BILLING CODE 3510-22-P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[RTID 0648-XR078]

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Marine Site Characterization Surveys off of Massachusetts, Rhode Island, Connecticut, and New York

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

ACTION: Notice; proposed incidental harassment authorization; request for comments.

SUMMARY: NMFS has received a request from Vineyard Wind, LLC (Vineyard Wind) for authorization to take marine mammals incidental to marine site characterization surveys of Massachusetts in the areas of the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0501 and OCS-A 0522) and along potential submarine cable routes to a landfall location in Massachusetts, Rhode Island, Connecticut, and New York. 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 marine mammals during the specified activities. NMFS is also requesting comments on a possible 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 [*insert date 30 days after date of publication in the FEDERAL REGISTER*].

ADDRESSES: Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service. Physical comments should be sent to 1315 East-West Highway, Silver Spring, MD 20910 and electronic comments should be sent to *ITP.pauline@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: Robert Pauline, Office of Protected Resources, NMFS, (301) 427-8401. 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.

The definitions of all applicable MMPA statutory terms cited above are included in the relevant sections below.

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 Vineyard Wind's application and this notice collectively provide the environmental information related to proposed issuance of these regulations and subsequent incidental take authorization 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 October 24, 2019, NMFS received a request from Vineyard Wind for an IHA to take marine mammals incidental to marine site characterization surveys offshore of Massachusetts in the areas of the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0501 and OCS-A 0522) and along potential submarine offshore export cable corridors (OECC) to a landfall locations in Massachusetts, Rhode Island, Connecticut, and New York. NMFS deemed that request to be adequate and complete on January 7, 2020. Vineyard Wind's request is for the take of 14 marine mammal species by Level B harassment that would occur over the course of up to 365 calendar days. Neither Vineyard Wind 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.

Description of the Proposed Activity

Overview

Vineyard Wind proposes to conduct high-resolution geophysical (HRG) surveys in support of offshore wind development projects in the areas of Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (#OCS-A 0501 and #OCS-A 0522) (Lease Areas) and along potential submarine cable routes to landfall locations in Massachusetts, Rhode Island, Connecticut, and New York.

The purpose of the marine site characterization surveys is to obtain a baseline assessment of seabed/sub-surface soil conditions in the Lease Area and cable route corridors to support the siting of potential future offshore wind projects. Underwater sound resulting from Vineyard Wind'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

The estimated duration of the activity is expected to be up to 365 survey days between April 1, 2020 and March 31, 2021. This schedule is based on 24-hour operations and includes potential down time due to inclement weather. With up to eight survey vessels operating concurrently, a maximum of 736 vessels days are anticipated.

Specific Geographic Region

Vineyard Wind's survey activities would occur in the Northwest Atlantic Ocean within Federal waters. The area includes Lease Area OCS-A 0501, located approximately 24 kilometers (km) (13 nautical miles [nm]) from the southeast corner of Martha's Vineyard and Lease Area OCS-A 0522, located approximately 46 km (25 nm) south of Nantucket. Additionally, OECC routes may also be surveyed within the area depicted in Figure 1.

Water depths across the lease areas range from approximately 35 to 63 meters (m) (115 to 207 feet [ft]); potential offshore export cable corridor (OECC) routes in the Project Area will be evaluated and will extend from the lease areas to shallow water areas near potential landfall locations in Massachusetts, Rhode Island, Connecticut, and New York as shown in Figure 1.

HRG survey activities south of Cape Cod are anticipated to begin on April 1, 2020 and will last for up to one year. HRG survey activities proposed for north and northeast of Cape Cod will be conducted exclusively during the months of August and September when North Atlantic right whales (NARWs; *Eubalaena glacialis*) are not anticipated to be present (Roberts *et al.* 2018).

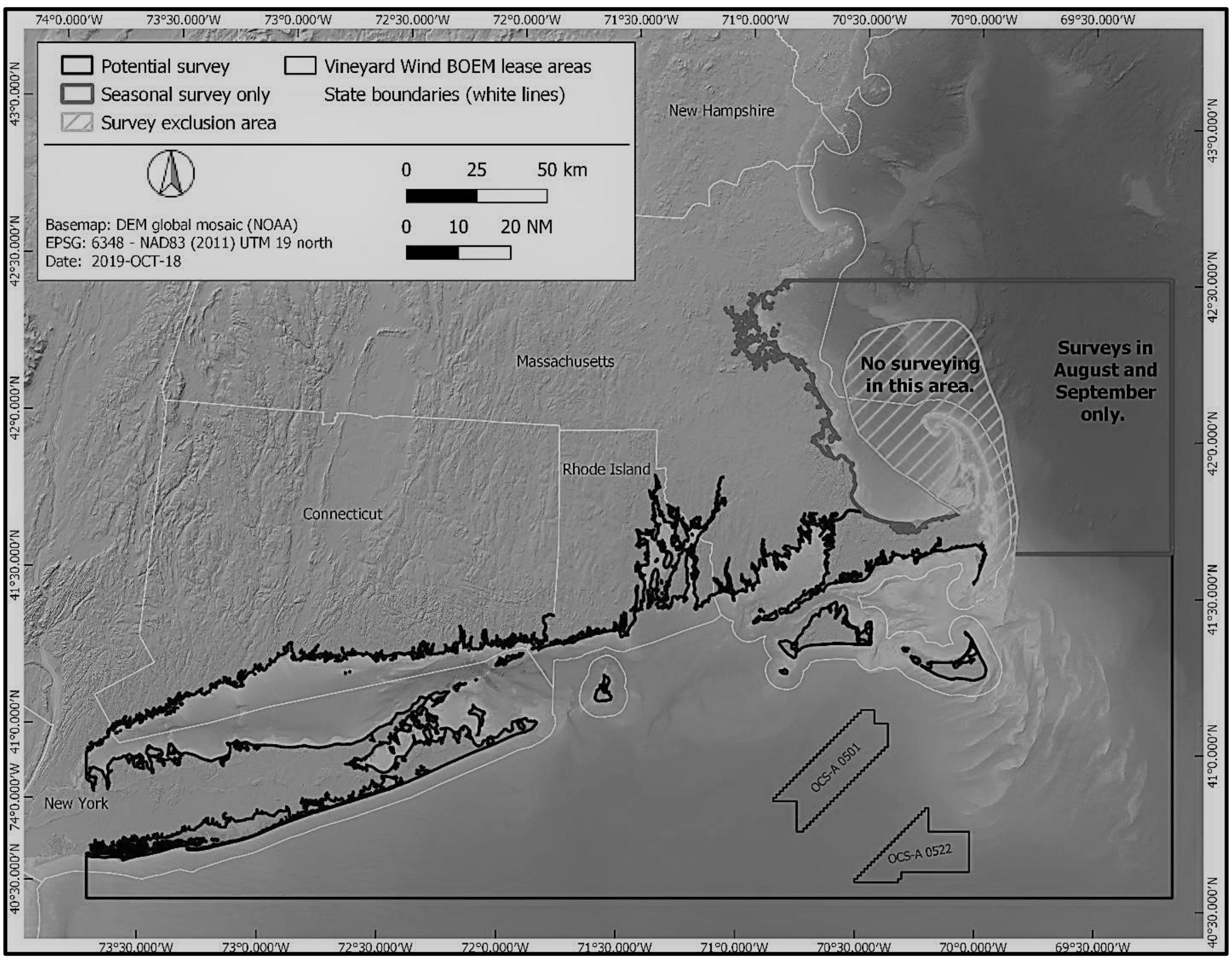

Figure 1. Project Area Location

Detailed Description of the Specified Activities

Vineyard Wind's proposed marine site characterization surveys include high-resolution geophysical (HRG) survey activities. Water depths in the Lease Areas range from 35 to 63 m (115 to 207 ft). Water depths along the potential OECC routes range from 5 to greater than 200 m (16 to >656 ft). The OECC routes will extend from the lease areas to shallow water areas near potential landfall locations in Massachusetts, Rhode Island, Connecticut, and New York

HRG equipment will be deployed from multiple vessels acquiring data concurrently within the HRG Project Area (Figure 1). HRG survey activities south of Cape Cod are anticipated to begin on April 1, 2020 and will last for up to 365 calendar days with a total of 736 vessel days. HRG survey activities proposed for north and northeast of Cape Cod will be conducted exclusively during the months of August and September when North Atlantic right whales (NARWs; *Eubalaena glacialis*) are not anticipated to be present (Nichols *et al.* 2008). For the purpose of this IHA the Lease Areas and submarine cable corridor are collectively termed the Project Area.

Geophysical survey activities are anticipated to include as many as eight survey vessels which may be operating concurrently. Survey vessels would maintain a speed of approximately 4 knots (kn) while transiting survey lines and each vessel would cover approximately 100 km per day. The proposed HRG survey activities are described below.

Geophysical survey activities

Vineyard Wind has proposed that HRG survey operations would be conducted continuously 24 hours per day. Based on 24-hour operations, the estimated duration of the geophysical survey activities would be up to 365 calendar days with a total of 736 total survey vessel days (including estimated weather down time). As many as eight survey vessels may be used concurrently during Vineyard Wind's proposed surveys. The geophysical survey activities proposed by Vineyard Wind would include the following:

- Shallow Penetration Sub-bottom Profilers (SBP; 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. 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. Sparkers create acoustic pulses from 50 Hz to 4 kHz omni-directionally from the source that can penetrate several hundred meters into the seafloor. Typically towed behind the vessel with adjacent hydrophone arrays to receive the return signals.

- Parametric SBPs, also called sediment echosounders, for providing high data density in sub-bottom profiles that are typically required for cable routes, very shallow water, and archaeological surveys. Typically mounted on the hull of the vessel or from a side pole.

- Multibeam Echosounders (MBESs) 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.

- Ultra-Short Baseline (USBL) Positioning and Global Acoustic Positioning System (GAPS) to provide high accuracy ranges by measuring the time between the acoustic pulses transmitted by the vessel transceiver and the equipment 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.

- Side-scan Sonar (SSS) for seabed sediment classification purposes and to identify natural and man-made acoustic targets on the seafloor. The sonar device emits conical or fan-shaped pulses down toward the seafloor in multiple beams at a wide angle, perpendicular to the path of the sensor through the water. 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 1 identifies the representative survey equipment that may be used in support of proposed geophysical survey activities that operate below 180 kilohertz (kHz) and have the potential to cause acoustic harassment to marine species, including marine mammals, and therefore require the establishment and monitoring of exclusion zones

HRG surveys are expected to use several equipment types concurrently in order to collect multiple aspects of geophysical data along one transect. Selection of equipment combinations is based on specific survey objectives.

