteristics, including water temperature, depth, salinity, and surface and bottom properties that cause refraction, reflection, absorption, and scattering of sound waves. Oceans are not homogeneous and the contribution of each of these individual factors is extremely complex and interrelated. The physical characteristics that determine the sound's speed through the water will change with depth, season, geographic location, and with time of day (as a result, in actual active sonar operations, crews will measure oceanic conditions, such as sea water temperature and depth, to calibrate models that determine the path the sonar signal will take as it travels through the ocean and how strong the sound signal will be at a given range along a particular transmission path). As sound travels through the ocean, the intensity associated with the wavefront diminishes, or attenuates. This decrease in intensity is referred to as propagation loss, also commonly called transmission loss.

Acoustic Impacts

Geophysical surveys may temporarily impact marine mammals in the area due to elevated in-water sound levels. Marine mammals are continually exposed to many sources of sound. Naturally occurring sounds such as lightning, rain, sub-sea earthquakes, and biological sounds (*e.g.,* snapping shrimp, whale songs) are widespread throughout the world's oceans. Marine mammals produce sounds in various contexts and use sound for various biological functions including, but not limited to: (1) Social interactions, (2) foraging, (3) orientation, and (4) predator detection. Interference with producing or receiving these sounds may result in adverse impacts. Audible distance, or received levels, of sound depends on the nature of the sound source, ambient noise conditions, and the sensitivity of the receptor to the sound (Richardson *et al.,* 1995). Type and significance of marine mammal reactions to sound are likely dependent on a variety of factors including, but not limited to: (1) The behavioral state of the animal (*e.g.,* feeding, traveling, etc.), (2) frequency of the sound, (3) distance between the animal and the source, and (4) the level of the sound relative to ambient conditions (Southall *et al.,* 2007).

When considering the influence of various kinds of sound on the marine environment, it is necessary to understand that different kinds of marine life are sensitive to different frequencies of sound. Current data indicate that not all marine mammal species have equal hearing capabilities (Richardson *et al.,* 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). Animals are less sensitive to sounds at the outer edges of their functional hearing range and are more sensitive to a range of frequencies within the middle of their functional hearing range.

Hearing Impairment

Marine mammals may experience temporary or permanent hearing impairment when exposed to loud sounds. Hearing impairment is classified by temporary threshold shift (TTS) and permanent threshold shift (PTS). PTS is considered auditory injury (Southall *et al.,* 2007) and occurs in a specific frequency range and amount. Irreparable damage to the inner or outer cochlear hair cells may cause PTS; however, other mechanisms are also involved, such as exceeding the elastic limits of certain tissues and membranes in the middle and inner ears and resultant changes in the chemical composition of the inner ear fluids (Southall *et al.,* 2007). There are no empirical data for onset of PTS in any marine mammal; therefore, PTS-onset must be estimated from TTS-onset measurements and from the rate of TTS growth with increasing exposure levels above the level eliciting TTS-onset. PTS is presumed to be likely if the hearing threshold is reduced by ≥40 dB (that is, 40 dB of TTS).

Temporary Threshold Shift (TTS)

TTS is the mildest form of hearing impairment that can occur during exposure to a loud sound (Kryter 1985). While experiencing TTS, the hearing threshold rises, and a sound must be louder in order to be heard. At least in terrestrial mammals, TTS can last from minutes or hours to (in cases of strong TTS) days, can be limited to a particular frequency range, and can occur to varying degrees (*i.e.,* a loss of a certain number of dBs of sensitivity). For sound exposures at or somewhat above the TTS threshold, hearing sensitivities in both terrestrial and marine mammals recover rapidly after exposure to the noise ends.

Marine mammal hearing plays a critical role in communication with conspecifics and in interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (*i.e.,* recovery time), and frequency range of TTS and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious. For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that takes place during a time when the animal is traveling through the open ocean, where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during a time when communication is critical for successful mother/calf interactions could have more serious impacts if it were in the same frequency band as the necessary vocalizations and of a severity that it impeded communication. The fact that animals exposed to levels and durations of sound that would be expected to result in this physiological response would also be expected to have behavioral responses of a comparatively more severe or sustained nature is also notable and potentially of more importance than the simple existence of a TTS.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin, beluga whale (*Delphinapterus leucas*), harbor porpoise, and Yangtze finless porpoise (*Neophocaena phocaenoides*)) and three species of pinnipeds (northern elephant seal (*Mirounga angustirostris*), harbor seal, and California sea lion (*Zalophus californianus*)) exposed to a limited number of sound sources (*i.e.,* mostly tones and octave-band noise) in laboratory settings (*e.g.,* Finneran *et al.,* 2002 and 2010; Nachtigall *et al.,* 2004; Kastak *et al.,* 2005; Lucke *et al.,* 2009; Mooney *et al.,* 2009a,b; Popov *et al.,* 2011; Finneran and Schlundt, 2010). In general, harbor seals (Kastak *et al.,* 2005; Kastelein *et al.,* 2012a) and harbor porpoises (Lucke *et al.,* 2009; Kastelein *et al.,* 2012b) have a lower TTS onset than other measured pinniped or cetacean species. However, even for these animals, which are better able to hear higher frequencies and may be more sensitive to higher frequencies, exposures on the order of approximately 170 dB_{rms} or higher for brief transient signals are likely required for even temporary (recoverable) changes in hearing sensitivity that would likely not be categorized as physiologically damaging (Lucke *et al.,* 2009).

Additionally, the existing marine mammal TTS data come from a limited number of individuals within these species. There are no data available on noise-induced hearing loss for mysticetes. For summaries of data on TTS in marine mammals or for further discussion of TTS onset thresholds, please see Finneran (2015).

Scientific literature highlights the inherent complexity of predicting TTS onset in marine mammals, as well as the importance of considering exposure duration when assessing potential impacts (Mooney *et al.,* 2009a, 2009b; Kastak *et al.,* 2007). Generally, with sound exposures of equal energy, quieter sounds (lower sound pressure levels (SPL)) of longer duration were found to induce TTS onset more than louder sounds (higher SPL) of shorter duration (more similar to sub-bottom profilers). For intermittent sounds, less threshold shift will occur than from a continuous exposure with the same energy (some recovery will occur between intermittent exposures) (Kryter *et al.,* 1966; Ward 1997). For sound exposures at or somewhat above the TTS-onset threshold, hearing sensitivity recovers rapidly after exposure to the sound ends; intermittent exposures recover faster in comparison with continuous exposures of the same duration (Finneran *et al.,* 2010). NMFS considers TTS as Level B harassment that is mediated by physiological effects on the auditory system.

Animals in the Survey Area during the HRG survey are unlikely to incur TTS hearing impairment due to the characteristics of the sound sources, which include relatively low source levels (176 to 232 dB re 1 µPa-m) and generally very short pulses and duration of the sound. Even for high-frequency cetacean species (*e.g.,* harbor porpoises), which may have increased sensitivity to TTS (Lucke *et al.,* 2009; Kastelein *et al.,* 2012b), individuals would have to make a very close approach and also remain very close to vessels operating these sources in order to receive multiple exposures at relatively high levels, as would be necessary to cause TTS. Intermittent exposures—as would occur due to the brief, transient signals produced by these sources—require a higher cumulative SEL to induce TTS than would continuous exposures of the same duration (*i.e.,* intermittent exposure results in lower levels of TTS) (Mooney *et al.,* 2009a; Finneran *et al.,* 2010). Moreover, most marine mammals would more likely avoid a loud sound source rather than swim in such close proximity as to result in TTS. Kremser *et al.* (2005) noted that the probability of a cetacean swimming through the area of exposure when a sub-bottom profiler emits a pulse is small—because if the animal was in the area, it would have to pass the transducer at close range in order to be subjected to sound levels that could cause TTS and would likely exhibit avoidance behavior to the area near the transducer rather than swim through at such a close range. Further, the restricted beam shape of the majority of the geophysical survey equipment planned for use (Table 2) makes it unlikely that an animal would be exposed more than briefly during the passage of the vessel.

Masking

Masking is the obscuring of sounds of interest to an animal by other sounds, typically at similar frequencies. Marine mammals are highly dependent on sound, and their ability to recognize sound signals amid other sound is important in communication and detection of both predators and prey (Tyack 2000). Background ambient sound may interfere with or mask the ability of an animal to detect a sound signal even when that signal is above its absolute hearing threshold. Even in the absence of anthropogenic sound, the marine environment is often loud. Natural ambient sound includes contributions from wind, waves, precipitation, other animals, and (at frequencies above 30 kHz) thermal sound resulting from molecular agitation (Richardson *et al.,* 1995).

Background sound may also include anthropogenic sound, and masking of natural sounds can result when human activities produce high levels of background sound. Conversely, if the background level of underwater sound is high (*e.g.,* on a day with strong wind and high waves), an anthropogenic sound source would not be detectable as far away as would be possible under quieter conditions and would itself be masked. Ambient sound is highly variable on continental shelves (Myrberg 1978; Desharnais *et al.,* 1999). This results in a high degree of variability in the range at which marine mammals can detect anthropogenic sounds.

Although masking is a phenomenon which may occur naturally, the introduction of loud anthropogenic sounds into the marine environment at frequencies important to marine mammals increases the severity and frequency of occurrence of masking. For example, if a baleen whale is exposed to continuous low-frequency sound from an industrial source, this would reduce the size of the area around that whale within which it can hear the calls of another whale. The components of background noise that are similar in frequency to the signal in question primarily determine the degree of masking of that signal. In general, little is known about the degree to which marine mammals rely upon detection of sounds from conspecifics, predators, prey, or other natural sources. In the absence of specific information about the importance of detecting these natural sounds, it is not possible to predict the impact of masking on marine mammals (Richardson *et al.,* 1995). In general, masking effects are expected to be less severe when sounds are transient than when they are continuous. Masking is typically of greater concern for those marine mammals that utilize low-frequency communications, such as baleen whales, because of how far low-frequency sounds propagate.

