DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 217

[Docket No. 230530–0140]

RIN 0648–BL96

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to the New England Wind Project Offshore Massachusetts

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

ACTION: Proposed rule; proposed letter of authorization; request for comments.

SUMMARY: NMFS has received a request from Park City Wind, LLC (Park City Wind) for Incidental Take Regulations (ITR) and an associated Letter of Authorization (LOA) pursuant to the Marine Mammal Protection Act (MMPA). The requested regulations would govern the authorization of take, by Level A harassment and/or Level B harassment, of small numbers of marine mammals over the course of 5 years (2025–2030) incidental to construction of the New England Wind Project. Park City Wind proposes to develop the New England Wind Project in two phases, known as Park City Wind (Phase 1) and Commonwealth Wind (Phase 2). Project activities that may result in incidental take include pile driving (impact and vibratory), drilling, unexploded ordnance or munitions and explosives of concern (UXO/MEC) detonation, and vessel-based site assessment surveys using high-resolution geophysical (HRG) equipment. NMFS requests comments on this proposed rule. NMFS will consider public comments prior to making any final decision on the promulgation of the requested ITR and issuance of the LOA; agency responses to public comments will be summarized in the final rule, if issued. If adopted, the proposed regulations would be effective March 27, 2025, through March 26, 2030.

DATES: Comments and information must be received no later than July 10, 2023.

ADDRESSES: Submit all electronic public comments via the Federal e-Rulemaking Portal. Go to *www.regulations.gov* and enter NOAA–NMFS–2023–0080 in the Search box. Click on the ''Comment'' icon, complete the required fields, and enter or attach your comments.

Instructions: Comments sent by any other method, to any other address or individual, or received after the end of the comment period, may not be considered by NMFS. All comments received are a part of the public record and will generally be posted for public viewing on *www.regulations.gov* without change. All personal identifying information (*e.g.,* name, address), confidential business information, or otherwise sensitive information submitted voluntarily by the sender will be publicly accessible. NMFS will accept anonymous comments (enter ''N/A'' in the required fields if you wish to remain anonymous). Attachments to electronic comments will be accepted in Microsoft Word, Excel, or Adobe PDF file formats only.

FOR FURTHER INFORMATION CONTACT: Jaclyn Daly, Office of Protected Resources, NMFS, (301) 427–8401.

SUPPLEMENTARY INFORMATION:

Availability

A copy of Park City Wind's Incidental Take Authorization (ITA) application and supporting documents, as well as a list of the references cited in this document, may be obtained online at *https://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 (see **FOR FURTHER INFORMATION CONTACT**).

Purpose and Need for Regulatory Action

This proposed rule would provide a framework under the authority of the MMPA (16 U.S.C. 1361 *et seq.*) to allow for the authorization of take of marine mammals incidental to construction of the New England Wind Project within the Bureau of Ocean Energy Management (BOEM) Renewable Energy Lease Area OCS–A 0534, the southwest (SW) portion of Lease Area OCS–A 0501, and along an export cable corridor to a landfall location in Massachusetts. NMFS received a request from Park City Wind for 5-year regulations and an LOA that would authorize take, by Level A harassment and/or Level B harassment, of 39 species of marine mammals incidental to Park City Wind's construction activities. After reviewing the request, NMFS is proposing to authorize the take, by harassment only, of 38 species, representing 38 stocks. No mortality or serious injury is anticipated or proposed for authorization. Please see the Estimated Take of Marine Mammals section below for definitions of relevant terms.

Legal Authority for the Proposed Action

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, regulations are promulgated, and public notice and an opportunity for public comment are provided.

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 the species or stocks for taking for certain subsistence uses (referred to as ''mitigation''); and requirements pertaining to the mitigation, monitoring and reporting of the takings are set forth.

As noted above, no serious injury or mortality is anticipated or proposed for authorization in this proposed rule. Relevant definitions of MMPA statutory and regulatory terms are included below:

- *Citizen*—individual U.S. citizens or any corporation or similar entity if it is organized under the laws of the United States or any governmental unit defined in 16 U.S.C. 1362(13) (*see* 50 CFR 216.103);
- *Take*—to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal (16 U.S.C. 1362);
- *Incidental taking*—an accidental taking. This does not mean that the taking is unexpected, but rather it includes those takings that are infrequent, unavoidable or accidental (see 50 CFR 216.103);
- *Serious Injury*—any injury that will likely result in mortality (50 CFR 216.3);
- *Level A harassment*—any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild (16 U.S.C. 1362; 50 CFR 216.3); and
- *Level B harassment*—any act of pursuit, torment, or annoyance which

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 (16 U.S.C. 1362).

Section 101(a)(5)(A) of the MMPA and the implementing regulations at 50 CFR part 216, subpart I provide the legal basis for proposing and, if appropriate, issuing 5-year regulations and an associated LOA. This proposed rule also establishes required mitigation, monitoring, and reporting requirements for Park City Wind's activities.

Summary of Major Provisions Within the Proposed Action

The major provisions within this proposed rule are as follows:

- Authorize take of marine mammals by Level A harassment and/or Level B harassment.
- No mortality or serious injury of any marine mammal is proposed to be authorized;
- Establish a seasonal moratorium on foundation installation and UXO/MEC detonations during the months of highest North Atlantic right whale (*Eubalaena glacialis*) presence in the project area (no foundation installation or UXO/MEC detonation from January 1–April 30; no vibratory pile driving in May and December; impact pile driving and drilling activities would not be planned or occur in December unless due to unforeseen circumstances and only with NMFS' approval; UXO/MEC detonations would not be planned or occur in December or May unless due to unforeseen circumstances and only with NMFS' approval);
- Enhanced North Atlantic right whale clearance, shutdown and restart procedures May 1 through May 14 and November 1 through December 31 (if a seasonally-restricted activity is approved in December due to unforeseen circumstances);
- Require both visual and passive acoustic monitoring by trained, NOAA Fisheries-approved Protected Species Observers (PSOs) and Passive Acoustic Monitoring (PAM; where required) operators before, during, and after select activities;
- Require the use of sound attenuation device(s) during all foundation installation activities and UXO/MEC detonations to reduce noise levels;
- Delay the start of foundation installation and UXO/MEC detonations if a North Atlantic right whale is observed at any distance by PSOs or acoustically detected within certain distances;
- Delay the start of foundation installation and UXO/MEC detonations if other marine mammals are observed entering or within their respective clearance zones;
- Shut down pile driving (if feasible) if a North Atlantic right whale is observed or if other marine mammals enter their respective shut down zones;
- Implement sound field verification requirements during impact pile driving and UXO/MEC detonations to measure in situ noise levels for comparison against the model results;
- Implement soft-starts for impact pile driving and use the least hammer energy possible;
- Require PSOs to continue to monitor for the presence of marine mammals for 30 minutes after any impact pile driving occurs;
- Implement ramp-up for HRG site characterization survey equipment;
- Increase awareness of North Atlantic right whale presence through monitoring of the appropriate networks and Channel 16, as well as reporting any sightings to the sighting network;
- Implement various vessel strike avoidance measures;
- Implement Best Management Practices (BMPs) during fisheries monitoring surveys, such as removing gear from the water if marine mammals are considered at-risk or are interacting with gear; and
- Require frequent scheduled and situational reporting including, but not limited to, information regarding activities occurring, marine mammal observations and acoustic detections, and sound field verification monitoring results.

Under Section 105(a)(1) of the MMPA, failure to comply with these requirements or any other requirements in a regulation or permit implementing the MMPA may result in civil monetary penalties. Pursuant to 50 CFR 216.106, violations may also result in suspension or withdrawal of the Letter of Authorization (LOA) for the project. Knowing violations may result in criminal penalties under Section 105(b) of the MMPA.

National Environmental Policy Act (NEPA)

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 the proposed action (*i.e.,* promulgation of regulations and subsequent issuance of a 5-year LOA) and alternatives with respect to potential impacts on the human environment.

Accordingly, NMFS proposes to adopt the BOEM's Environmental Impact Statement (EIS), provided our independent evaluation of the document finds that it includes adequate information analyzing the effects of promulgating the proposed regulations and LOA issuance on the human environment. NMFS is a cooperating agency on BOEM's EIS. BOEM's draft EIS, ''New England Wind Draft Environmental Impact Statement (DEIS) for Commercial Wind Lease OCS–A0534'', was made available for public comment on December 23, 2022 (87 FR 78993), beginning the 60-day comment period ending on February 21, 2023. Additionally, BOEM held three virtual public hearings on January 27, February 1, and February 6, 2023.

Information contained within Park City Wind's incidental take authorization (ITA) application and this **Federal Register** document provide the environmental information related to these proposed regulations and associated 5-year LOA for public review and comment. NMFS will review all comments submitted in response to this notice of proposed rulemaking prior to concluding the NEPA process or making a final decision on the requested 5-year ITR and LOA.

Fixing America's Surface Transportation Act (FAST–41)

This project is covered under Title 41 of the Fixing America's Surface Transportation Act, or ''FAST–41''. FAST–41 includes a suite of provisions designed to expedite the environmental review for covered infrastructure projects, including enhanced interagency coordination as well as milestone tracking on the public-facing Permitting Dashboard. FAST–41 also places a 2-year limitations period on any judicial claim that challenges the validity of a Federal agency decision to issue or deny an authorization for a FAST–41 covered project. 42 U.S.C. 4370m–6(a)(1)(A).

Park City Wind's proposed project is listed on the Permitting Dashboard, where milestones and schedules related to the environmental review and permitting for the project can be found at *https://www.permits.performance.gov/permitting-project/new-england-wind.*

Summary of Request

On December 1, 2021, Park City Wind, a limited liability company registered in the State of Delaware and wholly owned subsidiary of Avangrid Renewables, LLC, submitted a request for the promulgation of regulations and issuance of an associated 5-year LOA to take marine mammals incidental to construction activities associated with implementation of the New England Wind Project (hereafter ''Project'') offshore of Massachusetts in the BOEM Lease Area OCS–A 0534 and the possible use of their southwest (SW) portion of Lease Area OCS–A 0501. The request was for the incidental, but not intentional, taking of a small number of 39 marine mammal species (comprising 38 stocks). Neither Park City Wind nor NMFS expects serious injury or mortality to result from the specified activities nor is any proposed for authorization.

Park City Wind is proposing to develop the Project in two phases with a maximum of 132 wind turbine generators (WTGs) and electrical service platforms (ESP) positions. Two positions may potentially have co-located ESPs (*i.e.,* two foundations installed at one grid position); hence, the 132 foundations would be installed at 130 positions in the lease area. Phase 1 would include 41 to 62 WTGs and 1 or 2 ESPs while Phase 2 would include 64 to 88 WTG/ESP positions (up to 3 of those positions will be occupied by ESPs). Four or five offshore export cables will transmit electricity generated by the WTGs to onshore transmission systems in the Town of Barnstable, Massachusetts.

In response to our questions and comments and following extensive information exchange between Park City Wind and NMFS, Park City Wind submitted a final revised application on July 13, 2022. NMFS deemed it adequate and complete on July 20, 2022. This final application is available on NMFS' website at *https://www.fisheries.noaa.gov/protected-resource-regulations.*

On August 22, 2022, NMFS published a notice of receipt (NOR) of Park City Wind's adequate and complete application in the **Federal Register** (87 FR 51345), requesting public comments and information on Park City Wind's request during a 30-day public comment period. During the NOR public comment period, NMFS received comment letters from one private citizen and one non-governmental organization (ALLCO Renewable Energy Limited). NMFS has reviewed all submitted material and has taken the material into consideration during the drafting of this proposed rule. In January 2023 and again in March 2023, Park City Wind submitted memos to NMFS detailing updates and changes to their ITA application (''Application Update Report''). These are available on the NMFS website at *https://www.fisheries.noaa.gov/action/incidental-take-authorization-park-city-wind-llc-construction-new-england-wind-offshore-wind.*

NMFS previously issued one Incidental Harassment Authorization (IHA) to Park City Wind for the taking of marine mammals incidental to marine site characterization surveys, using high-resolution geophysical (HRG) of the Project Phase 1 in the BOEM Lease Area OCS–A 0534 (87 FR 44087, July 07, 2022). NMFS has also previously issued another IHA to Avangrid Renewables, LLC (Avangrid), owner of Park City Wind, LLC, to take small numbers of marine mammals incidental to an HRG survey for a BOEM Lease Area (OCS–A 0508) off the coasts of North Carolina and Virginia (84 FR 31032, June 28, 2019). To date, Park City Wind and Avangrid have complied with all IHA requirements (*e.g.,* mitigation, monitoring, and reporting). Applicable monitoring results may be found in the Estimated Take of Marine Mammals section. If available, the full monitoring reports can be found on NMFS' website at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-other-energy-activities-renewable.*

On August 1, 2022, NMFS announced proposed changes to the existing North Atlantic right whale vessel speed regulations (87 FR 46921, August 1, 2022) to further reduce the likelihood of mortalities and serious injuries to endangered right whales from vessel collisions, which are a leading cause of the species' decline and a primary factor in an ongoing Unusual Mortality Event. Should a final vessel speed rule be issued and become effective during the effective period of this ITR (or any other MMPA incidental take authorization), the authorization holder would be required to comply with any and all applicable requirements contained within the final rule. Specifically, where measures in any final vessel speed rule are more protective or restrictive than those in this or any other MMPA authorization, authorization holders would be required to comply with the requirements of the rule. Alternatively, where measures in this or any other MMPA authorization are more restrictive or protective than those in any final vessel speed rule, the measures in the MMPA authorization would remain in place. The responsibility to comply with the applicable requirements of any vessel speed rule would become effective immediately upon the effective date of any final vessel speed rule and, when notice is published on the effective date, NMFS would also notify Park City Wind if the measures in the speed rule were to supersede any of the measures in the MMPA authorization such that they were no longer required.

Description of the Specified Activities

Overview

Park City Wind has proposed to construct and operate a wind energy facility in State and Federal waters in the Atlantic Ocean in lease area OCS–A 0534. This lease area is located within the Massachusetts Wind Energy Area (MA WEA) and adjacent to the Rhode Island/Massachusetts Wind Energy Area (RI/MA WEA). The Project will occupy all of Lease Area OCS–A 0534 and potentially a portion of Lease Area OCS–A 0501 in the event that Vineyard Wind 1 does not develop spare or extra positions included in Lease Area OCS–A 0501. If Vineyard Wind 1 does not develop spare or extra positions in Lease Area OCS–A 0501, those positions would be assigned to Lease Area OCS–A 0534. Accordingly, for the purposes of the LOA, Park City Wind has defined the Southern Wind Development Area (SWDA) as all of Lease Area OCS–A 0534 and the southwest portion of Lease Area OCS–A 0501.

The Project would consist of several different types of permanent offshore infrastructure, including wind turbine generators (WTGs) and associated foundations, ESPs, and offshore cabling. Onshore cabling, substations, and operations and maintenance (O&M) facilities are also planned. The Project is divided into two phases: Park City Wind (Phase 1) and Commonwealth Wind (Phase 2). Phase 1 would occupy 150–231 km^2 (37,066–57,081 acres) which would include 41–62 WTGs and 1–2 ESPs. Phase 1 includes two WTG foundation types: monopiles and piled jackets. The ESP(s) will also be supported by a monopile or jacket foundation. Strings of WTGs will connect with the ESP(s) via a submarine inter-array cable transmission system. Two high-voltage alternating current (HVAC) offshore export cables, up to 101 km (62.8 mi) in length per cable, would be installed within the SWDA. An Offshore Export Cable Corridor (OECC) would transmit electricity from the ESP(s) to a landfall site.

Phase 2 depends upon the final footprint of Phase 1. Phase 2 is expected to contain 64 to 88 WTGs and 1–3 ESP positions within an area ranging from 222–303 km^2 (54,857–74,873 acres). Phase 2 includes three general WTG foundation types: monopiles, jackets (with piles or suction buckets), or bottom-frame foundations (with piles or suction buckets). Inter-array cables will transmit electricity from the WTGs to the ESP(s). The ESP(s) will also be supported by a monopile or jacket foundation (with piles or suction buckets). Two or three HVAC offshore export cables, each with a maximum length of 116–124 km (63–67 NM) per cable, will transmit power from the ESP(s) to shore. All Phase 2 offshore export cables are planned to use the same OECC as the Phase 1. Cables for Phase 1 and Phase 2 will diverge 2–3 km (1–2 mi) from shore to unique landfall locations.

The installation of WTGs and ESPs, would require impact and vibratory pile driving and drilling. Work would also include HRG vessel-based site characterization surveys using active acoustic sources with frequencies of less than 180 kHz and the potential detonations of 10 unexploded ordnances or Munitions and Explosives of Concern (UXO/MEC) of different charge weights. Additionally, project plans include trenching, laying, and burial activities associated with the installation of the export cable route from the ESP to the shore-based landing locations and the inter-array cables between turbines; site preparation work (*e.g.,* boulder removal); placement of scour protection around foundations; and several types of fishery and ecological monitoring surveys. Vessels would transit within the project area and between ports and the wind farm to transport crew, supplies, and materials to support pile installation. All offshore cables will connect to onshore export cables, substations, and grid connections, which would be located in Barnstable County, Massachusetts. Marine mammals exposed to elevated noise levels during impact and vibratory pile driving, drilling, detonations of UXOs, or site characterization surveys may be taken by Level A harassment and/or Level B harassment depending on the specified activity. No serious injury or mortality is anticipated or proposed for authorization.

Dates and Duration

Park City Wind anticipates that the Project activities with the potential to result in harassment of marine mammals would occur throughout all 5 years of the proposed regulations which, if promulgated, would be effective from March 27, 2025 through March 26, 2030. The estimated schedule, including dates and duration, for various activities is provided in Table 1 (also see Tables 1–3 in Application Update Report). However, this proposed rule considers the potential for activity schedules to shift. Detailed information about the activities themselves may be found in the *Detailed Description of the Specific Activities* subsection.

TABLE 1—ESTIMATED ACTIVITY SCHEDULE TO CONSTRUCT AND OPERATE THE PROJECT

Project activity	Estimated schedule	Estimated duration
HRG Surveys	Q1 2025–Q4 2029	Any time of the year, up to 25 days per year.
Scour Protection Pre- or Post-Installation	Q1 2025–Q4 2029	Any time of the year.
WTG and ESP Foundation Installation, Schedule A.	Q2–Q4 2026 and 2027 [1]	Up to 8 months per year.
WTG and ESP Foundation Installation, Schedule B.	Q2–Q4 2026, 2027, and 2028 [1]	Up to 8 months per year.
Horizontal Directional Drilling at Cable Landfall Sites.	Q4 2025–Q2 2026	Up to 150 days.
UXO/MEC Detonations	Q2–Q4 2025 and 2026 [3]	Up to 6 days in 2025 and 4 days in 2026. No more than 10 days total.
Inter-array Cable Installation	Q3–Q4 2026 and Q2 2027–Q2 2028	Phase 1: 5 months; [2] Phase 2: 10 months.[2]
Export Cable Installation and Termination	Q2 2026–Q2 2028	Phase 1: 8–9 months; [1] Phase 2: 13–17 months.[1]
Fishery Monitoring Surveys	Q1 2025–Q4 2029	Any time of year.
Turbine Operation	Initial turbines operational 2027, all turbines operational by 2028.	

[1] Foundation installation pile driving would be limited to May 1–December 31, annually; however, pile driving in December will not be planned but may occur due to unforeseen circumstances (*e.g.,* unanticipated extended weather delays, unexpected technical difficulties) and with NMFS approval.
[2] The Project is divided into 2 phases: Park City Wind (Phase 1) and Commonwealth Wind (Phase 2).
[3] Park City Wind requested UXO/MEC detonations be allowed Q1 2025–Q4 2026. We propose to only allow it May–December 2025 and 2026.

Specific Geographic Region

Park City Wind would construct the Project in Federal waters offshore of Massachusetts (Figure 1). The project area is part of the Rhode Island/Massachusetts Wind Energy Area (RI-MA WEA). The project area covers approximately 101,590 acres (411 km^2) in Lease Area OCS–A 0534. The project area is located about 20 miles (32 km) southwest of Martha's Vineyard, about 24 miles (39 km) south of Nantucket, and adjacent to the southwest boundary of the BOEM-approved Vineyard Wind 1 energy project (Lease Area OCS–A 0501; 65,296 acres (262 km^2) assigned for potential Project development). Water depths in the project area range from 43 to 62 m (141–203 ft) and in the OECC range from less than 2 m to 46 m (<7–151 ft). The onshore components of the Project will include up to three export cable landfalls in Barnstable County, Massachusetts (one for Phase 1 and up to two for Phase 2).

Park City Wind's specified activities would occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem (NES LME), an area of approximately 260,000 km^2 from Cape Hatteras in the south to the Gulf of Maine in the north. Specifically, the lease area and cable corridor are located within the Mid-Atlantic Bight subarea of the NES LME, which extends between Cape Hatteras, North Carolina, and Martha's Vineyard, Massachusetts, extending westward into the Atlantic to the 100-m isobath. In the Mid-Atlantic Bight, which extends from Massachusetts to North Carolina, the pattern of sediment distribution is relatively simple. The continental shelf south of New England is broad and flat, dominated by fine grained sediments. Most of the surficial sediments on the continental shelf are sands and gravels. Silts and clays predominate at and beyond the shelf edge, with most of the slope being 70–100 percent mud. Fine sediments are also common in the shelf valleys leading to the submarine canyons, as well as in areas such as the ''Mud Patch'' south of Rhode Island. There are some larger materials, including boulders and rocks, left on the seabed by retreating glaciers, along the coast of Long Island and to the north and east.

In support of the Rhode Island Ocean Special Area Management Plan development process, Codiga and Ullman (2011) reviewed and summarized the physical oceanography of coastal waters off Rhode Island. Conditions off the coast of Rhode Island are shaped by a complex interplay among wind-driven variability, tidal processes, and density gradients that arise from combined effects of interaction with adjacent estuaries, solar heating, and heat flux through the air-sea interface. In winter and fall, the stratification is minimal and circulation is a weak upwelling pattern directed offshore at shallow depths and onshore near the seafloor. In spring and summer, strong stratification develops due to an important temperature contribution, and a system of more distinct currents occurs, including a narrow flow that proceeds counterclockwise around the perimeter of Rhode Island Sound (RIS) likely in association with a tidal mixing front.

The waters in the vicinity of the Project are transitional waters positioned between the continental slope and the coastal environments of Rhode Island Sound and Nantucket Sound. The region is generally characterized by predominantly mobile sandy substrate, and the associated benthic communities are adopted to survive in a dynamic environment. The WEAs are composed of a mix of soft and hard bottom environments as defined by the dominant sediment grain size and composition (Continental Margin Mapping Program [Department of the Interior, 2020]; usSEABED (USGS, 2020)).

The benthic environment of the RI-MA WEA is dominated by sandy sediments that ranged from very fine to medium sand; very fine sands tend to be more prevalent in deeper, lower energy areas (*i.e.,* the southern portion of the MA WEA), whereas coarser sediments, including gravels (*e.g.,* patchy cobbles and boulders) were found in shallower areas (Bay State Wind, 2019; Deepwater Wind South Fork, LLC, 2019; DWW Rev I, LLC, 2020; Stokesbury, 2014; LaFrance *et al.,* 2010; McMaster, 1960; Popper *et al.,* 2014). The species that inhabit the benthic habitats of the OCS are typically described as infaunal species, those living in the sediments (*e.g.,* polychaetes, amphipods, mollusks), and epifaunal species, those living on the seafloor surface (mobile, *e.g.,* sea starts, sand dollars, sand shrimp) or attached to substrates (sessile, *e.g.,* barnacles, anemones, tunicates). Further detail on the benthic habitats found in the project area, including the results of site-specific benthic habitat assessments, can be found within Construction and Operations Plan (COP) Volume II–A, Section 5—Results Of Biological Surveys and COP Volume II–A Appendices—Appendix II–H 2016–2020 Benthic Reports.

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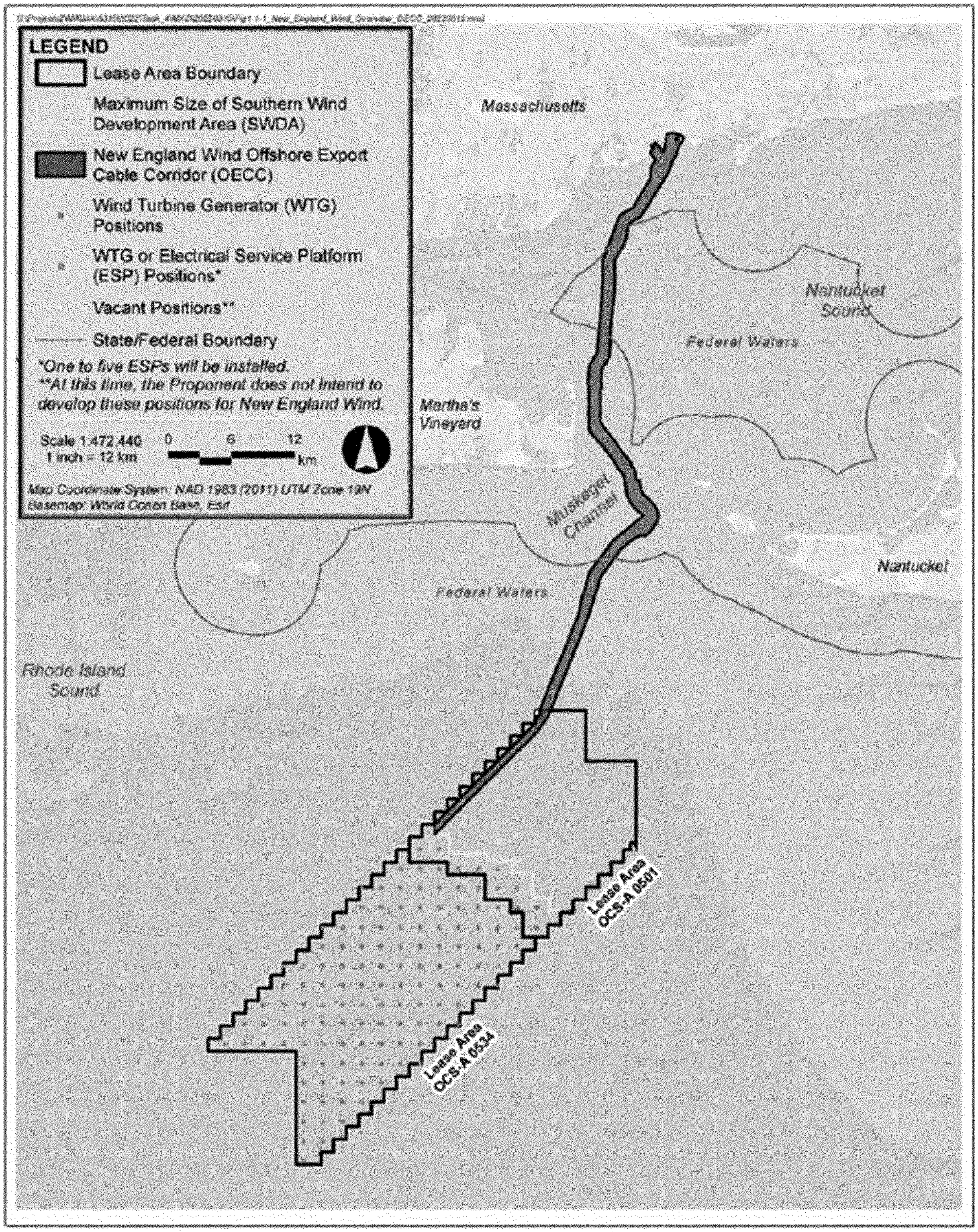

Figure 1– Project Location

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Detailed Description of Specific Activities

Below, we provide detailed descriptions of Park City Wind's activities, explicitly noting those that are anticipated to result in the take of marine mammals and for which incidental take authorization is requested. Additionally, a brief explanation is provided for those activities that are not expected to result in the take of marine mammals.