Table 1. Summary of Geophysical Survey Equipment Proposed for Use by Vineyard Wind

HRG Equipment Category	Specific HRG Equipment	Operating Frequency (kHz)	Beam width (°)	Source level (dB rms)	Peak source level (dB re 1 µPa m)	Pulse Duration (ms)	Repetition rate (Hz)
Shallow subbottom profiler	EdgeTech Chirp 216	2-10	65	178	182	2	3.75
	Innomar SES 2000 Medium	85-115	2	241	247	2	40
Deep seismic profiler	Applied Acoustics AA251 Boomer	0.2–15	180	205	212	0.9	2

	GeoMarine Geo Spark 2000 (400 tip)	0.25–5	180	206	214	2.8	1
Underwater positioning (USBL)	SonarDyne Scout Pro	35–50	180	188	191	Unknown	Unknown
	ixBlue Gaps	20–32	180	191	194	1	10

The deployment of HRG survey equipment, including the equipment anticipated for use during Vineyard Wind's proposed activity, produces sound in the marine environment that has the potential to result in harassment of marine mammals. However, sound propagation in water is dependent on several factors including operating mode, frequency and beam direction of the HRG equipment; thus, potential impacts to marine mammals from HRG equipment are driven by the specification of individual HRG sources. The specifications of the potential equipment proposed for use during HRG survey activities (Table 1) were analyzed to determine which types of equipment would have 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' web site (*www.fisheries.noaa.gov/find-species*).

Table 2 lists all species with expected potential for occurrence in the Project Area 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 (2016). 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's SARs). While no mortality is anticipated or authorized here, PBR and annual serious injury and mortality from anthropogenic sources are included here as gross indicators 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 Project 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' U.S. Atlantic SARs. All values presented in Table 2 are the most recent available at the time of publication and are available in either the 2018 Atlantic and Gulf of Mexico Marine Mammal Stock Assessments (Hayes *et al.*, 2019a), available online at*: www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region* or and draft 2019 Atlantic and Gulf of Mexico Marine Mammal Stock Assessments (Hayes *et al.* 2019b) available online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports.*

Table 2. Marine Mammals Known to Occur in the Project Area That May be Affected by Vineyard Wind'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	Annual M/SI[3]
Order Cetartiodactyla – Cetacea – Superfamily Mysticeti (baleen whales)						
Family Balaenidae						
North Atlantic Right whale	*Eubalaena glacialis*	Western North Atlantic (WNA)	E/D; Y	409[4] (0; 445; 2017)	0.9	5.56
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*	WNA	E/D; Y	7,418 (0.25; 6,029; See SAR)	12	2.35
Sei whale	*Balaenoptera borealis*	Nova Scotia	E/D; Y	6292 (1.015; 3,098; see SAR)236	6.2	1
Minke whale	*Balaenoptera acutorostrata*	Canadian East Coast	-/-; N	24,202 (0.3; 18,902; See SAR)	1189	8
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Physeteridae						
Sperm whale	*Physeter macrocephalus*	NA	E; Y	4349 (0.28;3,451; See SAR)	6.9	0
Family Delphinidae						
Long-finned pilot whale	*Globicephala melas*	WNA	-/-; Y	5,636 (0.63; 3,464)	35	38
Bottlenose dolphin	*Tursiops spp.*	WNA Offshore	-/-; N	62,851 (0.23; 51,914; Ses SAR)	591	28
Common dolphin	*Delphinus delphis*	WNA	-/-; N	172,825 (0.21; 145,216; See SAR)	1,452	419
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	WNA	-/-; N	92,233 (0.71; 54,433; See SAR)	544	26
Risso's dolphin	*Grampus griseus*	WNA	-/-; 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)						
Gray seal	*Halichoerus grypus*	WNA	-/-; N	27,131 (0.19; 23,158)	1,389	5,688

Harbor seal	*Phoca vitulina*	WNA	-/-; N	75,834 (0.15; 66,884)	345	333

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 - These values, found in NMFS's SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.*, commercial fisheries, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value or range.
4 - For the North Atlantic right whale the best available abundance estimate is derived from the 2018 North Atlantic Right Whale Consortium 2019 Annual Report Card (Pettis *et al.*, 20120.

As described below, 14 species (with 14 managed stocks) temporally and spatially co-occur with the activity 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 Project Area.

North Atlantic Right Whale

The North Atlantic right whale ranges from the calving grounds in the southeastern United States to feeding grounds in New England waters and into Canadian waters (Waring *et al.*, 2017). Surveys indicate that there are seven areas where NARWs 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). 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.

Aerial surveys indicated that right whales were consistently detected in or near the Lease Areas and surrounding survey areas during the winter and spring seasons. It appears that right whales begin to arrive in this area in December and remain in the area through at least April. Acoustic detections of right whales occurred during all months of the year, although the highest number of detections typically occurred between December and late May. Data indicate that right whales occur at elevated densities in the Project Area south and southwest of Martha's Vineyard in the spring (March-May) and south of Nantucket during winter (December-February)(Roberts *et al.* 2018; Leiter *et al.* 2017; Kraus *et al*. 2016). Consistent aggregations of right whales feeding and possibly mating within or close to these specific areas is such that they have been considered right whale "hotspots" (Leiter *et al*. 2017; Kraus *et al*. 2016). Additionally, numerous Dynamic Management Areas (DMAs) have been established in these areas in recent years. As of this writing a DMA has been established approximately 31 miles due south of Nantucket. Although there is variability in right whale distribution patterns among years, and some aggregations appear to be ephemeral, an analysis of hot spots suggests that there is some regularity in right whale use of the Lease Areas and surrounding Project Area (Kraus *et al.* 2016).

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. All vessels greater than 19.8 m (65 ft) in overall length must operate at speeds of 10 knots (5.1 m/s) or less within these areas during specific time periods. The Block Island Sound SMA overlaps with the southern portion of Lease Area OCS-A 0501 and is active between November 1 and April 30 each year. The Great South Channel SMA lies to the northeast of Lease Area OCS-A 0501 and is active April 1 to July 31.

Potential OECC routes lie within the Cape Cod Bay SMA, which is active between January 1 to May 15, and the Off Race Point SMA, which is active from March 1 to April 30.

NOAA Fisheries may also establish DMAs when and where NARWs are sighted outside SMAs. DMAs are generally in effect for two weeks. During this time, vessels are encouraged to avoid these areas or reduce speeds to 10 knots (5.1 m/s) or less while transiting through these areas.

The lease areas included in the HRG Project Area are encompassed by a right whale Biologically Important Area (BIA) for migration from March to April and from November to December (LaBrecque *et al.* 2015). Designated feeding BIAs occur in Cape Cod Bay from February to April and northeast of the Lease areas from April to June. A map showing designated BIAs is available at: *https://cetsound.noaa.gov/biologically-important-area-map.* Additionally, a small part of the proposed Project Area northeast of Cape Cod includes designated right whale critical habitat.

The western North Atlantic population demonstrated overall growth of 2.8 percent per year from 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). 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. However, in 2019 at least seven right whale calves were identified while six calves have been recorded in 2020. Unfortunately, one of the calves was struck by a vessel and suffered serious head injuries. It is not likely to survive. Data indicates that the number of adult females fell from 200 in 2010 to 186 in 2015 while 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. A total of 30 confirmed dead stranded whales (21 in Canada; 9 in the United States), have been documented to date. This event has been declared an Unusual Mortality Event (UME), with human interactions (*i.e.*, fishery-related entanglements and vessel strikes) identified as the most likely cause. More information is available online at: *https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2019-north-atlantic-right-whale-unusual-mortality-event (accessed January 9, 2020).*

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. NMFS recently evaluated the status of the species, and 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 Project 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 North Atlantic feeding areas (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). Other sightings of note include 46 sightings of humpbacks in the New York- New Jersey Harbor Estuary documented between 2011 and 2016 (Brown *et al.* 2017). Multiple humpbacks were observed feeding off Long Island during July of 2016 (*https://www.greateratlantic.fisheries.noaa.gov/mediacenter/2016/july/26_humpback_whales_visit_new_york.html*, accessed 31 December, 2018) and there were sightings during November–-December 2016 near New York City (*https://www.greateratlantic.fisheries.noaa.gov/mediacenter/2016/december/09_humans_and_humpbacks_of_new_york_2.html*, accessed 31 December 2018).

Kraus *et al. (*2016) observed humpback whales in the RI/MA & MA 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.* (2016) study. 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 winter and spring (Kraus *et al.* 2016).

Since January 2016, elevated humpback whale mortalities have occurred along the Atlantic coast from Maine through Florida. The event has been declared a UME. Partial or full necropsy examinations have been conducted on approximately half of the 111 known cases. A portion of the whales have shown evidence of pre-mortem vessel strike; however, this finding is not consistent across all of the whales examined so 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. More detailed information is available at*: https://www.fisheries.noaa.gov/national/marine-life-distress/2016-2019-humpback-whale-unusual-mortality-event-along-atlantic-coast* (accessed January 9, 2020). Three previous UMEs involving humpback whales have occurred since 2000, in 2003, 2005, and 2006. A BIA for humpback whales for feeding has been designated northeast of the lease areas from March through December (LaBrecque *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.*, 2017). 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, though densities vary seasonally (Waring *et al.*, 2017). While fin whales typically feed in the Gulf of Maine and the waters surrounding New England, their mating and calving (and general wintering) areas are largely unknown (Hain *et al.* 1992, Hayes *et al.* 2018). Acoustic detections of fin whale singers augment and confirm these visual sighting conclusions for males. Recordings from Massachusetts Bay, New York bight, and deep-ocean areas have detected some level of fin whale singing from September through June (Watkins *et al.* 1987, Clark and Gagnon 2002, Morano *et al.* 2012). These acoustic observations from both coastal and deep-ocean regions support the conclusion that male fin whales are broadly distributed throughout the western North Atlantic for most of the year (Hayes *et al.* 2019).

Kraus *et al.* (2016) suggest that, compared to other baleen whale species, fin whales have a high multi-seasonal relative abundance in the Rhode Island/Massachusetts and Massachusetts Wind Energy Areas (RI/MA & MA WEAs) and surrounding areas. Fin whales were observed in the Massachusetts Wind Energy Area (MA WEA) in spring and summer. This species was observed primarily in the offshore (southern) regions of the RI/MA & MA WEAs during spring and was found closer to shore (northern areas) during the summer months (Kraus *et al.* 2016). Calves were observed three times and feeding was observed nine times during the Kraus *et al.* (2016) study. Although fin whales were largely absent from visual surveys in the RI/MA & MA WEAs in the fall and winter months (Kraus *et al.* 2016), acoustic data indicated that this species was present in the RI/MA & MA WEAs during all months of the year

The main threats to fin whales are fishery interactions and vessel collisions (Waring *et al.*, 2017). New England waters represent a major feeding ground for fin whales. The proposed Project Area would overlap spatially and temporally with a feeding BIA for fin whales. The lease areas are flanked by two Biologically Important Areas (BIAs) for feeding fin whales–the area to the northeast is considered a BIA year-round, while the area off the tip of Long Island to the southwest is a BIA from March to October (LaBrecque *et al.* 2015).

Sei Whale

The Nova Scotia stock of sei whales can be found in deeper waters of the continental shelf edge waters of the northeastern United States and northeastward to south of Newfoundland. NOAA Fisheries considers sei whales occurring from the U.S. East Coast to Cape Breton, Nova Scotia, and east to 42° W as the Nova Scotia stock of sei whales (Waring *et al.* 2016; Hayes *et al.* 2018). In the Northwest Atlantic, it is speculated that the whales migrate from south of Cape Cod along the eastern Canadian coast in June and July, and return on a southward migration again in September and October (Waring *et al.* 2014; 2017). 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). A BIA for feeding for sei whales occurs east of the lease areas from May through November (LaBrecque *et al.* 2015).

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.,* 2017). 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 which spring to fall are times of relatively widespread and common occurrence, and when the whales are most abundant in New England waters, while during winter the species appears to be largely absent (Waring *et al.,* 2017).