Marine mammal communications would not likely be masked appreciably by the sub-bottom profiler signals given the directionality of the signals for most geophysical survey equipment types planned for use (Table 2) and the brief period when an individual mammal is likely to be within its beam.

Non-Auditory Physical Effects (Stress)

Classic stress responses begin when an animal's central nervous system perceives a potential threat to its homeostasis. That perception triggers stress responses regardless of whether a stimulus actually threatens the animal; the mere perception of a threat is sufficient to trigger a stress response (Moberg 2000; Seyle 1950). Once an animal's central nervous system perceives a threat, it mounts a biological response or defense that consists of a combination of the four general biological defense responses: behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses.

In the case of many stressors, an animal's first and sometimes most economical (in terms of biotic costs) response is behavioral avoidance of the potential stressor or avoidance of continued exposure to a stressor. An animal's second line of defense to stressors involves the sympathetic part of the autonomic nervous system and the classical ''fight or flight'' response which includes the cardiovascular system, the gastrointestinal system, the exocrine glands, and the adrenal medulla to produce changes in heart rate, blood pressure, and gastrointestinal activity that humans commonly associate with ''stress.'' These responses have a relatively short duration and may or may not have significant long-term effect on an animal's welfare.

An animal's third line of defense to stressors involves its neuroendocrine systems; the system that has received the most study has been the hypothalamus-pituitary-adrenal system (also known as the HPA axis in mammals). Unlike stress responses associated with the autonomic nervous system, virtually all neuro-endocrine functions that are affected by stress—including immune competence, reproduction, metabolism, and behavior—are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction (Moberg 1987; Rivier 1995), reduced immune competence (Blecha 2000), and behavioral disturbance. Increases in the circulation of glucocorticosteroids (cortisol, corticosterone, and aldosterone in marine mammals; see Romano *et al.,* 2004) have been long been equated with stress.

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and distress is the biotic cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose a risk to the animal's welfare. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other biotic function, which impairs those functions that experience the diversion. For example, when mounting a stress response diverts energy away from growth in young animals, those animals may experience stunted growth. When mounting a stress response diverts energy from a fetus, an animal's reproductive success and its fitness will suffer. In these cases, the animals will have entered a pre-pathological or pathological state which is called ''distress'' (Seyle 1950) or ''allostatic loading'' (McEwen and Wingfield 2003). This pathological state will last until the animal replenishes its biotic reserves sufficient to restore normal function. Note that these examples involved a long-term (days or weeks) stress response exposure to stimuli.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses have also been documented fairly well through controlled experiments; because this physiology exists in every vertebrate that has been studied, it is not surprising that stress responses and their costs have been documented in both laboratory and free-living animals (for examples see, Holberton *et al.,* 1996; Hood *et al.,* 1998; Jessop *et al.,* 2003; Krausman *et al.,* 2004; Lankford *et al.,* 2005; Reneerkens *et al.,* 2002; Thompson and Hamer, 2000). Information has also been collected on the physiological responses of marine mammals to exposure to anthropogenic sounds (Fair and Becker 2000; Romano *et al.,* 2004). For example, Rolland *et al.* (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales.

Studies of other marine animals and terrestrial animals would also lead us to expect some marine mammals to experience physiological stress responses and, perhaps, physiological responses that would be classified as ''distress'' upon exposure to high frequency, mid-frequency, and low-frequency sounds. For example, Jansen (1998) reported on the relationship between acoustic exposures and physiological responses that are indicative of stress responses in humans (*e.g.,* elevated respiration and increased heart rates). Jones (1998) reported on reductions in human performance when faced with acute, repetitive exposures to acoustic disturbance. Trimper *et al.* (1998) reported on the physiological stress responses of osprey to low-level aircraft noise while Krausman *et al.* (2004) reported on the auditory and physiology stress responses of endangered Sonoran pronghorn to military overflights. Smith *et al.* (2004a, 2004b), for example, identified noise-induced physiological transient stress responses in hearing-specialist fish (*i.e.,* goldfish) that accompanied short- and long-term hearing losses. Welch and Welch (1970) reported physiological and behavioral stress responses that accompanied damage to the inner ears of fish and several mammals.

Hearing is one of the primary senses marine mammals use to gather information about their environment and to communicate with conspecifics. Although empirical information on the relationship between sensory impairment (TTS, PTS, and acoustic masking) on marine mammals remains limited, it seems reasonable to assume that reducing an animal's ability to gather information about its environment and to communicate with other members of its species would be stressful for animals that use hearing as their primary sensory mechanism. Therefore, we assume that acoustic exposures sufficient to trigger onset PTS or TTS would be accompanied by physiological stress responses because terrestrial animals exhibit those responses under similar conditions (NRC 2003). More importantly, marine mammals might experience stress responses at received levels lower than those necessary to trigger onset TTS. Based on empirical studies of the time required to recover from stress responses (Moberg 2000), we also assume that stress responses are likely to persist beyond the time interval required for animals to recover from TTS and might result in pathological and pre-pathological states that would be as significant as behavioral responses to TTS.

In general, there are few data on the potential for strong, anthropogenic underwater sounds to cause non-auditory physical effects in marine mammals. The available data do not allow identification of a specific exposure level above which non-auditory effects can be expected (Southall *et al.,* 2007). There is currently no definitive evidence that any of these effects occur even for marine mammals in close proximity to an anthropogenic sound source. In addition, marine mammals that show behavioral avoidance of survey vessels and related sound sources are unlikely to incur non-auditory impairment or other physical effects. NMFS does not expect that the generally short-term, intermittent, and transitory HRG and geotechnical activities would create conditions of long-term, continuous noise and chronic acoustic exposure leading to long-term physiological stress responses in marine mammals.

Behavioral Disturbance

Behavioral disturbance may include a variety of effects, including subtle changes in behavior (*e.g.,* minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (*e.g.,* species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (*e.g.,* Richardson *et al.,* 1995; Wartzok *et al.,* 2003; Southall *et al.,* 2007; Weilgart 2007; Archer *et al.,* 2010). Behavioral reactions can vary not only among individuals but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison *et al.,* 2012), and can vary depending on characteristics associated with the sound source (*e.g.,* whether it is moving or stationary, number of sources, distance from the source). Please see Appendices B–C of Southall *et al.* (2007) for a review of studies involving marine mammal behavioral responses to sound.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al.,* 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. It is important to note that habituation is appropriately considered as a ''progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial,'' rather than as, more generally, moderation in response to human disturbance (Bejder *et al.,* 2009). The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. As noted, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson *et al.,* 1995; NRC 2003; Wartzok *et al.,* 2003). Controlled experiments with captive marine mammals have shown pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway *et al.,* 1997; Finneran *et al.,* 2003). Observed responses of wild marine mammals to loud, pulsed sound sources (typically seismic airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds, 2002; see also Richardson *et al.,* 1995; Nowacek *et al.,* 2007).

Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (*e.g.,* Lusseau and Bejder, 2007; Weilgart 2007; NRC 2005). However, there are broad categories of potential response, which we describe in greater detail here, that include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, and flight.

Changes in dive behavior can vary widely and may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive (*e.g.,* Frankel and Clark 2000; Costa *et al.,* 2003; Ng and Leung 2003; Nowacek *et al.,* 2004; Goldbogen *et al.,* 2013a,b). Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g.,* foraging) or they may be of little biological significance. The impact of an alteration to dive behavior resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (*e.g.,* bubble nets or sediment plumes), or changes in dive behavior. As for other types of behavioral response, the frequency, duration, and temporal pattern of signal presentation, as well as differences in species sensitivity, are likely contributing factors to differences in response in any given circumstance (*e.g.,* Croll *et al.,* 2001; Nowacek *et al.;* 2004; Madsen *et al.,* 2006; Yazvenko *et al.,* 2007). A determination of whether foraging disruptions incur fitness consequences would require information on or estimates of the energetic requirements of the affected individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Variations in respiration naturally vary with different behaviors and alterations to breathing rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Various studies have shown that respiration rates may either be unaffected or could increase, depending on the species and signal characteristics, again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure (*e.g.,* Kastelein *et al.,* 2001, 2005b, 2006; Gailey *et al.,* 2007).

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, echolocation click production, calling, and singing. Changes in vocalization behavior in response to anthropogenic noise can occur for any of these modes and may result from a need to compete with an increase in background noise or may reflect increased vigilance or a startle response. For example, in the presence of potentially masking signals, humpback whales and killer whales have been observed to increase the length of their vocalizations (Miller *et al.,* 2000; Fristrup *et al.,* 2003; Foote *et al.,* 2004), while right whales have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.,* 2007). In some cases, animals may cease sound production during production of aversive signals (Bowles *et al.,* 1994).

Avoidance is the displacement of an individual from an area or migration path as a result of the presence of a sound or other stressor and is one of the most obvious manifestations of disturbance in marine mammals (Richardson *et al.,* 1995). For example, gray whales are known to change direction—deflecting from customary migratory paths—in order to avoid noise from seismic surveys (Malme *et al.,* 1984). Avoidance may be short-term, with animals returning to the area once the noise has ceased (*e.g.,* Bowles *et al.,* 1994; Goold 1996; Stone *et al.,* 2000; Morton and Symonds, 2002; Gailey *et al.,* 2007). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (*e.g.,* Blackwell *et al.,* 2004; Bejder *et al.,* 2006; Teilmann *et al.,* 2006).

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (*e.g.,* directed movement, rate of travel). Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus, 1996). The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, marine mammal strandings (Evans and England, 2001). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves, 2008) and whether individuals are solitary or in groups may influence the response.