WTG and ESP Foundation Installation

Park City Wind proposes to install a maximum of 130 wind turbine generator (WTG) and electrical service platform (ESP) positions. Two positions may potentially have co-located ESPs (*i.e.,* 1

WTG and 1 ESP foundation installed at 1 grid position), resulting in 132 foundations. The WTGs would have a maximum tip height of 357 m (1,171 ft) and a maximum penetration depth of 85 m (279 ft). Each turbine would be spaced 1 nautical mile (nmi) apart in fixed east-to-west rows and north-to-south columns to create the 1 nmi by 1 nmi grid arrangement. Park City Wind anticipates that the initial WTGs (41–62 WTGs) would become operational in 2027 after installation is completed and all necessary components, such as array cables, ESPs, export cable routes, and onshore substations. Park City Wind expects that all remaining turbines will be operational by 2028. No more than one foundation will be installed at a time (*i.e.,* concurrent/simultaneous pile driving of foundations would not occur).

Phase 1 will include 41 to 62 WTGs and 1 or 2 ESPs for a total of 42 to 64 foundations. The total number of foundations in Phase 2 depends upon the final footprint of Phase 1. Phase 2 is expected to contain 64 to 88 WTG/ESP foundations (up to 3 of those positions will be occupied by ESPs). While only 132 foundations would be permanently installed, Park City Wind has accounted for up to 133 pile driving events in its take request to account for the instance wherein foundation installation began but is unable to be completed due to environmental or engineering constraints and the pile is re-driven at another position.

Phase 1 foundation types would be monopiles or jackets while Phase 2 foundation types include monopiles, jackets, or bottom-frame foundations. Jacket foundations require the installation of three to four jacket securing piles, known as pin piles. The bottom-frame foundation is similar to a conventional jacket foundation, but generally has fewer, larger structural tubular members, has a triangular space frame, no small-diameter lattice cross-bracing, and a single central vertical tubular column. At each foot, the structure would be secured to the seafloor using driven piles similar to those used by piled jacket foundations or suction buckets. For purposes of this analysis, the use of suction buckets to secure bottom-frame foundations is not being considered further in this analysis as installation of bottom-frame foundations using suction buckets is not anticipated to result in noise levels that would cause harassment to marine mammals.

The applicant proposed two construction schedules, A and B. Construction schedule A assumes a single 2-year construction scenario. Overall, 89 monopile foundations and 2 jacket foundations (8 pin piles) would be installed in 2026 over 52 days and 18 monopile foundations and 24 jacket foundations (96 pin piles) would be installed in 2027 over 35 days for a total of 87 days of pile driving to install all 133 foundations. All days would include impact pile driving and a subset may include vibratory pile driving and drilling. No more than one foundation would be installed at a time (*i.e.,* concurrent/simultaneous installation of more than one foundation would not occur). Park City Wind anticipates that a maximum of two monopiles or one jacket (up to four pin piles) is expected to be installed per day.

Construction schedule B assumes that all construction would occur over a 3-year period (2026–2028). Overall, 55 monopile foundations and 3 jacket foundations (12 pin piles) would be installed in 2026 over 38 days, 53 jackets (212 piles) would be installed in 2027 over 53 days, and 22 jackets (88 pin piles) would be installed over 22 days in 2028. In total, 133 foundations would be installed over 113 days. Similar to Schedule A, all days would include impact pile driving and a subset may include vibratory pile driving and drilling. Please see Table 2 and 3 in Park City Wind's March 2023 Application Update Report. Table 2 provides a summary of Construction Schedule A and B.

TABLE 2—FOUNDATION INSTALLATION CONSTRUCTION SCHEDULES

[Days]

Foundation type	Schedule A			Schedule B			
	2026	2027	Total	2026	2027	2028	Total
Monopiles	89	18	107	55	0	0	55
Jackets	2	24	26	3	53	22	78
No. of Days	52	35	87	38	53	22	113

Monopiles would be up to 12 m (39.37 ft) or 13 m (42.7 ft) in diameter and could be installed in both Phases 1 and 2. Jacket foundations require up to four pin piles and each would have a maximum diameter of 4 m (13.1 ft) diameter (see Figures 3–6 in the ITA application). When accounting for pre-piling preparatory work and post-piling activities, installation of a single monopile or jacket pile will take approximately 6–13 hours. Park City Wind anticipates at least 1 hour between monopile installations and 30 minutes between jacket pin pile installations. Park City Wind anticipates that a maximum of two monopiles or one jacket (up to four pin piles) is expected to be installed per day. Pile driving activities could occur within the 8-month period of May through December.

A WTG monopile foundation typically consists of a single steel tubular section with several sections of rolled steel plate welded together and secured to the seabed. Secondary structures on each WTG monopile foundation will include a boat landing or alternative means of safe access, ladders, a crane, and other ancillary components. A typical monopile installation sequence begins with the monopiles transported directly to the project area for installation or to the construction staging port by an installation vessel or a feeding barge. At the foundation location, the main installation vessel upends the monopile in a vertical position in the pile gripper mounted on the side of the vessel. The hammer is then lifted on top of the pile and pile driving commences with a soft-start and proceeds to completion. Piles are driven until the target embedment depth is met (up to 50 m), then the pile hammer is removed and the monopile is released from the pile gripper. Once installation of the monopile is complete, the vessel moves to the next installation location.

Monopiles would be installed using a 5,000 kJ to 6,000 kJ hammer to a maximum penetration depth of 40 m (131 ft). Park City Wind estimates that a monopile could require up to 6,970 strikes at up to 30.0 blows per minute (bpm) to reach full penetration depth. It is expected that each monopile installation will last less than 6 hours, with most installations anticipated to last between 3–4 hours. Figures 3–6 in Park City Wind's ITA application provide a conceptual example of the WTG support structures (*i.e.,* towers and foundations). WTGs would be designed to withstand severe weather conditions anticipated at the SWDA (COP Appendix I–E). While major storms, winter nor'easters, and, to a lesser extent, hurricanes pass through the SWDA regularly, the Project's offshore facilities are designed to withstand such severe weather events (COP Volume I).

Jacket foundations may be used. Once delivered to the SWDA, the jacket will be lifted off the transport or installation vessel and lowered to the seabed with the correct orientation. The piles will be driven to the engineered depth, following the same process described above for monopiles. The WTG jacket piles are expected to be pre-piled (*i.e.,* the jacket structure will be set on pre-installed piles). Up to three ESP jackets are expected to be post-piled (*i.e.,* the jacket is placed on the seafloor and piles are subsequently driven through guides at the base of each leg). For the ESP post-piled jackets, piling would be initiated during daylight hours (no later than 1.5 hours prior to civil sunset) and need to continue until all piles are installed due to health and safety concerns.

Jacket foundations would be installed using a 3,500 kJ hammer energy pile driving for a 4-m pin pile to reach their maximum penetration depth of 50 m (164 ft). There are four pins per jacket foundation, Park City Wind estimates that each pin will take up to 9,805 hammer strikes at up 30.0 bpm to reach full penetration depth (Table 1 in the ITA application). Foundation installation would use a 20-minute soft-start to ensure that the monopile or jacket foundation pile remains vertical and to allow any motile marine life to leave the area before the pile driving intensity is increased. Jacket foundation installation times will vary, but will likely take up to 6 hours per pin pile, depending on whether the jacket is pre- or post-piled (Table 4 ITA application). The bottom-frame foundation (for Phase 2 only) is similar to the jacket foundation, with shorter piles and shallower penetration. The potential acoustic impact of the bottom-frame foundation installation is equivalent to or less than that predicted for the jacket foundation. As the design and installation methods for bottom-frame foundations would be equivalent to or less than jacket foundations, bottom-frame foundations are not carried forward in this document.

During construction of the Project, it may be necessary to start pile installation using a vibratory hammer rather than using an impact hammer, a technique known as vibratory setting of piles. The vibratory method is particularly useful when soft seabed sediments are not sufficiently stiff to support the weight of the pile during the initial installation, increasing the risk of 'pile run' where a pile sinks rapidly through seabed sediments. Piles which experience pile run can be difficult to recover and pose significant safety risks to the personnel and equipment on the construction vessel. The vibratory hammer mitigates this risk by forming a hard connection to the pile using hydraulic clamps, thereby acting as a lifting/handling tool as well as a vibratory hammer. The tool is inserted into the pile on the construction vessel deck, and the connection made. The pile is then lifted, upended and lowered into position on the seabed using the vessel crane. After the pile is lowered into position, vibratory pile installation will commence. Vibratory pile installation is a technique where piles are driven into soil using a longitudinal vibration motion. The vibratory hammer installation method can continue until the pile is inserted to a depth that is sufficient to fully support the structure, and then the impact hammer can be positioned and operated to complete the pile installation. Of the 132 WTG/ESPs, Park City Wind estimates approximately 70 total foundations (53 percent) may require vibratory hammering before impact hammering. Table 7 and 8 in Park City Wind's application provides a breakdown of the number of potential days of pile installation, by activity, per month under the maximum design scenario for Schedules A and B, respectively.

Construction schedule A anticipates 20 days of vibratory hammering in 2026 and 25 days in 2027 (total 45 days) (Table 2). Construction schedule B anticipates 20 days of vibratory hammering in 2026, 25 days in 2027, and 9 days in 2028 (total 54 days) (Table 2). Comparisons of vibratory pile installation versus impulsive hammer pile installation indicate that vibratory pile installation typically produces lower amplitude sounds in the marine environment than impact hammer installation (Rausche and Beim 2012). The average expected duration of vibratory setting is approximately 30 minutes per pile for the Project. Due to the small size of the permanent threshold shift (PTS) ranges and the mitigation that will be applied during construction, no Level A harassment is expected. More information on vibratory pile setting is in Section 1.2.2 of the ITA application.

Drilling is a contingency measure that may be required to remove soil and/or boulders from inside the pile in cases of pile refusal during installation. A pile refusal can occur if the total frictional resistance of the soil becomes too much for the structural integrity of the pile and the capability of the impact hammer. Continuing to drive in a refused condition can lead to overstress in the pile and potential to buckle (tear) the pile material. The use of an offshore drill can reduce the frictional resistance by removing the material from inside the pile and allowing the continuation of safe pile driving. An offshore drill is an equipment piece consisting of a motor and bottom hole assembly (BHA). The drill is placed on top of the refused pile using the construction vessel crane, and the BHA is lowered down to the soil inside the pile. On the bottom face of the BHA is a traditional ''drill bit,'' which slowly rotates (at 4 or 5 revolutions per minute or approximately 0.4 m per hour) and begins to disturb the material inside the pile. As the disturbed material mixes with seawater which is pumped into the pile, it begins to liquefy. The liquefied material is pumped out to a pre-designated location, leaving only muddy seawater inside the pile instead of a solid ''soil plug,'' and largely reducing the frictional resistance generated by the material inside the pile. When enough material has been removed from inside the pile and the resistance has reduced sufficiently, the drill is then lifted off the pile and recovered to the vessel. The impact hammer is then docked onto the pile and impact pile driving commences. It may be necessary to remove and replace the drill several times in the driving process to achieve sufficiently low frictional resistance to achieve the design penetration through impact pile driving. Of the 132 WTG/ESPs, Park City Wind estimates 48 foundations (36 percent) may require drilling to remove soil and/or boulders from inside the pile that would otherwise affect the capability of the impact hammer. Construction schedule A anticipates 33 days of drilling in 2026 and 15 days in 2027 (total 48 days) (Table 2). Construction schedule B anticipates 20 days of drilling in 2026, 19 days in 2027, and 9 days in 2028 (total 48 days) (Tables 2).

While pre-piling preparatory work and post-piling activities could be ongoing at one foundation position as pile driving is occurring at another position, there is no concurrent/

simultaneous pile driving of foundations planned (see *Dates and Duration* section). Impact pile driving associated with foundation installation would be limited to the months of May through December and is currently scheduled to be conducted during 2026–2028 (depending which construction schedule is done, A or B). Installation of foundations is anticipated to result in the take of marine mammals due to noise generated during pile driving.

Park City Wind has proposed to conduct pile driving 24 hours per day. Once construction begins, Park City Wind would proceed as rapidly as possible, while meeting all required mitigation and monitoring measures, to reduce the total duration of construction. NMFS acknowledges the benefits of completing construction quickly during times when North Atlantic right whales are unlikely to be in the area but also recognizes challenges associated with monitoring during reduced visibility conditions such as night. Should Park City Wind submit a NMFS-approved Alternative Monitoring Plan, pile driving may be initiated at night. NMFS intends to condition the final rule, if issued, identifying if initiating pile driving at night may occur.

Installation of the WTG and ESP foundations is anticipated to result in the take of marine mammals due to noise generated during pile driving and drilling.

HRG Surveys

High-resolution geophysical site characterization surveys would occur annually throughout the 5 years the rule and LOA would be effective with duration dependent on the activities occurring in that year (*i.e.,* construction versus non-construction year). HRG surveys would utilize up to a maximum of three vessels working concurrently in different sections of the Lease Area and OECC corridor. Park City Wind estimates that no more than 3 years will have HRG surveys and each year would have at least 6,000 km surveyed. In total, no more than 18,000 km may be surveyed across the 5-years with a total of no more than 225 vessel days within the Lease Area and along the OECC corridor in water depths ranging from 1 m (3.6 ft) to 61.9 m (203 ft). Each day that a survey vessel covers 80 km (50 miles) of survey trackline is considered vessel day. For example, three vessels operating concurrently on the same calendar day, covering 80 km each, would be 3 vessel days.

HRG surveys would be conducted to identify any seabed debris and to support micrositing of the WTG and ESP foundations and cable routes. Geophysical survey instruments may include side scan sonar, synthetic aperture sonar, single and multibeam echosounders, sub-bottom profilers (SBP), and magnetometers/gradiometers, some of which are expected to result in the take of marine mammals (LOA Section 1.2.5.). Equipment may be mounted to the survey vessel or the Project may use autonomous surface vehicles (SFV) to carry out this work. Surveys would occur annually, with durations dependent on the activities occurring in that year (*i.e.,* construction years versus operational years).

As summarized previously, HRG surveys will be conducted using up to three vessels concurrently. Up to 80 km of survey lines will be surveyed per vessel each survey day at approximately 7.4 km/hour (4 knots) on a 24-hour basis. HRG surveys are anticipated to operate at any time of year for 25 days per year, a maximum of 125 days for the maximum of the 3 planned years covered under the 5-years of the LOA. Of the HRG equipment types proposed for use, the following sources have the potential to result in take of marine mammals:

- Medium penetration SBPs (boomers) to map deeper subsurface stratigraphy as needed. A boomer is a broad-band sound source operating in the 0.2 kHz to 15 kHz frequency range. This system is typically mounted on a sled and towed behind the vessel.
- Medium penetration SBPs (sparkers) to map deeper subsurface stratigraphy as needed. A sparker creates acoustic pulses from 0.05 kHz to 3 kHz omni-directionally from the source that can penetrate several hundred meters into the seafloor. These are typically towed behind the vessel with adjacent hydrophone arrays to receive the return signals.

Table 3 identifies all the representative survey equipment that operate below 180 kilohertz (kHz) (*i.e.,* at frequencies that are audible and have the potential to disturb marine mammals) that may be used in support of planned geophysical survey activities and are likely to be detected by marine mammals given the source level, frequency, and beamwidth of the equipment. Equipment with operating frequencies above 180 kHz and equipment that does not have an acoustic output (*e.g.,* magnetometers) may also be used but are not discussed further because they are outside the general hearing range of marine mammals likely to occur in the project area. In addition, due to the characteristics of non-impulsive sources (*i.e.,* Ultra-Short BaseLine (USBL), Innomar, and other parametric sub-bottom profilers), take is not anticipated due to operating characteristics like very narrow beam width which limit acoustic propagation. Therefore, no Level A harassment or B harassment can be reasonably expected from the operation of these sources. The sources that have the potential to result in harassment to marine mammals include boomers and sparkers (Table 3).

TABLE 3—SUMMARY OF REPRESENTATIVE HRG SURVEY EQUIPMENT

Equipment type	Name	Representative model	Operating frequency (kHz)	Source level (dB re 1 μPa m)	Peak source level 0-pk (dB re 1 μPa m)	Pulse duration (ms)	Repetition rate (Hz)	Beamwidth (degrees)	Information source
Boomer	Applied Acoustics AA251.	Applied Acoustics AA251 [a].	0.2–15	205	212	0.8	[e] 2	180	CF
Sparker	GeoMarine Geo Spark 2000 (400 tip).	SIG ELC 820 Sparker [b].	[c] 0.05–3	203	213	3.4	[e] 1	[d] 180	CF

[a] Frequency estimated from Figures 14 and 16 in Crocker and Fratantonio (2016). Source levels, beam width, and pulse duration from Table 5 in Crocker and Fratantonio (2016) at 300 J.
[b] SIG ELC 820 has similar operation settings as Geo Spark 2000 (Sect. I.5.1). See Table 9 in Crocker and Fratantonio (2016) source for levels at 5 m source depth, 750 J setting.
[c] Frequency source specifications provided by Vineyard Wind.
[d] Assumes omnidirectional source.
[e] Vineyard Wind indicates they will use this repetition rate.

UXO/MEC Detonations

Park City Wind anticipates encountering UXO/MECs during Project construction. UXO/MECs include explosive munitions (such as bombs, shells, mines, torpedoes, *etc.*) that did not explode when they were originally deployed or were intentionally discarded in offshore munitions dump sites to avoid land-based detonations. The risk of incidental detonation associated with conducting seabed-altering activities, such as cable laying and foundation installation, in proximity to UXO/MECs jeopardizes the health and safety of project participants.

For UXO/MECs that are positively identified in proximity to planned activities on the seabed, several alternative strategies will be considered prior to in-situ UXO/MEC disposal. These may include: (1) relocating the activity away from the UXO/MEC (avoidance), (2) physical UXO/MEC removal (lift and shift), (3) alternative combustive removal technique (low order disposal), (4) cutting the UXO/MEC open to apportion large ammunition or deactivate fused munitions (cut and capture), or (5) using shaped charges to ignite the explosive materials and allow them to burn at a slow rate rather than detonate instantaneously (deflagration). Only after these alternatives are considered and found infeasible would *in-situ* high-order UXO/MEC detonation be pursued. If detonation is necessary, detonation noise could result in the take of marine mammals by Level A harassment and Level B harassment.

Park City wind anticipates that up to 10 UXO/MECs may require disposal through high-order detonation and that these detonations would occur in 2025 and 2026. To better assess the likelihood of encountering UXO/MECs during project construction, Park City Wind is conducting HRG surveys to identify potential UXO/MECs that have not been previously mapped. As these surveys and analysis of data from them are still underway, the exact number and type of UXO/MECs in the project area are not yet known. However, Park City Wind assumes that up to 10 UXO/MECs charges, of up to 454-kg (1,000 pounds; lbs), which is the largest charge that is reasonably expected to be encountered (See Estimated Take of Marine Mammals for detailed description of UXO/MEC charge weights), may require *in-situ* detonation. Although it is highly unlikely that all charges would weigh 454 kg, this approach was determined to be the most conservative for the purposes of impact analysis. If necessary, these detonations would occur on up to 10 different days (*i.e.,* only one detonation would occur per day). Park City Wind anticipates up to six detonations could occur in 2025 and four in 2026. All detonations would occur during daylight hours only and would not occur from December 1 through May 31, annually; however, NMFS may approve detonating UXO/MECs on a case-by-case basis in December and May.

NMFS concurs with Park City Wind that Levels A and Level B harassment are possible for UXO/MEC detonation activities. Auditory injury or behavioral harassment may result from exposure to the sounds produced by UXO/MEC detonation; no non-auditory injury is anticipated.

Cable Laying and Installation

Up to five offshore export cables will transmit electricity generated by the WTGs to onshore transmission systems in the Town of Barnstable, Massachusetts. Underground onshore export cables, located primarily within existing roadway layouts, will connect the landfall site(s) to one or two new onshore substations in the Town of Barnstable, Massachusetts. Grid interconnection cables will then connect the Phase 1 onshore substation to the ISO New England (ISO–NE) electric grid at Eversource's existing 345 kilovolt substation in West Barnstable. Park City Wind intends to install all Phase 2 offshore export cables within the same OECC as the Phase 1 cables but will use separate landfall sites than Phase 1 in Barnstable. The offshore export cables will likely be transported directly to the Offshore Development Area in a cable laying vessel, on an ocean-going barge, or on a heavy transport vessel (which may also transport the cable laying vessel overseas) and installed by the cable laying vessel upon arrival. Vessel types under consideration for cable installation activities are presented in the COP Volume 1 Table 4.3–1.

Cable burial operations will occur both in the SWDA for the inter-array cables connecting the WTGs to the ESPs and in the Offshore Export Cable Corridor (OECC) for the cables carrying power from the ESPs to the landfall sites. Construction of the OECC and the inter-array cable installation would take place in 2026 through 2028 (Table 2). The target depth for cable burial is 1.5 m to 2.5 m (5–8 ft). Therefore, the seafloor in the direct path of the inter-array, inter-link, and offshore export cables within the SWDA will be disturbed from the surface to a depth of 1.5 to 2.5 m (5–8 ft). Where sufficient cable burial depths cannot be achieved, cable protection would be used. Cable laying, cable installation, and cable burial activities planned to occur during the construction of the project may include the following: jetting (*e.g.,* jet plow or jet trenching); vertical injection; leveling; mechanical cutting; plowing (with or without jet-assistance); pre-trenching; boulder removal; and controlled flow excavation. During construction related activities, including cable laying and construction material delivery, dynamic positioning (DP) thrusters may be used to maneuver and maintain station. No blasting is proposed for cable installation.

Bottom habitat may also be permanently altered to hard bottom substrate through the installation of cable protection (as described in Sections 3.2.1.5.4 and 4.2.1.5.4 of BOEM COP Volume I). Potential cable protection methods include: rock placement on top of the cables (6.4 cm in diameter or larger); Gabion rock bags on top of the cables; concrete mattresses; or half-shell pipes or similar (only for cable crossings or where the cable is laid on the seafloor). Cable protection will be up to 9 m (30 ft) wide. The offshore export cables will likely be transported directly to the Offshore Development Area in a cable laying vessel, on an ocean-going barge, or on a heavy transport vessel (which may also transport the cable laying vessel overseas) and installed by the cable laying vessel upon arrival. Phase 1 will consist of two offshore export cables with a maximum total length of ~202 km (~109 nmi). Phase 2 will consist of two or three offshore export cables with a maximum total length (assuming three cables) of 356 km (~192 nmi). The ends of the offshore export cables will likely be protected using protection conduits put in place at the approach to the ESP foundation(s). Installation of an offshore export cable is anticipated to last approximately 9 months for Phase 1 and approximately 13.5 months for Phase 2. Cable installation for each Phase may be continuous and take up to 2 years. The estimated installation time frame for the inter-array cables is over a period of approximately 4–5 months for Phase 1 and 9 months for Phase 2.

The ends of the offshore export cables will likely be protected using protection conduits put in place at the approach to the ESP foundation(s) (see COP Volume I Figure 3.2–8). This cable entry protection system consists of different components of composite material and/or cast-iron half-shells with suitable corrosion protection, which protect the cables from fatigue and mechanical loads as they transition above the seabed and enter the foundation.

Although a large majority of the cable entry protection system will likely lie on top of the monopile scour protection (if used), it will likely extend a short distance beyond the edge of the scour protection. Additional cable protection may be placed on top of the cable entry protection system (within the footprint of the scour protection) to secure the cable entry protection system in place and limit movement of the cable, which can damage the cable (for specific details see COP Volume I section 3.2.1.5.4).

For Phases 1 and 2, 66 to 132 kilovolt (kV) inter-array cables will connect ''strings'' of WTGs to an ESP. The maximum anticipated total length of the Phase 1 inter-array cables is approximately 225 km (121 nmi) and the maximum anticipated total length of the inter-link cable is approximately 20 km (11 nmi). The maximum anticipated total length of the Phase 2 inter-array cables is approximately 325 km (175 nmi) and the maximum anticipated total length of the inter-link cable is approximately ~60 km (~32 nmi). The target burial depth of the offshore export cables will be at least 1.5–2.5 m (5–8 ft) along their entire length. Like the offshore export cables, all inter-array cables and inter-link cables will likely be protected with cable entry protection systems at the approach to the WTG and ESP foundations.

Some dredging of the upper portions of sand waves may be required prior to cable laying to achieve sufficient burial depth below the stable sea bottom; large boulders may also need to be relocated. Dredging may be used to remove the upper portions of sand waves within the OECC and will be limited only to the extent required to achieve adequate cable burial depth during cable installation. Dredging could be accomplished by a trailing suction hopper dredge (TSHD) or controlled flow excavation.

The amount of habitat disturbance from the use of jack-up and/or anchored vessels, cable installation, and metocean buoy anchors would be approximately 4.08 km^2 (1.58 miles^2). The total area of alteration within the SWDA due to foundation and scour protection installation, jack-up and/or anchored vessel use, inter-array and inter-link cable installation, potential cable protection (if required), and metocean buoy anchors is 5.19 km^2, (2.00 miles^2) which is 1.1 percent of the maximum size of the SWDA. Metocean buoys are small buoys that collect various ocean data. As the noise levels generated from cable laying and installation work are low, the potential for take of marine mammals to result is discountable. Park City Wind is not requesting, and NMFS is not proposing to authorize, take associated with cable laying activities. Therefore, cable laying activities are not analyzed further in this document.