Kraus *et al.* (2016) observed minke whales in the RI/MA & MA WEAs and surrounding areas primarily from May to June. This species demonstrated a distinct seasonal habitat usage pattern that was consistent throughout the study. Though minke whales were observed in spring and summer months in the MA WEA, they were only observed in the lease areas in the spring.

Minke whales were not observed between October and February, but acoustic data indicate the presence of this species in the offshore proposed Project Area in winter months.

Since 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. Partial or full necropsy examinations have been conducted on more than 60 percent of the 79 known cases. Preliminary findings in several of the whales have shown evidence of human interactions or infectious disease. These findings are not consistent across all of the whales examined, so more research is needed. More information is available at: *https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2019-minke-whale-unusual-mortality-event-along-atlantic-coast* (accessed January 9, 2020).

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.* 2015). 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. Sperm whales are somewhat migratory; however, their migrations are not as specific as seen in most of the baleen whale species. In the North Atlantic, there appears to be a general shift northward during the summer, but there is no clear migration in some temperate areas (Rice 1989). 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. Their distribution is typically associated with waters over the continental shelf break and the continental slope and into deeper waters (Whitehead *et al.* 1991). Sperm whale concentrations near drop-offs and areas with strong currents and steep topography are correlated with high productivity. These whales occur almost exclusively found at the shelf break, regardless of season.

Kraus *et al.* (2016) observed sperm whales four times in the RI/MA & MA WEAs during the summer and fall from 2011 to 2015. Sperm whales, traveling singly or in groups of three or four, were observed three times in August and September of 2012, and once in June of 2015. One

Long-Finned Pilot Whale

Long-finned pilot whales are found from North Carolina and north to Iceland, Greenland and the Barents Sea (Waring *et al.*, 2016). They are generally found along the edge of the continental shelf (a depth of 330 to 3,300 feet (100 to 1,000 meters)), choosing areas of high relief or submerged banks in cold or temperate shoreline waters. In the western North Atlantic, long-finned pilot whales are pelagic, occurring in especially high densities in winter and spring over the continental slope, then moving inshore and onto the shelf in summer and autumn following squid and mackerel populations (Reeves *et al.* 2002). They frequently travel into the central and northern Georges Bank, Great South Channel, and Gulf of Maine areas during the late spring and remain through early fall (May and October) (Payne and Heinemann 1993).

Note that long-finned and short-finned pilot whales overlap spatially along the mid-Atlantic shelf break between New Jersey and the southern flank of Georges Bank (Payne and Heinemann 1993, Hayes *et al.* 2017) Long-finned pilot whales have occasionally been observed stranded as far south as South Carolina, and short-finned pilot whale have stranded as far north as Massachusetts (Hayes *et al.* 2017). The latitudinal ranges of the two species therefore remain uncertain. However, south of Cape Hatteras, most pilot whale sightings are expected to be short-finned pilot whales, while north of approximately 42° N, most pilot whale sightings are expected to be long-finned pilot whales (Hayes *et al.* 2017). Based on the distributions described in Hayes *et al.* (2017), pilot whale sightings in OCS-A 0501 and OCS-A 0522 would most likely be long-finned pilot whales.

Kraus *et al.* (2016) observed pilot whales infrequently in the RI/MA & MA WEAs and surrounding areas. Effort-weighted average sighting rates for pilot whales could not be calculated. No pilot whales were observed during the fall or winter, and these species were only observed 11 times in the spring and three times in the summer.

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.,* 2017). 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 collected 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.

Kraus *et al.* (2016) suggest that Atlantic white-sided dolphins occur infrequently in the RI/MA & MA WEAs and surrounding areas. Effort-weighted average sighting rates for Atlantic white-sided dolphins could not be calculated, because this species was only observed on eight occasions throughout the duration of the study (October 2011 to June 2015). No Atlantic white-sided dolphins were observed during the winter months, and this species was only sighted twice in the fall and three times in the spring and summer

Common Dolphin

The short-beaked common dolphin is found world-wide in temperate to subtropical seas. In the North Atlantic, short-beaked 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). This species is found between Cape Hatteras and Georges Bank from mid-January to May, although they migrate onto the northeast edge of Georges Bank in the fall where large aggregations occur (Kenney and Vigness-Raposa 2009), where large aggregations occur on Georges Bank in fall (Waring *et al.* 2007). Kraus *et al.* (2016) suggested that short-beaked common dolphins occur year-round in the RI/MA & MA WEAs and surrounding areas. Short-beaked common dolphins were the most frequently observed small cetacean species within the Kraus *et al.* (2016) study area. Short-beaked common dolphins were observed in the RI/MA & MA WEAs in all seasons and observed in the Lease Area OCS-A 0501 in spring, summer, and fall. Only the western North Atlantic stock may be present in the Project Area.

Bottlenose Dolphin

There are two distinct bottlenose dolphin ecotypes in the western North Atlantic: the coastal and offshore forms (Waring *et al.*, 2015). The migratory coastal morphotype resides in waters typically less than 65.6 ft (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 coast 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 most expected in waters north of Long Island, New York (Waring *et al.* 2017; Hayes *et al.* 2017; 2018). During HRG surveys, the Northern Migratory Coastal stock may be encountered while surveying potential OECC routes in the nearshore. Bottlenose dolphins encountered in the HRG Project Area would likely belong to the Western North Atlantic Offshore stock (Hayes *et al.* 2018). It is possible that a few animals could be from the Northern Migratory Coastal stock, but they generally do not range farther north than New Jersey.

Kraus *et al.* (2016) observed common bottlenose dolphins during all seasons within the RI/MA & MA WEAs. Common bottlenose dolphins were the second most commonly observed small cetacean species and exhibited little seasonal variability in abundance. They were observed in the MA WEA in all seasons and observed in Lease Area OCS-A 0501 in the fall and winter

Risso's Dolphins

Risso's dolphins are distributed worldwide in tropical and temperate seas (Jefferson *et al.* 2008, 2014), and in the Northwest Atlantic occur from Florida to eastern Newfoundland (Leatherwood *et al.* 1976; Baird and Stacey 1991). Off the northeastern U.S. coast, Risso's dolphins are distributed along the continental shelf edge from Cape Hatteras northward to Georges Bank during spring, summer, and autumn (CETAP 1982; Payne *et al.* 1984). In winter, the range is in the mid-Atlantic Bight and extends outward into oceanic waters (Payne *et al.* 1984). Kraus *et al.* (2016) results suggest that Risso's dolphins occur infrequently in the RI/MA & MA WEAs and surrounding areas.

Harbor Porpoise

In the Project 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.*, 2017). During fall (October–December) and spring (April–June) harbor porpoises are widely dispersed from New Jersey to Maine. During winter (January to March), intermediate densities of harbor porpoises can be found in waters off New Jersey to North Carolina, and lower densities are found in waters off New York to New Brunswick, Canada. They are seen from the coastline to deep waters (>1800 m; Westgate *et al.* 1998), although the majority of the population is found over the continental shelf (Waring *et al.*, 2017).

Kraus *et al.* (2016) indicate that harbor porpoises occur within the RI/MA & MA WEAs in fall, winter, and spring. Harbor porpoises were observed in groups ranging in size from three to 15 individuals and were primarily observed in the Kraus *et al.* (2016) study area from November through May, with very few sightings during June through September

Harbor Seal

Harbor seals are year-round inhabitants of the coastal waters of eastern Canada and Maine (Katona *et al.* 1993), and occur seasonally along the coasts from southern New England to New Jersey from September through late May. While harbor seals occur year-round north of Cape Cod, they only occur during winter migration, typically September through May, south of

Cape Cod (Southern New England to New Jersey) (Waring *et al.* 2015; Kenney and Vigness-Raposa 2009). *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 Project 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.,* 2017). 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.,* 2017). It is believed that recolonization by Canadian gray seals is the source of the U.S. population (Waring *et al.,* 2017). Gray seals are expected to occur year-round in at least some potential OECC routes, with seasonal occurrence in the offshore areas from September to May (Hayes *et al.* 2018).

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, seals showing clinical signs of stranding have occurred as far south as Virginia, although not in elevated numbers. Therefore the UME investigation now encompasses all seal strandings from Maine to Virginia. Between July 1, 2018 and January 9, 2020, a total of 3,050 seal strandings have been recorded as part of this designated Northeast Pinniped UME. Based on tests conducted so far, the main pathogen found in the seals is phocine distemper virus. Additional testing to identify other factors that may be involved in this UME are underway.

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 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. Marine mammal hearing groups and their associated hearing ranges are provided in Table 3.

Table 3. Marine Mammal Hearing Groups (NMFS, 2018).

Hearing Group	Generalized Hearing Range*
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
High-frequency (HF) cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*)	275 Hz to 160 kHz
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz

***** Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall *et al.* 2007) and PW pinniped (approximation).

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 (2018) for a review of available information. Fourteen mammal species (12 cetacean and 2 pinniped (both phocid) species) have the reasonable potential to co-occur with the proposed survey activities. Of the cetacean species that may be present, six are classified as low-frequency cetaceans (*i.e.*, all mysticete species), five are classified as mid-frequency cetaceans (*i.e.*, all delphinid species and the sperm whale), and one is classified as 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.

Description of Sound Sources

This section contains a brief technical background on sound, on the characteristics of certain sound types, and on metrics used in this proposal inasmuch as the information is relevant to the specified activity and to a discussion of the potential effects of the specified activity on marine mammals found later in this document. For general information on sound and its interaction with the marine environment, please see, *e.g.*, Au and Hastings (2008); Richardson *et al.* (1995).

Sound travels in waves, the basic components of which are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in hertz (Hz) or cycles per second. Wavelength is the distance between two peaks or corresponding points of a sound wave (length of one cycle). Higher frequency sounds have shorter wavelengths than lower frequency sounds, and typically attenuate (decrease) more rapidly, except in certain cases in shallower water. Amplitude is the height of the sound pressure wave or the “loudness” of a sound and is typically described using the relative unit of the decibel (dB). A sound pressure level (SPL) in dB is described as the ratio between a measured pressure and a reference pressure (for underwater sound, this is 1 microPascal (μPa)), and is a logarithmic unit that accounts for large variations in amplitude;

therefore, a relatively small change in dB corresponds to large changes in sound pressure. The source level (SL) represents the SPL referenced at a distance of 1 m from the source (referenced to 1 μPa), while the received level is the SPL at the listener's position (referenced to 1 μPa).

Root mean square (rms) is the quadratic mean sound pressure over the duration of an impulse. Root mean square is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average. Root mean square 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 (Hastings and Popper, 2005). 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 than by peak pressures.

Sound exposure level (SEL; represented as dB re 1 μPa^2-s) represents the total energy in a stated frequency band over a stated time interval or event, and considers both intensity and duration of exposure. The per-pulse SEL is calculated over the time window containing the entire pulse (*i.e.,* 100 percent of the acoustic energy). SEL is a cumulative metric; it can be accumulated over a single pulse, or calculated over periods containing multiple pulses. Cumulative SEL represents the total energy accumulated by a receiver over a defined time window or during an event. Peak sound pressure (also referred to as zero-to-peak sound pressure or 0-pk) is the maximum instantaneous sound pressure measurable in the water at a specified distance from the source, and is represented in the same units as the rms sound pressure.