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of focus and attention (*i.e.,* when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors such as foraging or resting). These effects have generally not been demonstrated for marine mammals, but studies involving fish and terrestrial animals have shown that increased vigilance may substantially reduce feeding rates (*e.g.,* Beauchamp and Livoreil 1997; Fritz *et al.,* 2002; Purser and Radford 2011). In addition, chronic disturbance can cause population declines through reduction of fitness (*e.g.,* decline in body condition) and subsequent reduction in reproductive success, survival, or both (*e.g.,* Harrington and Veitch, 1992; Daan *et al.,* 1996; Bradshaw *et al.,* 1998). However, Ridgway *et al.* (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a five-day period did not cause any sleep deprivation or stress effects.

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Disruptions of such functions resulting from reactions to stressors such as sound exposure are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.,* 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.,* 2007). Note that there is a difference between multi-day substantive behavioral reactions and multi-day anthropogenic activities. For example, just because an activity lasts for multiple days does not necessarily mean that individual animals are either exposed to activity-related stressors for multiple days or, further, exposed in a manner resulting in sustained multi-day substantive behavioral responses.

Marine mammals are likely to avoid the HRG survey activity, especially the naturally shy harbor porpoise, while harbor seals might be attracted to survey vessels out of curiosity. However, because the sub-bottom profilers and other HRG survey equipment operate from a moving vessel, and the maximum radius to the Level B harassment threshold is relatively small, the area and time that this equipment would be affecting a given location is very small. Further, once an area has been surveyed, it is not likely that it will be surveyed again, thereby reducing the likelihood of repeated HRG-related impacts within the survey area.

We have also considered the potential for severe behavioral responses such as stranding and associated indirect injury or mortality from Ørsted's use of HRG survey equipment, on the basis of a 2008 mass stranding of approximately 100 melon-headed whales in a Madagascar lagoon system. An investigation of the event indicated that use of a high-frequency mapping system (12-kHz multibeam echosounder) was the most plausible and likely initial behavioral trigger of the event, while providing the caveat that there is no unequivocal and easily identifiable single cause (Southall *et al.,* 2013). The investigatory panel's conclusion was based on: (1) Very close temporal and spatial association and directed movement of the survey with the stranding event. (2) the unusual nature of such an event coupled with previously documented apparent behavioral sensitivity of the species to other sound types (Southall *et al.,* 2006; Brownell *et al.,* 2009), and (3) the fact that all other possible factors considered were determined to be unlikely causes. Specifically, regarding survey patterns prior to the event and in relation to bathymetry, the vessel transited in a north-south direction on the shelf break parallel to the shore, ensonifying large areas of deep-water habitat prior to operating intermittently in a concentrated area offshore from the stranding site; this may have trapped the animals between the sound source and the shore, thus driving them towards the lagoon system. The investigatory panel systematically excluded or deemed highly unlikely nearly all other potential reasons for these animals leaving their typical pelagic habitat for an area extremely atypical for the species (*i.e.,* a shallow lagoon system). Notably, this was the first time that such a system has been associated with a stranding event. The panel also noted several site- and situation-specific secondary factors that may have contributed to the avoidance responses that led to the eventual entrapment and mortality of the whales. Specifically, shoreward-directed surface currents and elevated chlorophyll levels in the area preceding the event may have played a role (Southall *et al.,* 2013). The report also notes that prior use of a similar system in the general area may have sensitized the animals and also concluded that, for odontocete cetaceans that hear well in higher frequency ranges where ambient noise is typically quite low, high-power active sonars operating in this range may be more easily audible and have potential effects over larger areas than low frequency systems that have more typically been considered in terms of anthropogenic noise impacts. It is, however, important to note that the relatively lower output frequency, higher output power, and complex nature of the system implicated in this event, in context of the other factors noted here, likely produced a fairly unusual set of circumstances that indicate that such events would likely remain rare and are not necessarily relevant to use of lower-power, higher-frequency systems more commonly used for HRG survey applications. The risk of similar events recurring may be very low, given the extensive use of active acoustic systems used for scientific and navigational purposes worldwide on a daily basis and the lack of direct evidence of such responses previously reported.

Tolerance

Numerous studies have shown that underwater sounds from industrial activities are often readily detectable by marine mammals in the water at distances of many km. However, other studies have shown that marine mammals at distances more than a few km away often show no apparent response to industrial activities of various types (Miller *et al.,* 2005). This is often true even in cases when the sounds must be readily audible to the animals based on measured received levels and the hearing sensitivity of that mammal group. Although various baleen whales, toothed whales, and (less frequently) pinnipeds have been shown to react behaviorally to underwater sound from sources such as airgun pulses or vessels under some conditions, at other times, mammals of all three types have shown no overt reactions (*e.g.,* Malme *et al.,* 1986; Richardson *et al.,* 1995; Madsen and Mohl 2000; Croll *et al.,* 2001; Jacobs and Terhune 2002; Madsen *et al.,* 2002; Miller *et al.,* 2005). In general, pinnipeds seem to be more tolerant of exposure to some types of underwater sound than are baleen whales. Richardson *et al.* (1995) found that vessel sound does not seem to affect pinnipeds that are already in the water. Richardson *et al.* (1995) went on to explain that seals on haul-outs sometimes respond strongly to the presence of vessels and at other times appear to show considerable tolerance of vessels, and Brueggeman *et al.* (1992) observed ringed seals (*Pusa hispida*) hauled out on ice pans displaying short-term escape reactions when a ship approached within 0.16–0.31 miles (0.25–0.5 km). Due to the relatively high vessel traffic in the Survey Area it is possible that marine mammals are habituated to noise (*e.g.,* DP thrusters) from vessels in the area.

Vessel Strike

Ship strikes of marine mammals can cause major wounds, which may lead to the death of the animal. An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or a vessel's propeller could injure an animal just below the surface. The severity of injuries typically depends on the size and speed of the vessel (Knowlton and Kraus 2001; Laist *et al.,* 2001; Vanderlaan and Taggart 2007).

The most vulnerable marine mammals are those that spend extended periods of time at the surface in order to restore oxygen levels within their tissues after deep dives (*e.g.,* the sperm whale). In addition, some baleen whales, such as the North Atlantic right whale, seem generally unresponsive to vessel sound, making them more susceptible to vessel collisions (Nowacek *et al.,* 2004). These species are primarily large, slow moving whales. Smaller marine mammals (*e.g.,* bottlenose dolphin) move quickly through the water column and are often seen riding the bow wave of large ships. Marine mammal responses to vessels may include avoidance and changes in dive pattern (NRC 2003).

An examination of all known ship strikes from all shipping sources (civilian and military) indicates vessel speed is a principal factor in whether a vessel strike results in death (Knowlton and Kraus 2001; Laist *et al.,* 2001; Jensen and Silber 2003; Vanderlaan and Taggart 2007). In assessing records with known vessel speeds, Laist *et al.* (2001) found a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision. The authors concluded that most deaths occurred when a vessel was traveling in excess of 24.1 km/h (14.9 mph; 13 kn). Given the slow vessel speeds and predictable course necessary for data acquisition, ship strike is unlikely to occur during the geophysical surveys. Marine mammals would be able to easily avoid the survey vessel due to the slow vessel speed. Further, Ørsted would implement measures (*e.g.,* protected species monitoring, vessel speed restrictions and separation distances; see Proposed Mitigation) set forth in the BOEM lease to reduce the risk of a vessel strike to marine mammal species in the survey area.

Marine Mammal Habitat

The HRG survey equipment will not contact the seafloor and does not represent a source of pollution. We are not aware of any available literature on impacts to marine mammal prey from sound produced by HRG survey equipment. However, as the HRG survey equipment introduces noise to the marine environment, there is the potential for it to result in avoidance of the area around the HRG survey activities on the part of marine mammal prey. Any avoidance of the area on the part of marine mammal prey would be expected to be short term and temporary.

Because of the temporary nature of the disturbance, and the availability of similar habitat and resources (*e.g.,* prey species) in the surrounding area, the impacts to marine mammals and the food sources that they utilize are not expected to cause significant or long-term consequences for individual marine mammals or their populations. Impacts on marine mammal habitat from the proposed activities will be temporary, insignificant, and discountable.

Estimated Take

This section provides an estimate of the number of incidental takes proposed for authorization through this IHA, which will inform both NMFS' consideration of ''small numbers'' and the negligible impact determination.

Harassment is the only type of take expected to result from these activities. Except with respect to certain activities not pertinent here, section 3(18) of the MMPA defines ''harassment'' as any act of pursuit, torment, or annoyance, which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment), or (ii) 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 (Level B harassment).

Authorized takes would be by Level B harassment only, in the form of disruption of behavioral patterns for individual marine mammals resulting from exposure to noise from certain HRG sources. Based on the nature of the activity and the anticipated effectiveness of the mitigation measures (*i.e.,* exclusion zones and shutdown measures), discussed in detail below in Proposed Mitigation section, Level A harassment or and/or mortality is neither anticipated nor proposed to be authorized. Below we describe how the take is estimated.

Generally speaking, we estimate take by considering: (1) Acoustic thresholds recommended by NMFS for use in evaluating when marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment, (2) the area or volume of water that will be ensonified above these levels in a day, (3) the density or occurrence of marine mammals within these ensonified area, and (4) and the number of days of activities. We note that while these basic factors can contribute to a basic calculation to provide an initial prediction of takes, additional information that can qualitatively inform take estimates is also sometimes available (*e.g.,* previous monitoring results or average group size). Below, we describe the factors considered here in more detail and present the proposed take estimate.

Acoustic Thresholds

NMFS recommends use of acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment).