Site Preparation

Seabed preparation may be required prior to foundation installation, scour protection installation, or cable-laying (see Section 3.3.1.2 and 4.3.1.2 of the COP Volume I). This could include the removal of large obstructions and/or leveling of the seabed. Large boulders along the route may need to be relocated prior to cable installation. Some dredging of the upper portions of sand waves may also be required prior to cable laying to achieve sufficient burial depth below the stable sea bottom. However, depending on bottom conditions, water depth, and contractor preferences, other specialty techniques may be used in certain areas to ensure sufficient burial depth. For monopile and jacket pile installation, seafloor preparation will include required boulder clearance and removal of any obstructions within the seafloor preparation area at each foundation location. Scour protection installation will occur pre- or post-installation and will involve a rock dumping vessel placing scour using fall-pipes, side dumping, and/or placement using a crane/bucket at each foundation location (more details can be found in Park City Wind's COP Volume 1 Section 3.3.1.2).

For Phases 1 and 2, a pre-lay grapnel run and pre-lay survey are expected to be performed to clear obstructions, such as abandoned fishing gear and other marine debris, and inspect the route prior to cable laying. A specialized vessel will tow a grapnel rig that hooks and recovers obstructions, such as fishing gear, ropes, and wires from the seafloor. Boulder clearance may be required in targeted locations to clear boulders along the OECC, inter-array cable (IAC) routes, and/or foundations prior to installation.

Boulder removal would occur prior to installation and would be completed by a support vessel based. It is currently anticipated that boulders larger than approximately 0.2–0.3 m (0.7–1 ft) will be avoided or relocated outside of the final installation corridor to create an installation corridor wide enough to allow the installation tool to proceed unobstructed along the seafloor. If there are boulders along the final route that cannot be moved, a reasonable buffer of up to 5 m (16 ft) could be utilized. Further details on boulder relocation can be found in COP Volume 1 Section 3.3.1.3.2.

Dredging would also occur and be limited to the extent required to achieve adequate cable burial depth during cable installation. Where dredging is necessary, Park City Wind conservatively assumed that the dredge corridor would typically be 15 m (50 ft) wide at the bottom (to allow for equipment maneuverability) with approximately 1:3 sideslopes for each cable. However, the depth of dredging will vary with the height of sand waves and the dimensions of the sideslopes will likewise vary with the depth of dredging and sediment conditions. This dredge corridor includes up to 1 m (3.3 ft) wide cable installation trench and up to 3 m (10 ft) wide temporary disturbance zone from the tracks or skids of the cable installation equipment. The average dredge depth is approximately 0.5 m (1.6 ft) and may range up to 5.25 m (17 ft) in localized areas. The total vertical disturbance within sand waves is up to 8 m (26 ft), which includes dredging and cable installation.

Two installation methods may be used to complete sand leveling including Trailing Suction Hopper Dredging (TSHD) and controlled flow excavation (CFE). A TSHD can be used in sand waves of most sizes, whereas the controlled flow excavation technique is most likely to be used in areas where sand waves are less than 2 m (6.6 ft) high. A TSHD vessel contains one or more drag arms that extend from the vessel, rest on the seafloor, and suction up sediments. Any sediment removed would be deposited in the dredged material within the OECC. Bottom dumping of dredged material would only occur within sand waves. CFE is a contactless dredging tool, providing a method of clearing loose sediment below submarine cables, enabling burial. The CFE tool draws in seawater from the sides and then jets this water out from a vertical down pipe at a specified pressure and volume, which is then positioned over the cable alignment, enabling the stream of water to fluidize the sands around the cable. This allows the cable to settle into the trench under its own weight. Further details on dredging and sand level can be found in COP Volume I 3.3.1.3.5.

NMFS does not expect site preparation work, including boulder removal and sand leveling (*i.e.,* dredging), to generate noise levels that would cause take of marine mammals. Underwater noise associated with these activities is expected to be similar in nature to the sound produced by the dynamic positioning (DP) cable lay vessels used during cable installation activities within the project. Sound produced by DP vessels is considered non-impulsive and is typically more dominant than mechanical or hydraulic noises produced from the cable trenching or boulder removal vessels and equipment. Therefore, noise produced by those vessels would be comparable to or less than the noise produced by DP vessels, so impacts are also expected to be similar. Additionally, boulder clearance is a discreet action occurring over a short duration resulting in short term direct effects and sound produced by boulder clearance equipment would be preceded by, and associated with, sound from ongoing vessel noise and would be similar in nature.

NMFS expects that marine mammals would not be exposed to sounds levels or durations from seafloor preparation work that would disrupt behavioral patterns. Therefore, the potential for take of marine mammals to result from these activities is discountable and Park Wind did not request, and NMFS does not propose to authorize, any Level A harassment or Level B harassment takes associated with seafloor preparation work and these activities are not analyzed further in this document.

Vessel Operation

Park City Wind will utilize various types of vessels over the course of the 5-year proposed regulations. Park City Wind has identified several existing port facilities located in Massachusetts, Rhode Island, Connecticut, New York, and/or New Jersey to support offshore construction, assembly and fabrication, crew transfer and logistics, and other operational activities. In addition, some components, materials, and vessels could come from Canadian and European ports. A variety of vessels would be used throughout the construction activities. These range from crew transportation vessels, tugboats, jack-up vessels, cargo ships, and various support vessels (Table 4). Details on the vessels, related work, operational speeds, and general trip behavior can be found in Table 2 of the ITA application and Table 3.3–1 in the COP Volume 1. In addition to vessels, helicopters may be used for crew transfer and fast response visual inspections and repair activities during both construction and operations. It is not possible at this stage of the project to quantify the expected use of helicopters and any potential reduction in the number of vessel trips.

As part of various vessel-based construction activities, including cable laying and construction material delivery, dynamic positioning thrusters may be utilized to hold vessels in position or move slowly. Sound produced through use of dynamic positioning thrusters is similar to that produced by transiting vessels, and dynamic positioning thrusters are typically operated either in a similarly predictable manner or used for short durations around stationary activities. Sound produced by dynamic positioning thrusters would be preceded by, and associated with, sound from ongoing vessel noise and would be similar in nature; thus, any marine mammals in the vicinity of the activity would be aware of the vessel's presence. Construction-related vessel activity, including the use of dynamic positioning thrusters, is not expected to result in take of marine mammals. Park City Wind did not request, and NMFS does not propose to authorize, any take associated with vessel activity.

During construction and operation, crew transfer vessels (CTVs) and a service operation vessel (SOV) will be used to conduct maintenance activities. Although less likely, if an SOV is not used, several CTVs and helicopters would be used to frequently transport crew to and from the offshore facilities. Park City Wind has also included potential for helicopters to be used when rough weather limits or precludes the use of CTVs and during fast response visual inspections and repair activities during both construction and operations (COP Volume 1 Sections 3.3.1.12.1 and 4.3.1.12.1). The total vessels expected for use during the Project are in Table 4; more details can be found in Table 2 of the ITA application.

Assuming the maximum design scenario for each Phase individually, ~3,200 total vessel round trips (an average of approximately six round trips per day) are expected to occur during offshore construction of Phase 1 and ~3,800 total vessel round trips (an average of approximately seven round trips per day) are expected to occur during offshore construction of Phase 2 (For the purposes of estimating vessel trips, tugboats and barges are considered one vessel). Due to the range of buildout scenarios for Phases 1 and 2, Park City Wind expects the total number of vessel trips from both Phases of New England Wind combined to be less than the sum of vessel trips estimated for each Phase independently (section 1.1.2 ITA application). Park City Wind estimates that, between the 5 major port areas they intend to use, they expect an average of 15 round trips per day and 443 round trips per month during peak construction (Table 1 ITA application). Throughout the entire construction period, they expect an average of 8 round trips per day and 215 round trips per month (Table 1 ITA application).

TABLE 4—TYPE AND NUMBER OF VESSELS ANTICIPATED DURING CONSTRUCTION AND OPERATIONS

Project period	Vessel types	Max number of vessels
All Foundation Installation	Transport, Installation, and Support	20
All Foundation Installation	Crew Transfer	3
All Foundation Installation	Environmental Monitoring and Mitigation	8
WTG Installation	Transport, Installation, and Support	21
WTG Installation	Crew Transfer Vessel	3
Inter-array Cable Installation	Transport, Installation, and Support	7
Inter-array Cable Installation	Crew Transfer Vessel	2
ESP Installation	Transport, Installation, and Support	9
ESP Installation	Crew Transfer Vessel	1
Offshore Export Cable Installation	Transport, Installation, and Support	13
Offshore Export Cable Installation	Crew Transfer Vessel	1
All Other Construction Activities	Crew Transfer Vessel	4
All Other Construction Activities	Transport, Survey, and Support	4

NMFS is proposing to require extensive vessel strike avoidance measures that would avoid vessel strikes from occurring (see Proposed Mitigation section). Park City Wind has not requested, and NMFS is not proposing to authorize, take from vessel strikes.

Fisheries and Benthic Monitoring

Fisheries and benthic monitoring surveys are being designed for the project in accordance with recommendations set forth in ''Guidelines for Providing Information on Fisheries for Renewable Energy Development on the Atlantic Outer Continental Shelf'' (BOEM, 2019). Park City Wind would conduct trawl net sampling, video surveillance (drop camera), plankton (Neuston) net, ventless trap, and tagging surveys. Specifically, Park City Wind would conduct seasonal trawl surveys following the Northeast Area Monitoring and Assessment Program (NEAMAP) survey protocol to sample fish and invertebrates in the SWDA and control area. The surveys would be comprised of 200 tows per year conducted for 20 minutes at vessel speed of 3.0 knots. The ventless trap surveys would follow Massachusetts and Rhode Island Division of Marine Fisheries protocol to sample lobster, black sea bass, and Jonah crab. Surveys would be conducted twice per month from May to December in 30 stations across the SWDA and control areas with 6 lobster traps and 1 fish pot at each station. Because the drop camera, tagging efforts, and Neuston nets do not have components with which marine mammals are likely to interact (*i.e.,* become entangled in or hooked by), these activities are not anticipated to result in take of marine mammals and will not be discussed further. Only trap and trawl surveys have the potential to result in harassment to marine mammals. However, Park City Wind would implement mitigation and monitoring measures to avoid taking marine mammals, including, but not limited to, monitoring for marine mammals before and during trawling activities, not deploying or pulling trawl gear in certain circumstances, limiting tow times, and fully repairing nets. A full description of mitigation measures can be found in the Proposed Mitigation section.

With the implementation of these measures, Park City Wind does not anticipate, and NMFS is not proposing to authorize, take of marine mammals incidental to research trap and trawl surveys. Given no take is anticipated from these surveys, impacts from fishery surveys will not be discussed further in this document (with the exception of the description of measures in the Proposed Mitigation section).

Description of Marine Mammals in the Area of Specified Activities

Thirty-eight marine mammal species under NMFS' jurisdiction have geographic ranges within the western North Atlantic OCS (Hayes *et al.,* 2022). Park City Wind requested take of all 38 species (comprising 38 stocks) of marine mammals. The majority of takes are requested for only 17 species; the remaining 22 stocks are considered rare in the project area and Park City Wind is requested a limited amount of take for those species (*e.g.,* one group size). Sections 3 and 4 of Park City Wind's ITA application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history of the potentially affected species. NMFS fully considered all of this information, and we refer the reader to these descriptions in the application instead of reprinting the information. Additional information regarding population trends and threats may be found in NMFS's Stock Assessment Reports (SARs), *https://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's website (*https://www.fisheries.noaa.gov/find-species*).

Table 5 lists all species and stocks for which take is expected and proposed to be authorized for this action and summarizes information related to the population or stock, including regulatory status under the MMPA and Endangered Species Act (ESA) and potential biological removal (PBR) level, where known. The MMPA defines PBR 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'' (16 U.S.C. 1362(20)). PBR values are identified in NMFS's SARs. While no mortality is anticipated or proposed to be authorized, 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 survey area. NMFS's stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some stocks, this geographic area may extend beyond U.S. waters. All managed stocks in this region are assessed in NMFS's U.S. Atlantic and Gulf of Mexico SARs. All values presented in Table 5 are the most recent available at the time of publication and, unless noted otherwise, use NMFS' 2022 SARs (Hayes *et al.,* 2023) available online at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports.*

TABLE 5—MARINE MAMMAL SPECIES THAT MAY OCCUR IN THE PROJECT AREA AND BE TAKEN, BY HARASSMENT

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	PBR	Annual mortalities or serious injuries (M/SI) [3]
Order Artiodactyla—Cetacea—Superfamily Mysticeti (baleen whales)						
Family Balaenidae:						
North Atlantic right whale	*Eubalaena glacialis*	Western Atlantic	E,D,Y	338 (0; 332; 2020)	0.7	8.1
Family Balaenopteridae (rorquals):						
Blue whale	*Balaenoptera musculus*	Western North Atlantic	E,D,Y	UNK (UNK, 402, 2019)	0.8	0
Fin whale	*Balaenoptera physalus*	Western North Atlantic	E,D,Y	6,802 (0.24; 5,573; 2016)	11	1.8
Humpback whale	*Megaptera novaeangliae*	Gulf of Maine	-,-,Y	1,396 (0; 1,380; 2016)	22	12.15
Minke whale	*Balaenoptera acutorostrata.*	Canadian Eastern Coastal	-,-,N	21,968 (0.31; 17,002; 2016).	170	10.6
Sei whale	*Balaenoptera borealis*	Nova Scotia	E,D,Y	6,292 (1.02; 3,098; 2016)	6.2	0.8

TABLE 5—MARINE MAMMAL SPECIES THAT MAY OCCUR IN THE PROJECT AREA AND BE TAKEN, BY HARASSMENT—Continued

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	PBR	Annual mortalities or serious injuries (M/SI) [3]
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Physeteridae:						
Sperm whale	*Physeter macrocephalus*	North Atlantic	E,D,Y	4,349 (0.28; 3,451; 2016)	3.9	0
Family Kogiidae:						
Dwarf sperm whale [4]	*Kogia sima*	Western North Atlantic	-,-,N	7,750 (0.38; 5,689; 2016)	46	0
Pygmy sperm whale [4]	*Kogia breviceps*	Western North Atlantic	-,-,N	7,750 (0.38; 5,689; 2016)	46	0
Family Ziphiidae:						
Cuvier's beaked whale	*Ziphius cavirostris*	Western North Atlantic	-,-,N	5,744 (0.36, 4,282, 2016)	43	0.2
Blainville's beaked whale	*Mesoplodon densirostris*	Western North Atlantic	-,-,N	10,107 (0.27, 8,085, 2016).	81	[5] 0.2
Gervais' beaked whale	*Mesoplodon europaeus*	Western North Atlantic	-,-,N	5,744 (0.36, 4,282, 2016)	81	[5] 0
Sowerby's beaked whale	*Mesoplodon bidens*	Western North Atlantic	-,-,N	10,107 (0.27, 8,085, 2016).	81	[5] 0
True's beaked whale	*Mesoplodon mirus*	Western North Atlantic	-,-,N	10,107 (0.27, 8,085, 2016).	81	[5] 0
Northern bottlenose whale	*Hyperoodon ampullatus*	Western North Atlantic	-,-,N	UNK (UNK, UNK, 2016)	UNK	0
Family Delphinidae:						
Atlantic spotted dolphin	*Stenella frontalis*	Western North Atlantic	-,-,N	39,921 (0.27; 32,032; 2016).	320	0
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Western North Atlantic	-,-,N	93,233 (0.71; 54,433; 2016).	544	27
Bottlenose dolphin	*Tursiops truncatus*	Western North Atlantic—Offshore.	-,-,N	62,851 (0.23; 51,914; 2016).	519	28
Clymene dolphin	*Stenella clymene*	Western North Atlantic	-,-,N	4,237 (1.03; 2,071; 2016)	21	0
Common dolphin	*Delphinus delphis*	Western North Atlantic	-,-,N	172,897 (0.21; 145,216; 2016).	1,452	390
Long-finned pilot whale	*Globicephala melas*	Western North Atlantic	-,-,N	39,215 (0.3; 30,627; 2016).	306	29
Short-finned pilot whale	*Globicephala macrorhynchus.*	Western North Atlantic	-,-,Y	28,924 (0.24, 23,637, See SAR).	236	136
Risso's dolphin	*Grampus griseus*	Western North Atlantic	-,-,N	35,215 (0.19; 30,051; 2016).	301	34
False killer whale	*Pseudorca crassidens*	Western North Atlantic	-,-,N	1,791 (0.56, 1,154, 2016)	12	0
Fraser's dolphin	*Lagenodelphis hosei*	Western North Atlantic	-,-,N	UNK (UNK, UNK, 2016)	UNK	0
Killer whale	*Orcinus orca*	Western North Atlantic	-,-,N	UNK (UNK, UNK, 2016)	UNK	0
Melon-headed whale	*Peponocephala electra*	Western North Atlantic	-,-,N	UNK (UNK, UNK, 2016)	UNK	0
Pantropical spotted dolphin	*Stenella attenuata*	Western North Atlantic	-,D,N	6,593 (0.52, 4,367, 2016)	44	0
Pygmy killer whale	*Feresa attenuata*	Gulf of Maine/Bay of Fundy	-,-,N	UNK (UNK, UNK, 2016)	UNK	0
Rough-toothed dolphin	*Steno bredanensis*	Western North Atlantic	-,-,N	136 (1.0, 67, 2016)	0.7	0
Spinner dolphin	*Stenella longirostris*	Western North Atlantic	-,D,N	4,102 (0.99, 2,045, 2016)	20	0
Striped dolphin	*Halichoerus grypus*	Western North Atlantic	-,-,N	67,036 (0.29; 52,939; 2016).	529	0
White-beaked dolphin	*Phoca vitulina*	Western North Atlantic	-,-,N	536,016 (0.31; 415,344; 2016).	4,153	0
Family Phocoenidae (porpoises):						
Harbor porpoise	*Phocoena phocoena*	Gulf of Maine/Bay of Fundy	-,-,N	95,543 (0.31; 74,034; 2016).	851	16
Order Carnivora—Superfamily Pinnipedia						
Family Phocidae (earless seals):						
Gray seal [6]	*Halichoerus grypus*	Western North Atlantic	-,-,N	27,300 (0.22; 22,785; 2016).	1,389	4,453
Harbor seal	*Phoca vitulina*	Western North Atlantic	-,-,N	61,336 (0.08; 57,637; 2018).	1,729	339
Harp seal	*Pagophilus groenlandicus*	Western North Atlantic	-,-,N	7.6M (UNK; 7.1M; 2019)	426,000	178,573
Hooded seal	*Cystophora cristata*	Western North Atlantic	-,-,N	UNK (UNK, UNK, N/A)	UNK	1,680

[1] 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 can be found online at *www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*. CV is the coefficient of variation; N_{min} is the minimum estimate of stock abundance. In some cases, CV is not applicable.

[3] These values, found in NMFS' SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.,* commercial fisheries, ship strike). (*https://marinemammalscience.org/science-and-publications/list-marine-mammal-species-subspecies/*; Committee on Taxonomy (2022)).

[4] Accounts for both *Kogia* species.

[5] Accounts for all *Mesoplodon* species.

[6] NMFS' stock abundance estimate (and associated PBR value) applies to the U.S. population only. Total stock abundance (including animals in Canada) is approximately 451,431. The annual M/SI value given is for the total stock.

In addition to the species listed in Table 5, the Florida manatees (*Trichechus manatus;* a sub-species of the West Indian manatee) has been previously documented as an occasional visitor to the Northeast region during summer months (U.S. Fish and Wildlife Service (USFWS), 2019). However, manatees are managed by the USFWS and are not considered further in this document.

Park City Wind also requested take for beluga whales (*Delphinapterus leucas*), however, beluga whales are so rare in the project area that there is no beluga whale stock designated along the U.S. Eastern Seaboard as it is a more northerly species. In 2014, a beluga whale was observed in Taunton River, Massachusetts, however, experts opined that this whale was far from its natural habitat (which include arctic and subarctic waters) (Swaintek, 2014). It is not anticipated that beluga whales would occur in the project area; therefore, beluga whales are not considered further in this document.

Between October 2011 and June 2015, a total of 76 aerial surveys were conducted throughout the MA and RI/MA WEAs (the Project is contained within the MA WEA and adjacent to the RI/MA WEA along with several other offshore renewable energy Lease Areas). Between November 2011 and March 2015, Marine Autonomous Recording Units (MARU; a type of static passive acoustic monitoring (PAM) recorder) were deployed at nine sites in the MA and RI/MA WEAs. The goal of the study was to collect visual and acoustic baseline data on distribution, abundance, and temporal occurrence patterns of marine mammals (Kraus *et al.,* 2016). The New England Aquarium conducted additional aerial surveys throughout the MA and RI/MA WEAs from February 2017 through July 2018 (38 surveys), October 2018 through August 2019 (40 surveys), and March 2020 through July 2021 (12 surveys) (Quintana and Kraus, 2019; O'Brien *et al.,* 2021a; O'Brien *et al.,* 2021b). As indicated above, 17 species and stocks in Table 5 are known to temporally and spatially co-occur with the activity. Additionally, 22 stocks are rare in the project area. However, Park City Wind has conservatively requested a limited amount of take to ensure MMPA compliance in the unlikely event that one or more of these rare species are encountered during project activities that may result in take (Table 32). Five of the marine mammal species for which take is requested are listed as threatened or endangered under the ESA: North Atlantic right, blue, fin, sei, and sperm whales.

In addition to what is included in Sections 3 and 4 of Park City Wind's ITA application (*https://www.fisheries.noaa.gov/action/incidental-take-authorization-park-city-wind-llc-construction-new-england-wind-offshore-wind*), the SARs (*https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*), and NMFS' website (*https://www.fisheries.noaa.gov/species-directory/marine-mammals*), we provide further detail below informing the baseline for select species (*e.g.,* information regarding current Unusual Mortality Events (UME) and known important habitat areas, such as Biologically Important Areas (BIAs) (Van Parijs, 2015)). There are no ESA-designated critical habitats for any species within the project area (*https://www.fisheries.noaa.gov/resource/map/national-esa-critical-habitat-mapper*).

Under the MMPA, a UME is defined as ''a stranding that is unexpected; involves a significant die-off of any marine mammal population; and demands immediate response'' (16 U.S.C. 1421h(6)). As of May 2023, five UMEs are active. Four of these UMEs are occurring along the U.S. Atlantic coast for various marine mammal species. Of these, the most relevant to the project area are the North Atlantic right whale, humpback whale, and harbor and gray seal UMEs given the prevalence of these species in the project area. More information on UMEs, including all active, closed, or pending, can be found on NMFS' website at *https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events.*

Below, we include information for a subset of the species that presently have an active or recently closed UME occurring along the Atlantic coast or for which there is information available related to areas of biological significance. Blue whales have been included due to their ESA-listing and not due to any UME or area of biological significance. For the majority of species potentially present in the specific geographic region, NMFS has designated only a single generic stock (*e.g.,* ''western North Atlantic'') for management purposes. This includes the ''Canadian east coast'' stock of minke whales, which includes all minke whales found in U.S. waters and is also a generic stock for management purposes. For humpback and sei whales, NMFS defines stocks on the basis of feeding locations (*i.e.,* Gulf of Maine and Nova Scotia, respectively). However, references to humpback whales and sei whales in this document refer to any individuals of the species that are found in the project area. Any areas of known biological importance (including the BIAs identified in LaBrecque *et al.,* 2015) that overlap spatially (or are adjacent) with the project area are addressed in the species sections below.

North Atlantic Right Whales

The North Atlantic right whale has been listed as Endangered since the ESA's enactment in 1973. The species was recently uplisted from Endangered to Critically Endangered on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Cooke, 2020). The uplisting was due to a decrease in population size (Pace *et al.,* 2017), an increase in vessel strikes and entanglements in fixed fishing gear (Daoust *et al.,* 2017; Davis & Brillant, 2019; Knowlton *et al.,* 2012; Knowlton *et al.,* 2022; Moore *et al.,* 2021; Sharp *et al.,* 2019), and a decrease in birth rate (Pettis *et al.,* 2022; Reed *et al.,* 2022). The Western Atlantic stock is considered depleted under the MMPA (Hayes *et al.,* 2022). There is a recovery plan (NMFS, 2005) for the North Atlantic right whale, and NMFS completed 5-year reviews of the species in 2012, 2017, and 2022 which concluded no change to the listing status is warranted.

Designated by NMFS as a Species in the Spotlight, the North Atlantic right whale is considered among the species with the greatest risk of extinction in the near future (*https://www.fisheries.noaa.gov/topic/endangered-species-conservation/species-in-the-spotlight*).

The North Atlantic right whale population had only a 2.8 percent recovery rate between 1990 and 2011 and an overall abundance decline of 23.5 percent from 2011–2019 (Hayes *et al.,* 2022). Since 2010, the North Atlantic right whale population has been in decline (Pace *et al.,* 2017; Pace *et al.,* 2021), with a 40 percent decrease in calving rate (Kraus *et al.,* 2016; Moore *et al.,* 2021). North Atlantic right whale calving rates dropped from 2017 to 2020 with zero births recorded during the 2017–2018 season. The 2020–2021 calving season had the first substantial calving increase in 5 years with 20 calves born followed by 15 calves during the 2021–2022 calving season. However, mortalities continue to outpace births, and best estimates indicate fewer than 70 reproductively active females remain in the population.

Critical habitat for North Atlantic right whales is not present in the project area. However, the project area both spatially and temporally overlaps a portion of the migratory corridor BIA within which North Atlantic right whales migrate south to calving grounds generally in November and December, followed by a northward migration into feeding areas east and north of the project area in March and April (LaBrecque *et al.,* 2015; Van Parijs *et al.,* 2015). While the project does not overlap any North Atlantic right whale feeding BIAs, it does spatially overlap a more recently described important feeding area. North Atlantic right whales have recently been observed feeding year-round in the region south of Martha's Vineyard and Nantucket with larger numbers in this area in the winter making it the only known winter foraging habitat for the species (Leiter *et al.,* 2017; Quintana-Rizzo *et al.,* 2021).

NMFS' regulations at 50 CFR 224.105 designated Seasonal Management Areas (SMAs) for North Atlantic right whales in 2008 (73 FR 60173, October 10, 2008). SMAs were developed to reduce the threat of collisions between ships and North Atlantic right whales around their migratory route and calving grounds. The Block Island SMA is near the proposed project area; this SMA is currently active from November 1 through April 30 of each year and may be used by North Atlantic right whales for feeding (although to a lesser extent than the area to the east near Nantucket Shoals) and/or migrating. As noted above, NMFS is proposing changes to the North Atlantic right whale speed rule (87 FR 46921, August 1, 2022). Due to the current status of North Atlantic right whales and the spatial proximity overlap of the proposed project with areas of biological significance, (*i.e.,* a migratory corridor, SMA), the potential impacts of the proposed project on North Atlantic right whales warrant particular attention.