When underwater objects vibrate or activity occurs, sound-pressure waves are created. These waves alternately compress and decompress the water as the sound wave travels. Underwater sound waves radiate in a manner similar to ripples on the surface of a pond and may be either directed in a beam or beams or may radiate in all directions (omnidirectional sources). The compressions and decompressions associated with sound waves are detected as changes in pressure by aquatic life and man-made sound receptors such as hydrophones.

Even in the absence of sound from the specified activity, the underwater environment is typically loud due to ambient sound, which is defined as environmental background sound levels lacking a single source or point (Richardson *et al.*, 1995). The sound level of a region is defined by the total acoustical energy being generated by known and unknown sources. These sources may include physical (*e.g.*, wind and waves, earthquakes, ice, atmospheric sound), biological (*e.g.*, sounds produced by marine mammals, fish, and invertebrates), and anthropogenic (*e.g.*, vessels, dredging, construction) sound. A number of sources contribute to ambient sound, including wind and waves, which are a main source of naturally occurring ambient sound for frequencies between 200 hertz (Hz) and 50 kilohertz (kHz) (Mitson, 1995). In general, ambient sound levels tend to increase with increasing wind speed and wave height. Precipitation can become an important component of total sound at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times. Marine mammals can contribute significantly to ambient sound levels, as can some fish and snapping shrimp. The frequency band for biological contributions is from approximately 12 Hz to over 100 kHz. Sources of ambient sound related to human activity include transportation (surface vessels), dredging and construction, oil and gas drilling and production, geophysical surveys, sonar, and explosions. Vessel noise typically dominates the total ambient sound for frequencies between 20 and 300 Hz. In general, the frequencies of anthropogenic sounds are below 1 kHz and, if higher frequency sound levels are created, they attenuate rapidly.

The sum of the various natural and anthropogenic sound sources that comprise ambient sound at any given location and time depends not only on the source levels (as determined by current weather conditions and levels of biological and human activity) but also on the ability of sound to propagate through the environment. In turn, sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor, and is frequency-dependent. As a result of the dependence on a large number of varying factors, ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Sound levels at a given frequency and location can vary by 10-20 decibels (dB) from day to day (Richardson *et al.*, 1995). The result is that, depending on the source type and its intensity, sound from the specified activity may be a negligible addition to the local environment or could form a distinctive signal that may affect marine mammals.

Sounds are often considered to fall into one of two general types: pulsed and non-pulsed. The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (*e.g.*, Ward, 1997 in Southall *et al.*, 2007). Please see Southall *et al.* (2007) for an in-depth discussion of these concepts. The distinction between these two sound types is not always obvious, as certain signals share properties of both pulsed and non-pulsed sounds. A signal near a source could be categorized as a pulse, but due to propagation effects as it moves farther from the source, the signal duration becomes longer (*e.g.*, Greene and Richardson, 1988).

Pulsed sound sources (*e.g.*, airguns, explosions, gunshots, sonic booms, impact pile driving) produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (ANSI, 1986, 2005; Harris, 1998; NIOSH, 1998; ISO, 2003) and occur either as isolated events or repeated in some succession. Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury as compared with sounds that lack these features.

Non-pulsed sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or intermittent (ANSI, 1995; NIOSH, 1998). Some of these non-pulsed sounds can be transient signals of short duration but without the essential properties of pulses (*e.g.*, rapid rise time). Examples of non-pulsed sounds include those produced by vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems. The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

Potential Effects of Underwater Sound

For study-specific citations, please see that work. Anthropogenic sounds cover a broad range of frequencies and sound levels and can have a range of highly variable impacts on marine life, from none or minor to potentially severe responses, depending on received levels, duration of exposure, behavioral context, and various other factors. The potential effects of underwater sound from active acoustic sources can potentially result in one or more of the following: temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, stress, and masking (Richardson *et al.*, 1995; Gordon *et al.*, 2004; Nowacek *et al.*, 2007; Southall *et al.*, 2007; Götz *et al.*, 2009). The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure. In general, sudden, high level sounds can cause hearing loss, as can longer exposures to lower level sounds. Temporary or permanent loss of hearing will occur almost exclusively for noise within an animal's hearing range.

Richardson *et al.* (1995) described zones of increasing intensity of effect that might be expected to occur, in relation to distance from a source and assuming that the signal is within an animal's hearing range. First is the area within which the acoustic signal would be audible (potentially perceived) to the animal but not strong enough to elicit any overt behavioral or physiological response. The next zone corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological responsiveness. Third is a zone within which, for signals of high intensity, the received level is sufficient to potentially cause discomfort or tissue damage to auditory or other systems. Overlaying these zones to a certain extent is the area within which masking (*i.e.*, when a sound interferes with or masks the ability of an animal to detect a signal of interest that is above the absolute hearing threshold) may occur; the masking zone may be highly variable in size.

We describe the more severe effects (*i.e.*, certain non-auditory physical or physiological effects) only briefly as we do not expect that there is a reasonable likelihood that HRG surveys may result in such effects (see below for further discussion). Potential effects from impulsive sound sources can range in severity from effects such as behavioral disturbance or tactile perception to physical discomfort, slight injury of the internal organs and the auditory system, or mortality (Yelverton *et al.*, 1973). Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to high level underwater sound or as a secondary effect of extreme behavioral reactions (*e.g.*, change in dive profile as a result of an avoidance reaction) caused by exposure to sound include neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox *et al.*, 2006; Southall *et al.*, 2007; Zimmer and Tyack, 2007; Tal *et al.*, 2015). The activities considered here do not involve the use of devices such as explosives or mid-frequency tactical sonar that are associated with these types of effects.

Threshold Shift – Note that, in the following discussion, we refer in many cases to a review article concerning studies of noise-induced hearing loss conducted from 1996-2015 (*i.e.*, Finneran, 2015). Marine mammals exposed to high-intensity sound, or to lower-intensity sound for prolonged periods, can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Finneran, 2015). TS can be permanent (PTS), in which case the loss of hearing sensitivity is not fully recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time (Southall *et al.*, 2007). Repeated sound exposure that leads to TTS could cause PTS. In severe cases of PTS, there can be total or partial deafness, while in most cases the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985).

When PTS occurs, there is physical damage to the sound receptors in the ear (*i.e.*, tissue damage), whereas TTS represents primarily tissue fatigue and is reversible (Southall *et al.*, 2007). In addition, other investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury (*e.g.*, Ward, 1997). Therefore, NMFS does not consider TTS to constitute auditory injury.

Relationships between TTS and PTS thresholds have not been studied in marine mammals, and there is no PTS data for cetaceans, but such relationships are assumed to be similar to those in humans and other terrestrial mammals. PTS typically occurs at exposure levels at least several decibels above (a 40-dB threshold shift approximates PTS onset; *e.g.*, Kryter *et al.*, 1966; Miller, 1974) that inducing mild TTS (a 6-dB threshold shift approximates

TTS onset; *e.g.*, Southall *et al.* 2007). Based on data from terrestrial mammals, a precautionary assumption is that the PTS thresholds for impulse sounds (such as impact pile driving pulses as received close to the source) are at least 6 dB higher than the TTS threshold on a peak-pressure basis and PTS cumulative sound exposure level thresholds are 15 to 20 dB higher than TTS cumulative sound exposure level thresholds (Southall *et al.*, 2007). Given the higher level of sound or longer exposure duration necessary to cause PTS as compared with TTS, it is considerably less likely that PTS could occur.

TTS is the mildest form of hearing impairment that can occur during exposure to sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises, and a sound must be at a higher level in order to be heard. In terrestrial and marine mammals, TTS can last from minutes or hours to days (in cases of strong TTS). In many cases, hearing sensitivity recovers rapidly after exposure to the sound ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals.

Marine mammal hearing plays a critical role in communication with conspecifics, and 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 occurs during a time 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 time when communication is critical for successful mother/calf interactions could have more serious impacts.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin, beluga whale (*Delphinapterus leucas*), harbor porpoise, and Yangtze finless porpoise (*Neophocoena asiaeorientalis*)) 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 (Finneran, 2015). TTS was not observed in trained spotted (*Phoca largha*) and ringed (*Pusa hispida*) seals exposed to impulsive noise at levels matching previous predictions of TTS onset (Reichmuth *et al.*, 2016). In general, harbor seals and harbor porpoises have a lower TTS onset than other measured pinniped or cetacean species (Finneran, 2015). 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 Southall *et al.* (2007), Finneran and Jenkins (2012), Finneran (2015), and NMFS (2018).

Animals in the Project Area during the proposed survey are unlikely to incur TTS due to the characteristics of the sound sources, which include relatively low source levels 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 proposed for use makes it unlikely that an animal would be exposed more than briefly during the passage of the vessel.

Behavioral Effects – 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 showed 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 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). However, many delphinids approach low-frequency airgun source vessels with no apparent discomfort or obvious behavioral change (*e.g.*, Barkaszi *et al.*, 2012), indicating the importance of frequency output in relation to the species' hearing sensitivity.

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, 2013b). 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, 2005, 2006; Gailey *et al.*, 2007; Gailey *et al.*, 2016).

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 songs (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 stressors, 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 airgun 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). Disruption 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.

We expect that some marine mammals may exhibit behavioral responses to the HRG survey activities in the form of avoidance of the area during the activity, especially the naturally shy harbor porpoise, while others such as delphinids might be attracted to the survey activities out of curiosity. However, because the HRG survey equipment operates 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 impacts within the Project Area.

We have also considered the potential for severe behavioral responses such as stranding and associated indirect injury or mortality from Vineyard Wind’s use of HRG survey equipment. Previous commenters have referenced 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 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 is likely 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.

Stress Responses – An animal's perception of a threat may be sufficient to trigger stress responses consisting of some combination of behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses (*e.g.*, Seyle, 1950; Moberg, 2000). In many cases, an animal's first and sometimes most economical (in terms of energetic costs) response is behavioral avoidance of the potential stressor. Autonomic nervous system responses to stress typically involve changes in heart rate, blood pressure, and gastrointestinal activity. These responses have a relatively short duration and may or may not have a significant long-term effect on an animal's fitness.

Neuroendocrine stress responses often involve the hypothalamus-pituitary-adrenal system. Virtually all neuroendocrine 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, altered metabolism, reduced immune competence, and behavioral disturbance (*e.g.*, Moberg, 1987; Blecha, 2000). Increases in the circulation of glucocorticoids are also equated with stress (Romano *et al.*, 2004).

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and "distress" is the 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 serious fitness consequences. 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 functions. This state of distress will last until the animal replenishes its energetic reserves sufficient to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well studied through controlled experiments and for both laboratory and free-ranging animals (*e.g.*, Holberton *et al.*, 1996; Hood *et al.*, 1998; Jessop *et al.*, 2003; Krausman *et al.*, 2004; Lankford *et al.*, 2005). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker, 2000; Romano *et al.*, 2002b) and, more rarely, studied in wild populations (*e.g.*, Romano *et al.*, 2002a). 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.

These and other studies lead to a reasonable expectation that some marine mammals will experience physiological stress responses upon exposure to acoustic stressors and that it is possible that some of these would be classified as "distress." In addition, any animal experiencing TTS would likely also experience stress responses (NRC, 2003).