Level B Harassment for non-explosive sources—Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source (*e.g.,* frequency, predictability, duty cycle), the environment (*e.g.,* bathymetry), and the receiving animals (hearing, motivation, experience, demography, behavioral context) and can be difficult to predict (Southall *et al.,* 2007, Ellison *et al.,* 2012). Based on what the available science indicates and the practical need to use a threshold based on a factor that is both predictable and measurable for most activities, NMFS uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. NMFS predicts that marine mammals are likely to be behaviorally harassed in a manner we consider Level B harassment when exposed to underwater anthropogenic noise above received levels of 120 dB re 1 microPascal root mean square (μPa rms) for continuous (*e.g.,* vibratory driving, drilling) and above 160 dB re 1 μPa (rms) for non-explosive impulsive (*e.g.,* seismic airguns) or intermittent sources (*e.g.,* scientific sonar) sources. Ørsted's proposed activity includes the use of intermittent sources, therefore the 160 dB re 1 μPa (rms) threshold is applicable. Some of the sources planned for use (*i.e.,* sparkers and boomers) are also impulsive.

Level A harassment for non-explosive sources—NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) (NMFS, 2018) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). As mentioned previously, Ørsted's proposed activity includes the use of impulsive (*e.g.,* sparkers and boomers) and non-impulsive intermittent (*e.g.,* CHIRP SBPs) sources.

These thresholds are provided in Table 4 below. The references, analysis, and methodology used in the development of the thresholds are described in NMFS 2018 Technical Guidance, which may be accessed at: *www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance.*

TABLE 4—THRESHOLDS IDENTIFYING THE ONSET OF PERMANENT THRESHOLD SHIFT

Hearing group	PTS onset acoustic thresholds * (received level)	
	Impulsive	Non-impulsive
Low-Frequency (LF) Cetaceans	*Cell 1:* $L_{pk,flat}$: 219 dB; $L_{E,LF,24h}$: 183 dB	*Cell 2:* $L_{E,LF,24h}$: 199 dB.
Mid-Frequency (MF) Cetaceans	*Cell 3:* $L_{pk,flat}$: 230 dB; $L_{E,MF,24h}$: 185 dB	*Cell 4:* $L_{E,MF,24h}$: 198 dB.
High-Frequency (HF) Cetaceans	*Cell 5:* $L_{pk,flat}$: 202 dB; $L_{E,HF,24h}$: 155 dB	*Cell 6:*$L_{E,HF,24h}$: 173 dB.
Phocid Pinnipeds (PW) (Underwater)	*Cell 7:* $L_{pk,flat}$: 218 dB; $L_{E,PW,24h}$: 185 dB	*Cell 8:* $L_{E,PW,24h}$: 201 dB.
Otariid Pinnipeds (OW) (Underwater)	*Cell 9:* $L_{pk,flat}$: 232 dB; $L_{E,OW,24h}$: 203 dB	*Cell 10:* $L_{E,OW,24h}$: 219 dB.

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

Note: Peak sound pressure (L_{pk}) has a reference value of 1 μPa, and cumulative sound exposure level (L_E) has a reference value of 1μPa^{2}s. In this Table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI 2013). However, peak sound pressure is defined by ANSI as incorporating frequency weighting, which is not the intent for this Technical Guidance. Hence, the subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the generalized hearing range. The subscript associated with cumulative sound exposure level thresholds (L_E) indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (*i.e.,* varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.

Ensonified Area

Here, we describe operational and environmental parameters of the activity that will feed into identifying the area ensonified above the acoustic thresholds, which include sources levels and transmission loss coefficient.

NMFS has developed a user-friendly methodology for determining the rms sound pressure level (SPL_{rms}) at the 160-dB isopleth for the purposes of estimating the extent of Level B harassment isopleths associated with HRG survey equipment (NMFS, 2020). This methodology incorporates frequency and some directionality to refine estimated ensonified zones. Ørsted used NMFS's methodology with additional modifications to incorporate a seawater absorption formula and account for energy emitted outside of the primary beam of the source. For sources that operate with different beam widths, the maximum beam width was used (see Table 2). The lowest frequency of the source was used when calculating the absorption coefficient (Table 2).

NMFS considers the data provided by Crocker and Fratantonio (2016) to represent the best available information on source levels associated with HRG equipment and, therefore, recommends that source levels provided by Crocker and Fratantonio (2016) be incorporated in the method described above to estimate isopleth distances to the Level A and Level B harassment thresholds. In cases when the source level for a specific type of HRG equipment is not provided in Crocker and Fratantonio (2016), NMFS recommends that either the source levels provided by the manufacturer be used, or, in instances where source levels provided by the manufacturer are unavailable or unreliable, a proxy from Crocker and Fratantonio (2016) be used instead. Table 2 shows the HRG equipment types that may be used during the proposed surveys and the sound levels associated with those HRG equipment types.

Results of modeling using the methodology described above indicated that, of the HRG survey equipment planned for use by Ørsted that has the potential to result in Level B harassment of marine mammals, sound produced by the Applied Acoustics Dura-Spark UHD sparkers and GeoMarine Geo-Source sparker would propagate furthest to the Level B harassment threshold (141 m; Table 5). As described above, only a portion of Ørsted's survey activity days will employ sparkers or boomers; therefore, for the purposes of the exposure analysis, it was assumed that sparkers would be the dominant acoustic source for approximately 701 of the total 1,302 survey activity days. For the remaining 601 survey days, the TB Chirp III (54 m; Table 5) was assumed to be the dominant source. Thus, the distances to the isopleths corresponding to the threshold for Level B harassment for sparkers (141 m) and the TB Chirp III (54 m) were used as the basis of the take calculation for all marine mammals for 54% and 46% of survey activity days, respectively.

TABLE 5—MODELED RADIAL DISTANCES FROM HRG SURVEY EQUIPMENT TO ISOPLETHS CORRESPONDING TO LEVEL A HARASSMENT AND LEVEL B HARASSMENT THRESHOLDS

Sound source	Radial distance to level A harassment threshold (m) *				Radial distance to level B harassment threshold (m)
	Low frequency cetaceans	Mid frequency cetaceans	High frequency cetaceans	Phocid pinnipeds (underwater)	All marine mammals
ET 216 CHIRP	<1	<1	2.9	0	12
ET 424 CHIRP	0	0	0	0	4
ET 512i CHIRP	0	0	<1	0	6
GeoPulse 5430	<1	<1	36.5	<1	29
TB CHIRP III	<1	<1	16.9	<1	54
Innomar Parametric SBPs	<1	<1	1.7	<1	4
AA Triple plate S-Boom (700/1,000 J)	<1	0	4.7	<1	76
AA, Dura-spark UHD (500 J/400 tip)	<1	0	2.8	<1	141
AA, Dura-spark UHD 400+400	<1	0	2.8	<1	141
GeoMarine, Geo-Source dual 400 tip sparker	<1	0	2.8	<1	141
Pangeo Acoustic Corer (LF CHIRP)	<1	0	<1	<1	4
Pangeo Acoustic Corer (HF CHIRP)	<1	<1	<1	<1	4
USBL (all models)	0	0	1.7	0	50

* AA = Applied Acoustics; CHIRP = Compressed High-Intensity Radiated Pulse; ET = EdgeTech; SBP = Sub-bottom Profiler; TB = Teledyne Benthos; UHD = Ultra-high Definition; USBL = Ultra-short Baseline. Distances to the Level A harassment threshold based on the larger of the dual criteria (peak SPL and SEL_{cum}) are shown.

Isopleth distances to Level A harassment thresholds for all types of HRG equipment and all marine mammal functional hearing groups were modeled using the NMFS User Spreadsheet and NMFS Technical Guidance (2018). The dual criteria (peak SPL and SEL_{cum}) were applied to all HRG sources using the modeling methodology as described above, and the isopleth distances for each functional hearing group were then carried forward in the exposure analysis. For the GeoMarine Geo-Source dual 400 tip sparker, Applied Acoustics Triple plate S-Boom and Dura-Spark models, the peak SPL metric resulted in larger isopleth distances for the high frequency hearing group; for all other HRG sources, the SEL_{cum} metric resulted in larger isopleth distances. Distances to the Level A harassment threshold based on the larger of the dual criteria (peak SPL and SEL_{cum}) are shown in Table 5.

Distances to the Level A harassment threshold for Innomar were calculated using a Matlab-based numerical model. Cumulative sound exposure level from a moving source to an assumed stationary marine mammal was calculated based on the safe distance method described in Sivle et al. (2015), with modifications to include absorption loss and beamwidth. The cumulative received level was then frequency weighted using the NMFS (2018) frequency weighting function for each marine mammal functional hearing group. Finally, the safe horizontal distance (*i.e.,* isopleth distance to the Level A harassment threshold) was determined numerically at a point where the SEL_{cum} would not exceed the 24-hour SEL_{cum}.

Modeled distances to isopleths corresponding to the Level A harassment threshold are very small (<1 m) for three of the four marine mammal functional hearing groups that may be impacted by the proposed activities (*i.e.,* low frequency and mid frequency cetaceans, and phocid pinnipeds; see Table 5). Based on the extremely small Level A harassment zones for these functional hearing groups, the potential for species within these functional hearing groups to be taken by Level A harassment is considered so low as to be discountable. These three functional hearing groups encompass all but one of the marine mammal species listed in Table 3 that may be impacted by the proposed activities. There is one species (harbor porpoise) within the high frequency functional hearing group that may be impacted by the proposed activities. However, the largest modeled distance to the Level A harassment threshold for the high frequency functional hearing group was only 36.5 m (Table 5). As noted above, modeled distances to isopleths corresponding to the Level A harassment threshold are also assumed to be conservative. Level A harassment would also be more likely to occur at close approach to the sound source or as a result of longer duration exposure to the sound source, and mitigation measures—including a 100 m exclusion zone for harbor porpoises—are expected to minimize the potential for close approach or longer duration exposure to active HRG sources. In addition, harbor porpoises are a notoriously shy species which is known to avoid vessels. Harbor porpoise would also be expected to avoid a sound source prior to that source reaching a level that would result in injury (Level A harassment). Therefore, we have determined that the potential for take by Level A harassment of harbor porpoises is so low as to be discountable. As NMFS has determined that the likelihood of take of any marine mammals in the form of Level A harassment occurring as a result of the proposed surveys is so low as to be discountable, we therefore do not propose to authorize the take by Level A harassment of any marine mammals. For more information about Level A harassment exposure estimation, please see section 6.2.1 of the IHA application.