North Atlantic right whale presence in the project area is predominately seasonal; however, year-round occurrence is documented. Abundance is highest in winter with irregular occurrence during summer months and similar occurrence rates in spring and fall (O'Brien *et al.,* 2022; Quintana-Rizzo *et al.,* 2021; Estabrook *et al.,* 2022). Model outputs suggest that 23 percent of the North Atlantic right whale population is present from December through May, and the mean residence time has tripled to an average of 13 days during these months (Quintana-Rizzo *et al.,* 2021).

North Atlantic right whale distribution can also be derived from acoustic data. A review of passive acoustic monitoring data from 2004 to 2014 collected throughout the western North Atlantic demonstrated nearly continuous year-round North Atlantic right whale presence across their entire habitat range with a decrease in summer months, including in locations previously thought of as migratory corridors suggesting that not all of the population undergoes a consistent annual migration (Davis *et al.,* 2017). To describe seasonal trends in North Atlantic right whale presence, Estabrook *et al.* (2022) analyzed North Atlantic right whale acoustic detections collected between 2011–2015 during winter (January–March), spring (April–June), summer (July–September), and autumn (October–December). Winter had the highest presence (75 percent array-days, n = 193), and summer had the lowest presence (10 percent array-days, n = 27). Spring and autumn were similar, where 45 percent (n = 117) and 51 percent (n = 121) of the array-days had detections, respectively. Across all years, detections were consistently lowest in August and September. In Massachusetts Bay and Cape Cod Bay, located outside of the project area, acoustic detections of North Atlantic right whales increased in more recent years in both the peak season of late winter through early spring and in summer and fall, likely reflecting broad-scale regional habitat changes (Charif *et al.,* 2020). NMFS' Passive Acoustic Cetacean Map (PACM) contains up-to-date acoustic data that contributes to our understanding of when and where specific whales (including North Atlantic right whales), dolphin, and other cetacean species are acoustically detected in the North Atlantic. These data support the findings of the aforementioned literature.

In late fall (*i.e.,* November), a portion of the right whale population (including pregnant females) typically departs the feeding grounds in the North Atlantic, moves south along the migratory corridor BIA, including through the project area, to right whale calving grounds off Georgia and Florida. However, recent research indicates understanding of their movement patterns remains incomplete and not all of the population undergoes a consistent annual migration (Davis *et al.,* 2017; Gowan *et al.,* 2019; Krzystan *et al.,* 2018). The results of multistate temporary emigration capture-recapture modeling, based on sighting data collected over the past 22 years, indicate that non-calving females may remain in the feeding grounds, during the winter in the years preceding and following the birth of a calf to increase their energy stores (Gowan *et al.,* 2019).

Southern New England waters are a migratory corridor in the spring and early winter and a primary feeding habitat for North Atlantic right whales during late winter through spring. Right whales feed primarily on the copepod *Calanus finmarchicus,* a species whose availability and distribution has changed both spatially and temporally over the last decade due to an oceanographic regime shift that has been ultimately linked to climate change (Meyer-Gutbrod *et al.,* 2021; Record *et al.,* 2019; Sorochan *et al.,* 2019). This distribution change in prey availability has led to shifts in North Atlantic right whale habitat-use patterns within the region over the same time period (Davis *et al.,* 2020; Meyer-Gutbrod *et al.,* 2022; Quintana-Rizzo *et al.,* 2021; O'Brien *et al.,* 2022). Since 2010, North Atlantic right whales have reduced their use of foraging habitats in the Great South Channel and Bay of Fundy while increasing their use of habitat within Cape Cod Bay as well as a region south of Martha's Vineyard and Nantucket Islands (Stone *et al.,* 2017; Mayo *et al.,* 2018; Ganley *et al.,* 2019; Record *et al.,* 2019; Meyer-Gutbrod *et al.,* 2021). The SWDA and OECC are south and east of Martha's Vineyard and south and west of Nantucket Islands.

Since 2017, 98 dead, seriously injured, or sublethally injured or ill North Atlantic right whales along the U.S. and Canadian coasts have been documented, necessitating a UME declaration and investigation. The leading category for the cause of death for this ongoing UME is "human interaction," specifically from entanglements or vessel strikes. As of May 17, 2023, there have been 36 confirmed mortalities (dead stranded or floaters) and 33 seriously injured free-swimming whales for a total of 69 whales. Beginning on October 14, 2022, the UME also considers animals with sublethal injury or illness bringing the total number of whales in the UME to 98. Approximately 42 percent of the population is known to be in reduced health (Hamilton *et al.,* 2021) likely contributing to smaller body sizes at maturation, making them more susceptible to threats and reducing fecundity (Moore *et al.,* 2021; Reed *et al.,* 2022; Stewart *et al.,* 2022). More information about the North Atlantic right whale UME is available online at *https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2023-north-atlantic-right-whale-unusual-mortality-event.*

Humpback Whales

Humpback whales were listed as endangered under the Endangered Species Conservation Act (ESCA) in June 1970. In 1973, the ESA replaced the ESCA, and humpbacks continued to be listed as endangered. On September 8, 2016, NMFS divided the once single species into 14 distinct population segments (DPS), removed the 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 whales that is expected to occur in the project area. Bettridge *et al.* (2015) estimated the size of the West Indies DPS population at 12,312 (95 percent confidence interval (CI) 8,688–15,954) whales in 2004–05, which is consistent with previous population estimates of approximately 10,000–11,000 whales (Stevick *et al.,* 2003; Smith *et al.,* 1999) and the increasing trend for the West Indies DPS (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 (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). Kraus *et al.* (2016) observed humpbacks in the RI/MA & MA WEAs and surrounding areas during all seasons but most often during spring and summer months with a peak from April to June. Acoustic data indicate that this species may be present within the RI/MA WEA year-round with the highest rates of acoustic detections in the winter and spring (Kraus *et al.,* 2016).

The project area does not overlap any ESA-designated critical habitat, BIAs, or other important areas for the humpback whales. A humpback whale feeding BIA extends throughout the Gulf of Maine, Stellwagen Bank, and Great South Channel from May through December, annually (LaBrecque *et al.,* 2015). However, this BIA is located further east and north of, and thus, does not overlap, the project area.

Since January 2016, elevated humpback whale mortalities along the Atlantic coast from Maine to Florida led to the declaration of a UME. As of May 17, 2023, 191 humpback whales have stranded as part of this UME. Partial or full necropsy examinations have been conducted on approximately 90 of the known cases. Of the whales examined, about 40 percent had evidence of human interaction, either ship strike or entanglement. While a portion of the whales have shown evidence of pre-mortem vessel strike, this finding is not consistent across all whales examined and more research is needed. More information is available at *https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events.*

Fin Whales

Fin whales typically feed in the Gulf of Maine and the waters surrounding New England, but their mating and calving (and general wintering) areas are largely unknown (Hain *et al.,* 1992; Hayes *et al.,* 2022). 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.,* 2022).

Kraus *et al.* (2016) suggest that, compared to other baleen whale species, fin whales have a high multi-seasonal relative abundance in the RI/MA & MA WEAs and surrounding areas. Fin whales were observed in the 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 indicate that this species is present in the RI/MA & MA WEAs during all months of the year, although less so in summer months (Morano *et al.,* 2012; Muirhead *et al.,* 2018; Davis *et al.,* 2020).

New England waters represent a major feeding ground for fin whales. The project area partially overlaps the fin whale feeding BIA (2,933 km^2) offshore of Montauk Point, New York from March to October (Hain *et al.,* 1992; LaBrecque *et al.,* 2015). A separate larger year-round feeding BIA (18,015 km^2) located far to the northeast in the southern Gulf of Maine does not overlap with the project area and would thus not be impacted by project activities.

Minke Whales

Minke whales are common and widely distributed throughout the U.S. Atlantic EEZ (Cetacean and Turtle Assessment Program (CETAP), 1982; Hayes *et al.,* 2022), although their distribution has a strong seasonal component. Minke whale occurrence is common and widespread in New England from spring to fall, although the species is largely absent in the winter (Hayes *et al.,* 2022; Risch *et al.,* 2013). Surveys conducted in the RI/MA WEAs from October 2011 through June 2015 reported 103 minke whale sightings within the area, predominantly in the spring followed by summer and fall (Kraus *et al.,* 2016). Recent surveys conducted in the RI/MA WEAs from February 2017 through July 2018, October 2018 through August 2019, and March 2020 through July 2021 documented minke whales as the most common rorqual (baleen whales with pleated throat grooves) sighted in the WEAs. Surveys also reported a shift in the greatest seasonal abundance of minke whales from spring (2017–2018) (Quintana and Kraus, 2018) to summer (2018–2019 and 2020–2021) (O'Brien *et al.,* 2021a, b).

There are two minke whale feeding BIAs identified in the southern and southwestern section of the Gulf of Maine, including Georges Bank, the Great South Channel, Cape Cod Bay and Massachusetts Bay, Stellwagen Bank, Cape Anne, and Jeffreys Ledge from March through November, annually (LaBrecque *et al.,* 2015). However, these BIAs do not overlap the project area as they are located further east and north. A migratory route for minke whales transiting between northern feeding grounds and southern breeding areas may exist to the east of the proposed project area as minke whales may track warmer waters along the continental shelf while migrating (Risch *et al.,* 2014).

From 2017 through 2022, elevated minke whale mortalities detected along the Atlantic coast from Maine through South Carolina resulted in the declaration of a UME. As of April 14, 2023, a total of 142 minke whale mortalities have occurred during this UME. Full or partial necropsy examinations were conducted on more than 60 percent of the whales. Preliminary findings in several of the whales have shown evidence of human interactions or infectious disease, but these findings are not consistent across all of the minke whales examined, so more research is needed. More information is available at *https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2022-minke-whale-unusual-mortality-event-along-atlantic-coast.*

Sei Whale

The Nova Scotia stock of sei whales can be found in deeper waters of the continental shelf edge of the eastern United States and northeastward to south of Newfoundland (Mitchell, 1975; Hain *et al.,* 1985; Hayes *et al.,* 2022). During spring and summer, the stock is mainly concentrated in northern feeding areas, including the Scotian Shelf (Mitchell and Chapman, 1977), the Gulf of Maine, Georges Bank, the Northeast Channel, and south of Nantucket (CETAP, 1982; Kraus *et al.,* 2016; Roberts *et al.,* 2016; Palka *et al.,* 2017; Cholewiak *et al.,* 2018; Hayes *et al.,* 2022). Sei whales have been detected acoustically along the Atlantic Continental Shelf and Slope from south of Cape Hatteras, North Carolina to the Davis Strait, with acoustic occurrence increasing in the mid-Atlantic region since 2010 (Davis *et al.,* 2020).

Although their migratory movements are not well understood, sei whales are believed to migrate north in June and July to feeding areas and south in September and October to breeding areas (Mitchell, 1975; CETAP, 1982; Davis *et al.,* 2020). Although sei whales generally occur offshore, individuals may also move into shallower, more inshore waters (Payne *et al.,* 1990; Halpin *et al.,* 2009; Hayes *et al.,* 2022). A sei whale feeding BIA occurs in New England waters from May through November (LaBrecque *et al.,* 2015). This BIA is located nearby but not within the project area and is not expected to be impacted by the Project activities.

Blue Whales

Blue whales are included within this section due to their ESA-listing status and not to any active BIA or UME in the project area. Blue whales are widely distributed throughout the world's oceans and are an ESA-listed species throughout their range. Their Western North Atlantic Stock occurs in the western North Atlantic and generally ranges from the Arctic to at least mid-latitude waters. Blue whales are most frequently sighted in more northerly waters off eastern Canada, with the majority of records from the Gulf of St. Lawrence by Newfoundland, Canada (Hayes *et al.,* 2019). They often are found near the continental shelf edge where upwelling produces concentrations of krill, their main prey species (Yochem and Leatherwood, 1985; Fiedler *et al.,* 1998; Gill *et al.,* 2011). The blue whale is not common in the project area. A 2008 study detected blue whale calls in offshore areas of the New York Bight on 28 out of 258 days of recordings (11 percent of the days), mostly during winter (Muirhead *et al.,* 2018). Kraus *et al.* (2016) conducted aerial and acoustic surveys between 2011–2015 in the MA and RI/MA WEAs and surrounding areas. Blue whales were not visually observed and were only sparsely acoustically detected in the MA and RI/MA WEAs during winter; the acoustic detection could have been due to very distant vocalizations. These data suggest that blue whales are rarely, if at all, present in the MA and RI/MA WEAs (Kraus *et al.,* 2016). Surveys conducted in 2018–2020, did not result in any sightings of blue whales in MA and RI/MA WEAs (O'Brien *et al.,* 2021a; O'Brien *et al.,* 2021b). However, Park City Wind has requested a small amount of take for blue whales on the minimal chance of encounter.

Much is not known about the blue whale populations, the last minimum population abundance was estimated at 402 (Hayes *et al.,* 2023). There are insufficient data to determine population trends for blue whales. The total level of human caused mortality and serious injury is unknown, but it is believed to be insignificant and approaching a zero mortality and serious injury rate (Hayes *et al.,* 2019). There are no blue whale BIAs or ESA-protected critical habitat identified in the project area or along the U.S. Eastern Seaboard. There is no UME for blue whales. More information is available at *https://www.fisheries.noaa.gov/species/blue-whale.*

Pinnipeds

Since June 2022, elevated numbers of harbor seal and gray seal mortalities have occurred across the southern and central coast of Maine. This event has been declared a UME. Preliminary testing of samples has found some harbor and gray seals positive for highly pathogenic avian influenza. While the UME is not occurring in the project area, the populations affected by the UME are the same as those potentially affected by the project. Information on this UME is available online at *https://www.fisheries.noaa.gov/2022-2023-pinniped-unusual-mortality-event-along-maine-coast.*

The above event was preceded by a different UME, occurring from 2018–2020 (closure of the 2018–2020 UME is pending). Beginning in July 2018, elevated numbers of harbor seal and gray seal mortalities occurred across Maine, New Hampshire, and Massachusetts. Additionally, stranded seals have shown clinical signs as far south as Virginia, although not in elevated numbers, therefore the UME investigation encompassed all seal strandings from Maine to Virginia. A total of 3,152 reported strandings (of all species) occurred from July 1, 2018, through March 13, 2020. Full or partial necropsy examinations have been conducted on some of the seals and samples have been collected for testing. Based on tests conducted thus far, the main pathogen found in the seals is phocine distemper virus. NMFS is performing additional testing to identify any other factors that may be involved in this UME, which is pending closure. Information on this UME is available online at *https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-life-distress/2018-2020-pinniped-unusual-mortality-event-along.*

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.,* Richardson *et al.,* 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.,* low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 decibel (dB) threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. Marine mammal hearing groups and their associated hearing ranges are provided in Table 6.

TABLE 6—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.

* 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 (Hemilä *et al.,* 2006; 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.

NMFS notes that in 2019a, Southall *et al.* recommended new names for hearing groups that are widely recognized. However, this new hearing group classification does not change the weighting functions or acoustic thresholds (*i.e.,* the weighting functions and thresholds in Southall *et al.* (2019a) are identical to NMFS 2018 Revised Technical Guidance). When NMFS updates our Technical Guidance, we will be adopting the updated Southall *et al.* (2019a) hearing group classification.

Potential Effects of the 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 of Marine Mammals 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 of Marine Mammals 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. General background information on marine mammal hearing was provided previously (see the Description of Marine Mammals in the Area of the Specified Activities section). Here, the potential effects of sound on marine mammals are discussed.

Park City Wind has requested, and NMFS proposes to authorize, the take of marine mammals incidental to the construction activities associated with the project area. In their application and Application Update Report, Park City Wind presented their analyses of potential impacts to marine mammals from the acoustic and explosive sources. NMFS both carefully reviewed the information provided by Park City Wind, as well as independently reviewed applicable scientific research and literature and other information to evaluate the potential effects of the Project's activities on marine mammals.

The proposed activities would result in the construction and placement of up to 132 permanent foundations to support WTGs and ESPs and seafloor mapping using HRG surveys. Additionally, up to 10 UXO/MEC detonations may occur during construction if they cannot be safely removed by other means. There are a variety of types and degrees of effects to marine mammals, prey species, and habitat that could occur as a result of the Project. Below we provide a brief description of the types of sound sources that would be generated by the project, the general impacts from these types of activities, and an analysis of the anticipated impacts on marine mammals from the project, with consideration of the proposed mitigation measures.

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 Au and Hastings (2008); Richardson *et al.* (1995); Urick (1983) as well as the Discovery of Sound in the Sea (DOSITS) website at *https://dosits.org/.* Sound is a vibration that travels as an acoustic wave through a medium such as a gas, liquid or solid. Sound waves alternately compress and decompress the medium as the wave travels. These compressions and decompressions are detected as changes in pressure by aquatic life and man-made sound receptors such as hydrophones (underwater microphones). In water, sound waves radiate in a manner similar to ripples on the surface of a pond and may be either directed in a beam (narrow beam or directional sources) or sound beams may radiate in all directions (omnidirectional sources).

Sound travels in water more efficiently than almost any other form of energy, making the use of acoustics ideal for the aquatic environment and its inhabitants. In seawater, sound travels at roughly 1,500 meters per second (m/s). In-air, sound waves travel much more slowly, at about 340 m/s. However, the speed of sound can vary by a small amount based on characteristics of the transmission medium, such as water temperature and salinity. Sound travels in water more efficiently than almost any other form of energy, making the use of acoustics ideal for the aquatic environment and its inhabitants. In seawater, sound travels at roughly 1,500 m/s. In-air, sound waves travel much more slowly, at about 340 m/s. However, the speed of sound can vary by a small amount based on characteristics of the transmission medium, such as water temperature and salinity.

The basic components of a sound wave 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 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.

The intensity (or amplitude) of sounds are measured in decibels (dB), which are a relative unit of measurement that is used to express the ratio of one value of a power or field to another. Decibels are measured on a logarithmic scale, so a small change in dB corresponds to large changes in sound pressure. For example, a 10-dB increase is a ten-fold increase in acoustic power. A 20-dB increase is then a 100-fold increase in power and a 30-dB increase is a 1000-fold increase in power. However, a ten-fold increase in acoustic power does not mean that the sound is perceived as being 10 times louder. Decibels are a relative unit comparing two pressures, therefore, a reference pressure must always be indicated. For underwater sound, this is 1 microPascal (μPa). For in-air sound, the reference pressure is 20 microPascal (μPa). The amplitude of a sound can be presented in various ways; however, NMFS typically considers three metrics. In this proposed rule, all decibel levels referenced to 1μPa.

Sound exposure level (SEL) represents the total energy in a stated frequency band over a stated time interval or event, and considers both amplitude and duration of exposure (represented as dB re 1 μPa^2-s). SEL is a cumulative metric; it can be accumulated over a single pulse (for pile driving this is often referred to as single-strike SEL; SEL_{ss}), or calculated over periods containing multiple pulses (SEL_{cum}). Cumulative SEL represents the total energy accumulated by a receiver over a defined time window or during an event. The SEL metric is useful because it allows sound exposures of different durations to be related to one another in terms of total acoustic energy. The duration of a sound event and the number of pulses, however, should be specified as there is no accepted standard duration over which the summation of energy is measured.

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 (Urick, 1983). 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.

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. Along with SEL, this metric is used in evaluating the potential for PTS (permanent threshold shift) and TTS (temporary threshold shift). Peak sound pressure is also used to evaluate the potential for gastro-intestinal tract injury (Level A harassment) from explosives.

For explosives, an impulse metric (Pa-s), which is the integral of a transient sound pressure over the duration of the pulse, is used to evaluate the potential for mortality (*i.e.,* severe lung injury) and slight lung injury. These impulse metric thresholds account for animal mass and depth.

Sounds can be either impulsive or non-impulsive. 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 NMFS *et al.* (2018) and Southall *et al.* (2007, 2019a) for an in-depth discussion of these concepts. Impulsive 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 (American National Standards Institute (ANSI), 1986, 2005; Harris, 1998; National Institute for Occupational Safety and Health (NIOSH), 1998; International Organization for Standardization (ISO), 2003) and occur either as isolated events or repeated in some succession. Impulsive 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. Impulsive sounds are typically intermittent in nature.

Non-impulsive 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-impulsive sounds can be transient signals of short duration but without the essential properties of pulses (*e.g.,* rapid rise time). Examples of non-impulsive sounds include those produced by vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems. Sounds are also characterized by their temporal component. Continuous sounds are those whose sound pressure level remains above that of the ambient sound with negligibly small fluctuations in level (NIOSH, 1998; ANSI, 2005) while intermittent sounds are defined as sounds with interrupted levels of low or no sound (NIOSH, 1998). NMFS identifies Level B harassment thresholds based on if a sound is continuous or intermittent.

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 Hz and 50 kHz (International Council for the Exploration of the Sea (ICES), 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 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. Human-generated sound is a significant contributor to the acoustic environment in the project location.

Potential Effects of Underwater Sound on Marine Mammals

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. Broadly, underwater sound from active acoustic sources, such as those in the Project, 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.,* 2003; Nowacek *et al.,* 2007; Southall *et al.,* 2007; Götz *et al.,* 2009). 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).

In general, the degree of effect of an acoustic exposure is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure, in addition to the contextual factors of the receiver (*e.g.,* behavioral state at time of exposure, age class, *etc.*). In general, sudden, high level sounds can cause hearing loss as can longer exposures to lower level sounds. Moreover, any temporary or permanent loss of hearing will occur almost exclusively for noise within an animal's hearing range. We describe below the specific manifestations of acoustic effects that may occur based on the activities proposed by Park City Wind.

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 (at the greatest distance) 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 (closer to the receiving animal) corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological responsiveness. The 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.

Below, we provide additional detail regarding potential impacts on marine mammals and their habitat from noise in general, starting with hearing impairment, as well as from the specific activities Park City Wind plans to conduct, to the degree it is available (noting that there is limited information regarding the impacts of offshore wind construction on marine mammals).

Hearing Threshold Shift

Marine mammals exposed to high-intensity sound or to lower-intensity sound for prolonged periods can experience hearing threshold shift (TS), which NMFS defines as a change, usually an increase, in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level expressed in decibels (NMFS, 2018). Threshold shifts can be permanent, in which case there is an irreversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range or temporary, in which there is reversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range and the animal's hearing threshold would fully recover over time (Southall *et al.,* 2019a). Repeated sound exposure that leads to TTS could cause PTS.

When PTS occurs, there can be physical damage to the sound receptors in the ear (*i.e.,* tissue damage) whereas TTS represents primarily tissue fatigue and is reversible (Henderson *et al.,* 2008). 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; Southall *et al.,* 2019a). 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. However, such relationships are assumed to be similar to those in humans and other terrestrial mammals. Noise exposure can result in either a permanent shift in hearing thresholds from baseline (PTS; a 40 dB threshold shift approximates a PTS onset; *e.g.,* Kryter *et al.,* 1966; Miller, 1974; Henderson *et al.,* 2008) or a temporary, recoverable shift in hearing that returns to baseline (a 6 dB threshold shift approximates a TTS onset; *e.g.,* Southall *et al.,* 2019a). Based on data from terrestrial mammals, a precautionary assumption is that the PTS thresholds, expressed in the unweighted peak sound pressure level metric (PK), for impulsive sounds (such as impact pile driving pulses) are at least 6 dB higher than the TTS thresholds and the weighted PTS cumulative sound exposure level thresholds are 15 (impulsive sound) to 20 (non-impulsive sounds) dB higher than TTS cumulative sound exposure level thresholds (Southall *et al.,* 2019a). Given the higher level of sound or longer exposure duration necessary to cause PTS as compared with TTS, PTS is less likely to occur as a result of these activities, but it is possible and a small amount has been proposed for authorization for several species.

TTS is the mildest form of hearing impairment that can occur during exposure to sound, with a TTS of 6 dB considered the minimum threshold shift clearly larger than any day-to-day or session-to-session variation in a subject's normal hearing ability (Schlundt *et al.,* 2000; Finneran *et al.,* 2000; Finneran *et al.,* 2002). 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. There is data on sound levels and durations necessary to elicit mild TTS for marine mammals, but recovery is complicated to predict and dependent on multiple factors.

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 depending on the degree of interference of marine mammals hearing. 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 (*e.g.,* for successful mother/calf interactions, consistent detection of prey) 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 (*Neophocaena asiaeorientalis*)) and six species of pinnipeds (northern elephant seal (*Mirounga angustirostris*), harbor seal, ring seal, spotted seal, bearded seal, and California sea lion (*Zalophus californianus*)) that were exposed to a limited number of sound sources (*i.e.,* mostly tones and octave-band noise with limited number of exposure to impulsive sources such as seismic airguns or impact pile driving) in laboratory settings (Southall *et al.,* 2019a). There is currently no data available on noise-induced hearing loss for mysticetes. For summaries of data on TTS or PTS in marine mammals or for further discussion of TTS or PTS onset thresholds, please see Southall *et al.* (2019a) and NMFS (2018).

Recent studies with captive odontocete species (bottlenose dolphin, harbor porpoise, beluga, and false killer whale) have observed increases in hearing threshold levels when individuals received a warning sound prior to exposure to a relatively loud sound (Nachtigall and Supin, 2013, 2015; Nachtigall *et al.,* 2016a, 2016b, 2016c; Finneran, 2018; Nachtigall *et al.,* 2018). These studies suggest that captive animals have a mechanism to reduce hearing sensitivity prior to impending loud sounds. Hearing change was observed to be frequency dependent and Finneran (2018) suggests hearing attenuation occurs within the cochlea or auditory nerve. Based on these observations on captive odontocetes, the authors suggest that wild animals may have a mechanism to self-mitigate the impacts of noise exposure by dampening their hearing during prolonged exposures of loud sound or if conditioned to anticipate intense sounds (Finneran, 2018; Nachtigall *et al.,* 2018).

Behavioral Effects

Exposure of marine mammals to sound sources can result in, but is not limited to, no response or any of the following observable responses: increased alertness; orientation or attraction to a sound source; vocal modifications; cessation of feeding; cessation of social interaction; alteration of movement or diving behavior; habitat abandonment (temporary or permanent); and in severe cases, panic, flight, stampede, or stranding, potentially resulting in death (Southall *et al.,* 2007). A review of marine mammal responses to anthropogenic sound was first conducted by Richardson (1995). More recent reviews address studies conducted since 1995 and focused on observations where the received sound level of the exposed marine mammal(s) was known or could be estimated (Nowacek *et al.,* 2007; DeRuiter *et al.,* 2012 and 2013; Ellison *et al.,* 2012; Gomez *et al.,* 2016). Gomez *et al.* (2016) conducted a review of the literature considering the contextual information of exposure in addition to received level and found that higher received levels were not always associated with more severe behavioral responses and vice versa. Southall *et al.* (2021) states that results demonstrate that some individuals of different species display clear yet varied responses, some of which have negative implications while others appear to tolerate high levels and that responses may not be fully predictable with simple acoustic exposure metrics (*e.g.,* received sound level). Rather, the authors state that differences among species and individuals along with contextual aspects of exposure (*e.g.,* behavioral state) appear to affect response probability.