NMFS does not expect that the generally short-term, intermittent, and transitory HRG activities would create conditions of long-term, continuous noise and chronic acoustic exposure leading to long-term physiological stress responses in marine mammals.

Auditory Masking – Sound can disrupt behavior through masking, or interfering with, an animal's ability to detect, recognize, or discriminate between acoustic signals of interest (*e.g.*, those used for intraspecific communication and social interactions, prey detection, predator avoidance, navigation) (Richardson *et al.*, 1995; Erbe *et al.*, 2016). Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity, and may occur whether the sound is natural (*e.g.*, snapping shrimp, wind, waves, precipitation) or anthropogenic (*e.g.*, shipping, sonar, seismic exploration) in origin. The ability of a noise source to mask biologically important sounds depends on the characteristics of both the noise source and the signal of interest (*e.g.*, signal-to-noise ratio, temporal variability, direction), in relation to each other and to an animal's hearing abilities (*e.g.*, sensitivity, frequency range, critical ratios, frequency discrimination, directional discrimination, age or TTS hearing loss), and existing ambient noise and propagation conditions.

Under certain circumstances, marine mammals experiencing significant masking could also be impaired from maximizing their performance fitness in survival and reproduction. Therefore, when the coincident (masking) sound is man-made, it may be considered harassment if disrupting behavioral patterns. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which occurs during the sound exposure. Because masking (without resulting in TS) is not associated with abnormal physiological function, it is not considered a physiological effect, but rather a potential behavioral effect.

The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. For example, low-frequency signals may have less effect on high-frequency echolocation sounds produced by odontocetes but are more likely to affect detection of mysticete communication calls and other potentially important natural sounds such as those produced by surf and some prey species. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (*e.g.*, Clark *et al.*, 2009) and may result in energetic or other costs as animals change their vocalization behavior (*e.g.*, Miller *et al.*, 2000; Foote *et al.*, 2004; Parks *et al.*, 2007; Di Iorio and Clark, 2009; Holt *et al.*, 2009). Masking can be reduced in situations where the signal and noise come from different directions (Richardson *et al.*, 1995), through amplitude modulation of the signal, or through other compensatory behaviors (Houser and Moore, 2014). Masking can be tested directly in captive species (*e.g.*, Erbe, 2008), but in wild populations it must be either modeled or inferred from evidence of masking compensation. There are few studies addressing real-world masking sounds likely to be experienced by marine mammals in the wild (*e.g.*, Branstetter *et al.*, 2013).

Masking affects both senders and receivers of acoustic signals and can potentially have long-term chronic effects on marine mammals at the population level as well as at the individual level. Low-frequency ambient sound levels have increased by as much as 20 dB (more than three times in terms of SPL) in the world’s ocean from pre-industrial periods, with most of the increase from distant commercial shipping (Hildebrand, 2009). All anthropogenic sound sources, but especially chronic and lower-frequency signals (*e.g.*, from vessel traffic), contribute to elevated ambient sound levels, thus intensifying masking.

Marine mammal communications would not likely be masked appreciably by the HRG equipment given the directionality of the signals (for most geophysical survey equipment types proposed for use (Table 1) and the brief period when an individual mammal is likely to be within its beam.

Vessel Strike

Vessel strikes of marine mammals can cause significant 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, Vineyard Winds 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 Project Area.

Anticipated Effects on Marine Mammal Habitat

The proposed activities would not result in permanent impacts to habitats used directly by marine mammals, but may have potential minor and short-term impacts to food sources such as forage fish. The proposed activities could affect acoustic habitat (see masking discussion above), but meaningful impacts are unlikely. There are no feeding areas, rookeries, or mating grounds known to be biologically important to marine mammals within the proposed project area with the exception of feeding BIAs for right, humpback, fin, and sei whales and a migratory BIA for right whales which were described previously. There is also designated critical habitat for right whales. The HRG survey equipment will not contact the substrate and does not represent a source of pollution. Impacts to substrate or from pollution are therefore not discussed further.

Effects to Prey – Sound may affect marine mammals through impacts on the abundance, behavior, or distribution of prey species (*e.g.*, crustaceans, cephalopods, fish, zooplankton). Marine mammal prey varies by species, season, and location and, for some, is not well documented. Here, we describe studies regarding the effects of noise on known marine mammal prey.

Fish utilize the soundscape and components of sound in their environment to perform important functions such as foraging, predator avoidance, mating, and spawning (*e.g.*, Zelick *et al.*, 1999; Fay, 2009). Depending on their hearing anatomy and peripheral sensory structures, which vary among species, fishes hear sounds using pressure and particle motion sensitivity capabilities and detect the motion of surrounding water (Fay *et al.*, 2008). The potential effects of noise on fishes depends on the overlapping frequency range, distance from the sound source, water depth of exposure, and species-specific hearing sensitivity, anatomy, and physiology. Key impacts to fishes may include behavioral responses, hearing damage, barotrauma (pressure-related injuries), and mortality.

Fish react to sounds which are especially strong and/or intermittent low-frequency sounds, and behavioral responses such as flight or avoidance are the most likely effects. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. The reaction of fish to noise depends on the physiological state of the fish, past exposures, motivation (*e.g.*, feeding, spawning, migration), and other environmental factors. Hastings and Popper (2005) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Several studies have demonstrated that impulse sounds might affect the distribution and behavior of some fishes, potentially impacting foraging opportunities or increasing energetic costs (*e.g.*, Fewtrell and McCauley, 2012; Pearson *et al.*, 1992; Skalski *et al.*, 1992; Santulli *et al.*, 1999; Paxton *et al.*, 2017). However, some studies have shown no or slight reaction to impulse sounds (*e.g.*, Pena *et al.*, 2013; Wardle *et al.*, 2001; Jorgenson and

Gyselman, 2009; Cott *et al.*, 2012). More commonly, though, the impacts of noise on fish are temporary.

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. The duration of fish avoidance of an area after HRG surveys depart the area is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. In general, impacts to marine mammal prey species are expected to be minor and temporary due to the expected short daily duration of the proposed HRG survey, the fact that the proposed survey is mobile rather than stationary, and the relatively small areas potentially affected. The areas likely impacted by the proposed activities are relatively small compared to the available habitat in the Atlantic Ocean. Any behavioral avoidance by fish of the disturbed area would still leave significantly large areas of fish and marine mammal foraging habitat in the nearby vicinity. Based on the information discussed herein, we conclude that impacts of the specified activity are not likely to have more than short-term adverse effects on any prey habitat or populations of prey species. Because of the temporary nature of the disturbance, and the availability of similar habitat and resources (*e.g.*, prey species) in the surrounding area, any impacts to marine mammal habitat are not expected to result in significant or long-term consequences for individual marine mammals, or to contribute to adverse impacts on their populations. Effects to habitat will not be discussed further in this document.

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 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 is neither anticipated nor proposed to be authorized.

As described previously, no mortality is anticipated or proposed to be authorized for this activity. Below we describe how the take is estimated.

Generally speaking, we estimate take by considering: (1) acoustic thresholds above which NMFS believes the best available science indicates 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 areas; 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

Using the best available science, NMFS has developed 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 160 dB re 1 μPa (rms) for impulsive and/or intermittent sources (*e.g.*, impact pile driving) and 120 dB rms for continuous sources (*e.g.*, vibratory driving). Vineyard Wind’s proposed activity includes the use of impulsive sources (geophysical survey equipment), and therefore use of the 160 dB re 1 μPa (rms) threshold is applicable.

Level A harassment for non-explosive sources – NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) (Technical Guidance, 2018) identifies dual criteria (cumulative sound exposure level (SELcum) and peak sound pressure level metrics) 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). The components of Vineyard Wind's proposed activity includes the use of impulsive sources.

Predicted distances to Level A harassment isopleths, which vary based on marine mammal functional hearing groups were calculated. The updated acoustic thresholds for impulsive sounds (such as HRG survey equipment) contained in the Technical Guidance (NMFS, 2018) were presented as dual metric acoustic thresholds using both using both SEL_{cum} and peak sound pressure level metrics. As dual metrics, NMFS considers onset of PTS (Level A harassment) to have occurred when either one of the two metrics is exceeded (*i.e.*, metric resulting in the largest isopleth). The SEL_{cum} metric considers both level and duration of exposure, as well as auditory weighting functions by marine mammal hearing group.

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

	PTS Onset Acoustic Thresholds* **(Received Level)**	
Hearing Group	**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 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 source levels and transmission loss coefficient.

The proposed survey would entail the use of HRG equipment. The distance to the isopleths corresponding to both Level A and Level B harassment was calculated for all HRG equipment with the potential to result in harassment of marine mammals. In their application, Vineyard Wind employed a new model for determining the horizontal distance to Level A harassment isopleths (See Appendix A). This new model was developed by the applicant since the optional User Spreadsheet devised by NMFS to calculate PTS isopleths is not specifically designed for HRG surveys and does not take into account seawater absorption or fully consider beam patterns, both of which can influence received sound levels. To account for seawater absorption the model calculated an appropriate absorption coefficient using the lowest frequency employed by a specific device. To account for beam pattern, an out-of-beam source correction factor was derived and used to establish the out-of-beam source level as shown in Table 5. Separate impact ranges were calculated using the in-beam source level at the angle corresponding to the −3 dB half-width and the out-of-beam source level in the horizontal direction. The higher of the two sound levels was then selected for assessing impact distance. Dual metric acoustic thresholds using both cumulative sound exposure level (SELcum) and peak sound pressure level metrics were calculated. For all equipment categories, use of the SELcum resulted in larger Level A harassment isopleths.

As part of this model, sources that operate with a repetition rate greater than 10 Hz were assessed with the non-impulsive source criteria while sources with a repetition rate equal to or less than 10 Hz were assessed with the impulsive source criteria. Under this system all HRG sources would be classified as impulsive. NMFS does not agree with the classification of all HRG sources as impulsive. The use of the 10 Hz repetition rate would be precedent-setting and NMFS believes that this issue requires further evaluation. However, NMFS opted to include the modeled Level A distances in the proposed IHA, since classification of all HRG sources as impulsive results in more conservative Level A harassment isopleths.

NMFS considers the data provided by Crocker and Fratantonio (2016) to represent the best available information on source levels associated with HRG equipment and therefore recommends that source levels provided by Crocker and Fratantonio (2016) be incorporated in the method described above to estimate isopleth distances to the Level B harassment threshold. In cases when the source level for a specific type of HRG equipment is not provided in Crocker and Fratantonio (2016), NMFS recommends that either the source levels provided by the manufacturer be used, or, in instances where source levels provided by the manufacturer are unavailable or unreliable, a proxy from Crocker and Fratantonio (2016) be used instead. Table 1 shows the HRG equipment types that may be used during the proposed surveys and the sound levels associated with those HRG equipment types. Table A-3 in Appendix A of the IHA application shows the literature sources for the sound source levels that were incorporated into the model.