Marine Mammal Occurrence

In this section we provide the information about the presence, density, or group dynamics of marine mammals that will inform the take calculations.

The habitat-based density models produced by the Duke University Marine Geospatial Ecology Laboratory (Roberts *et al.,* 2016a,b, 2017, 2018) represent the best available information regarding marine mammal densities in the proposed survey area. The density data presented by Roberts *et al.* (2016a,b, 2017, 2018) incorporates aerial and shipboard line-transect survey data from NMFS and other organizations and incorporates data from 8 physiographic and 16 dynamic oceanographic and biological covariates, and controls for the influence of sea state, group size, availability bias, and perception bias on the probability of making a sighting. These density models were originally developed for all cetacean taxa in the U.S. Atlantic (Roberts *et al.,* 2016a,b). In subsequent years, certain models have been updated based on additional data as well as certain methodological improvements. More information is available online at *seamap.env.duke.edu/models/Duke-EC-GOM-2015/.* Marine mammal density estimates in the Survey Area (animals/ km^2) were obtained using the most recent model results for all taxa (Roberts *et al.,* 2016b, 2017, 2018). The updated models incorporate additional sighting data, including sightings from the NOAA Atlantic Marine Assessment Program for Protected Species (AMAPPS) surveys from 2010–2014 (NEFSC & SEFSC, 2011, 2012, 2014a, 2014b, 2015, 2016).

For the exposure analysis, density data from Roberts *et al.* (2016b, 2017, 2018) were mapped using a geographic information system (GIS). Density grid cells that included any portion of the proposed Survey Area were selected for all survey months. Densities for the recently split Lease Areas OCS–A 0486 and OCS–A 0517 were combined, as the Lease Areas occupy the same habitat and densities and, therefore, overlap. For each of the survey areas (*i.e.,* OCS–A 0486/0517, OCS–A 0487. OCS–A 0500, and ECR Area), the densities of each species as reported by Roberts *et al.* (2016b, 2017, 2018) were averaged by month; those values were then used to calculate a mean annual density for each species for each segment of the Survey Area. Estimated mean monthly and annual densities (animals per km^2) of all marine mammal species that may be taken by the proposed survey, for all survey areas, are shown in Tables 8, 9, 10, and 11 of the IHA application. The mean annual density values used to estimate take numbers are shown in Table 6 below.

For bottlenose dolphin densities, Roberts *et al.* (2016b 2017, 2018) does not differentiate by stock. The Western North Atlantic northern migratory coastal stock primarily occurs in coastal waters from the shoreline to approximately the 20 m isobath (Hayes *et al.,* 2018). As the Lease Area is located north of the northern extent of the range of the Western North Atlantic Migratory Coastal Stock and within depths exceeding 20 m, where only the offshore stock would be expected to occur, all calculated bottlenose dolphin exposures within the Lease Area are expected to be from the offshore stock. Similarly, Roberts *et al.* (2018) produced density models for all seals but did not differentiate by seal species. Because the seasonality and habitat use by gray seals roughly overlaps with that of harbor seals in the survey areas, it was assumed that the mean annual density of seals could refer to either of the respective species and was, therefore, divided equally between the two species.

TABLE 6—MEAN ANNUAL MARINE MAMMAL DENSITIES (NUMBER OF ANIMALS PER 100 km^2) IN THE SURVEY AREAS

Species	OCS–A 0486/0517	OCS–A 0487	OCS–A 0500	ECR Area
North Atlantic right whale	0.21	0.19	0.18	0.07
Humpback whale	0.14	0.13	0.12	0.05
Fin whale	0.21	0.26	0.27	0.15
Sei whale	0.01	0.01	0.02	0.01
Minke whale	0.05	0.06	0.07	0.04
Sperm Whale	0.01	0.01	0.01	0.01
Pilot whale	0.16	0.33	0.68	0.37
Bottlenose dolphin	1.17	0.77	0.72	3.51
Common dolphin	4.68	7.58	4.40	2.60
Atlantic white-sided dolphin	1.46	2.55	3.86	1.98
Atlantic spotted dolphin	0.01	0.02	0.05	0.05
Risso's dolphin	0.00	0.00	0.01	0.01
Harbor porpoise	3.44	4.62	5.65	3.20
Gray seal	0.73	0.70	0.65	1.59
Harbor seal	0.73	0.70	0.65	1.59

Note: All density values derived from Roberts *et al.* (2016b, 2017, 2018). Densities shown represent the mean annual density values calculated.

Take Calculation and Estimation

Here we describe how the information provided above is brought together to produce a quantitative take estimate. In order to estimate the number of marine mammals predicted to be exposed to sound levels that would result in harassment, radial distances to predicted isopleths corresponding to Level B harassment thresholds are calculated, as described above. Those distances are then used to calculate the area(s) around the HRG survey equipment predicted to be ensonified to sound levels that exceed harassment thresholds. The area estimated to be ensonified to relevant thresholds in a single day is then calculated, based on areas predicted to be ensonified around the HRG survey equipment and the estimated trackline distance traveled per day by the survey vessel. The daily area is multiplied by the mean annual density of a given marine mammal species. This value is then multiplied by the number of proposed vessel days.

As noted previously, not all noise producing survey equipment/sources will be operated concurrently by each survey vessel on every vessel day. The greatest distance to the Level B harassment threshold for impulsive sources (sparkers or boomers) is 141 m, while the greatest distance to the Level B harassment threshold for other intermittent sources (*e.g.,* CHIRPs, Innomar, USBL) is 54 m. Therefore, the distance used to estimate take by Level B harassment was 141 m for the portion of survey days (54%) employing sparkers and boomers and 54 m for the portion of survey days (46%) when only non-impulsive sources will be used.

Ørsted estimates that the proposed surveys will achieve a maximum daily track line distance of 70 km per 24-hour day during the proposed HRG survey activity days; this distance accounts for the vessel traveling at approximately 4.0 kn, during active survey periods only. Estimates of incidental take by Level B harassment for impulsive and non-impulsive HRG equipment were calculated using the 141 m and 54 m Level B harassment isopleths, respectively, to determine the daily ensonified areas for 24-hour operations (impulsive 19.8 km²; non-impulsive 7.659 km²), estimated daily vessel track of approximately 70 km, and the relevant species density, multiplied by the number of survey days estimated for the specific Survey Area segment (Tables 7 and 8).

For the North Atlantic right whale, NMFS proposes to establish a 500-m exclusion zone which substantially exceeds the distance to the Level B harassment isopleth for both survey days using impulsive sources (141 m) and survey days using non-impulsive sources (54 m). However, Ørsted will be operating 24 hours per day for a majority of the total of 1,302 vessel days. Even with the implementation of mitigation measures (including visual monitoring at night with use of night vision devices), it is reasonable to assume that night time operations for an extended period could result in a limited number of right whales being exposed to underwater sound exceeding Level B harassment levels. Take has been conservatively calculated based on the largest isopleth for both types of survey days (*i.e.,* using impulsive or non-impulsive sources), and is thereby likely an overestimate because the acoustic source resulting in the largest isopleth would not be used on 100 percent of survey days for each category. In addition, Ørsted will implement specific mitigation and monitoring protocols for both types of survey days (*e.g.,* night vision goggles with thermal clip-ons for nighttime operations, exclusion zones, ramp-up and shutdown protocols). NMFS predicts that, in the absence of mitigation, 24 right whales may be taken by Level B harassment throughout the Survey Area over the 12-month project duration. The conservative estimate of exposure at Level B harassment levels coupled with the proposed monitoring and mitigation measures make it likely that this prediction is an overestimate.

As described above, NMFS has determined that the likelihood of take of any marine mammals in the form of Level A harassment occurring as a result of the proposed surveys is so low as to be discountable; therefore, we do not propose to authorize take of any marine mammals by Level A harassment.

TABLE 7—NUMBERS OF POTENTIAL INCIDENTAL TAKE BY LEVEL B HARASSMENT OF MARINE MAMMALS IN EACH OF THE SURVEY SEGMENTS BY SURVEY TYPE AND DURATION (* I = IMPULSIVE; NI = NON-IMPULSIVE)

Survey type	Estimated takes by Level B harassment							
	OCS–A 0486/0517		OCS–A 0487		OCS–A 0500		ECR Area	
	I *	NI *	I	NI	I	NI	I	NI
Vessel days	114	103	97	164	112	52	378	283
Species:								
North Atlantic right whale	4.74	1.64	3.65	2.36	3.99	0.71	5.24	1.5
Humpback whale	3.16	1.09	2.50	1.61	2.66	0.47	3.74	1.07
Fin whale	4.74	1.64	4.99	3.23	5.99	1.06	11.23	3.21
Sei whale	0.23	0.08	0.19	0.12	0.44	0.08	0.75	0.21
Minke whale	1.13	0.39	1.15	0.74	1.55	0.28	3.0	0.86
Sperm whale	0.02	0.08	0.19	0.12	0.22	0.04	0.75	0.21
Long-finned pilot whale	3.61	1.25	6.34	4.10	15.08	2.68	27.69	7.93
Bottlenose dolphin (W.N. Atlantic Offshore)	26.40	9.12	14.79	9.56	15.97	2.83	262.70	75.19
Common dolphin	105.64	36.49	145.58	94.09	97.57	17.32	194.59	55.69
Atlantic white-sided dolphin	32.96	11.38	48.98	31.65	85.60	15.19	148.19	42.41
Atlantic spotted dolphin	0.23	0.08	0.45	0.25	1.11	0.20	3.74	1.07
Risso's dolphin	0.00	0.00	0.00	0.00	0.22	0.04	0.75	0.21
Harbor porpoise	77.65	26.82	88.73	57.35	125.29	22.24	239.50	68.54
Gray seal	16.48	5.69	13.44	8.69	14.41	2.56	119.00	34.06
Harbor seal	16.48	5.69	13.44	8.69	14.41	2.56	119.00	34.06