Behavioral responses to sound are highly variable and context-specific. Many different variables can influence an animal's perception of and response to (nature and magnitude) an acoustic event. An animal's prior experience with a sound or sound source affects whether it is less likely (habituation) or more likely (sensitization) to respond to certain sounds in the future (animals can also be innately predisposed to respond to certain sounds in certain ways) (Southall *et al.,* 2019a). Related to the sound itself, the perceived nearness of the sound, bearing of the sound (approaching vs. retreating), the similarity of a sound to biologically relevant sounds in the animal's environment (*i.e.,* calls of predators, prey, or conspecifics), and familiarity of the sound may affect the way an animal responds to the sound (Southall *et al.,* 2007, DeRuiter *et al.,* 2013). Individuals (of different age, gender, reproductive status, *etc.*) among most populations will have variable hearing capabilities, and differing behavioral sensitivities to sounds that will be affected by prior conditioning, experience, and current activities of those individuals. Often, specific acoustic features of the sound and contextual variables (*i.e.,* proximity, duration, or recurrence of the sound or the current behavior that the marine mammal is engaged in or its prior experience), as well as entirely separate factors, such as the physical presence of a nearby vessel, may be more relevant to the animal's response than the received level alone.

Overall, the variability of responses to acoustic stimuli depends on the species receiving the sound, the sound source, and the social, behavioral, or environmental contexts of exposure (*e.g.,* DeRuiter *et al.,* 2012). For example, Goldbogen *et al.* (2013a) demonstrated that individual behavioral state was critically important in determining response of blue whales to sonar, noting that some individuals engaged in deep (greater than 50 m) feeding behavior had greater dive responses than those in shallow feeding or non-feeding conditions. Some blue whales in the Goldbogen *et al.* (2013a) study that were engaged in shallow feeding behavior demonstrated no clear changes in diving or movement even when received levels were high (~160 dB re 1μPa) for exposures to 3–4 kHz sonar signals, while deep feeding and non-feeding whales showed a clear response at exposures at lower received levels of sonar and pseudorandom noise. Southall *et al.* (2011) found that blue whales had a different response to sonar exposure depending on behavioral state, more pronounced when deep feeding/travel modes than when engaged in surface feeding.

With respect to distance influencing disturbance, DeRuiter *et al.* (2013) examined behavioral responses of Cuvier's beaked whales to mid-frequency sonar and found that whales responded strongly at low received levels (89–127 dB re 1μPa) by ceasing normal fluking and echolocation, swimming rapidly away, and extending both dive duration and subsequent non-foraging intervals when the sound source was 3.4–9.5 km away. Importantly, this study also showed that whales exposed to a similar range of received levels (78–106 dB re 1μPa) from distant sonar exercises (118 km away) did not elicit such responses, suggesting that context may moderate reactions. Thus, distance from the source is an important variable in influencing the type and degree of behavioral response and this variable is independent of the effect of received levels (*e.g.,* DeRuiter *et al.,* 2013; Dunlop *et al.,* 2017a, 2017b; Falcone *et al.,* 2017; Dunlop *et al.,* 2018; Southall *et al.,* 2019a).

Ellison *et al.* (2012) outlined an approach to assessing the effects of sound on marine mammals that incorporates contextual-based factors. The authors recommend considering not just the received level of sound but also the activity the animal is engaged in at the time the sound is received, the nature and novelty of the sound (*i.e.,* is this a new sound from the animal's perspective), and the distance between the sound source and the animal. They submit that this ''exposure context,'' as described, greatly influences the type of behavioral response exhibited by the animal. Forney *et al.* (2017) also point out that an apparent lack of response (*e.g.,* no displacement or avoidance of a sound source) may not necessarily mean there is no cost to the individual or population, as some resources or habitats may be of such high value that animals may choose to stay, even when experiencing stress or hearing loss. Forney *et al.* (2017) recommend considering both the costs of remaining in an area of noise exposure such as TTS, PTS, or masking, which could lead to an increased risk of predation or other threats or a decreased capability to forage, and the costs of displacement, including potential increased risk of vessel strike, increased risks of predation or competition for resources, or decreased habitat suitable for foraging, resting, or socializing. This sort of contextual information is challenging to predict with accuracy for ongoing activities that occur over large spatial and temporal expanses. However, distance is one contextual factor for which data exist to quantitatively inform a take estimate, and the method for predicting Level B harassment in this rule does consider distance to the source. Other factors are often considered qualitatively in the analysis of the likely consequences of sound exposure where supporting information is available.

Behavioral change, such as disturbance manifesting in lost foraging time, in response to anthropogenic activities is often assumed to indicate a biologically significant effect on a population of concern. However, individuals may be able to compensate for some types and degrees of shifts in behavior, preserving their health and thus their vital rates and population dynamics. For example, New *et al.* (2013) developed a model simulating the complex social, spatial, behavioral and motivational interactions of coastal bottlenose dolphins in the Moray Firth, Scotland, to assess the biological significance of increased rate of behavioral disruptions caused by vessel traffic. Despite a modeled scenario in which vessel traffic increased from 70 to 470 vessels a year (a six-fold increase in vessel traffic) in response to the construction of a proposed offshore renewables' facility, the dolphins' behavioral time budget, spatial distribution, motivations and social structure remained unchanged. Similarly, two bottlenose dolphin populations in Australia were also modeled over 5 years against a number of disturbances (Reed *et al.,* 2020) and results indicate that habitat/noise disturbance had little overall impact on population abundances in either location, even in the most extreme impact scenarios modeled.

Friedlaender *et al.* (2016) provided the first integration of direct measures of prey distribution and density variables incorporated into across-individual analyses of behavior responses of blue whales to sonar and demonstrated a fivefold increase in the ability to quantify variability in blue whale diving behavior. These results illustrate that responses evaluated without such measurements for foraging animals may be misleading, which again illustrates the context-dependent nature of the probability of response.

The following subsections provide examples of behavioral responses that give an idea of the variability in behavioral responses that would be expected given the differential sensitivities of marine mammal species to sound, contextual factors, and the wide range of potential acoustic sources to which a marine mammal may be exposed. Behavioral responses that could occur for a given sound exposure should be determined from the literature that is available for each species, or extrapolated from closely related species when no information exists, along with contextual factors.

Avoidance and Displacement

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 (*Eschrichtius robustus*) and humpback whales are known to change direction—deflecting from customary migratory paths—in order to avoid noise from airgun surveys (Malme *et al.,* 1984; Dunlop *et al.,* 2018). Avoidance is qualitatively different from the flight response but also differs in the magnitude of the response (*i.e.,* directed movement, rate of travel, *etc.*). Avoidance may be short-term with animals returning to the area once the noise has ceased (*e.g.,* Malme *et al.,* 1984; Bowles *et al.,* 1994; Goold, 1996; Stone *et al.,* 2000; Morton and Symonds, 2002; Gailey *et al.,* 2007; Dähne *et al.,* 2013; Russel *et al.,* 2016). 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; Forney *et al.,* 2017). Avoidance of marine mammals during the construction of offshore wind facilities (specifically, impact pile driving) has been documented in the literature with some significant variation in the temporal and spatial degree of avoidance and with most studies focused on harbor porpoises as one of the most common marine mammals in European waters (*e.g.,* Tougaard *et al.,* 2009; Dähne *et al.,* 2013; Thompson *et al.,* 2013; Russell *et al.,* 2016; Brandt *et al.,* 2018).

Available information on impacts to marine mammals from pile driving associated with offshore wind is limited to information on harbor porpoises and seals, as the vast majority of this research has occurred at European offshore wind projects where large whales and other odontocete species are uncommon. Harbor porpoises and harbor seals are considered to be behaviorally sensitive species (*e.g.,* Southall *et al.,* 2007) and the effects of wind farm construction in Europe on these species has been well documented. These species have received particular attention in European waters due to their abundance in the North Sea (Hammond *et al.,* 2002; Nachtsheim *et al.,* 2021). A summary of the literature on documented effects of wind farm construction on harbor porpoise and harbor seals is described below.

Brandt *et al.* (2016) summarized the effects of the construction of eight offshore wind projects within the German North Sea (*i.e.,* Alpha Ventus, BARD Offshore I, Borkum West II, DanTysk, Global Tech I, Meerwind Süd/Ost, Nordsee Ost, and Riffgat) between 2009 and 2013 on harbor porpoises, combining PAM data from 2010–2013 and aerial surveys from 2009–2013 with data on noise levels associated with pile driving. Results of the analysis revealed significant declines in porpoise detections during pile driving when compared to 25–48 hours before pile driving began, with the magnitude of decline during pile driving clearly decreasing with increasing distances to the construction site. During the majority of projects, significant declines in detections (by at least 20 percent) were found within at least 5–10 km of the pile driving site, with declines at up to 20–30 km of the pile driving site documented in some cases. Similar results demonstrating the long-distance displacement of harbor porpoises (18–25 km) and harbor seals (up to 40 km) during impact pile driving have also been observed during the construction at multiple other European wind farms (Tougaard *et al.,* 2009; Bailey *et al.,* 2010; Dähne *et al.,* 2013; Lucke *et al.,* 2012; Haelters *et al.,* 2015).

While harbor porpoises and seals tend to move several kilometers away from wind farm construction activities, the duration of displacement has been documented to be relatively temporary. In two studies at Horns Rev II using impact pile driving, harbor porpoise returned within 1–2 days following cessation of pile driving (Tougaard *et al.,* 2009; Brandt *et al.,* 2011). Similar recovery periods have been noted for harbor seals off England during the construction of four wind farms (Brasseur *et al.,* 2012; Carroll *et al.,* 2010; Hamre *et al.,* 2011; Hastie *et al.,* 2015; Russell *et al.,* 2016). In some cases, an increase in harbor porpoise activity has been documented inside wind farm areas following construction (*e.g.,* Lindeboom *et al.,* 2011). Other studies have noted longer term impacts after impact pile driving. Near Dogger Bank in Germany, harbor porpoises continued to avoid the area for over 2 years after construction began (Gilles *et al.,* 2009). Approximately 10 years after construction of the Nysted wind farm, harbor porpoise abundance had not recovered to the original levels previously seen, although the echolocation activity was noted to have been increasing when compared to the previous monitoring period (Teilmann and Carstensen, 2012). However, overall, there are no indications for a population decline of harbor porpoises in European waters (*e.g.,* Brandt *et al.,* 2016). Notably, where significant differences in displacement and return rates have been identified for these species, the occurrence of secondary project-specific influences such as use of mitigation measures (*e.g.,* bubble curtains, acoustic deterrent devices (ADDs)) or the manner in which species use the habitat in the project area are likely the driving factors of this variation.

NMFS notes the aforementioned studies from Europe involve installing much smaller piles than Park City Wind proposes to install and, therefore, we anticipate noise levels from impact pile driving to be louder. For this reason, we anticipate that the greater distances of displacement observed in harbor porpoise and harbor seals documented in Europe are likely to occur off Massachusetts. However, we do not anticipate any greater severity of response due to harbor porpoise and harbor seal habitat use off Massachusetts or population-level consequences similar to European findings. In many cases, harbor porpoises and harbor seals are resident to the areas where European wind farms have been constructed. However, off Massachusetts, harbor porpoises are primarily transient (with higher abundances in winter when foundation installation and UXO/MEC detonations would not occur) and a very small percentage of the large harbor seal population are only seasonally present with no rookeries established. In summary, we anticipate that harbor porpoise and harbor seals will likely respond to pile driving by moving several kilometers away from the source but return to typical habitat use patterns when pile driving ceases.

Some avoidance behavior of other marine mammal species has been documented to be dependent on distance from the source. As described above, DeRuiter *et al.* (2013) noted that distance from a sound source may moderate marine mammal reactions in their study of Cuvier's beaked whales (an acoustically sensitive species), which showed the whales swimming rapidly and silently away when a sonar signal was 3.4–9.5 km away while showing no such reaction to the same signal when the signal was 118 km away even though the received levels were similar. Tyack *et al.* (1983) conducted playback studies of Surveillance Towed Array Sensor System (SURTASS) low frequency active (LFA) sonar in a gray whale migratory corridor off California. Similar to North Atlantic right whales, gray whales migrate close to shore (approximately +2 kms) and are low frequency hearing specialists. The LFA sonar source was placed within the gray whale migratory corridor (approximately 2 km offshore) and offshore of most, but not all, migrating whales (approximately 4 km offshore). These locations influenced received levels and distance to the source. For the inshore playbacks, not unexpectedly, the louder the source level of the playback (*i.e.,* the louder the received level), whale avoided the source at greater distances. Specifically, when the source level was 170 dB rms and 178 dB rms, whales avoided the inshore source at ranges of several hundred meters, similar to avoidance responses reported by Malme *et al.* (1983, 1984). Whales exposed to source levels of 185 dB rms demonstrated avoidance levels at ranges of +1 km. Responses to the offshore source broadcasting at source levels of 185 and 200 dB, avoidance responses were greatly reduced. While there was observed deflection from course, in no case did a whale abandon its migratory behavior.

The signal context of the noise exposure has been shown to play an important role in avoidance responses. In a 2007–2008 Bahamas study, playback sounds of a potential predator—a killer whale—resulted in a similar but more pronounced reaction in beaked whales (an acoustically sensitive species), which included longer inter-dive intervals and a sustained straight-line departure of more than 20 km from the area (Boyd *et al.,* 2008; Southall *et al.,* 2009; Tyack *et al.,* 2011). Park City Wind does not anticipate, and NMFS is not proposing to authorize take of beaked whales and, moreover, the sounds produced by Park City Wind do not have signal characteristics similar to predators. Therefore we would not expect such extreme reactions to occur. Southall *et al.* (2011) found that blue whales had a different response to sonar exposure depending on behavioral state, more pronounced when deep feeding/travel modes than when engaged in surface feeding.

One potential consequence of behavioral avoidance is the altered energetic expenditure of marine mammals because energy is required to move and avoid surface vessels or the sound field associated with active sonar (Frid and Dill, 2002). Most animals can avoid that energetic cost by swimming away at slow speeds or speeds that minimize the cost of transport (Miksis-Olds, 2006), as has been demonstrated in Florida manatees (Miksis-Olds, 2006).

Those energetic costs increase, however, when animals shift from a resting state, which is designed to conserve an animal's energy, to an active state that consumes energy the animal would have conserved had it not been disturbed. Marine mammals that have been disturbed by anthropogenic noise and vessel approaches are commonly reported to shift from resting to active behavioral states, which would imply that they incur an energy cost.

Forney *et al.* (2017) detailed the potential effects of noise on marine mammal populations with high site fidelity, including displacement and auditory masking, noting that a lack of observed response does not imply absence of fitness costs and that apparent tolerance of disturbance may have population-level impacts that are less obvious and difficult to document. Avoidance of overlap between disturbing noise and areas and/or times of particular importance for sensitive species may be critical to avoiding population-level impacts because (particularly for animals with high site fidelity) there may be a strong motivation to remain in the area despite negative impacts. Forney *et al.* (2017) stated that, for these animals, remaining in a disturbed area may reflect a lack of alternatives rather than a lack of effects.

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; Frid and Dill, 2002). 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, beaked whale strandings (Cox *et al.,* 2006; D'Amico *et al.,* 2009). 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. Flight responses of marine mammals have been documented in response to mobile high intensity active sonar (*e.g.,* Tyack *et al.,* 2011; DeRuiter *et al.,* 2013; Wensveen *et al.,* 2019), and more severe responses have been documented when sources are moving towards an animal or when they are surprised by unpredictable exposures (Watkins, 1986; Falcone *et al.,* 2017). Generally speaking, however, marine mammals would be expected to be less likely to respond with a flight response to either stationery pile driving (which they can sense is stationery and predictable) or significantly lower-level HRG surveys, unless they are within the area ensonified above behavioral harassment thresholds at the moment the source is turned on (Watkins, 1986; Falcone *et al.,* 2017).

Diving and Foraging

Changes in dive behavior in response to noise exposure can vary widely. They 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; Goldbogen *et al.,* 2013b). Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g.,* foraging) or they may be of little biological significance. Variations in dive behavior may also expose an animal to potentially harmful conditions (*e.g.,* increasing the chance of ship-strike) or may serve as an avoidance response that enhances survivorship. The impact of a variation in diving resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure, the type and magnitude of the response, and the context within which the response occurs (*e.g.,* the surrounding environmental and anthropogenic circumstances).

Nowacek *et al.* (2004) reported disruptions of dive behaviors in foraging North Atlantic right whales when exposed to an alerting stimulus, an action, they noted, that could lead to an increased likelihood of ship strike. The alerting stimulus was in the form of an 18 minute exposure that included three 2-minute signals played three times sequentially. This stimulus was designed with the purpose of providing signals distinct to background noise that serve as localization cues. However, the whales did not respond to playbacks of either right whale social sounds or vessel noise, highlighting the importance of the sound characteristics in producing a behavioral reaction. Although source levels for the proposed pile driving activities may exceed the received level of the alerting stimulus described by Nowacek *et al.* (2004), proposed mitigation strategies (further described in the Proposed Mitigation section) will reduce the severity of response to proposed pile driving activities. Converse to the behavior of North Atlantic right whales, Indo-Pacific humpback dolphins have been observed to dive for longer periods of time in areas where vessels were present and/or approaching (Ng and Leung, 2003). In both of these studies, the influence of the sound exposure cannot be decoupled from the physical presence of a surface vessel, thus complicating interpretations of the relative contribution of each stimulus to the response. Indeed, the presence of surface vessels, their approach, and speed of approach, seemed to be significant factors in the response of the Indo-Pacific humpback dolphins (Ng and Leung, 2003). Low frequency signals of the Acoustic Thermometry of Ocean Climate (ATOC) sound source were not found to affect dive times of humpback whales in Hawaiian waters (Frankel and Clark, 2000) or to overtly affect elephant seal dives (Costa *et al.,* 2003). They did, however, produce subtle effects that varied in direction and degree among the individual seals, illustrating the equivocal nature of behavioral effects and consequent difficulty in defining and predicting them.

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 cessation of secondary indicators of foraging (*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.,* 2006a; Yazvenko *et al.,* 2007; Southall *et al.,* 2019b). An understanding 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 can facilitate the assessment of whether foraging disruptions are likely to incur fitness consequences (Goldbogen *et al.,* 2013b; Farmer *et al.,* 2018; Pirotta *et al.,* 2018; Southall *et al.,* 2019a; Pirotta *et al.,* 2021).

Impacts on marine mammal foraging rates from noise exposure have been documented, though there is little data regarding the impacts of offshore turbine construction specifically. Several broader examples follow, and it is reasonable to expect that exposure to noise produced during the 5-years the proposed rule would be effective could have similar impacts.

Visual tracking, passive acoustic monitoring, and movement recording tags were used to quantify sperm whale behavior prior to, during, and following exposure to airgun arrays at received levels in the range 140–160 dB at distances of 7–13 km, following a phase-in of sound intensity and full array exposures at 1–13 km (Madsen *et al.,* 2006a; Miller *et al.,* 2009). Sperm whales did not exhibit horizontal avoidance behavior at the surface. However, foraging behavior may have been affected. The sperm whales exhibited 19 percent less vocal (buzz) rate during full exposure relative to post exposure, and the whale that was approached most closely had an extended resting period and did not resume foraging until the airguns had ceased firing. The remaining whales continued to execute foraging dives throughout exposure; however, swimming movements during foraging dives were 6 percent lower during exposure than control periods (Miller *et al.,* 2009). Miller *et al.* (2009) noted that more data are required to understand whether the differences were due to exposure or natural variation in sperm whale behavior.

Balaenopterid whales exposed to moderate low-frequency signals similar to the ATOC sound source demonstrated no variation in foraging activity (Croll *et al.,* 2001), whereas five out of six North Atlantic right whales exposed to an acoustic alarm interrupted their foraging dives (Nowacek *et al.,* 2004). Although the received SPLs were similar in the latter two studies, the frequency, duration, and temporal pattern of signal presentation were different. These factors, as well as differences in species sensitivity, are likely contributing factors to the differential response. The source levels of both the proposed construction and HRG activities exceed the source levels of the signals described by Nowacek *et al.* (2004) and Croll *et al.* (2001), and noise generated by Park City Wind's activities at least partially overlap in frequency with the described signals. Blue whales exposed to mid-frequency sonar in the Southern California Bight were less likely to produce low frequency calls usually associated with feeding behavior (Melcón *et al.,* 2012). However, Melcón *et al.* (2012) were unable to determine if suppression of low frequency calls reflected a change in their feeding performance or abandonment of foraging behavior and indicated that implications of the documented responses are unknown. Further, it is not known whether the lower rates of calling actually indicated a reduction in feeding behavior or social contact since the study used data from remotely deployed, passive acoustic monitoring buoys. Results from the 2010–2011 field season of a behavioral response study in Southern California waters indicated that, in some cases and at low received levels, tagged blue whales responded to mid-frequency sonar but that those responses were mild and there was a quick return to their baseline activity (Southall *et al.,* 2011; Southall *et al.,* 2012b, Southall *et al.,* 2019).

Information on or estimates of the energetic requirements of the individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal will help better inform a determination of whether foraging disruptions incur fitness consequences. Foraging strategies may impact foraging efficiency, such as by reducing foraging effort and increasing success in prey detection and capture, in turn promoting fitness and allowing individuals to better compensate for foraging disruptions. Surface feeding blue whales did not show a change in behavior in response to mid-frequency simulated and real sonar sources with received levels between 90 and 179 dB re 1 μPa, but deep feeding and non-feeding whales showed temporary reactions including cessation of feeding, reduced initiation of deep foraging dives, generalized avoidance responses, and changes to dive behavior (DeRuiter *et al.,* 2017; Goldbogen *et al.,* 2013b; Sivle *et al.,* 2015). Goldbogen *et al.* (2013b) indicate that disruption of feeding and displacement could impact individual fitness and health. However, for this to be true, we would have to assume that an individual whale could not compensate for this lost feeding opportunity by either immediately feeding at another location, by feeding shortly after cessation of acoustic exposure, or by feeding at a later time. There is no indication that individual fitness and health would be impacted, particularly since unconsumed prey would likely still be available in the environment in most cases following the cessation of acoustic exposure.

Similarly, while the rates of foraging lunges decrease in humpback whales due to sonar exposure, there was variability in the response across individuals, with one animal ceasing to forage completely and another animal starting to forage during the exposure (Sivle *et al.,* 2016). In addition, almost half of the animals that demonstrated avoidance were foraging before the exposure but the others were not; the animals that avoided while not feeding responded at a slightly lower received level and greater distance than those that were feeding (Wensveen *et al.,* 2017). These findings indicate the behavioral state of the animal and foraging strategies play a role in the type and severity of a behavioral response. For example, when the prey field was mapped and used as a covariate in examining how behavioral state of blue whales is influenced by mid-frequency sound, the response in blue whale deep-feeding behavior was even more apparent, reinforcing the need for contextual variables to be included when assessing behavioral responses (Friedlaender *et al.,* 2016).

Vocalizations and Auditory Masking

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, production of echolocation clicks, calling, and singing. Changes in vocalization behavior in response to anthropogenic noise can occur for any of these modes and may result directly from increased vigilance or a startle response, or from a need to compete with an increase in background noise (see Erbe *et al.,* 2016 review on communication masking), the latter of which is described more below.

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) and blue whales increased song production (Di Iorio and Clark, 2009), while North Atlantic 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 or reduce sound production during production of aversive signals (Bowles *et al.,* 1994; Thode *et al.,* 2020; Cerchio *et al.,* 2014; McDonald *et al.,* 1995). Blackwell *et al.* (2015) showed that whales increased calling rates as soon as airgun signals were detectable before ultimately decreasing calling rates at higher received levels.

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, or navigation) (Richardson *et al.,* 1995; Erbe and Farmer, 2000; Tyack, 2000; 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.

Masking these acoustic signals can disturb the behavior of individual animals, groups of animals, or entire populations. Masking can lead to behavioral changes including vocal changes (*e.g.,* Lombard effect, increasing amplitude, or changing frequency), cessation of foraging or lost foraging opportunities, and leaving an area, to both signalers and receivers, in an attempt to compensate for noise levels (Erbe *et al.,* 2016) or because sounds that would typically have triggered a behavior were not detected. In humans, significant masking of tonal signals occurs as a result of exposure to noise in a narrow band of similar frequencies. As the sound level increases, though, the detection of frequencies above those of the masking stimulus decreases also. This principle is expected to apply to marine mammals as well because of common biomechanical cochlear properties across taxa.

Therefore, when the coincident (masking) sound is man-made, it may be considered harassment when disrupting behavioral patterns. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which only occurs during the sound exposure. Because masking (without resulting in threshold shift) 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; Matthews *et al.,* 2017) 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; Cholewiak *et al.,* 2018).

The echolocation calls of toothed whales are subject to masking by high-frequency sound. Human data indicate low-frequency sound can mask high-frequency sounds (*i.e.,* upward masking). Studies on captive odontocetes by Au *et al.* (1974, 1985, 1993) indicate that some species may use various processes to reduce masking effects (*e.g.,* adjustments in echolocation call intensity or frequency as a function of background noise conditions). There is also evidence that the directional hearing abilities of odontocetes are useful in reducing masking at the high-frequencies these cetaceans use to echolocate, but not at the low-to-moderate frequencies they use to communicate (Zaitseva *et al.,* 1980). A study by Nachtigall and Supin (2008) showed that false killer whales adjust their hearing to compensate for ambient sounds and the intensity of returning echolocation signals.

Impacts on signal detection, measured by masked detection thresholds, are not the only important factors to address when considering the potential effects of masking. As marine mammals use sound to recognize conspecifics, prey, predators, or other biologically significant sources (Branstetter *et al.,* 2016), it is also important to understand the impacts of masked recognition thresholds (often called ''informational masking''). Branstetter *et al.* (2016) measured masked recognition thresholds for whistle-like sounds of bottlenose dolphins and observed that they are approximately 4 dB above detection thresholds (energetic masking) for the same signals. Reduced ability to recognize a conspecific call or the acoustic signature of a predator could have severe negative impacts. Branstetter *et al.* (2016) observed that if ''quality communication'' is set at 90 percent recognition the output of communication space models (which are based on 50 percent detection) would likely result in a significant decrease in communication range.