Table 5: Derived Out-of-Beam Source Levels

Description		**In-beam**		**Correction (dB)**	**Out-of-beam**	
Equipment Type	System	Source level (dB re 1 µPa m)	Peak source level (dB re 1 µPa m)		Source level (dB re 1 µPa m)	Peak source level (dB re 1 µPa m)
Shallow subbottom profilers	EdgeTech Chirp 216	178	182	-8.1	169.9	173.9
Shallow subbottom profilers	Innomar SES 2000 Medium	241	247	-36.3	204.7	210.7
Deep seismic profilers	Applied Acoustics AA251 Boomer	205	212	0.0	205	212
Deep seismic profilers	GeoMarine Geo Spark 2000 (400 tip)	206	214	0.0	206	214
Underwater positioning (USBL)	SonarDyne Scout Pro	188	191	0.0	188	191
Underwater positioning (USBL)	ixBlue Gaps	191	194	0.0	191	194

NMFS has developed an interim methodology for determining the rms sound pressure level (SPLrms) at the 160-dB isopleth for the purposes of estimating take by Level B harassment resulting from exposure to HRG survey equipment (NOAA 19 Sep 2019). Vineyard Wind used this methodology with additional modifications that provide a more accurate seawater absorption formula and account for energy emitted outside of the primary beam of the source. This approach is described in detail in Appendix B.

Note that Vineyard Wind initially proposed to use a blanket 100-ms integration time to adjust the source level for all HRG sound sources and all species to estimate Level B harassment distances. However, it is known that integration time varies and depends on a multitude of factors, including frequency, repetition rate, bandwidth, and species. NMFS agrees that integration time is an important factor for consideration, but using a single number to encompass all sound sources and species seems like a potential oversimplification. Therefore, NMFS used pulse duration only to estimate Level B harassment isopleths. Calculated results using both pulse duration and a 100-ms integration time are shown in Appendix B for comparative purposes.

Results of modeling described above indicated that sound produced by the GeoMarine Geo Spark 2000 would propagate furthest to the Level B harassment threshold; therefore, for the purposes of the exposure analysis, it was assumed the GeoMarine Geo Spark 2000 would be active during the entirety of the survey. The distance to the isopleth corresponding to the threshold for Level B harassment for the GeoMarine Geo Spark 2000 (estimated at 195 m; Table 6) was used as the basis of the take calculation for all marine mammals. Note that this likely provides a conservative estimate of the total ensonified area resulting from the proposed activities. Vineyard Wind may not operate the GeoMarine Geo Spark 2000 during the entirety of the proposed survey, and for any survey segments in which it is not used the distance to the

Level B harassment threshold would be less than 195 m and the corresponding ensonified area would also decrease. The model also assumed that the sparker (GeoMarine Geo Spark 2000) is omnidirectional. This assumption, which is made because the beam pattern is unknown, results in precautionary estimates of received levels generally, and in particular is likely to overestimate both SPL and PK. This overestimation of the SPL likely results in an overestimation of the number of takes by Level B harassment for this type of equipment.

Table 6. Modeled Radial Distances from HRG Survey Equipment to Isopleths Corresponding to Level A Harassment and Level B Harassment Thresholds[1]

HRG Survey Equipment		**Level A Harassment Horizontal Impact Distance (m)**				**Level B Harassment Horizontal Impact Distance (m)**
		Low frequency cetaceans	Mid frequency cetaceans	High frequency cetaceans	Phocid pinnipeds	All
Shallow subbottom profilers	EdgeTech Chirp 216	<1	<1	<1	<1	4
Shallow subbottom profilers	Innomar SES 2000 Medium	<1	<1	60	<1	116
Deep seismic profilers	Applied Acoustics AA251 Boomer	<1	<1	60	<1	178
Deep seismic profilers	GeoMarine Geo Spark 2000 (400 tip)	<1	<1	6	<1	195
Underwater positioning (USBL)	SonarDyne Scout Pro	*	*	*	*	24
Underwater positioning (USBL)	ixBlue Gaps	<1 m	<1 m	55	<1 m	35

[1]Note that SELcum was greater than peak SPL in all instances

Due to the small estimated distances to Level A harassment thresholds for all marine mammal functional hearing groups (less than 1 m for all hearing groups including all equipment types and no more than 60 m for high frequency cetaceans including all equipment types), and in consideration of the proposed mitigation measures (see the *Proposed Mitigation* section for more detail), NMFS has determined that the likelihood of take of marine mammals in the form of Level A harassment occurring as a result of the proposed survey is so low as to be discountable, and we therefore do not propose to authorize the take by Level A harassment of any marine mammals.

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.*, 2016, 2017, 2018) represent the best available information regarding marine mammal densities in the proposed Project Area. The density data presented by Roberts *et al.* (2016, 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.*, 2016). In subsequent years, certain models have been updated on the basis of additional data as well as certain methodological improvements. Although these updated models (and a newly developed seal density model) are not currently publicly available, our evaluation of the changes leads to a conclusion that these represent the best scientific evidence available. More information, including the model results and supplementary information for each model, is available online at *seamap.env.duke.edu/models/Duke-EC-GOM-2015/*. Marine mammal density estimates in the project area (animals/km^2) were obtained using these model results (Roberts *et al.*, 2016, 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 purposes of the exposure analysis, density data from Roberts *et al.* (2016, 2017, 2018) were mapped using a geographic information system (GIS). The density coverages that included any portion of the proposed project area were selected for all survey months. Monthly density data for each species were then averaged over the year to come up with a mean annual density value for each species. The mean annual density values used to estimate take numbers are shown in Table 7 below.

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 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. Vineyard Wind estimates that proposed survey vessels will achieve a maximum daily track line distance of 100 km per day during proposed HRG surveys. This distance accounts for the vessel traveling at roughly 4 knots and accounts for non-active survey periods. Based on the maximum estimated distance to the Level B harassment threshold of 195 m (Table 6) and the maximum estimated daily track line distance of 100 km, an area of 39.12 km^2 would be ensonified to the Level B harassment threshold per day during Vineyard Wind's proposed HRG surveys. As described above, this is a conservative estimate as it assumes the HRG sources that result in the greatest isopleth distances to the Level B harassment threshold would be operated at all times during the all 736 vessel days.

The number of marine mammals expected to be incidentally taken per day is then calculated by estimating the number of each species predicted to occur within the daily ensonified area (animals / km^2) by incorporating the estimated marine mammal densities as described above. Estimated numbers of each species taken per day are then multiplied by the total number of vessel days (*i.e.*, 736). The product is then rounded, to generate an estimate of the total number of instances of harassment expected for each species over the duration of the survey. A summary of this method is illustrated in the following formula:

Estimated Take = D × ZOI × # of days

Where: D = average species density (per km^2) and ZOI = maximum daily ensonified area to relevant thresholds.

Using this method to calculate take, Vineyard wind estimated that there would be takes of several species by Level A harassment including Atlantic White-sided dolphin, bottlenose dolphin, short-beaked common dolphin, harbor porpoise, gray seal, and harbor seal in the absence of mitigation (see Table 10 in the IHA application for the estimated number of Level A takes for all potential HRG equipment types). However, as described above, due to the very small estimated distances to Level A harassment thresholds (Table 6), and in consideration of the proposed mitigation measures, the likelihood of the proposed survey resulting in take in the form of Level A harassment is considered so low as to be discountable; therefore, we do not propose to authorize take of any marine mammals by Level A harassment. Proposed take numbers by Level B harassment are shown in Table 7.

Table 7. Total Numbers of Potential Incidental Take of Marine Mammals Proposed for Authorization and Proposed Takes as a Percentage of Population

Species	Annual density Mean (km^{-2})	Estimated Level B Harassment Takes	Proposed Takes by Level B Harassment	% Population[1]
Fin whale	0.0023	67.28	67	0.91
Humpback whale	0.0016	45.73	46	3.28
Minke whale	0.001	41.20	41	0.17
North Atlantic right whale	0.001	30.32	10	7.41
Sei whale	0.000	3.23	3.23	0.05
Atlantic white sided dolphin	0.0351	1,011.19	1,011	1.10
Bottlenose dolphin	0.0283	814.91	815	1.30
Pilot whales[2]	0.0049	1,41.98	142	2.52
Risso's dolphin[3]	0.000	5.74	30	<0.08
Common dolphin	0.071	2,035.87	2,036	1.18
Sperm whale	0.000	3.82	4	0.09
Harbor porpoise	0.0363	1,044.87	1,045	1.09
Gray seal	0.1404	4,043.67	4,044	14.90
Harbor seal	0.1404	4,043.67	4,044	5.33

[1] Calculations of percentage of stock taken are based on the best available abundance estimate as shown in Table 2. In most cases the best available abundance estimate is provided by Roberts *et al.* (2016, 2017, 2018), when available, to maintain consistency with density estimates derived from Roberts *et al.* (2016, 2017, 2018). For North Atlantic right whales the best available abundance estimate is derived from the 2018 North Atlantic Right Whale Consortium 2019 Annual Report Card (Pettis *et al.*, 2020).
[2] Long- and short-finned pilot whales are grouped together as a guild.
[3] Mean group sizes for species derived from Kenney and Vigness-Raposa (2010).
[4] Exclusion zone exceeds Level B isopleth; take adjusted to 10 given duration of survey.

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 Vineyard Wind's proposed marine site characterization surveys.

Marine Mammal Exclusion Zones, Buffer Zone and Monitoring Zone

Marine mammal exclusion zones (EZ) would be established around the HRG survey equipment and monitored by protected species observers (PSO) during HRG surveys as follows:

- A 500-m EZ would be required for North Atlantic right whales
- A 100-m EZ would be required for all other marine mammals (with the exception of certain small dolphin species specified below).

If a marine mammal is detected approaching or entering the EZs during the proposed survey, the vessel operator would adhere to the shutdown procedures described below. In addition to the EZs described above, PSOs would visually monitor a 200-m Buffer Zone. During use of acoustic sources with the potential to result in marine mammal harassment (i.e., anytime the acoustic source is active, including ramp-up), occurrences of marine mammals within the Buffer Zone (but outside the EZs) would be communicated to the vessel operator to prepare for potential shutdown of the acoustic source. The Buffer Zone is not applicable when the EZ is greater than 100 meters. PSOs would also be required to observe a 500-m Monitoring Zone and record the presence of all marine mammals within this zone. In addition, any marine mammals observed within 195 m of the active HRG equipment operating at or below 180 kHz would be documented by PSOs as taken by Level B harassment. The zones described above would be based upon the radial distance from the active equipment (rather than being based on distance from the vessel itself).

Visual Monitoring

NMFS only requires a single PSO to be on duty during daylight hours and 30 minutes prior to and during nighttime ramp-ups for HRG surveys. Vineyard Wind has voluntarily proposed that a minimum of two (2) NMFS-approved PSOs must be on duty and conducting visual observations on all survey vessels at all times when HRG equipment is in use (i.e. daylight and nighttime operations). PSOs must be on duty 30 minutes prior to and during nighttime ramp-ups of HRG equipment. Visual monitoring would begin no less than 30 minutes prior to ramp-up of HRG equipment and would continue until 30 minutes after use of the acoustic source. PSOs would establish and monitor the applicable EZs, Buffer Zone and Monitoring Zone as described above. Visual PSOs would coordinate to ensure 360° visual coverage around the vessel from the most appropriate observation posts, and would conduct visual observations using binoculars and the naked eye while free from distractions and in a consistent, systematic, and diligent manner. PSOs would estimate distances to marine mammals located in proximity to the vessel and/or relevant using range finders. It would be the responsibility of the Lead PSO on duty to communicate the presence of marine mammals as well as to communicate and enforce the action(s) that are necessary to ensure mitigation and monitoring requirements are implemented as appropriate. Position data would be recorded using hand-held or vessel global positioning system (GPS) units for each confirmed marine mammal sighting.