TABLE 8—NUMBERS OF POTENTIAL INCIDENTAL TAKE OF MARINE MAMMALS PROPOSED FOR AUTHORIZATION AND PROPOSED TAKES AS A PERCENTAGE OF POPULATION

Species	Estimated takes by Level B harassment	Proposed takes by Level B harassment	Total takes proposed for authorization	Total proposed instances of take as a percentage of population
North Atlantic right whale	24	24	24	5.60
Humpback whale [1]	16	21	21	1.50
Fin whale	36	36	36	0.49
Sei whale	2	2	2	0.03
Minke whale [1]	9	13	13	0.05
Sperm whale [1]	2	3	3	0.07
Long-finned pilot whale	69	69	69	0.18
Bottlenose dolphin (W.N. Atlantic Offshore) [2]	417	417	419	0.67
Common dolphin [1 2]	747	2,205	2,211	1.28
Atlantic white-sided dolphin [2]	416	416	418	0.45
Atlantic spotted dolphin	7	7	7	0.02
Risso's dolphin [1]	1	30	30	0.08
Harbor porpoise [2]	706	706	916	0.96
Harbor seal [2]	214	214	215	0.28

TABLE 8—NUMBERS OF POTENTIAL INCIDENTAL TAKE OF MARINE MAMMALS PROPOSED FOR AUTHORIZATION AND PROPOSED TAKES AS A PERCENTAGE OF POPULATION—Continued

Species	Estimated takes by Level B harassment	Proposed takes by Level B harassment	Total takes proposed for authorization	Total proposed instances of take as a percentage of population
Gray seal [2]	214	214	215	0.79

[1] The proposed number of authorized takes (Level B harassment only) for these species has been increased from the estimated take number to mean group size (Risso's dolphin: Palka (2012); sperm whale: Barkaszi and Kelly (2018)) or increased based on PSO sighting observations from Ørsted's HRG survey activities in the same Survey Area in 2019 and 2020 (humpback and minke whales, and common dolphins).

[2] Total take by Level B harassment proposed for authorization has been increased to include modeled exposures resulting from estimation of take by Level A harassment, which is not anticipated (see Section 6.2.1 of the IHA application).

Orsted has requested additional take authorizations beyond the modelled takes for humpback and minke whales and common dolphins, based on increased detection of these species during its 2019 survey. Orsted's justification for this request can be found in its application, which is available here: *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.* We specifically invite comment on this aspect of Orsted's requested take authorization.

Proposed Mitigation

In order to issue an IHA under Section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses (latter not applicable for this action). NMFS regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, as well as subsistence uses where applicable, we carefully consider two primary factors:

(1) The manner in which, and the degree to which, the successful implementation of the measure(s) is expected to reduce impacts to marine mammals, marine mammal species or stocks, and their habitat. This considers the nature of the potential adverse impact being mitigated (likelihood, scope, range). It further considers the likelihood that the measure will be effective if implemented (probability of accomplishing the mitigating result if implemented as planned), the likelihood of effective implementation (probability implemented as planned), and

(2) The practicability of the measures for applicant implementation, which may consider such things as cost, impact on operations, and, in the case of a military readiness activity, personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

Proposed Mitigation Measures

NMFS proposes the following mitigation measures be implemented during Ørsted's proposed marine site characterization surveys.

Marine Mammal Exclusion Zones and Monitoring Zone

Marine mammal exclusion zones (EZ) would be established around the HRG survey equipment and monitored by protected species observers (PSOs):

- 500 m EZ for North Atlantic right whales;
- 100 m EZ for all marine mammals, with the exception of certain small delphinids specified below, for survey days operating impulsive acoustic sources (boomer and/or sparker).

If a marine mammal is detected approaching or entering the EZs during the HRG survey, the vessel operator would adhere to the shutdown procedures described below to minimize noise impacts on the animals. These stated requirements will be included in the site-specific training to be provided to the survey team.

Pre-Clearance of the Exclusion Zones

Ørsted would implement a 30-minute pre-clearance period of the exclusion zones prior to the initiation of ramp-up of HRG equipment. During this period, the exclusion zone will be monitored by the PSOs, using the appropriate visual technology. Ramp-up may not be initiated if any marine mammal(s) is within its respective exclusion zone. If a marine mammal is observed within an exclusion zone during the pre-clearance period, ramp-up may not begin until the animal(s) has been observed exiting its respective exclusion zone or until an additional time period has elapsed with no further sighting (*i.e.,* 15 minutes for small odontocetes and seals, and 30 minutes for all other species).

Ramp-Up of Survey Equipment

When technically feasible, a ramp-up procedure would be used for HRG survey equipment capable of adjusting energy levels at the start or re-start of survey activities. The ramp-up procedure would be used at the beginning of HRG survey activities in order to provide additional protection to marine mammals near the Survey Area by allowing them to vacate the area prior to the commencement of survey equipment operation at full power.

A ramp-up would begin with the powering up of the smallest acoustic HRG equipment at its lowest practical power output appropriate for the survey. When technically feasible, the power would then be gradually turned up and other acoustic sources would be added.

Ramp-up activities will be delayed if a marine mammal(s) enters its respective exclusion zone. Ramp-up will continue if the animal has been observed exiting its respective exclusion zone or until an additional time period has elapsed with no further sighting (*i.e,* 15 minutes for small odontocetes and seals and 30 minutes for all other species).

Activation of survey equipment through ramp-up procedures may not occur when visual observation of the pre-clearance zone is not expected to be effective (*i.e.,* during inclement conditions such as heavy rain or fog).

Shutdown Procedures

An immediate shutdown of the impulsive HRG survey equipment would be required if a marine mammal is sighted entering or within its respective exclusion zone. No shutdown is required for surveys operating only non-impulsive acoustic sources. 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 exclusion zone or until an additional time period has elapsed *(i.e.,* 15 minutes for small odontocetes and seals and 30 minutes for all other species).

If a species for which authorization has not been granted, or, a species for which authorization has been granted but the authorized number of takes have been met, approaches or is observed within the Level B harassment zone (54 m, non-impulsive; 141 m impulsive), shutdown would occur.

If the acoustic source is shut down for reasons other then mitigation (*e.g.,* mechanical difficulty) for less than 30 minutes, it may be activated again without ramp-up if PSOs have maintained constant observation and no detections of any marine mammal have occurred within the respective exclusion zones. If the acoustic source is shut down for a period longer than 30 minutes and PSOs have maintained constant observation, then pre-clearance and ramp-up procedures will be initiated as described in the previous section.

The shutdown requirement would be waived for small delphinids of the following genera: *Delphinus, Lagenorhynchus, Stenella,* and *Tursiops.* Specifically, if a delphinid from the specified genera is visually detected approaching the vessel (*i.e.,* to bow ride) or towed equipment, shutdown is not required. Furthermore, if there is uncertainty regarding identification of a marine mammal species (*i.e.,* whether the observed marine mammal(s) belongs to one of the delphinid genera for which shutdown is waived), PSOs must use best professional judgement in making the decision to call for a shutdown. Additionally, shutdown is required if a delphinid is detected in the exclusion zone and belongs to a genus other than those specified.

Vessel Strike Avoidance

Ørsted will ensure that vessel operators and crew maintain a vigilant watch for cetaceans and pinnipeds and slow down or stop their vessels to avoid striking these species. Survey vessel crew members responsible for navigation duties will receive site-specific training on marine mammals and sea turtle sighting/reporting and vessel strike avoidance measures. Vessel strike avoidance measures would include the following, except under circumstances when complying with these requirements would put the safety of the vessel or crew at risk:

- Vessel operators and crews must maintain a vigilant watch for all protected species and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any protected species. A visual observer aboard the vessel must monitor a vessel strike avoidance zone around the vessel (distances stated below). Visual observers monitoring the vessel strike avoidance zone may be third-party observers (*i.e.,* PSOs) or crew members, but crew members responsible for these duties must be provided sufficient training to (1) distinguish protected species from other phenomena and (2) broadly to identify a marine mammal as a right whale, other whale (defined in this context as sperm whales or baleen whales other than right whales), or other marine mammal.
- All vessels (*e.g.,* source vessels, chase vessels, supply vessels), regardless of size, must observe a 10-knot speed restriction in specific areas designated by NMFS for the protection of North Atlantic right whales from vessel strikes: any dynamic management areas (DMAs) when in effect, the Cape Cod Bay Seasonal Management Area (SMA) (from January 1 through May 15), the Off Race Point SMA (from March 1 through April 30), the Great South Channel SMA (from April 1 through July 31), the Mid-Atlantic SMAs (from November 1 through April 30), and the Southeast SMA (from November 15 through April 15). See *www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-ship-strikes-north-atlantic-right-whales* for specific detail regarding these areas.
- Vessel speeds must also be reduced to 10 knots or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near a vessel.
- All vessels must maintain a minimum separation distance of 500 m from right whales. If a whale is observed but cannot be confirmed as a species other than a right whale, the vessel operator must assume that it is a right whale and take appropriate action.
- All vessels must maintain a minimum separation distance of 100 m from sperm whales and all other baleen whales.
- All vessels must, to the maximum extent practicable, attempt to maintain a minimum separation distance of 50 m from all other marine mammals, with an understanding that at times this may not be possible (*e.g.,* for animals that approach the vessel).
- When protected species are sighted while a vessel is underway, the vessel shall take action as necessary to avoid violating the relevant separation distance (*e.g.,* attempt to remain parallel to the animal's course, avoid excessive speed or abrupt changes in direction until the animal has left the area). If marine mammals are sighted within the relevant separation distance, the vessel must reduce speed and shift the engine to neutral, not engaging the engines until animals are clear of the area. This does not apply to any vessel towing gear or any vessel that is navigationally constrained.
- These requirements do not apply in any case where compliance would create an imminent and serious threat to a person or vessel or to the extent that a vessel is restricted in its ability to maneuver and, because of the restriction, cannot comply.