As marine mammals use sound to recognize predators (Allen *et al.,* 2014; Cummings and Thompson, 1971; Curé *et al.,* 2015; Fish and Vania, 1971), the presence of masking noise may also prevent marine mammals from responding to acoustic cues produced by their predators, particularly if it occurs in the same frequency band. For example, harbor seals that reside in the coastal waters off British Columbia are frequently targeted by mammal-eating killer whales. The seals acoustically discriminate between the calls of mammal-eating and fish-eating killer whales (Deecke *et al.,* 2002), a capability that should increase survivorship while reducing the energy required to attend to all killer whale calls. Similarly, sperm whales (Curé *et al.,* 2016; Isojunno *et al.,* 2016), long-finned pilot whales (Visser *et al.,* 2016), and humpback whales (Curé *et al.,* 2015) changed their behavior in response to killer whale vocalization playbacks; these findings indicate that some recognition of predator cues could be missed if the killer whale vocalizations were masked. The potential effects of masked predator acoustic cues depends on the duration of the masking noise and the likelihood of a marine mammal encountering a predator during the time that detection and recognition of predator cues are impeded.

Redundancy and context can also facilitate detection of weak signals. These phenomena may help marine mammals detect weak sounds in the presence of natural or manmade noise. Most masking studies in marine mammals present the test signal and the masking noise from the same direction. The dominant background noise may be highly directional if it comes from a particular anthropogenic source such as a ship or industrial site. Directional hearing may significantly reduce the masking effects of these sounds by improving the effective signal-to-noise ratio.

Masking affects both senders and receivers of acoustic signals and, at higher levels and longer duration, 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; Cholewiak *et al.,* 2018). All anthropogenic sound sources, but especially chronic and lower-frequency signals (*e.g.,* from commercial vessel traffic), contribute to elevated ambient sound levels, thus intensifying masking.

In addition to making it more difficult for animals to perceive and recognize acoustic cues in their environment, anthropogenic sound presents separate challenges for animals that are vocalizing. When they vocalize, animals are aware of environmental conditions that affect the ''active space'' (or communication space) of their vocalizations, which is the maximum area within which their vocalizations can be detected before it drops to the level of ambient noise (Brenowitz, 2004; Brumm *et al.,* 2004; Lohr *et al.,* 2003). Animals are also aware of environmental conditions that affect whether listeners can discriminate and recognize their vocalizations from other sounds, which is more important than simply detecting that a vocalization is occurring (Brenowitz, 1982; Brumm *et al.,* 2004; Dooling, 2004; Marten and Marler, 1977; Patricelli and Blickley, 2006). Most species that vocalize have evolved with an ability to make adjustments to their vocalizations to increase the signal-to-noise ratio, active space, and recognizability/distinguishability of their vocalizations in the face of temporary changes in background noise (Brumm *et al.,* 2004; Patricelli and Blickley, 2006). Vocalizing animals can make adjustments to vocalization characteristics such as the frequency structure, amplitude, temporal structure, and temporal delivery (repetition rate), or ceasing to vocalize.

Many animals will combine several of these strategies to compensate for high levels of background noise. Anthropogenic sounds that reduce the signal-to-noise ratio of animal vocalizations, increase the masked auditory thresholds of animals listening for such vocalizations, or reduce the active space of an animal's vocalizations impair communication between animals. Most animals that vocalize have evolved strategies to compensate for the effects of short-term or temporary increases in background or ambient noise on their songs or calls. Although the fitness consequences of these vocal adjustments are not directly known in all instances, like most other trade-offs animals must make, some of these strategies likely come at a cost (Patricelli and Blickley, 2006; Noren *et al.,* 2017; Noren *et al.,* 2020). Shifting songs and calls to higher frequencies may also impose energetic costs (Lambrechts, 1996).

Marine mammals are also known to make vocal changes in response to anthropogenic noise. In cetaceans, vocalization changes have been reported from exposure to anthropogenic noise sources such as sonar, vessel noise, and seismic surveying (see the following for examples: Gordon *et al.,* 2003; Di Iorio and Clark, 2009; Hatch *et al.,* 2012; Holt *et al.,* 2009; Holt *et al.,* 2011; Lesage *et al.,* 1999; McDonald *et al.,* 2009; Parks *et al.,* 2007; Risch *et al.,* 2012; Rolland *et al.,* 2012), as well as changes in the natural acoustic environment (Dunlop *et al.,* 2014). Vocal changes can be temporary, or can be persistent. For example, model simulation suggests that the increase in starting frequency for the North Atlantic right whale upcall over the last 50 years resulted in increased detection ranges between right whales. The frequency shift, coupled with an increase in call intensity by 20 dB, led to a call detectability range of less than 3 km to over 9 km (Tennessen and Parks, 2016). Holt *et al.* (2009) measured killer whale call source levels and background noise levels in the 1 to 40 kHz band and reported that the whales increased their call source levels by 1 dB SPL for every one dB SPL increase in background noise level. Similarly, another study on St. Lawrence River belugas reported a similar rate of increase in vocalization activity in response to passing vessels (Scheifele *et al.,* 2005). Di Iorio and Clark (2009) showed that blue whale calling rates vary in association with seismic sparker survey activity, with whales calling more on days with surveys than on days without surveys. They suggested that the whales called more during seismic survey periods as a way to compensate for the elevated noise conditions.

In some cases, these vocal changes may have fitness consequences, such as an increase in metabolic rates and oxygen consumption, as observed in bottlenose dolphins when increasing their call amplitude (Holt *et al.,* 2015). A switch from vocal communication to physical, surface-generated sounds such as pectoral fin slapping or breaching was observed for humpback whales in the presence of increasing natural background noise levels, indicating that adaptations to masking may also move beyond vocal modifications (Dunlop *et al.,* 2010).

While these changes all represent possible tactics by the sound-producing animal to reduce the impact of masking, the receiving animal can also reduce masking by using active listening strategies such as orienting to the sound source, moving to a quieter location, or reducing self-noise from hydrodynamic flow by remaining still. The temporal structure of noise (*e.g.,* amplitude modulation) may also provide a considerable release from masking through comodulation masking release (a reduction of masking that occurs when broadband noise, with a frequency spectrum wider than an animal's auditory filter bandwidth at the frequency of interest, is amplitude modulated) (Branstetter and Finneran, 2008; Branstetter *et al.,* 2013). Signal type (*e.g.,* whistles, burst-pulse, sonar clicks) and spectral characteristics (*e.g.,* frequency modulated with harmonics) may further influence masked detection thresholds (Branstetter *et al.,* 2016; Cunningham *et al.,* 2014).

Masking is more likely to occur in the presence of broadband, relatively continuous noise sources, such as vessels. Several studies have shown decreases in marine mammal communication space and changes in behavior as a result of the presence of vessel noise. For example, right whales were 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) as well as increasing the amplitude (intensity) of their calls (Parks, 2009; Parks *et al.,* 2011). Clark *et al.* (2009) observed that right whales' communication space decreased by up to 84 percent in the presence of vessels. Cholewiak *et al.* (2018) also observed loss in communication space in Stellwagen National Marine Sanctuary for North Atlantic right whales, fin whales, and humpback whales with increased ambient noise and shipping noise. Although humpback whales off Australia did not change the frequency or duration of their vocalizations in the presence of ship noise, their source levels were lower than expected based on source level changes to wind noise, potentially indicating some signal masking (Dunlop, 2016). Multiple delphinid species have also been shown to increase the minimum or maximum frequencies of their whistles in the presence of anthropogenic noise and reduced communication space (for examples see: Holt *et al.,* 2009; Holt *et al.,* 2011; Gervaise *et al.,* 2012; Williams *et al.,* 2013; Hermannsen *et al.,* 2014; Papale *et al.,* 2015; Liu *et al.,* 2017). While masking impacts are not a concern from lower intensity, higher frequency HRG surveys, some degree of masking would be expected in the vicinity of turbine pile driving and concentrated support vessel operation. However, pile driving is an intermittent sound and would not be continuous throughout a day.

Habituation and Sensitization

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 having a neutral or positive outcome (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.

Both habituation and sensitization require an ongoing learning process. 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; National Research Council (NRC), 2003; Wartzok *et al.,* 2003; Southall *et al.,* 2019b). Controlled experiments with captive marine mammals have shown pronounced behavioral reactions, including avoidance of loud sound sources (*e.g.,* Ridgway *et al.,* 1997; Finneran *et al.,* 2003; Houser *et al.,* 2013a; Houser *et al.,* 2013b; Kastelein *et al.,* 2018). Observed responses of wild marine mammals to loud impulsive 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; Tougaard *et al.,* 2009; Brandt *et al.,* 2011; Brandt *et al.,* 2012; Dähne *et al.,* 2013; Brandt *et al.,* 2014; Russell *et al.,* 2016; Brandt *et al.,* 2018).

Stone (2015) reported data from at-sea observations during 1,196 airgun surveys from 1994 to 2010. When large arrays of airguns (considered to be 500 in 3 or more) were firing, lateral displacement, more localized avoidance, or other changes in behavior were evident for most odontocetes. However, significant responses to large arrays were found only for the minke whale and fin whale. Behavioral responses observed included changes in swimming or surfacing behavior with indications that cetaceans remained near the water surface at these times. Behavioral observations of gray whales during an airgun survey monitored whale movements and respirations pre-, during-, and post-seismic survey (Gailey *et al.,* 2016). Behavioral state and water depth were the best 'natural' predictors of whale movements and respiration and after considering natural variation, none of the response variables were significantly associated with survey or vessel sounds. 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.

Physiological 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 sufficiently 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.,* Lusseau and Bejder, 2007; Romano *et al.,* 2002a; Rolland *et al.,* 2012). 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, 2017).

Respiration naturally varies with different behaviors and variations in respiration 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. Mean exhalation rates of gray whales at rest and while diving were found to be unaffected by seismic surveys conducted adjacent to the whale feeding grounds (Gailey *et al.,* 2007). Studies with captive harbor porpoises show increased respiration rates upon introduction of acoustic alarms (Kastelein *et al.,* 2001; Kastelein *et al.,* 2006a) and emissions for underwater data transmission (Kastelein *et al.,* 2005). However, exposure of the same acoustic alarm to a striped dolphin under the same conditions did not elicit a response (Kastelein *et al.,* 2006a), 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.

Stranding

The definition for a stranding under title IV of the MMPA is that (A) a marine mammal is dead and is (i) on a beach or shore of the United States; or (ii) in waters under the jurisdiction of the

United States (including any navigable waters); or (B) a marine mammal is alive and is (i) on a beach or shore of the United States and is unable to return to the water; (ii) on a beach or shore of the United States and, although able to return to the water, is in need of apparent medical attention; or (iii) in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance (16 U.S.C. 1421h).

Marine mammal strandings have been linked to a variety of causes, such as illness from exposure to infectious agents, biotoxins, or parasites; starvation; unusual oceanographic or weather events; or anthropogenic causes including fishery interaction, ship strike, entrainment, entrapment, sound exposure, or combinations of these stressors sustained concurrently or in series. There have been multiple events worldwide in which marine mammals (primarily beaked whales, or other deep divers) have stranded coincident with relatively nearby activities utilizing loud sound sources (primarily military training events), and five in which mid-frequency active sonar has been more definitively determined to have been a contributing factor.

There are multiple theories regarding the specific mechanisms responsible for marine mammal strandings caused by exposure to loud sounds. One primary theme is the behaviorally mediated responses of deep-diving species (odontocetes), in which their startled response to an acoustic disturbance (1) affects ascent or descent rates, the time they stay at depth or the surface, or other regular dive patterns that are used to physiologically manage gas formation and absorption within their bodies, such that the formation or growth of gas bubbles damages tissues or causes other injury, or (2) results in their flight to shallow areas, enclosed bays, or other areas considered ''out of habitat,'' in which they become disoriented and physiologically compromised. For more information on marine mammal stranding events and potential causes, please see the Mortality and Stranding section of NMFS Proposed Incidental Take Regulations for the Navy's Training and Testing Activities in the Hawaii-Southern California Training and Testing Study Area (50 CFR part 218, Volume 83, No. 123, June 26, 2018).

The construction activities proposed by Park City Wind (*i.e.,* pile driving, drilling, UXO/MEC detonation) do not inherently have the potential to result in marine mammal strandings. While vessel strikes and UXO/MEC detonation could kill or injure a marine mammals (which may eventually strand), the required mitigation measures would reduce the potential for take from these activities to *de minimus* levels (see Proposed Mitigation section for more details). As described above, no mortality or serious injury is anticipated or proposed to be authorized from any Project activities.

Of the strandings documented to date worldwide, NMFS is not aware of any being attributed to pile driving, a single UXO/MEC detonation of the charge weights proposed here, or the types of HRG equipment proposed for use during the Project. Recently, there has been heightened interest in HRG surveys and their potential role in recent marine mammals strandings along the U.S. east coast. HRG surveys involve the use of certain sources to image the ocean bottom, which are very different from seismic airguns used in oil and gas surveys or tactical military sonar, in that they produce much smaller impact zones. Marine mammals may respond to exposure to these sources by, for example, avoiding the immediate area, which is why offshore wind developers have authorization to allow for Level B (behavioral) harassment, including Park City Wind. However, because of the combination of lower source levels, higher frequency, narrower beam-width (for some sources), and other factors, the area within which a marine mammal might be expected to be behaviorally disturbed by HRG sources is much smaller (by orders of magnitude) than the impact areas for seismic airguns or the military sonar with which a small number of marine mammal have been causally associated. Specifically, estimated harassment zones for HRG surveys are typically less than 200m (such as those associated with the Project), while zones for military mid-frequency active sonar or seismic airgun surveys typically extend for several kms ranging up to 10s of km. Further, because of this much smaller ensonified area, any marine mammal exposure to HRG sources is reasonably expected to be at significantly lower levels and shorter duration (associated with less severe responses), and there is no evidence suggesting, or reason to speculate, that marine mammals exposed to HRG survey noise are likely to be injured, much less strand, as a result. Last, all but one of the small number of marine mammal stranding events that have been causally associated with exposure to loud sound sources have been deep-diving toothed whale species (not mysticetes), which are known to respond differently to loud sounds.

Potential Effects of Disturbance on Marine Mammal Fitness

The different ways that marine mammals respond to sound are sometimes indicators of the ultimate effect that exposure to a given stimulus will have on the well-being (survival, reproduction, *etc.*) of an animal. There are numerous data relating the exposure of terrestrial mammals from sound to effects on reproduction or survival, and data for marine mammals continues to grow. Several authors have reported that disturbance stimuli may cause animals to abandon nesting and foraging sites (Sutherland and Crockford, 1993); may cause animals to increase their activity levels and suffer premature deaths or reduced reproductive success when their energy expenditures exceed their energy budgets (Daan *et al.,* 1996; Feare, 1976; Mullner *et al.,* 2004); or may cause animals to experience higher predation rates when they adopt risk-prone foraging or migratory strategies (Frid and Dill, 2002). Each of these studies addressed the consequences of animals shifting from one behavioral state (*e.g.,* resting or foraging) to another behavioral state (*e.g.,* avoidance or escape behavior) because of human disturbance or disturbance stimuli.

Attention is the cognitive process of selectively concentrating on one aspect of an animal's environment while ignoring other things (Posner, 1994). Because animals (including humans) have limited cognitive resources, there is a limit to how much sensory information they can process at any time. The phenomenon called ''attentional capture'' occurs when a stimulus (usually a stimulus that an animal is not concentrating on or attending to) ''captures'' an animal's attention. This shift in attention can occur consciously or subconsciously (for example, when an animal hears sounds that it associates with the approach of a predator) and the shift in attention can be sudden (Dukas, 2002; van Rij, 2007). Once a stimulus has captured an animal's attention, the animal can respond by ignoring the stimulus, assuming a ''watch and wait'' posture, or treat the stimulus as a disturbance and respond accordingly, which includes scanning for the source of the stimulus or ''vigilance'' (Cowlishaw *et al.,* 2004).

Vigilance is an adaptive behavior that helps animals determine the presence or absence of predators, assess their distance from conspecifics, or to attend cues from prey (Bednekoff and Lima, 1998; Treves, 2000). Despite those benefits, however, vigilance has a cost of time; when animals focus their attention on specific environmental cues, they are not attending to other activities 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 (Saino, 1994; Beauchamp and Livoreil, 1997; Fritz *et al.,* 2002; Purser and Radford, 2011). Animals will spend more time being vigilant, which may translate to less time foraging or resting, when disturbance stimuli approach them more directly, remain at closer distances, have a greater group size (*e.g.,* multiple surface vessels), or when they co-occur with times that an animal perceives increased risk (*e.g.,* when they are giving birth or accompanied by a calf).

The primary mechanism by which increased vigilance and disturbance appear to affect the fitness of individual animals is by disrupting an animal's time budget and, as a result, reducing the time they might spend foraging and resting (which increases an animal's activity rate and energy demand while decreasing their caloric intake/energy). In a study of northern resident killer whales off Vancouver Island, exposure to boat traffic was shown to reduce foraging opportunities and increase traveling time (Holt *et al.,* 2021). A simple bioenergetics model was applied to show that the reduced foraging opportunities equated to a decreased energy intake of 18 percent while the increased traveling incurred an increased energy output of 3–4 percent, which suggests that a management action based on avoiding interference with foraging might be particularly effective.

On a related note, many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hr cycle). Behavioral reactions to noise exposure (such as disruption of critical life functions, displacement, or avoidance of important habitat) are more likely to be significant for fitness if they last more than one diel cycle or recur on subsequent days (Southall *et al.,* 2007). Consequently, a behavioral response lasting less than 1 day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.,* 2007). It is important to note the difference between behavioral reactions lasting or recurring over multiple days and anthropogenic activities lasting or recurring over multiple days. For example, just because certain activities last for multiple days does not necessarily mean that individual animals will be either exposed to those activity-related stressors (*i.e.,* sonar) for multiple days or further exposed in a manner that would result in sustained multi-day substantive behavioral responses. However, special attention is warranted where longer-duration activities overlay areas in which animals are known to congregate for longer durations for biologically important behaviors.

There are few studies that directly illustrate the impacts of disturbance on marine mammal populations. Lusseau and Bejder (2007) present data from three long-term studies illustrating the connections between disturbance from whale-watching boats and population-level effects in cetaceans. In Shark Bay, Australia, the abundance of bottlenose dolphins was compared within adjacent control and tourism sites over three consecutive 4.5-year periods of increasing tourism levels. Between the second and third time periods, in which tourism doubled, dolphin abundance decreased by 15 percent in the tourism area and did not change significantly in the control area. In Fiordland, New Zealand, two populations (Milford and Doubtful Sounds) of bottlenose dolphins with tourism levels that differed by a factor of seven were observed and significant increases in traveling time and decreases in resting time were documented for both. Consistent short-term avoidance strategies were observed in response to tour boats until a threshold of disturbance was reached (average 68 minutes between interactions), after which the response switched to a longer-term habitat displacement strategy. For one population, tourism only occurred in a part of the home range. However, tourism occurred throughout the home range of the Doubtful Sound population and once boat traffic increased beyond the 68-minute threshold (resulting in abandonment of their home range/preferred habitat), reproductive success drastically decreased (increased stillbirths) and abundance decreased significantly (from 67 to 56 individuals in a short period).

In order to understand how the effects of activities may or may not impact species and stocks of marine mammals, it is necessary to understand not only what the likely disturbances are going to be but how those disturbances may affect the reproductive success and survivorship of individuals and then how those impacts to individuals translate to population-level effects. Following on the earlier work of a committee of the U.S. National Research Council (NRC, 2005), New *et al.* (2014), in an effort termed the Potential Consequences of Disturbance (PCoD), outline an updated conceptual model of the relationships linking disturbance to changes in behavior and physiology, health, vital rates, and population dynamics. This framework is a four-step process progressing from changes in individual behavior and/or physiology, to changes in individual health, then vital rates, and finally to population-level effects. In this framework, behavioral and physiological changes can have direct (acute) effects on vital rates, such as when changes in habitat use or increased stress levels raise the probability of mother-calf separation or predation; indirect and long-term (chronic) effects on vital rates, such as when changes in time/energy budgets or increased disease susceptibility affect health, which then affects vital rates; or no effect to vital rates (New *et al.,* 2014).

Since the PCoD general framework was outlined and the relevant supporting literature compiled, multiple studies developing state-space energetic models for species with extensive long-term monitoring (*e.g.,* southern elephant seals, North Atlantic right whales, Ziphiidae beaked whales, and bottlenose dolphins) have been conducted and can be used to effectively forecast longer-term, population-level impacts from behavioral changes. While these are very specific models with very specific data requirements that cannot yet be applied broadly to project-specific risk assessments for the majority of species, they are a critical first step towards being able to quantify the likelihood of a population level effect. Since New *et al.* (2014), several publications have described models developed to examine the long-term effects of environmental or anthropogenic disturbance of foraging on various life stages of selected species (*e.g.,* sperm whale, Farmer *et al.* (2018); California sea lion, McHuron *et al.* (2018); blue whale, Pirotta *et al.* (2018a); humpback whale, Dunlop *et al.* (2021)). These models continue to add to refinement of the approaches to the PCoD framework. Such models also help identify what data inputs require further investigation. Pirotta *et al.* (2018b) provides a review of the PCoD framework with details on each step of the process and approaches to applying real data or simulations to achieve each step.

Despite its simplicity, there are few complete PCoD models available for any marine mammal species due to a lack of data available to parameterize many of the steps. To date, no PCoD model has been fully parameterized with empirical data (Pirotta *et al.,* 2018a) due to the fact they are data intensive and logistically challenging to complete. Therefore, most complete PCoD models include simulations, theoretical modeling, and expert opinion to move through the steps. For example, PCoD models have been developed to evaluate the effect of wind farm construction on the North Sea harbor porpoise populations (*e.g.,* King *et al.,* 2015; Nabe-Nielsen *et al.,* 2018). These models include a mix of empirical data, expert elicitation (King *et al.,* 2015) and simulations of animals' movements, energetics, and/or survival (New *et al.,* 2014; Nabe-Nielsen *et al.,* 2018).

PCoD models may also be approached in different manners. Dunlop *et al.* (2021) modeled migrating humpback whale mother-calf pairs in response to seismic surveys using both a forwards and backwards approach. While a typical forwards approach can determine if a stressor would have population-level consequences, Dunlop *et al.* demonstrated that working backwards through a PCoD model can be used to assess the ''worst case'' scenario for an interaction of a target species and stressor. This method may be useful for future management goals when appropriate data becomes available to fully support the model. In another example, harbor porpoise PCoD model investigating the impact of seismic surveys on harbor porpoise included an investigation on underlying drivers of vulnerability. Harbor porpoise movement and foraging were modeled for baseline periods and then for periods with seismic surveys as well; the models demonstrated that temporal (*i.e.,* seasonal) variation in individual energetics and their link to costs associated with disturbances was key in predicting population impacts (Gallagher *et al.,* 2021).

Behavioral change, such as disturbance manifesting in lost foraging time, in response to anthropogenic activities is often assumed to indicate a biologically significant effect on a population of concern. However, as described above, individuals may be able to compensate for some types and degrees of shifts in behavior, preserving their health and thus their vital rates and population dynamics. For example, New *et al.* (2013) developed a model simulating the complex social, spatial, behavioral and motivational interactions of coastal bottlenose dolphins in the Moray Firth, Scotland, to assess the biological significance of increased rate of behavioral disruptions caused by vessel traffic. Despite a modeled scenario in which vessel traffic increased from 70 to 470 vessels a year (a six-fold increase in vessel traffic) in response to the construction of a proposed offshore renewables' facility, the dolphins' behavioral time budget, spatial distribution, motivations, and social structure remain unchanged. Similarly, two bottlenose dolphin populations in Australia were also modeled over 5 years against a number of disturbances (Reed *et al.,* 2020), and results indicated that habitat/noise disturbance had little overall impact on population abundances in either location, even in the most extreme impact scenarios modeled.

By integrating different sources of data (*e.g.,* controlled exposure data, activity monitoring, telemetry tracking, and prey sampling) into a theoretical model to predict effects from sonar on a blue whale's daily energy intake, Pirotta *et al.* (2021) found that tagged blue whales' activity budgets, lunging rates, and ranging patterns caused variability in their predicted cost of disturbance. This method may be useful for future management goals when appropriate data becomes available to fully support the model. Harbor porpoise movement and foraging were modeled for baseline periods and then for periods with seismic surveys as well; the models demonstrated that the seasonality of the seismic activity was an important predictor of impact (Gallagher *et al.,* 2021).

In their Table 1, Keen *et al.* (2021) summarize the emerging themes in PCoD models that should be considered when assessing the likelihood and duration of exposure and the sensitivity of a population to disturbance (see Table 1 from Keen *et al.,* 2021, below). The themes are categorized by life history traits (movement ecology, life history strategy, body size, and pace of life), disturbance source characteristics (overlap with biologically important areas, duration and frequency, and nature and context), and environmental conditions (natural variability in prey availability and climate change). Keen *et al.* (2021) then summarize how each of these features influence an assessment, noting, for example, that individual animals with small home ranges have a higher likelihood of prolonged or year-round exposure, that the effect of disturbance is strongly influenced by whether it overlaps with biologically important habitats when individuals are present, and that continuous disruption will have a greater impact than intermittent disruption.

Nearly all PCoD studies and experts agree that infrequent exposures of a single day or less are unlikely to impact individual fitness, let alone lead to population level effects (Booth *et al.,* 2016; Booth *et al.,* 2017; Christiansen and Lusseau 2015; Farmer *et al.,* 2018; Wilson *et al.,* 2020; Harwood and Booth 2016; King *et al.,* 2015; McHuron *et al.,* 2018; National Academies of Sciences, Engineering, and Medicine (NAS), 2017; New *et al.,* 2014; Pirotta *et al.,* 2018a; Southall *et al.,* 2007; Villegas-Amtmann *et al.,* 2015). As described through this proposed rule, NMFS expects that any behavioral disturbance that would occur due to animals being exposed to construction activity would be of a relatively short duration, with behavior returning to a baseline state shortly after the acoustic stimuli ceases or the animal moves far enough away from the source. Given this, and NMFS' evaluation of the available PCoD studies, and the required mitigation discussed later, any such behavioral disturbance resulting from Park City Wind's activities is not expected to impact individual animals' health or have effects on individual animals' survival or reproduction, thus no detrimental impacts at the population level are anticipated. Marine mammals may temporarily avoid the immediate area but are not expected to permanently abandon the area or their migratory or foraging behavior. Impacts to breeding, feeding, sheltering, resting, or migration are not expected nor are shifts in habitat use, distribution, or foraging success.