Pre-Clearance of the Exclusion Zones

Prior to initiating HRG survey activities, Vineyard Wind would implement a 30-minute pre-clearance period. During pre-clearance monitoring (i.e., before ramp-up of HRG equipment begins), the Buffer Zone would also act as an extension of the 100-m EZ in that observations of marine mammals within the 200-m Buffer Zone would also preclude HRG operations from beginning. During this period, PSOs would ensure that no marine mammals are observed within

200 m of the survey equipment (500 m in the case of North Atlantic right whales). HRG equipment would not start up until this 200-m zone (or, 500-m zone in the case of North Atlantic right whales) is clear of marine mammals for at least 30 minutes. The vessel operator would notify a designated PSO of the proposed start of HRG survey equipment as agreed upon with the lead PSO; the notification time should not be less than 30 minutes prior to the planned initiation of HRG equipment order to allow the PSOs time to monitor the EZs and Buffer Zone for the 30 minutes of pre-clearance. A PSO conducting pre-clearance observations would be notified again immediately prior to initiating active HRG sources.

If a marine mammal were observed within the relevant EZs or Buffer Zone during the pre-clearance period, initiation of HRG survey equipment would not begin until the animal(s) has been observed exiting the respective EZ or Buffer Zone, or, until an additional time period has elapsed with no further sighting (i.e., minimum 15 minutes for small odontocetes and seals, and 30 minutes for all other species). The pre-clearance requirement would include small delphinoids that approach the vessel (*e.g.*, bow ride). PSOs would also continue to monitor the zone for 30 minutes after survey equipment is shut down or survey activity has concluded.

Ramp-Up of Survey Equipment

When technically feasible, a ramp-up procedure would be used for geophysical 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 Project Area by allowing them to detect the presence of the survey and vacate the area prior to the commencement of survey equipment operation at full power. Ramp-up of the survey equipment would not begin until the relevant EZs and Buffer Zone has been cleared by the PSOs, as described above. HRG equipment would be initiated at their lowest power output and would be incrementally increased to full power. If any marine mammals are detected within the EZs or Buffer Zone prior to or during ramp-up, the HRG equipment would be shut down (as described below).

Shutdown Procedures

If an HRG source is active and a marine mammal is observed within or entering a relevant EZ (as described above) an immediate shutdown of the HRG survey equipment would be required. When shutdown is called for by a PSO, the acoustic source would be immediately deactivated and any dispute resolved only following deactivation. Any PSO on duty would have the authority to delay the start of survey operations or to call for shutdown of the acoustic source if a marine mammal is detected within the applicable EZ. The vessel operator would establish and maintain clear lines of communication directly between PSOs on duty and crew controlling the HRG source(s) to ensure that shutdown commands are conveyed swiftly while allowing PSOs to maintain watch. Subsequent restart of the HRG equipment would only occur after the marine mammal has either been observed exiting the relevant EZ, or, until an additional time period has elapsed with no further sighting of the animal within the relevant EZ (*i.e.*, 15 minutes for small odontocetes and seals, and 30 minutes for large whales).

Upon implementation of shutdown, the HRG source may be reactivated after the marine mammal that triggered the shutdown has been observed exiting the applicable EZ (i.e., the animal is not required to fully exit the Buffer Zone where applicable) or, following a clearance period of 15 minutes for small odontocetes and seals and 30 minutes for all other species with no further observation of the marine mammal(s) within the relevant EZ. If the HRG equipment shuts down for brief periods (i.e., less than 30 minutes) for reasons other than mitigation (*e.g.*, mechanical or electronic failure) the equipment may be re-activated as soon as is practicable at full operational level, without 30 minutes of pre-clearance, only if PSOs have maintained constant visual observation during the shutdown and no visual detections of marine mammals occurred within the applicable EZs and Buffer Zone during that time. For a shutdown of 30 minutes or longer, or if visual observation was not continued diligently during the pause, pre-clearance observation is required, as described above.

The shutdown requirement would be waived for certain genera of small delphinids (i.e., *Delphinus, Lagenorhynchus, and Tursiops)* under certain circumstances. If a delphinid(s) from these genera is visually detected approaching the vessel (i.e., to bow ride) or towed survey equipment, shutdown would not be required. 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 would use best professional judgment in making the decision to call for a shutdown.

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 area encompassing the Level B harassment isopleth (195 m), shutdown would occur.

Vessel Strike Avoidance

Vessel strike avoidance measures would include, but would not be limited to, the following, except under circumstances when complying with these requirements would put the safety of the vessel or crew at risk:

- All vessel operators and crew will maintain vigilant watch for cetaceans and pinnipeds, and slow down or stop their vessel to avoid striking these protected species;

- All survey 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 DMAs when in effect, and the Block Island Seasonal Management Area (SMA) (from November 1 through April 30), Cape Cod Bay SMA (from January 1 through May 15), Off Race Point SMA (from March 1 through April 30) and Great South Channel SMA (from April 1 through July 31). Note that this requirement includes vessels, regardless of size, to adhere to a 10 knot speed limit in SMAs and DMAs, not just vessels 65 ft or greater in length.
- All vessel operators will reduce vessel speed to 10 knots (18.5 km/hr) or less when any large whale, any mother/calf pairs, large assemblages of non-delphinoid cetaceans are observed near (within 100 m (330 ft)) an underway vessel;
- All vessels will maintain a separation distance of 500 m (1640 ft) or greater from any sighted North Atlantic right whale;
- If underway, vessels must steer a course away from any sighted North Atlantic right whale at 10 knots (18.5 km/hr) or less until the 500-m (1640 ft) minimum separation distance has been established. If a North Atlantic right whale is sighted in a vessel's path, or within 100 m (330 ft) to an underway vessel, the underway vessel must reduce speed and shift the engine to neutral. Engines will not be engaged until the North Atlantic right whale has moved outside of the vessel's path and beyond 100 m. If stationary, the vessel must not engage engines until the North Atlantic right whale has moved beyond 100 m;
- All vessels will maintain a separation distance of 100 m (330 ft) or greater from any sighted non-delphinoid cetacean. If sighted, the vessel underway must reduce speed and shift the engine to neutral, and must not engage the engines until the non-delphinoid

cetacean has moved outside of the vessel's path and beyond 100 m. If a survey vessel is stationary, the vessel will not engage engines until the non-delphinoid cetacean has moved out of the vessel's path and beyond 100 m;

- All vessels will maintain a separation distance of 50 m (164 ft) or greater from any sighted delphinoid cetacean. Any vessel underway remain parallel to a sighted delphinoid cetacean's course whenever possible, and avoid excessive speed or abrupt changes in direction. Any vessel underway reduces vessel speed to 10 knots (18.5 km/hr) or less when pods (including mother/calf pairs) or large assemblages of delphinoid cetaceans are observed. Vessels may not adjust course and speed until the delphinoid cetaceans have moved beyond 50 m and/or the abeam of the underway vessel;
- All vessels will maintain a separation distance of 50 m (164 ft) or greater from any sighted pinniped; and
- All vessels underway will not divert or alter course in order to approach any whale, delphinoid cetacean, or pinniped. Any vessel underway will avoid excessive speed or abrupt changes in direction to avoid injury to the sighted cetacean or pinniped.

Project-specific training will be conducted for all vessel crew prior to the start of survey activities. Confirmation of the training and understanding of the requirements will be documented on a training course log sheet. Signing the log sheet will certify that the crew members understand and will comply with the necessary requirements throughout the survey activities.

Seasonal Operating Requirements

Vineyard Wind will conduct HRG survey activities in the Cape Cod Bay SMA and Off Race Point SMA only during the months of August and September to ensure sufficient buffer between the SMA restrictions (January to May 15) and known seasonal occurrence of the NARW north and northeast of Cape Cod (fall, winter, and spring). Vineyard Wind will also limit to three the number survey vessels that will operate concurrently from March through June within the lease areas (OCS-A 0501 and 0487) and OECC areas north of the lease areas up to, but not including, coastal and bay waters. The boundaries of this area are delineated by a polygon with the following vertices: 40.746 N 70.748 W; 40.953 N 71.284 W; 41.188 N 71.284 W; ~ 41.348 N 70.835 W; 41.35 N 70.455 W; 41.097 N 70.372 W; and 41.021 N 70.37 W. This area is delineated by the dashed line shown in Figure 2. Another seasonal restriction area south of Nantucket will be in effect from December to February in the area delineated by the current DMA (Effective from January 31, 2020 through February 15, 2020). The winter seasonal restriction area is delineated by latitudes and longitudes of 41.1838 N; 40.3666 N; 69.5333 W; and 70.6166 W. This area is delineated by the solid line in Figure 2.

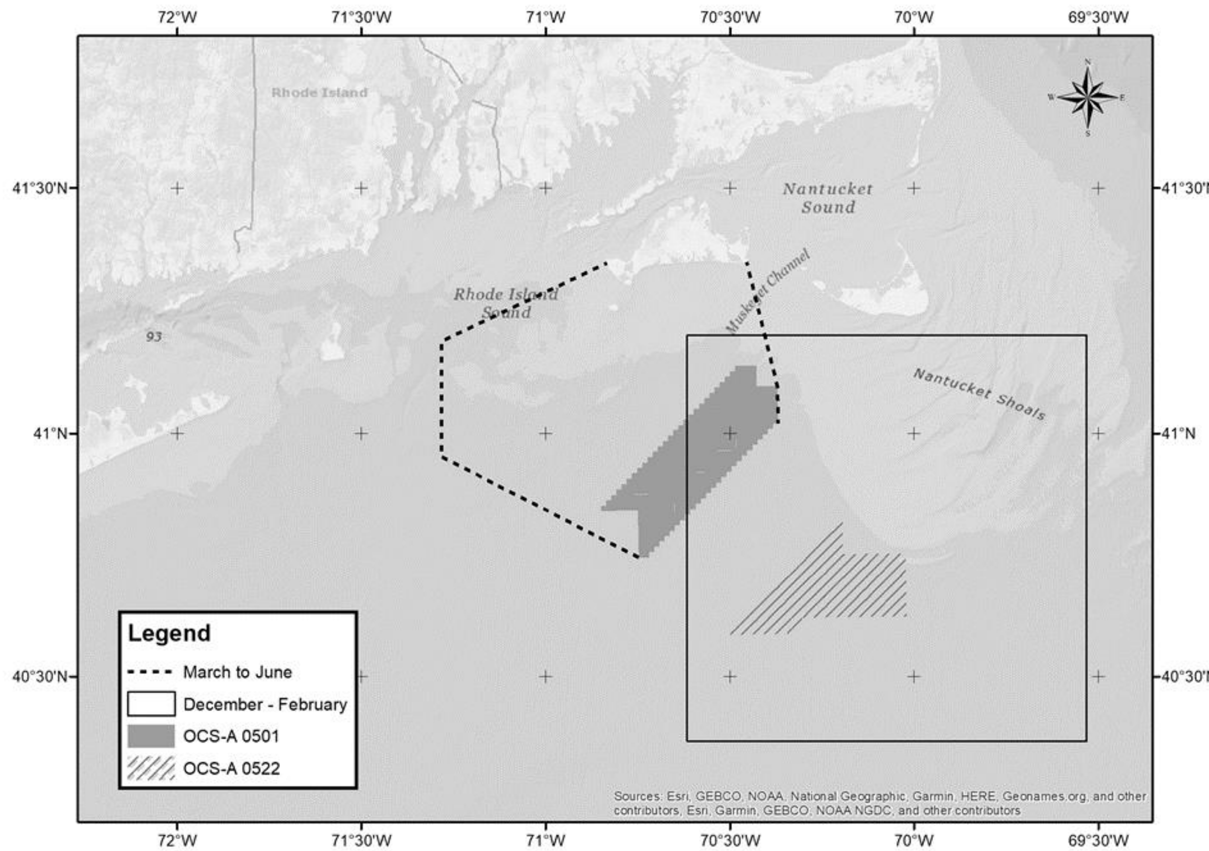

Figure 2. Seasonally Restricted Areas

Vineyard Wind 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 December-February and March-June timeframes when right whale densities are greatest. The seasonal restrictions described above will help to reduce both the number and intensity of right whale takes.