Seasonal Operating Requirements

Ørsted will limit to three the number of survey vessels that will operate concurrently from March through June within the Lease Areas (OSC–A 0486/0517, OCS–A 0487, and OCS–A 500) and ECR Area north of the Lease Areas up to, but not including, coastal and bay waters. Ørsted would operate either a single vessel, two vessels concurrently or, for short periods, no more than three survey vessels concurrently in the areas described above during the March-June timeframe when right whale densities are greatest. This practice will help to reduce the number of right whale takes and to minimize the number of times that right whales may be exposed to project noise in a day.

Between watch shifts, members of the monitoring team will consult NOAA Fisheries North Atlantic right whale reporting systems for the presence of North Atlantic right whales throughout survey operations. The Survey Area occurs near the SMAs located off the coast of Rhode Island (Block Island Sounds SMA) and at the entrance to New York Harbor (New York Bight SMA). If survey vessels transit through these SMAs, they must adhere to the seasonal mandatory speed restrictions from November 1 through April 30. Throughout all survey operations, Ørsted will monitor NOAA Fisheries North Atlantic right whale reporting systems for the establishment of a DMA. If NOAA Fisheries should establish a DMA in the Lease Area under survey, the vessels will abide by speed restrictions in the DMA per the lease condition.

Based on our evaluation of the applicant's proposed measures, as well as other measures considered by NMFS, NMFS has preliminarily determined that the proposed mitigation measures provide the means of effecting the least practicable impact on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Proposed Monitoring and Reporting

In order to issue an IHA for an activity, Section 101(a)(5)(D) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

- Occurrence of marine mammal species or stocks in the area in which take is anticipated (*e.g.,* presence, abundance, distribution, density).
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) Action or environment (*e.g.,* source characterization, propagation, ambient noise); (2) affected species (*e.g.,* life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.,* age, calving or feeding areas).
- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors.
- How anticipated responses to stressors impact either: (1) Long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks.
- Effects on marine mammal habitat (*e.g.,* marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat).
- Mitigation and monitoring effectiveness.

Proposed Monitoring Measures

Visual monitoring will be performed by qualified, NMFS-approved PSOs, the resumes of whom will be provided to NMFS for review and approval prior to the start of survey activities. Ørsted would employ independent, dedicated, trained PSOs, meaning that the PSOs must (1) be employed by a third-party observer provider, (2) have no tasks other than to conduct observational effort, collect data, and communicate with and instruct relevant vessel crew with regard to the presence of marine mammals and mitigation requirements (including brief alerts regarding maritime hazards), and (3) have successfully completed an approved PSO training course appropriate for their designated task. On a case-by-case basis, non-independent observers may be approved by NMFS for limited, specific duties in support of approved, independent PSOs on smaller vessels with limited crew capacity operating in nearshore waters.

The PSOs will be responsible for monitoring the waters surrounding each survey vessel to the farthest extent permitted by sighting conditions, including exclusion zones, during all HRG survey operations. PSOs will visually monitor and identify marine mammals, including those approaching or entering the established exclusion zones during survey activities. It will be the responsibility of the Lead PSO on duty to communicate the presence of marine mammals as well as to communicate the action(s) that are necessary to ensure mitigation and monitoring requirements are implemented as appropriate.

During all HRG survey operations (*e.g.,* any day on which use of an HRG source is planned to occur), a minimum of one PSO must be on duty during daylight operations on each survey vessel, conducting visual observations at all times on all active survey vessels during daylight hours (*i.e.,* from 30 minutes prior to sunrise through 30 minutes following sunset). Two PSOs will be on watch during nighttime operations. The PSO(s) would ensure 360° visual coverage around the vessel from the most appropriate observation posts and would conduct visual observations using binoculars and/or NVDs and the naked eye while free from distractions and in a consistent, systematic, and diligent manner. PSOs may be on watch for a maximum of four consecutive hours followed by a break of at least two hours between watches and may conduct a maximum of 12 hours of observation per 24-hour period. In cases where multiple vessels are surveying concurrently, any observations of marine mammals would be communicated to PSOs on all nearby survey vessels.

PSOs must be equipped with binoculars and have the ability to estimate distance and bearing to detected marine mammals, particularly in proximity to exclusion zones. Reticulated binoculars must also be available to PSOs for use as appropriate based on conditions and visibility to support the sighting and monitoring of marine mammals. During nighttime operations, night-vision goggle with thermal clip-ons and infrared technology would be used. Position data would be recorded using hand-held or vessel GPS units for each sighting.

During good conditions (*e.g.,* daylight hours; Beaufort sea state (BSS) 3 or less), to the maximum extent practicable, PSOs would also conduct observations when the acoustic source is not operating for comparison of sighting rates and behavior with and without use of the active acoustic sources. Any observations of marine mammals by crew members aboard any vessel associated with the survey would be relayed to the PSO team.

Data on all PSO observations would be recorded based on standard PSO collection requirements. This would include dates, times, and locations of survey operations; dates and times of observations, location and weather; details of marine mammal sightings (*e.g.,* species, numbers, behavior); and details of any observed marine mammal behavior that occurs (*e.g.,* noted behavioral disturbances).

Proposed Reporting Measures

Within 90 days after completion of survey activities, a final technical report will be provided to NMFS that fully documents the methods and monitoring protocols, summarizes the data recorded during monitoring, summarizes the number of marine mammals observed during survey activities (by species, when known), summarizes the mitigation actions taken during surveys (including what type of mitigation and the species and number of animals that prompted the mitigation action, when known), and provides an interpretation of the results and effectiveness of all mitigation and monitoring. Any recommendations made by NMFS must be addressed in the final report prior to acceptance by NMFS.

In addition to the final technical report, Ørsted will provide the reports described below as necessary during survey activities.

In the event that Ørsted personnel discover an injured or dead marine mammal, Ørsted would report the incident to the NMFS Office of Protected Resources (OPR) and the NMFS New England/Mid-Atlantic Stranding Coordinator as soon as feasible. The report would include the following information:

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

In the unanticipated event of a ship strike of a marine mammal by any vessel involved in the activities covered by the IHA, Ørsted would report the incident to the NMFS OPR and the NMFS New England/Mid-Atlantic Stranding Coordinator as soon as feasible. The report would include the following information:

- Time, date, and location (latitude/longitude) of the incident;
- Species identification (if known) or description of the animal(s) involved;
- Vessel's speed during and leading up to the incident;
- Vessel's course/heading and what operations were being conducted (if applicable);
- Status of all sound sources in use;
- Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike;
- Environmental conditions (*e.g.,* wind speed and direction, Beaufort sea state, cloud cover, visibility) immediately preceding the strike;
- Estimated size and length of animal that was struck;
- Description of the behavior of the marine mammal immediately preceding and following the strike;
- If available, description of the presence and behavior of any other marine mammals immediately preceding the strike;
- Estimated fate of the animal (*e.g.,* dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and
- To the extent practicable, photographs or video footage of the animal(s).

Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.,* population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be ''taken'' through harassment, NMFS considers other factors, such as the likely nature of any responses (*e.g.,* intensity, duration), the context of any responses (*e.g.,* critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness of the mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS's implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.,* as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

To avoid repetition, our analysis applies to all the species listed in Table 3, given that NMFS expects the anticipated effects of the proposed survey to be similar in nature. NMFS does not anticipate that serious injury or mortality would occur as a result from HRG surveys, even in the absence of mitigation, and no serious injury or mortality is proposed to be authorized. As discussed in the Potential Effects section, non-auditory physical effects and vessel strike are not expected to occur. We expect that all potential takes would be in the form of short-term Level B behavioral harassment in the form of temporary avoidance of the area or decreased foraging (if such activity was occurring), reactions that are considered to be of low severity and with no lasting biological consequences (*e.g.,* Southall *et al.,* 2007). Even repeated Level B harassment of some small subset of an overall stock is unlikely to result in any significant realized decrease in viability for the affected individuals, and thus would not result in any adverse impact to the stock as a whole. As described above, Level A harassment is not expected to occur given the nature of the operations, the estimated size of the Level A harassment zones, the relatively low densities of marine mammals in the Survey Area, and the required shutdown zones for certain activities.

In addition to being temporary, the maximum expected harassment zone around a survey vessel is 141 m; almost half of survey days would include activity with a reduced acoustic harassment zone of 54 m per vessel, producing expected effects of particularly low severity. Therefore, the ensonified area surrounding each vessel is relatively small compared to the overall distribution of the animals in the area and their use of the habitat. Feeding behavior is not likely to be significantly impacted as prey species are mobile and are broadly distributed throughout the Survey Area; therefore, marine mammals that may be temporarily displaced during survey activities are expected to be able to resume foraging once they have moved away from areas with disturbing levels of underwater noise. Because of the temporary nature of the disturbance and the availability of similar habitat and resources in the surrounding area, the impacts to marine mammals and the food sources that they utilize are not expected to cause significant or long-term consequences for individual marine mammals or their populations.

ESA-listed species for which takes are proposed are North Atlantic right, fin, sei, and sperm whales; impacts on these species are anticipated to be limited to lower level behavioral effects. NMFS does not anticipate that serious injury or mortality would occur to ESA-listed species, even in the absence of proposed mitigation, and the proposed authorization does not authorize any serious injury or mortality. The proposed survey activities are not anticipated to affect the fitness or reproductive success of individual animals. Since impacts to individual survivorship and fecundity are unlikely, the proposed survey is not expected to result in population-level effects for any

ESA-listed species or alter current population trends of any ESA-listed species.