Potential Effects From Explosive Sources

With respect to the noise from underwater explosives, the same acoustic-related impacts described above apply and are not repeated here. Noise from explosives can cause hearing impairment if an animal is close enough to the sources; however, because noise from an explosion is discrete, lasting less than approximately 1 second, no behavioral impacts below the TTS threshold are anticipated considering that Park City Wind would not detonate more than 1 UXO/MEC per day and only 10 during the life of the proposed rule. This section focuses on the pressure-related impacts of underwater explosives, including physiological injury and mortality.

Underwater explosive detonations send a shock wave and sound energy through the water and can release gaseous by-products, create an oscillating bubble, or cause a plume of water to shoot up from the water surface. The shock wave and accompanying noise are of most concern to marine animals. Depending on the intensity of the shock wave and size, location, and depth of the animal, an animal can be injured, killed, suffer non-lethal physical effects, experience hearing related effects with or without behavioral responses, or exhibit temporary behavioral responses or tolerance from hearing the blast sound. Generally, exposures to higher levels of impulse and pressure levels would result in greater impacts to an individual animal.

Injuries resulting from a shock wave take place at boundaries between tissues of different densities. Different velocities are imparted to tissues of different densities, and this can lead to their physical disruption. Blast effects are greatest at the gas-liquid interface (Landsberg, 2000). Gas-containing organs, particularly the lungs and gastrointestinal tract, are especially susceptible (Goertner, 1982; Hill, 1978; Yelverton *et al.,* 1973). Intestinal walls can bruise or rupture, with subsequent hemorrhage and escape of gut contents into the body cavity. Less severe gastrointestinal tract injuries include contusions, petechiae (small red or purple spots caused by bleeding in the skin), and slight hemorrhaging (Yelverton *et al.,* 1973).

Because the ears are the most sensitive to pressure, they are the organs most sensitive to injury (Ketten, 2000). Sound-related damage associated with sound energy from detonations can be theoretically distinct from injury from the shock wave, particularly farther from the explosion. If a noise is audible to an animal, it has the potential to damage the animal's hearing by causing decreased sensitivity (Ketten, 1995). Lethal impacts are those that result in immediate death or serious debilitation in or near an intense source and are not, technically, pure acoustic trauma (Ketten, 1995). Sublethal impacts include hearing loss, which is caused by exposures to perceptible sounds. Severe damage (from the shock wave) to the ears includes tympanic membrane rupture, fracture of the ossicles, and damage to the cochlea, hemorrhage, and cerebrospinal fluid leakage into the middle ear. Moderate injury implies partial hearing loss due to tympanic membrane rupture and blood in the middle ear. Permanent hearing loss also can occur when the hair cells are damaged by one very loud event as well as by prolonged exposure to a loud noise or chronic exposure to noise. The level of impact from blasts depends on both an animal's location and, at outer zones, its sensitivity to the residual noise (Ketten, 1995).

Given the mitigation measures proposed, it is unlikely that any of the more serious injuries or mortality discussed above are likely to result from any UXO/MEC detonation that Park City Wind might need to undertake. PTS, TTS, and brief startle reactions are the most likely impacts to result from this activity, if it occurs (noting detonation is the last method to be chosen for removal).

Potential Effects From Vessel Strike

Vessel collisions with marine mammals, also referred to as vessel strikes or ship strikes, can result in death or serious injury of the animal. Wounds resulting from ship strike may include massive trauma, hemorrhaging, broken bones, or propeller lacerations (Knowlton and Kraus, 2001). An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or an animal just below the surface could be cut by a vessel's propeller. Superficial strikes may not kill or result in the death of the animal. Lethal interactions are typically associated with large whales, which are occasionally found draped across the bulbous bow of large commercial ships upon arrival in port. Although smaller cetaceans are more maneuverable in relation to large vessels than are large whales, they may also be susceptible to strike. 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; Conn and Silber, 2013). Impact forces increase with speed, as does the probability of a strike at a given distance (Silber *et al.,* 2010; Gende *et al.,* 2011).

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 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. 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 occurs and, if so, whether it results in injury, serious injury, or mortality (Knowlton and Kraus, 2001; Laist *et al.,* 2001; Jensen and Silber, 2003; Pace and Silber, 2005; Vanderlaan and Taggart, 2007; Conn and Silber, 2013). In assessing records in which vessel speed was known, 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 13 knots.

Jensen and Silber (2003) detailed 292 records of known or probable ship strikes of all large whale species from 1975 to 2002. Of these, vessel speed at the time of collision was reported for 58 cases. Of these 58 cases, 39 (or 67 percent) resulted in serious injury or death (19 of those resulted in serious injury as determined by blood in the water, propeller gashes or severed tailstock, and fractured skull, jaw, vertebrae, hemorrhaging, massive bruising or other injuries noted during necropsy and 20 resulted in death). Operating speeds of vessels that struck various species of large whales ranged from 2 to 51 knots. The majority (79 percent) of these strikes occurred at speeds of 13 knots or greater. The average speed that resulted in serious injury or death was 18.6 knots. Pace and Silber (2005) found that the probability of death or serious injury increased rapidly with increasing vessel speed. Specifically, the predicted probability of serious injury or death increased from 45 to 75 percent as vessel speed increased from 10 to 14 knots, and exceeded 90 percent at 17 knots. Higher speeds during collisions result in greater force of impact and also appear to increase the chance of severe injuries or death. While modeling studies have suggested that hydrodynamic forces pulling whales toward the vessel hull increase with increasing speed (Clyne, 1999; Knowlton *et al.,* 1995), this is inconsistent with Silber *et al.* (2010), which demonstrated that there is no such relationship (*i.e.,* hydrodynamic forces are independent of speed).

In a separate study, Vanderlaan and Taggart (2007) analyzed the probability of lethal mortality of large whales at a given speed, showing that the greatest rate of change in the probability of a lethal injury to a large whale as a function of vessel speed occurs between 8.6 and 15 knots. The chances of a lethal injury decline from approximately 80 percent at 15 knots to approximately 20 percent at 8.6 knots. At speeds below 11.8 knots, the chances of lethal injury drop below 50 percent, while the probability asymptotically increases toward 100 percent above 15 knots.

The Jensen and Silber (2003) report notes that the Large Whale Ship Strike Database represents a minimum number of collisions, because the vast majority probably goes undetected or unreported. In contrast, the Project's personnel are likely to detect any strike that does occur because of the required personnel training and lookouts, along with the inclusion of Protected Species Observers (as described in the Proposed Mitigation section), and they are required to report all ship strikes involving marine mammals.

There are no known vessel strikes of marine mammals by any offshore wind energy vessel in the U.S. Given the extensive mitigation and monitoring measures (see the Proposed Mitigation and Proposed Monitoring and Reporting section) that would be required of Park City Wind, NMFS believes that a vessel strike is not likely to occur.

Potential Effects to Marine Mammal Habitat

Park City Wind's proposed activities could potentially affect marine mammal habitat through the introduction of impacts to the prey species of marine mammals (through noise, oceanographic processes, or reef effects), acoustic habitat (sound in the water column), water quality, and biologically important habitat for marine mammals.

Effects on Prey

Sound may affect marine mammals through impacts on the abundance, behavior, or distribution of prey species (*e.g.,* crustaceans, cephalopods, fish, and 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 and Mann, 1999; Fay, 2009). The most likely effects on fishes exposed to loud, intermittent, low-frequency sounds are behavioral responses (*i.e.,* flight or avoidance). Short duration, sharp sounds (such as pile driving or airguns) can cause overt or subtle changes in fish behavior and local distribution. The reaction of fish to acoustic sources depends on the physiological state of the fish, past exposures, motivation (*e.g.,* feeding, spawning, migration), and other environmental factors. Key impacts to fishes may include behavioral responses, hearing damage, barotrauma (pressure-related injuries), and mortality. While it is clear that the behavioral responses of individual prey, such as displacement or other changes in distribution, can have direct impacts on the foraging success of marine mammals, the effects on marine mammals of individual prey that experience hearing damage, barotrauma, or mortality is less clear, though obviously population scale impacts that meaningfully reduce the amount of prey available could have more serious impacts.

Fishes, like other vertebrates, have a variety of different sensory systems to glean information from ocean around them (Astrup and Mohl, 1993; Astrup, 1999; Braun and Grande, 2008; Carroll *et al.,* 2017; Hawkins and Johnstone, 1978; Ladich and Popper, 2004; Ladich and Schulz-Mirbach, 2016; Mann, 2016; Nedwell *et al.,* 2004; Popper *et al.,* 2003; Popper *et al.,* 2005). 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) (terrestrial vertebrates generally only detect pressure). Most marine fishes primarily detect particle motion using the inner ear and lateral line system while some fishes possess additional morphological adaptations or specializations that can enhance their sensitivity to sound pressure, such as a gas-filled swim bladder (Braun and Grande, 2008; Popper and Fay, 2011).

Hearing capabilities vary considerably between different fish species with data only available for just over 100 species out of the 34,000 marine and freshwater fish species (Eschmeyer and Fong, 2016). In order to better understand acoustic impacts on fishes, fish hearing groups are defined by species that possess a similar continuum of anatomical features, which result in varying degrees of hearing sensitivity (Popper and Hastings, 2009a). There are four hearing groups defined for all fish species (modified from Popper *et al.,* 2014) within this analysis, and they include: fishes without a swim bladder (*e.g.,* flatfish, sharks, rays, *etc.*); fishes with a swim bladder not involved in hearing (*e.g.,* salmon, cod, pollock, *etc.*); fishes with a swim bladder involved in hearing (*e.g.,* sardines, anchovy, herring, *etc.*); and fishes with a swim bladder involved in hearing and high-frequency hearing (*e.g.,* shad and menhaden). Most marine mammal fish prey species would not be likely to perceive or hear mid- or high-frequency sonars. While hearing studies have not been done on sardines and northern anchovies, it would not be unexpected for them to have hearing similarities to Pacific herring (up to 2–5 kHz) (Mann *et al.,* 2005). Currently, less data are available to estimate the range of best sensitivity for fishes without a swim bladder.

In terms of physiology, multiple scientific studies have documented a lack of mortality or physiological effects to fish from exposure to low- and mid-frequency sonar and other sounds (Halvorsen *et al.,* 2012a; Jørgensen *et al.,* 2005; Juanes *et al.,* 2017; Kane *et al.,* 2010; Kvadsheim and Sevaldsen, 2005; Popper *et al.,* 2007; Popper *et al.,* 2016; Watwood *et al.,* 2016). Techer *et al.* (2017) exposed carp in floating cages for up to 30 days to low-power 23 and 46 kHz source without any significant physiological response. Other studies have documented either a lack of TTS in species whose hearing range cannot perceive sonar (such as Navy sonar), or for those species that could perceive sonar-like signals, any TTS experienced would be recoverable (Halvorsen *et al.,* 2012a; Ladich and Fay, 2013; Popper and Hastings, 2009a, 2009b; Popper *et al.,* 2014; Smith, 2016). Only fishes that have specializations that enable them to hear sounds above about 2,500 Hz (2.5 kHz), such as herring (Halvorsen *et al.,* 2012a; Mann *et al.,* 2005; Mann, 2016; Popper *et al.,* 2014), would have the potential to receive TTS or exhibit behavioral responses from exposure to mid-frequency sonar. In addition, any sonar induced TTS to fish whose hearing range could perceive sonar would only occur in the narrow spectrum of the source (*e.g.,* 3.5 kHz) compared to the fish's total hearing range (*e.g.,* 0.01 kHz to 5 kHz).

In terms of behavioral responses, Juanes *et al.* (2017) discuss the potential for negative impacts from anthropogenic noise on fish, but the author's focus was on broader based sounds, such as ship and boat noise sources. Watwood *et al.* (2016) also documented no behavioral responses by reef fish after exposure to mid-frequency active sonar. Doksaeter *et al.* (2009; 2012) reported no behavioral responses to mid-frequency sonar (such as naval sonar) by Atlantic herring; specifically, no escape reactions (vertically or horizontally) were observed in free swimming herring exposed to mid-frequency sonar transmissions. Based on these results (Doksaeter *et al.,* 2009; Doksaeter *et al.,* 2012; Sivle *et al.,* 2012), Sivle *et al.* (2014) created a model in order to report on the possible population-level effects on Atlantic herring from active sonar. The authors concluded that the use of sonar poses little risk to populations of herring regardless of season, even when the herring populations are aggregated and directly exposed to sonar. Finally, Bruintjes *et al.* (2016) commented that fish exposed to any short-term noise within their hearing range might initially startle, but would quickly return to normal behavior.

Pile-driving noise during construction is of particular concern as the very high sound pressure levels could potentially prevent fish from reaching breeding or spawning sites, finding food, and acoustically locating mates. A playback study in West Scotland revealed that there was a significant movement response to the pile-driving stimulus in both species at relatively low received sound pressure levels (sole: 144–156 dB re 1µPa Peak; cod: 140–161 dB re 1 µPa Peak, particle motion between 6.51 × 10^3 and 8.62 × 10^4 m/s² peak) (Mueller-Blenkle *et al.,* 2010). The swimming speed of sole increased significantly during the playback of construction noise when compared to the playbacks of before and after construction. While not statistically significant, cod also displayed a similar behavioral response during before, during, and after construction playbacks. However, cod demonstrated a specific and significant freezing response at the onset and cessation of the playback recording. In both species, indications were present displaying directional movements away from the playback source. During wind farm construction in the Eastern Taiwan Strait, Type 1 soniferous fish chorusing showed a relatively lower intensity and longer duration while Type 2 chorusing exhibited higher intensity and no changes in its duration. Deviation from regular fish vocalization patterns may affect fish reproductive success, cause migration, augmented predation, or physiological alterations.

Occasional behavioral reactions to activities that produce underwater noise sources are unlikely to cause long-term consequences for individual fish or populations. The most likely impact to fish from impact and vibratory pile driving activities at the project areas would be temporary behavioral avoidance of the area. 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. The duration of fish avoidance of an area after pile driving stops 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 individual pile driving events and the relatively small areas being affected.

SPLs of sufficient strength have been known to cause fish auditory impairment, injury and mortality. Popper *et al.* (2014) found that fish with or without air bladders could experience TTS at 186 dB SEL_{cum}. Mortality could occur for fish without swim bladders at >216 dB SEL_{cum}. Those with swim bladders or at the egg or larvae life stage, mortality was possible at >203 dB SEL_{cum}. Other studies found that 203 dB SEL_{cum} or above caused a physiological response in other fish species (Casper *et al.,* 2012, Halvorsen *et al.,* 2012a, Halvorsen *et al.,* 2012b, Casper *et al.,* 2013a; Casper *et al.,* 2013b). However, in most fish species, hair cells in the ear continuously regenerate and loss of auditory function likely is restored when damaged cells are replaced with new cells. Halvorsen *et al.* (2012a) showed that a TTS of 4–6 dB was recoverable within 24 hours for one species. Impacts would be most severe when the individual fish is close to the source and when the duration of exposure is long. Injury caused by barotrauma can range from slight to severe and can cause death, and is most likely for fish with swim bladders. Barotrauma injuries have been documented during controlled exposure to impact pile driving (Halvorsen *et al.,* 2012b; Casper *et al.,* 2013).

As described in the Proposed Mitigation section below, Park City Wind would utilize a sound attenuation device which would reduce potential for injury to marine mammal prey. Other fish that experience hearing loss as a result of exposure to impulsive sound sources may have a reduced ability to detect relevant sounds such as predators, prey, or social vocalizations. However, PTS has not been known to occur in fishes and any hearing loss in fish may be as temporary as the timeframe required to repair or replace the sensory cells that were damaged or destroyed (Popper *et al.,* 2005; Popper *et al.,* 2014; Smith *et al.,* 2006). It is not known if damage to auditory nerve fibers could occur, and if so, whether fibers would recover during this process.

It is also possible for fish to be injured or killed by an explosion from UXO/MEC detonation. Physical effects from pressure waves generated by underwater sounds (*e.g.,* underwater explosions) could potentially affect fish within proximity of training or testing activities. The shock wave from an underwater explosion is lethal to fish at close range, causing massive organ and tissue damage and internal bleeding (Keevin and Hempen, 1997). At greater distance from the detonation point, the extent of mortality or injury depends on a number of factors including fish size, body shape, orientation, and species (Keevin and Hempen, 1997; Wright, 1982). At the same distance from the source, larger fish are generally less susceptible to death or injury, elongated forms that are round in cross-section are less at risk than deep-bodied forms, and fish oriented sideways to the blast suffer the greatest impact (Edds-Walton and Finneran, 2006; O'Keeffe, 1984; O'Keeffe and Young, 1984; Wiley *et al.,* 1981; Yelverton *et al.,* 1975). Species with gas-filled organs are more susceptible to injury and mortality than those without them (Gaspin, 1975; Gaspin *et al.,* 1976; Goertner *et al.,* 1994). Barotrauma injuries have been documented during controlled exposure to impact pile driving (an impulsive noise source, as are explosives and airguns) (Halvorsen *et al.,* 2012b; Casper *et al.,* 2013a).

Fish not killed by an explosion might change their behavior, feeding pattern, or distribution. Changes in behavior of fish have been observed as a result of sound produced by explosives, with effect intensified in areas of hard substrate (Wright, 1982). Stunning from pressure waves could also temporarily immobilize fish, making them more susceptible to predation. The abundances of various fish (and invertebrates) near the detonation point for explosives could be altered for a few hours before animals from surrounding areas repopulate the area. However, these populations would likely be replenished as waters near the detonation point are mixed with adjacent waters. Repeated exposure of individual fish to sounds from underwater explosions is not likely and are expected to be short-term and localized. Long-term consequences for fish populations would not be expected. Several studies have demonstrated that airgun 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).

UXO/MEC detonations would be dispersed in space and time; therefore, repeated exposure of individual fishes are unlikely. Mortality and injury effects to fishes from explosives would be localized around the area of a given in-water explosion but only if individual fish and the explosive (and immediate pressure field) were co-located at the same time. Fishes deeper in the water column or on the bottom would not be affected by water surface explosions. Repeated exposure of individual fish to sound and energy from underwater explosions is not likely given fish movement patterns, especially schooling prey species. Most acoustic effects, if any, are expected to be short-term and localized. Long-term consequences for fish populations, including key prey species within the project area, would not be expected.

Required soft-starts would allow prey and marine mammals to move away from the source prior to any noise levels that may physically injure prey and the use of the noise attenuation devices would reduce noise levels to the degree any mortality or injury of prey is also minimized. Use of bubble curtains, in addition to reducing impacts to marine mammals, for example, is a key mitigation measure in reducing injury and mortality of ESA-listed salmon on the U.S. West Coast. However, we recognize some mortality, physical injury and hearing impairment in marine mammal prey may occur, but we anticipate the amount of prey impacted in this manner is minimal compared to overall availability. Any behavioral responses to pile driving by marine mammal prey are expected to be brief. We expect that other impacts, such as stress or masking, would occur in fish that serve as marine mammals prey (Popper *et al.,* 2019); however, those impacts would be limited to the duration of impact pile driving and during any UXO/MEC detonations and, if prey were to move out the area in response to noise, these impacts would be minimized.

In addition to fish, prey sources such as marine invertebrates could potentially be impacted by noise stressors as a result of the proposed activities. However, most marine invertebrates' ability to sense sounds is limited. Invertebrates appear to be able to detect sounds (Pumphrey, 1950; Frings and Frings, 1967) and are most sensitive to low-frequency sounds (Packard *et al.,* 1990; Budelmann and Williamson, 1994; Lovell *et al.,* 2005; Mooney *et al.,* 2010). Data on response of invertebrates such as squid, another marine mammal prey species, to anthropogenic sound is more limited (de Soto, 2016; Sole *et al.,* 2017). Data suggest that cephalopods are capable of sensing the particle motion of sounds and detect low frequencies up to 1–1.5 kHz, depending on the species, and so are likely to detect airgun noise (Kaifu *et al.,* 2008; Hu *et al.,* 2009; Mooney *et al.,* 2010; Samson *et al.,* 2014). Sole *et al.* (2017) reported physiological injuries to cuttlefish in cages placed at-sea when exposed during a controlled exposure experiment to low-frequency sources (315 Hz, 139 to 142 dB *re 1* μPa^2 and 400 Hz, 139 to 141 dB *re 1* μPa^2). Fewtrell and McCauley (2012) reported squids maintained in cages displayed startle responses and behavioral changes when exposed to seismic airgun sonar (136–162 re 1 $\mu Pa^2 \cdot s$). Jones *et al.* (2020) found that when squid (*Doryteuthis pealeii*) were exposed to impulse pile driving noise, body pattern changes, inking, jetting, and startle responses were observed and nearly all squid exhibited at least one response. However, these responses occurred primarily during the first eight impulses and diminished quickly, indicating potential rapid, short-term habituation.

Cephalopods have a specialized sensory organ inside the head called a statocyst that may help an animal determine its position in space (orientation) and maintain balance (Budelmann, 1992). Packard *et al.* (1990) showed that cephalopods were sensitive to particle motion, not sound pressure, and Mooney *et al.* (2010) demonstrated that squid statocysts act as an accelerometer through which particle motion of the sound field can be detected. Auditory injuries (lesions occurring on the statocyst sensory hair cells) have been reported upon controlled exposure to low-frequency sounds, suggesting that cephalopods are particularly sensitive to low-frequency sound (Andre *et al.,* 2011; Sole *et al.,* 2013). Behavioral responses, such as inking and jetting, have also been reported upon exposure to low-frequency sound (McCauley *et al.,* 2000; Samson *et al.,* 2014). Squids, like most fish species, are likely more sensitive to low frequency sounds and may not perceive mid- and high-frequency sonars. Cumulatively for squid as a prey species, individual and population impacts from exposure to explosives, like fish, are not likely to be significant, and explosive impacts would be short-term and localized.

With regard to potential impacts on zooplankton, McCauley *et al.* (2017) found that exposure to airgun noise resulted in significant depletion for more than half the taxa present and that there were two to three times more dead zooplankton after airgun exposure compared with controls for all taxa, within 1 km of the airguns. However, the authors also stated that in order to have significant impacts on r-selected species (*i.e.,* those with high growth rates and that produce many offspring) such as plankton, the spatial or temporal scale of impact must be large in comparison with the ecosystem concerned, and it is possible that the findings reflect avoidance by zooplankton rather than mortality (McCauley *et al.,* 2017). In addition, the results of this study are inconsistent with a large body of research that generally finds limited spatial and temporal impacts to zooplankton as a result of exposure to airgun noise (*e.g.,* Dalen and Knutsen, 1987; Payne, 2004; Stanley *et al.,* 2011). Most prior research on this topic, which has focused on relatively small spatial scales, has showed minimal effects (*e.g.,* Kostyuchenko, 1973; Booman *et al.,* 1996; Sætre and Ona, 1996; Pearson *et al.,* 1994; Bolle *et al.,* 2012).

A modeling exercise was conducted as a follow-up to the McCauley *et al.* (2017) study (as recommended by McCauley *et al.*), in order to assess the potential for impacts on ocean ecosystem dynamics and zooplankton population dynamics (Richardson *et al.,* 2017). Richardson *et al.* (2017) found that a full-scale airgun survey would impact copepod abundance within the survey area, but that effects at a regional scale were minimal (2 percent decline in abundance within 150 km of the survey area and effects not discernible over the full region). The authors also found that recovery within the survey area would be relatively quick (3 days following survey completion), and suggest that the quick recovery was due to the fast growth rates of zooplankton, and the dispersal and mixing of zooplankton from both inside and outside of the impacted region. The authors also suggest that surveys in areas with more dynamic ocean circulation in comparison with the study region and/or with deeper waters (*i.e.,* typical offshore wind locations) would have less net impact on zooplankton.

Notably, a recently described study produced results inconsistent with those of McCauley *et al.* (2017). Researchers conducted a field and laboratory study to assess if exposure to airgun noise affects mortality, predator escape response, or gene expression of the copepod *Calanus finmarchicus* (Fields *et al.,* 2019). Immediate mortality of copepods was significantly higher, relative to controls, at distances of 5 m or less from the airguns. Mortality 1 week after the airgun blast was significantly higher in the copepods placed 10 m from the airgun but was not significantly different from the controls at a distance of 20 m from the airgun. The increase in mortality, relative to controls, did not exceed 30 percent at any distance from the airgun. Moreover, the authors caution that even this higher mortality in the immediate vicinity of the airguns may be more pronounced than what would be observed in free-swimming animals due to increased flow speed of fluid inside bags containing the experimental animals. There were no sub-lethal effects on the escape performance or the sensory threshold needed to initiate an escape response at any of the distances from the airgun that were tested. Whereas McCauley *et al.* (2017) reported an SEL of 156 dB at a range of 509–658 m, with zooplankton mortality observed at that range, Fields *et al.* (2019) reported an

SEL of 186 dB at a range of 25 m, with no reported mortality at that distance.

The presence of large numbers of turbines has been shown to impact meso- and sub-meso-scale water column circulation, which can affect the density, distribution, and energy content of zooplankton and thereby, their availability as marine mammal prey. Topside, atmospheric wakes result in wind speed reductions influencing upwelling and downwelling in the ocean while underwater structures such as WTG and ESP foundations may cause turbulent current wakes, which impact circulation, stratification, mixing, and sediment resuspension (Daewel *et al.,* 2022). Overall, the presence and operation of structures such as wind turbines are, in general, likely to result in local and broader oceanographic effects in the marine environment and may disrupt marine mammal prey, such as dense aggregations and distribution of zooplankton through altering the strength of tidal currents and associated fronts, changes in stratification, primary production, the degree of mixing, and stratification in the water column (Chen *et al.,* 2021; Johnson *et al.,* 2021; Christiansen *et al.,* 2022; Dorrell *et al.,* 2022). However, the scale of impacts is difficult to predict and may vary from meters to hundreds of meters for local individual turbine impacts (Schultze *et al.,* 2020) to large-scale dipoles of surface elevation changes stretching hundreds of kilometers (Christiansen *et al.,* 2022).

Park City Wind intends to install up to 130 WTG and ESP positions. Two positions may potentially have co-located ESPs (*i.e.,* 1 WTG and 1 ESP foundation installed at 1 grid position), resulting in 132 foundations with turbine operations commencing in 2027 and all turbines being operational in 2028. As described above, there is scientific uncertainty around the scale of oceanographic impacts (meters to kilometers) associated with turbine operation. The project is located in an area of southern New England that experiences coastal upwelling, a consequence of the predominant wind direction and the orientation of the coastline. Along the coast of Rhode Island and southern Massachusetts, upwelling of deeper, nutrient-rich waters frequently leads to late summer blooms of phytoplankton and subsequently increased biological productivity (Gong *et al.,* 2010; Glenn *et al.,* 2004). The lease area is located within a core winter foraging habitat for North Atlantic right whales (Leiter *et al.,* 2017; Quintano-Rizzo *et al.,* 2021); however, prime foraging habitat on and near Nantucket Shoals is unlikely to be influenced.