Vineyard Wind would also employ passive acoustic monitoring (PAM) to support monitoring during night time operations to provide for acquisition of species detections at night. While PAM is not typically required by NMFS for HRG surveys, it may a provide additional benefit as a mitigation and monitoring measure to further limit potential exposure to underwater sound at levels that could result in injury or behavioral harassment.

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 effecting the least practicable impact on the affected 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

As described above, visual monitoring would be performed by qualified and NMFS-approved PSOs. Vineyard Wind would use independent, dedicated, trained PSOs, meaning that the PSOs must be employed by a third-party observer provider, must 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 must have successfully completed an approved PSO training course appropriate for their designated task. Vineyard Wind would provide resumes of all proposed PSOs (including alternates) to NMFS for review and approval prior to the start of survey operations.

During survey operations (*e.g.*, any day on which use of an HRG source is planned to occur), a minimum of two PSOs must be on duty and conducting visual observations at all times on all active survey vessels when HRG equipment is operating, including both daytime and nighttime operations. Visual monitoring would begin no less than 30 minutes prior to initiation of HRG survey equipment and would continue until one hour after use of the acoustic source ceases. PSOs would coordinate to ensure 360° visual coverage around the vessel from the most appropriate observation posts, and would conduct visual observations using binoculars 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 survey vessels.

PSOs would be equipped with binoculars and have the ability to estimate distances to marine mammals located in proximity to the vessel and/or exclusion zone using range finders. Reticulated binoculars will also be available to PSOs for use as appropriate based on conditions and visibility to support the monitoring of marine mammals. Position data would be recorded using hand-held or vessel GPS units for each sighting. Observations would take place from the highest available vantage point on the survey vessel. General 360-degree scanning would occur during the monitoring periods, and target scanning by the PSO would occur when alerted of a marine mammal presence.

During good conditions (*e.g.*, daylight hours; Beaufort sea state (BSS) 3 or less), to the maximum extent practicable, PSOs would conduct observations when the acoustic source is not operating for comparison of sighting rates and behavior with and without use of the acoustic source and between acquisition periods. 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 take 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 estimated to have been taken 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 the event that Vineyard Wind personnel discover an injured or dead marine mammal, Vineyard Wind shall report the incident to the Office of Protected Resources (OPR), NMFS and to the New England/Mid-Atlantic Regional Stranding Coordinator as soon as feasible. The report must include the following information:

- Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);
- Species identification (if known) or description of the animal(s) involved;
- Condition of the animal(s) (including carcass condition if the animal is dead);
- Observed behaviors of the animal(s), if alive;

- If available, photographs or video footage of the animal(s); and
- General circumstances under which the animal was discovered.

In the event of a ship strike of a marine mammal by any vessel involved in the activities covered by the authorization, the IHA-holder shall report the incident to OPR, NMFS and to the New England/Mid-Atlantic Regional Stranding Coordinator as soon as feasible. The report must 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 2, given that NMFS expects the anticipated effects of the proposed survey to be similar in nature. As discussed in the “Potential Effects of the Specified Activity on Marine Mammals and Their Habitat” section, PTS, masking, non-auditory physical effects, and vessel strike are not expected to occur.

The majority of impacts to marine mammals are expected to be short-term disruption of behavioral patterns, primarily in the form of avoidance or potential interruption of foraging. Marine mammal feeding behavior is not likely to be significantly impacted.

Regarding impacts to marine mammal habitat, prey species are mobile, and are broadly distributed throughout the Project Area and the footprint of the activity is small; 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 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. The HRG survey equipment itself will not result in physical habitat disturbance. Avoidance of the area around the HRG survey activities by marine mammal prey species is possible. However, any avoidance by prey species would be expected to be short term and temporary.

ESA-listed species for which takes are authorized are right, fin, sei, and sperm whales, and these effects 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 mitigation and no serious injury or mortality is authorized. As discussed in the *Potential Effects* section, non-auditory physical effects and vessel strike are not expected to occur. We expect that most 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 were occurring), reactions that are considered to be of low severity and with no lasting biological consequences (*e.g.,* Southall *et al.,* 2007). The proposed survey is 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. NMFS has rigorously assessed potential impacts to right whales from this survey. We have established a 500-m shutdown zone for right whales which is precautionary considering the Level B harassment isopleth for the largest source utilized (i.e. GeoMarine Geo Spark 2000 (400 tip) is estimated to be 195 m.

NMFS is also requiring Vineyard Wind to limit the number of survey vessels operating concurrently to no more than three in specified areas during periods when right whale densities are likely to be elevated. This includes a specified area approximately 31 miles due south of Nantucket including Lease Area OCS-A 0522 from December to February as well as Lease Area OCS-A 0501 and surrounding Project Areas south and southwest of Martha's Vineyard from March to June. Numerous right whale aggregations have been reported in these areas during the winter and spring. Furthermore, surveys in right whale critical habitat area will be limited to August and September when the whales are unlikely to be present. Due to the length of the survey and continuous night operations, it is conceivable that a limited number of right whales could enter into the Level B harassment zone without being observed. Any potential impacts to right whales would consist of, at most, low-level, short-term behavioral harassment in a limited number of animals.

The proposed Project Area encompasses or is in close proximity to feeding BIAs for right whales (February-April), humpback whales (March-December), fin whales (March-October), and sei whales (May-November) as well as a migratory BIA or right whales (March-April and November-December. Most of these feeding BIAs are extensive and sufficiently large (705 km^2

and 3,149 km^2 for right whales; 47,701 km^2 for humpback whales; 2,933 km^2 for fin whales; and 56,609 km^2 for sei whales), and the acoustic footprint of the proposed survey is sufficiently small that feeding opportunities for these whales would not be reduced appreciably. Any whales temporarily displaced from the proposed Project Area would be expected to have sufficient remaining feeding 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 whales from the BIA or interruption of foraging bouts would be expected to be temporary in nature. Therefore, we do not expect whales with feeding BIAs to be negatively impacted by the proposed survey.

A migratory BIA for North Atlantic right whales (effective March-April and November-December) extends from Massachusetts to Florida (LaBrecque, *et al.*, 2015). Off the south coast of Massachusetts and Rhode Island, this BIA extends from the coast to beyond the shelf break. The fact that the spatial acoustic footprint of the proposed survey is very small relative to the spatial extent of the available migratory habitat means that 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. NMFS is expanding the standard avoidance measures by requiring that all vessels, regardless of size, adhere to a 10 knot speed limit in SMAs and DMA. Additionally, limited take by Level B harassment of North Atlantic right whales has been authorized as HRG survey operations are required to shut down at 500 m to minimize the potential for behavioral harassment of this species.

As noted previously, 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 healthy. 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 North Atlantic right whale mortalities began in June 2017, primarily in Canada. Overall, preliminary findings support human interactions, specifically vessel strikes or rope entanglements, as the cause of death for the majority of the right 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 (345) is well below PBR (2,006) (Hayes *et al.*, 2018). For gray seals, the population abundance in the United States is over 27,000, with an estimated abundance including seals in Canada of approximately 505,000, and abundance is likely increasing in the U.S. Atlantic EEZ as well as in Canada (Hayes *et al.*, 2018).

Direct physical interactions (ship strikes and entanglements) appear to be responsible for many of the UME humpback and right whale mortalities recorded. The proposed HRG survey will require ship strike avoidance measures which would minimize the risk of ship strikes while fishing gear and in-water lines will not be employed as part of the survey. Furthermore, the proposed activities are not expected to promote the transmission of infectious disease among marine mammals. The survey is not expected to result in the deaths of any marine mammals or combine with the effects of the ongoing UMEs to result in any additional impacts not analyzed here. Accordingly, Vineyard Wind did not request, and NMFS is not proposing to authorize, take of marine mammals by serious injury, or mortality.

The required mitigation measures are expected to reduce the number and/or severity of takes by giving animals the opportunity to move away from the sound source before HRG survey equipment reaches full energy and preventing animals from being exposed to sound levels that have the potential to cause injury (Level A harassment) and more severe Level B harassment during HRG survey activities, even in the biologically important areas described above. No Level A harassment is anticipated or authorized.

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

In summary and as described above, the following factors primarily support our 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;

- Any foraging interruptions are expected to be short term and unlikely to be cause significantly impacts;
- Impacts on marine mammal habitat and species that serve as prey species for marine mammals are expected to be minimal and the alternate areas of similar habitat value for marine mammals are readily available;
- Take is anticipated to be primarily Level B behavioral harassment consisting of brief startling reactions and/or temporary avoidance of the Project Area;
- Survey activities would occur in such a comparatively small portion of the biologically important areas for north Atlantic right whale migration, including a small area of designated critical habitat, that any avoidance of the Project Area due to activities would not affect migration. In addition, mitigation measures to shut down at 500 m to minimize potential for Level B behavioral harassment would limit both the number and severity of take of the species.
- Similarly, due to the relatively small footprint of the survey activities in relation to the size of a biologically important areas for right, humpback, fin, and sei whales foraging, the survey activities would not affect foraging behavior of this species; and
- Proposed mitigation measures, including visual monitoring and shutdowns, are expected to minimize the intensity of 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 required monitoring and mitigation measures, NMFS finds that the total marine mammal take from Vineyard Wind’s proposed HRG survey activities will have a negligible impact on the 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 considered small relative to the relevant stocks or populations (less than 15 percent for all species and stocks) as shown in Table 7. 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 the 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.

The NMFS Office of Protected Resources Permits and Conservation Division is proposing to authorize the incidental take of four species of marine mammals which are listed under the ESA: the North Atlantic right, fin, sei, and sperm whale. The Permits and Conservation Division has requested initiation of Section 7 consultation with NMFS GARFO for the issuance of this IHA. NMFS will conclude the ESA section 7 consultation prior to reaching a determination regarding the proposed issuance of the authorization.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to Vineyard Wind for conducting marine site characterization surveys offshore of Massachusetts in the areas of the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0501 and OCS-A 0522) and along potential submarine cable routes to a landfall location in Massachusetts, Rhode Island, Connecticut, and New York, from April 1, 2020 through March 31, 2021, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. A draft of the proposed IHA can be found at *https://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 the proposed HRG survey. 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-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: February 5, 2020.

Donna S. Wieting,

Director, Office of Protected Resources,

National Marine Fisheries Service.

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