The status of the North Atlantic right whale population is of heightened concern and, therefore, merits additional analysis. Elevated North Atlantic right whale mortalities began in June 2017, primarily in Canada. Overall, preliminary findings support human interactions, specifically vessel strikes and entanglements, as the cause of death for the majority of right whales. The proposed survey area includes a biologically important migratory route for North Atlantic right whales (effective March–April and November–December) that extends from Massachusetts to Florida (LeBrecque *et al.,* 2015). Off the south coast of Massachusetts and Rhode Island, this biologically important migratory area extends from the coast to beyond the shelf break. The spatial acoustic footprint of the proposed survey is very small relative to the spatial extent of the available migratory habitat; therefore, right whale migration is not expected to be impacted by the proposed survey. Required vessel strike avoidance measures will also decrease risk of ship strike during migration; no ship strike is expected to occur. Additionally, only very limited take by Level B harassment of North Atlantic right whales has been proposed as HRG survey operations are required to maintain a 500 m EZ and shutdown if a North Atlantic right whale is sighted at or within the EZ. The 500 m shutdown zone for right whales is conservative, considering the Level B harassment isopleth for the most impactful acoustic source (*i.e.,* GeoMarine Geo-Source 400 tip sparker) is estimated to be 141 m, and thereby minimizes the potential for behavioral harassment of this species.

The proposed Survey Area includes a fin whale feeding BIA effective between March and October. The fin whale feeding area is sufficiently large (2,933 km^2), and the acoustic footprint of the proposed survey is sufficiently small that whale feeding habitat would not be reduced in any way, and any impacts to foraging behavior within the habitat are expected to be minimal. Behavioral harassment is typically context-dependent, and current literature demonstrates that some mysticetes are less likely to be susceptible to disruption of behavioral patterns when engaged in feeding (Southall *et al.,* 2007; Goldbogen *et al.,* 2013; Harris *et al.,* 2019). Any fin whales temporarily displaced from the proposed survey area would be expected to have sufficient habitat available to them and would not be prevented from feeding in other areas within the biologically important feeding habitat. In addition, any displacement of fin whales from the BIA would be expected to be temporary in nature. Therefore, we do not expect fin whale feeding to be negatively impacted by the proposed survey.

As noted previously, there are several active UMEs occurring in the vicinity of Ørsted's proposed Survey Area. Elevated humpback whale mortalities have occurred along the Atlantic coast from Maine through Florida since January 2016. Of the cases examined, approximately half had evidence of human interaction (ship strike or entanglement). The UME does not yet provide cause for concern regarding population-level impacts. Despite the UME, the relevant population of humpback whales (the West Indies breeding population, or distinct population segment (DPS)) remains stable at approximately 12,000 individuals.

Beginning in January 2017, elevated minke whale strandings have occurred along the Atlantic coast from Maine through South Carolina, with highest numbers in Massachusetts, Maine, and New York. This event does not provide cause for concern regarding population level impacts, as the likely population abundance is greater than 20,000 whales.

Elevated numbers of harbor seal and gray seal mortalities were first observed in July 2018 and have occurred across Maine, New Hampshire, and Massachusetts. Based on tests conducted so far, the main pathogen found in the seals is phocine distemper virus, although additional testing to identify other factors that may be involved in this UME are underway. The UME does not yet provide cause for concern regarding population-level impacts to any of these stocks. For harbor seals, the population abundance is over 75,000 and annual M/SI (350) is well below PBR (2,006) (Hayes *et al.,* 2018). The population abundance for gray seals in the United States is over 27,000, with an estimated abundance, including seals in Canada, of approximately 505,000. In addition, the abundance of gray seals is likely increasing in the U.S. Atlantic EEZ as well as in Canada (Hayes *et al.,* 2018).

The required mitigation measures are expected to reduce the number and/or severity of takes by providing animals the opportunity to move away from the sound source throughout the Survey Area before HRG survey equipment reaches full energy, thus preventing animals from being exposed to sound levels that have the potential to cause injury (Level A harassment) or more severe Level B harassment. No Level A harassment is anticipated or authorized.

NMFS expects that takes would be in the form of short-term Level B behavioral harassment by way of brief startling reactions and/or temporary vacating of the area, or decreased foraging (if such activity was occurring)—reactions that (at the scale and intensity anticipated here) are considered to be of low severity, with no lasting biological consequences. Since both the sources and marine mammals are mobile, animals would only be exposed briefly to a small ensonified area that might result in take. Additionally, required mitigation measures would further reduce exposure to sound that could result in more severe behavioral harassment.

In summary and as described above, the following factors primarily support our preliminary determination that the impacts resulting from this activity are not expected to adversely affect the species or stock through effects on annual rates of recruitment or survival:

- No mortality or serious injury is anticipated or authorized;
- No Level A harassment (PTS) is anticipated or authorized;
- Foraging success is not likely to be significantly impacted as effects on species that serve as prey species for marine mammals from the survey are expected to be minimal;
- The availability of alternate areas of similar habitat value for marine mammals to temporarily vacate the survey area during the planned survey to avoid exposure to sounds from the activity;
- Take is anticipated to be primarily Level B behavioral harassment consisting of brief startling reactions and/or temporary avoidance of the Survey Area;
- While the Survey Area is within areas noted as biologically important for North Atlantic right whale migration, the activities would occur in such a comparatively small area such that any avoidance of the Survey Area due to activities would not affect migration. In addition, mitigation measures to shutdown at 500 m to minimize potential for Level B behavioral harassment would limit any take of the species. Similarly, due to the small footprint of the survey activities in relation to the size of a biologically important area for fin whales' foraging, the survey activities would not affect foraging behavior of this species; and
- The proposed mitigation measures, including visual monitoring and shutdowns, are expected to minimize potential impacts to marine mammals.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed monitoring and mitigation measures, NMFS preliminarily finds that the total marine mammal take from the proposed activity will have a negligible impact on all affected marine mammal species or stocks.

Small Numbers

As noted above, only small numbers of incidental take may be authorized under sections 101(a)(5)(A) and (D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities.

The numbers of marine mammals that we propose for authorization to be taken, for all species and stocks, would be small relative to the relevant stocks or populations (less than 6 percent for all species and stocks) as shown in Table 8. Based on the analysis contained herein of the proposed activity (including the proposed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals will be taken relative to the population size of all affected species or stocks.

Unmitigable Adverse Impact Analysis and Determination

There are no relevant subsistence uses of the affected marine mammal stocks or species implicated by this action. Therefore, NMFS has determined that the total taking of affected species or stocks would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Endangered Species Act

Section 7(a)(2) of the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*) requires that each Federal agency insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. To ensure ESA compliance for the issuance of IHAs, NMFS consults internally, in this case with the NMFS Greater Atlantic Regional Fisheries Office (GARFO), whenever we propose to authorize take for endangered or threatened species. Within the Survey Area, fin, sei, humpback, North Atlantic right, and sperm whales are listed as endangered species under the ESA. Under section 7 of the ESA, BOEM consulted with NMFS on commercial wind lease issuance and site assessment activities on the Atlantic Outer Continental Shelf in Massachusetts, Rhode Island, New York, and New Jersey Wind Energy Areas. NOAA's GARFO issued a Biological Opinion concluding that these activities may adversely affect but are not likely to jeopardize the continues existence of these marine mammal species. The Biological Opinion can be found online at: *https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-biological-opinions-greater-atlantic-region.* NMFS will conclude the ESA section 7 consultation prior to reaching a determination regarding the proposed issuance of the authorization. If the IHA is issued, the Biological Opinion may be amended to include an incidental take statement for these marine mammal species, as appropriate.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to Ørsted for HRG survey activities effective one year from the date of issuance, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. A draft of the proposed IHA itself is available for review in conjunction with this notice at: *www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.*

Request for Public Comments

We request comment on our analyses, the proposed authorization, and any other aspect of this Notice of Proposed IHA for Ørsted's proposed activity. We also request at this time comment on the potential Renewal of this proposed IHA as described in the paragraph below. Please include with your comments any supporting data or literature citations to help inform decisions on the request for this IHA or a subsequent Renewal IHA.

On a case-by-case basis, NMFS may issue a one-time one-year Renewal IHA following notice to the public providing an additional 15 days for public comments when (1) up to another year of identical or nearly identical, or nearly identical, activities as described in the Specified Activities section of this notice is planned or (2) the activities as described in the Specified Activities section of this notice would not be completed by the time the IHA expires and a Renewal would allow for completion of the activities beyond that described in the *Dates and Duration* section of this notice, provided all of the following conditions are met:

- A request for renewal is received no later than 60 days prior to the needed Renewal IHA effective date (recognizing that the Renewal IHA expiration date cannot extend beyond one year from expiration of the initial IHA).
- The request for renewal must include the following:

(1) An explanation that the activities to be conducted under the requested Renewal IHA are identical to the activities analyzed under the initial IHA, are a subset of the activities, or include changes so minor (*e.g.,* reduction in pile size) that the changes do not affect the previous analyses, mitigation and monitoring requirements, or take estimates (with the exception of reducing the type or amount of take).

(2) A preliminary monitoring report showing the results of the required monitoring to date and an explanation showing that the monitoring results do not indicate impacts of a scale or nature not previously analyzed or authorized.

- Upon review of the request for Renewal, the status of the affected species or stocks, and any other pertinent information, NMFS determines that there are no more than minor changes in the activities, the mitigation and monitoring measures will remain the same and appropriate, and the findings in the initial IHA remain valid.

Dated: August 5, 2020.

Donna Wieting,

Director, Office of Protected Resources, National Marine Fisheries Service.

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

Science Advisory Board

AGENCY: National Oceanic and Atmospheric Administration (NOAA), Department of Commerce (DOC).

ACTION: Notice of public meetings.

SUMMARY: This notice sets forth the schedule and proposed agenda of two meetings of the Science Advisory Board