These potential impacts on prey could impact the distribution of marine mammals within the project area, potentially necessitating additional energy expenditure to find and capture prey, but at the temporal and spatial scales anticipated for this activity are not expected to impact the reproduction or survival of any individual marine mammals. Although studies assessing the impacts of offshore wind development on marine mammals are limited, the repopulation of wind energy areas by harbor porpoises (Brandt *et al.,* 2016; Lindeboom *et al.,* 2011) and harbor seals (Lindeboom *et al.,* 2011; Russell *et al.,* 2016) following the installation of wind turbines are promising. Overall, any impacts to marine mammal foraging capabilities due to effects on prey aggregation from the turbine presence and operation during the effective period of the proposed rule is likely to be limited. Nearby habitat that is known to support North Atlantic right whale foraging would be unaffected by the project's operation.

In general, impacts to marine mammal prey species are expected to be relatively minor and temporary due to the expected short daily duration of individual pile driving events and the relatively small areas being affected. The most likely impacts of prey fish from UXO/MEC detonations, if determined to be necessary, are injury or mortality if they are located within the vicinity when detonation occurs. However, given the likely spread of any UXOs/MECs in the project area, the low chance of detonation (as lift-and-shift and deflagration are the primary removal approaches), and that this area is not a biologically important foraging ground, overall effects should be minimal to marine mammal species. NMFS does not expect HRG acoustic sources to impact fish and most sources are likely outside the hearing range of the primary prey species in the project area.

Overall, the combined impacts of sound exposure, explosions, water quality, and oceanographic impacts on marine mammal habitat resulting from the proposed activities would not be expected to have measurable effects on populations of marine mammal prey species. Prey species exposed to sound might move away from the sound source, experience TTS, experience masking of biologically relevant sounds, or show no obvious direct effects.

Reef Effects

The presence of monopile foundations, scour protection, and cable protection will result in a conversion of the existing sandy bottom habitat to a hard bottom habitat with areas of vertical structural relief. This could potentially alter the existing habitat by creating an ''artificial reef effect'' that results in colonization by assemblages of both sessile and mobile animals within the new hard-bottom habitat (Wilhelmsson *et al.,* 2006; Reubens *et al.,* 2013; Bergström *et al.,* 2014; Coates *et al.,* 2014). This colonization by marine species, especially hard-substrate preferring species, can result in changes to the diversity, composition, and/or biomass of the area thereby impacting the trophic composition of the site (Wilhelmsson *et al.,* 2010, Krone *et al.,* 2013; Bergström *et al.,* 2014, Hooper *et al.,* 2017; Raoux *et al.,* 2017; Harrison and Rousseau, 2020; Taormina *et al.,* 2020; Buyse *et al.,* 2022a; ter Hofstede *et al.,* 2022).

Artificial structures can create increased habitat heterogeneity important for species diversity and density (Langhamer, 2012). The WTG and ESP foundations will extend through the water column, which may serve to increase settlement of meroplankton or planktonic larvae on the structures in both the pelagic and benthic zones (Boehlert and Gill, 2010). Fish and invertebrate species are also likely to aggregate around the foundations and scour protection which could provide increased prey availability and structural habitat (Boehlert and Gill, 2010; Bonar *et al.,* 2015). Further, instances of species previously unknown, rare, or nonindigenous to an area have been documented at artificial structures, changing the composition of the food web and possibly the attractability of the area to new or existing predators (Adams *et al.,* 2014; de Mesel, 2015; Bishop *et al.,* 2017; Hooper *et al.,* 2017; Raoux *et al.,* 2017; van Hal *et al.,* 2017; Degraer *et al.,* 2020; Fernandez-Betelu *et al.,* 2022). Notably, there are examples of these sites becoming dominated by marine mammal prey species, such as filter-feeding species and suspension-feeding crustaceans (Andersson and Öhman, 2010; Slavik *et al.,* 2019; Hutchison *et al.,* 2020; Pezy *et al.,* 2020; Mavraki *et al.,* 2022).

Numerous studies have documented significantly higher fish concentrations including species like cod and pouting (*Trisopterus luscus*), flounder (*Platichthys flesus*), eelpout (*Zoarces viviparus*), and eel (*Anguilla anguilla*) near in-water structures than in surrounding soft bottom habitat (Langhamer and Wilhelmsson, 2009; Bergström *et al.,* 2013; Reubens *et al.,* 2013). In the German Bight portion of the North Sea, fish were most densely congregated near the anchorages of jacket foundations, and the structures extending through the water column were thought to make it more likely that juvenile or larval fish encounter and settle on them (Rhode Island Coastal Resources Management Council (RI–CRMC), 2010; Krone *et al.,* 2013). In addition, fish can take advantage of the shelter provided by these structures while also being exposed to stronger currents created by the structures, which generate increased feeding opportunities and decreased potential for predation (Wilhelmsson *et al.,* 2006). The presence of the foundations and resulting fish aggregations around the foundations is expected to be a long-term habitat impact, but the increase in prey availability could potentially be beneficial for some marine mammals.

The most likely impact to marine mammal habitat from the project is expected to be from pile driving and UXO/MEC detonations, which may affect marine mammal food sources such as forage fish and could also affect acoustic habitat effects on marine mammal prey (*e.g.,* fish).

Water Quality

Temporary and localized reduction in water quality will occur as a result of in-water construction activities. Most of this effect will occur during pile driving and installation of the cables, including auxiliary work such as dredging and scour placement. These activities will disturb bottom sediments and may cause a temporary increase in suspended sediment in the project area. Currents should quickly dissipate any raised total suspended sediment (TSS) levels, and levels should return to background levels once the project activities in that area cease. No direct impacts on marine mammals is anticipated due to increased TSS and turbidity; however, turbidity within the water column has the potential to reduce the level of oxygen in the water and irritate the gills of prey fish species in the proposed project area. However, turbidity plumes associated with the project would be temporary and localized, and fish in the proposed project area would be able to move away from and avoid the areas where plumes may occur. Therefore, it is expected that the impacts on prey fish species from turbidity, and therefore on marine mammals, would be minimal and temporary.

Equipment used by Park City Wind within the project area, including ships and other marine vessels, potentially aircrafts, and other equipment, are also potential sources of by-products (*e.g.,* hydrocarbons, particulate matter, heavy metals). All equipment is properly maintained in accordance with applicable legal requirements. All such operating equipment meets Federal water quality standards, where applicable. Given these requirements, impacts to water quality are expected to be minimal.

Acoustic Habitat

Acoustic habitat is the soundscape, which encompasses all of the sound present in a particular location and time, as a whole when considered from the perspective of the animals experiencing it. Animals produce sound for, or listen for sounds produced by, conspecifics (communication during feeding, mating, and other social activities), other animals (finding prey or avoiding predators), and the physical environment (finding suitable habitats, navigating). Together, sounds made by animals and the geophysical environment (*e.g.,* produced by earthquakes, lightning, wind, rain, waves) make up the natural contributions to the total acoustics of a place. These acoustic conditions, termed acoustic habitat, are one attribute of an animal's total habitat.

Soundscapes are also defined by, and acoustic habitat influenced by, the total contribution of anthropogenic sound. This may include incidental emissions from sources such as vessel traffic or may be intentionally introduced to the marine environment for data acquisition purposes (as in the use of airgun arrays) or for Navy training and testing purposes (as in the use of sonar and explosives and other acoustic sources). Anthropogenic noise varies widely in its frequency, content, duration, and loudness and these characteristics greatly influence the potential habitat-mediated effects to marine mammals (please also see the previous discussion on Masking), which may range from local effects for brief periods of time to chronic effects over large areas and for long durations. Depending on the extent of effects to habitat, animals may alter their communications signals (thereby potentially expending additional energy) or miss acoustic cues (either conspecific or adventitious). Problems arising from a failure to detect cues are more likely to occur when noise stimuli are chronic and overlap with biologically relevant cues used for communication, orientation, and predator/prey detection (Francis and Barber, 2013). For more detail on these concepts, see Barber *et al.,* 2009; Pijanowski *et al.,* 2011; Francis and Barber, 2013; Lillis *et al.,* 2014.

The term ''listening area'' refers to the region of ocean over which sources of sound can be detected by an animal at the center of the space. Loss of communication space concerns the area over which a specific animal signal, used to communicate with conspecifics in biologically important contexts (*e.g.,* foraging, mating), can be heard, in noisier relative to quieter conditions (Clark *et al.,* 2009). Lost listening area concerns the more generalized contraction of the range over which animals would be able to detect a variety of signals of biological importance, including eavesdropping on predators and prey (Barber *et al.,* 2009). Such metrics do not, in and of themselves, document fitness consequences for the marine animals that live in chronically noisy environments. Long-term population-level consequences mediated through changes in the ultimate survival and reproductive success of individuals are difficult to study, and particularly so underwater. However, it is increasingly well documented that aquatic species rely on qualities of natural acoustic habitats, with researchers quantifying reduced detection of important ecological cues (*e.g.,* Francis and Barber, 2013; Slabbekoorn *et al.,* 2010) as well as survivorship consequences in several species (*e.g.,* Simpson *et al.,* 2014; Nedelec *et al.,* 2014).

Sound produced from construction activities in the project area would be temporary and transitory. The sounds produced during construction activities may be widely dispersed or concentrated in small areas for varying periods. Any anthropogenic noise attributed to construction activities in the project area would be temporary and the affected area would be expected to immediately return to the original state when these activities cease.

Although this proposed rulemaking primarily covers the noise produced from construction activities relevant to this offshore wind facility, operational noise was a consideration in NMFS' analysis of the project, as all turbines would become operational within the effective dates of the rule (if issued). It is expected that all turbines would be operational in 2028. Once operational, offshore wind turbines are known to produce continuous, non-impulsive underwater noise, primarily below 1 kHz (Tougaard *et al.,* 2020; Stöber and Thomsen, 2021).

In both newer, quieter, direct-drive systems (such as what has been proposed for use in the Project) and older generation, geared turbine designs, recent scientific studies indicate that operational noise from turbines is on the order of 110 to 125 dB re 1 μPa root-mean-square sound pressure level (SPL_{rms}) at an approximate distance of 50 m (Tougaard *et al.,* 2020). Recent measurements of operational sound generated from wind turbines (direct drive, 6 MW, jacket piles) at Block Island wind farm (BIWF) indicate average broadband levels of 119 dB at 50 m from the turbine, with levels varying with wind speed (HDR, Inc., 2019). Interestingly, measurements from BIWF turbines showed operational sound had less tonal components compared to European measurements of turbines with gear boxes.

Tougaard *et al.* (2020) further stated that the operational noise produced by WTGs is static in nature and lower than noise produced by passing ships. This is a noise source in this region to which marine mammals are likely already habituated. Furthermore, operational noise levels are likely lower than those ambient levels already present in active shipping lanes, such that operational noise would likely only be detected in very close proximity to the WTG (Thomsen *et al.,* 2006; Tougaard *et al.,* 2020). Similarly, recent measurements from a wind farm (3 MW turbines) in China found at above 300 Hz, turbines produced sound that was similar to background levels (Zhang *et al.,* 2021). Other studies by Jansen and de Jong (2016) and Tougaard *et al.* (2009) determined that, while marine mammals would be able to detect operational noise from offshore wind farms (again, based on older 2 MW models) for several kilometers, they expected no significant impacts on individual survival, population viability, marine mammal distribution, or the behavior of the animals considered in their study (harbor porpoises and harbor seals).

More recently, Stöber and Thomsen (2021) used monitoring data and modeling to estimate noise generated by more recently developed, larger (10 MW) direct-drive WTGs. Their findings, similar to Tougaard *et al.* (2020), demonstrate that there is a trend that operational noise increases with turbine size. Their study predicts broadband source levels could exceed 170 dB SPL_{rms} for a 10 MW WTG; however, those noise levels were generated based on geared turbines; newer turbines operate with direct drive technology. The shift from using gear boxes to direct drive technology is expected to reduce the levels by 10 dB. The findings in the Stöber and Thomsen (2021) study have not been experimentally validated, though the modeling (using largely geared turbines) performed by Tougaard *et al.* (2020) yields similar results for a hypothetical 10 MW WTG. Overall, noise from operating turbines would raise ambient noise levels in the immediate vicinity of the turbines; however, the spatial extent of increased noise levels would be limited. NMFS proposes to require Park City Wind to measure operational noise levels.

In addition, Madsen *et al.* (2006b) found the intensity of noise generated by operational wind turbines to be much less than the noises present during construction, although this observation was based on a single turbine with a maximum power of 2 MW. Other studies by Jansen and de Jong (2016) and Tougaard *et al.* (2009) determined that, while marine mammals would be able to detect operational noise from offshore wind farms (again, based on older 2 MW models) for several thousand kilometer, they expected no significant impacts on individual survival, population viability, marine mammal distribution, or the behavior of the animals considered in their study (harbor porpoises and harbor seals).

More recently, Stöber and Thomsen (2021) used monitoring data and modeling to estimate noise generated by more recently developed, larger (10 MW) direct-drive WTGs. Their findings, similar to Tougaard *et al.* (2020), demonstrate that there is a trend that operational noise increases with turbine size. Their study found noise levels could exceed 170 (to 177 dB re 1 μPa SPL_{rms} for a 10 MW WTG); however, those noise levels were generated by geared turbines, but newer turbines operate with direct drive technology. The shift from using gear boxes to direct drive technology is expected to reduce the sound level by 10 dB. The findings in the Stöber and Thomsen (2021) study have not been validated. Park City Wind did not request, and NMFS is not proposing to authorize, take incidental to operational noise from WTGs. Therefore, the topic is not discussed or analyzed further herein.

Estimated Take of Marine Mammals

This section provides an estimate of the number of incidental takes proposed for authorization through the regulations, 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 has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment) or 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 primarily be by Level B harassment, as noise from pile driving, drilling, HRG surveys, and UXO/MEC detonations could result in behavioral disturbance of marine mammals that qualifies as take. Impacts such as masking and TTS can contribute to the disruption of behavioral patterns and are accounted for within those takes proposed for authorization. There is also some potential for auditory injury (Level A harassment) of all marine mammals except North Atlantic right whales. However, the amount of Level A harassment that Park City Wind requested, and NMFS proposes to authorize, is low. While NMFS is proposing to authorize Level A harassment and Level B harassment, the proposed mitigation and monitoring measures are expected to minimize the amount and severity of such taking to the extent practicable (see Proposed Mitigation and Proposed Monitoring and Reporting).

As described previously, no serious injury or mortality is anticipated or proposed to be authorized incidental to the specified activities. Even without mitigation, both pile driving activities and HRG surveys would not have the potential to directly cause marine mammal mortality or serious injury. However, NMFS is proposing measures to more comprehensively reduce impacts to marine mammal species. While, in general, mortality and serious injury of marine mammals could occur from vessel strikes or UXO/MEC detonation if an animal is close enough to the source, the mitigation and monitoring measures contained within this proposed rule would avoid vessel strikes and the potential for marine mammals to be close enough to any UXO/MEC detonation to incur mortality or non-auditory injury (see Proposed Mitigation section). No other activities have the potential to result in mortality or serious injury.

For acoustic impacts, we estimate take by considering: (1) acoustic thresholds above which 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) the number of days of activities. We note that while these factors can contribute to a basic calculation to provide an initial prediction of potential 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 estimates.

As described below, there are multiple methods available to predict density or occurrence and, for each species and activity, the largest value resulting from the three take estimation methods described below (*i.e.,* density-based, PSO-based, or mean group size) was carried forward as the amount of take proposed for authorization, by Level B harassment. The amount of take proposed for authorization, by Level A harassment, reflects the density-based exposure estimates and, for some species and activities, consideration of other data such as mean group size.

Below, we describe NMFS' acoustic thresholds, acoustic and exposure modeling methodologies, marine mammal density calculation methodology, occurrence information, and the modeling and methodologies applied to estimate take for each of the Project's proposed construction activities. NMFS has carefully considered all information and analysis presented by Park City Wind, as well as all other applicable information and, based on the best available science, concurs that the Project's estimates of the types and amounts of take for each species and stock are reasonable, and is proposing to authorize the amount requested. NMFS notes the take estimates described herein for foundation installation can be considered conservative as the estimates do not reflect the implementation of clearance and shutdown zones for any marine mammal species or stock.

Acoustic Thresholds

NMFS recommends the use of acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed (Level B harassment) or to incur PTS of some degree (Level A harassment). A summary of all NMFS' thresholds can be found at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance.*

Level B Harassment

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 or exposure context (*e.g.,* frequency, predictability, duty cycle, duration of the exposure, signal-to-noise ratio, distance to the source, ambient noise, and the receiving animal's hearing, motivation, experience, demography, behavior at time of exposure, life stage, depth) and can be difficult to predict (*e.g.,* Southall *et al.,* 2007, 2021; Ellison *et al.,* 2012). Based on what the available science indicates and the practical need to use a threshold based on a metric that is both predictable and measurable for most activities, NMFS typically uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment.

NMFS generally predicts that marine mammals are likely to be behaviorally harassed in a manner considered to be Level B harassment when exposed to underwater anthropogenic noise above the received sound pressure levels (SPL_{RMS}) of 120 dB for continuous sources (*e.g.,* vibratory pile-driving, drilling) and above the received SPL_{RMS} 160 dB for non-explosive impulsive or intermittent sources (*e.g.,* impact pile driving, scientific sonar). Generally speaking, Level B harassment take estimates based on these behavioral harassment thresholds are expected to include any likely takes by TTS as, in most cases, the likelihood of TTS occurs at distances from the source less than those at which behavioral harassment is likely. TTS of a sufficient degree can manifest as behavioral harassment, as reduced hearing sensitivity and the potential reduced opportunities to detect important signals (conspecific communication, predators, prey) may result in changes in behavioral patterns that would not otherwise occur.

The proposed Project's construction activities include the use of continuous (*e.g.,* vibratory pile driving, drilling) and impulsive or intermittent sources (*e.g.,* impact pile driving, some HRG acoustic sources); therefore, the 120 and 160 dB re 1 μPa (rms) thresholds are applicable to our analysis. Level B harassment thresholds associated with UXO/MEC detonations are addressed in the Explosives Source Thresholds section below.

Level A Harassment

NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0; Technical Guidance) (NMFS, 2018) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). As 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). As described above, Park City Wind's proposed activities include the use of both impulsive and non-impulsive sources. NMFS' thresholds identifying the onset of PTS are provided in Table 7. 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 7—PERMANENT THRESHOLD SHIFT (PTS) ONSET THRESHOLDS *

[NMFS, 2018]

Hearing group	PTS onset thresholds * (received level)	
	Impulsive	Non-Impulsive
Low-Frequency (LF) Cetaceans	*Cell 1:* $L_{p,0\text{-}pk,flat}$: 219 dB; $L_{E,p,\ LF,24h}$: 183 dB	*Cell 2:* $L_{E,p,\ LF,24h}$: 199 dB.
Mid-Frequency (MF) Cetaceans	*Cell 3:* $L_{p,0\text{-}pk,flat}$: 230 dB; $L_{E,p,\ MF,24h}$: 185 dB	*Cell 4:* $L_{E,p,\ MF,24h}$: 198 dB.
High-Frequency (HF) Cetaceans	*Cell 5:* $L_{p,0\text{-}pk,flat}$: 202 dB; $L_{E,p,HF,24h}$: 155 dB	*Cell 4:* $L_{E,p,\ HF,24h}$: 198 dB.
Phocid Pinnipeds (PW) (Underwater)	*Cell 7:* $L_{p,0\text{-}pk,flat}$: 218 dB; $L_{E,p,PW,24h}$: 185 dB	*Cell 8:* $L_{E,p,PW,24h}$: 201 dB.

* Dual metric 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 are recommended for consideration.

Note: Peak sound pressure level ($L_{p,0\text{-}pk}$) has a reference value of 1 μPa, and weighted cumulative sound exposure level ($L_{E,p}$) has a reference value of 1μPa^{2}s. In this table, thresholds are abbreviated to be more reflective of International Organization for Standardization standards (ISO, 2017). The subscript "flat" is being included to indicate peak sound pressure are flat weighted or unweighted within the generalized hearing range of marine mammals (*i.e.,* 7 Hz to 160 kHz). The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW pinnipeds) and that the recommended accumulation period is 24 hours. The weighted 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 thresholds will be exceeded.

Explosives Source Thresholds

Based on the best scientific information available, NMFS uses the acoustic and pressure thresholds indicated in Table 8 to predict the onset of PTS and TTS during UXO/MEC detonation. For a single detonation (within a 24-hour period), NMFS relies on the TTS onset threshold to assess the potential for Level B harassment. The proposed rule is conditioned such that Park City Wind would limit detonations to one per day and would be limited to daylight hours only.

TABLE 8—PTS ONSET, TTS ONSET, FOR UNDERWATER EXPLOSIVES

[NMFS, 2018]

Hearing group	PTS impulsive thresholds	TTS impulsive thresholds
Low-Frequency (LF) Cetaceans	*Cell 1:* $L_{pk,flat}$: 219 dB; $L_{E,LF,24h}$: 183 dB	*Cell 2:* $L_{pk,flat}$: 213 dB $L_{E,LF,24h}$: 168 dB.
Mid-Frequency (MF) Cetaceans	*Cell 4:* $L_{pk,flat}$: 230 dB; $L_{E,MF,24h}$: 185 dB	*Cell 5:* $L_{pk,flat}$: 224 dB; $L_{E,MF,24h}$: 170 dB.
High-Frequency (HF) Cetaceans	*Cell 7:* $L_{pk,flat}$: 202 dB; $L_{E,HF,24h}$: 155 dB	*Cell 8:* $L_{pk,flat}$: 196 dB; $L_{E,HF,24h}$: 140 dB.
Phocid Pinnipeds (PW) (Underwater)	*Cell 10:* $L_{pk,flat}$: 218 dB; $L_{E,PW,24h}$: 185 dB	*Cell 11:* $L_{pk,flat}$: 212 dB; $L_{E,PW,24h}$: 170 dB.

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS/TTS onset.

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, ANSI defines peak sound pressure 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 overall marine mammal 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 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.

Additional thresholds for non-auditory injury to lung and gastrointestinal (GI) tracts from the blast shock wave and/or onset of high peak pressures are also relevant (at relatively close ranges) as UXO/MEC detonations, in general, have potential to result in mortality and non-auditory injury (Table 9). Marine mammal lung injury criteria have been developed by the U.S. Navy (DoN (U.S. Department of the Navy), 2017) and are based on the mass of the animal and the depth at which it is present in the water column due to blast pressure. This means that specific decibel levels for each hearing group are not provided and instead, the criteria are presented as equations that allow for incorporation of specific mass and depth values. The GI tract injury threshold is based on peak pressure. The modified Goertner equations below represent the potential onset of lung injury and GI tract injury (Table 9).

TABLE 9—LUNG AND G.I. TRACT INJURY THRESHOLDS

[DoN, 2017]

Hearing group	Mortality (severe lung injury) *	Slight lung injury *	G.I. tract injury
All Marine Mammals	*Cell 1:* Modified Goertner model; Equation 1.	*Cell 2:* Modified Goertner model; Equation 2.	*Cell 3:* $L_{pk,flat}$: 237 dB.

* Lung injury (severe and slight) thresholds are dependent on animal mass (Recommendation: Table C.9 from DoN (2017) based on adult and/or calf/pup mass by species).

Note: Peak sound pressure (L_{pk}) has a reference value of 1 μPa. In this table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI, 2013). However, ANSI defines peak sound pressure 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 overall marine mammal generalized hearing range.

Modified Goertner Equations for severe and slight lung injury (pascal-second):
Equation 1: $103M^{1/3}(1 + D/10.1)^{1/6}$ Pa-s.
Equation 2: $47.5M^{1/3}(1 + D/10.1)^{1/6}$ Pa-s.
M animal (adult and/or calf/pup) mass (kg) (Table C.9 in DoN, 2017).
D animal depth (meters).

Below, we describe the assumptions and methodologies used to estimate take, in consideration of acoustic thresholds and appropriate marine mammals density and occurrence information, for WTG and ESP foundation installation, UXO/MEC detonation, and HRG surveys. Resulting distances to thresholds, densities used, activity-specific exposure estimates (as relevant to the analysis), and activity-specific take estimates can be found in each activity subsection below. At the end of this section, we present the amount of annual and 5-year take that Park City Wind requested, and NMFS proposes to authorize, from all activities combined.

Acoustic and Exposure Modeling

The predominant underwater noise associated with the construction of the Project results from impact and vibratory pile driving and drilling. Park City Wind employed JASCO Applied Sciences (USA) Inc. (JASCO) to conduct acoustic modeling to better understand sound fields produced during these activities (Küsel *et al.,* 2022). The basic modeling approach is to characterize the sounds produced by the source, and determine how the sounds propagate within the surrounding water column. For impact pile driving, JASCO conducted sophisticated source and propagation modeling (as described below). For vibratory pile driving and drilling activities, JASCO applied *in situ* data to estimate source levels and applied a general practical spreading loss (15logR) assumption. To assess the potential for take from impact pile driving, JASCO also conducted animal movement modeling to estimate take; JASCO estimated species-specific exposure probability by considering the range- and depth-dependent sound fields in relation to animal movement in simulated representative construction scenarios. To assess the potential for take from vibratory pile driving and drilling, exposure modeling was not conducted. More details on these acoustic source modeling, propagation modeling and exposure modeling methods are described below.

JASCO's Pile Driving Source Model (PDSM), a physical model of pile vibration and near-field sound radiation (MacGillivray, 2014), was used in conjunction with the GRL, Inc. Wave Equation Analysis of Pile Driving (GRLWEAP) 2010 wave equation model (Pile Dynamics, 2010) to predict source levels associated with impact pile driving activities (WTG and ESP foundation installation). The PDSM physical model computes the underwater vibration and sound radiation of a pile by solving the theoretical equations of motion for axial and radial vibrations of a cylindrical shell. This model is used to estimate the energy distribution per frequency (source spectrum) at a close distance from the source (10 m). Piles are modeled as a vertical installation using a finite-difference structural model of pile vibration based on thin-shell theory. To model the sound emissions from the piles, the force of the pile driving hammers also had to be modeled. The force at the top of each monopile and jacket foundation pile was computed using the GRLWEAP 2010 wave equation model (GRLWEAP; Pile Dynamics, 2010), which includes a large database of simulated hammers. The forcing functions from GRLWEAP were used as inputs to the finite difference model to compute the resulting pile vibrations (see Figures 13–15 in Appendix A of Park City Wind's ITA application for the computed forcing functions). The sound radiating from the pile itself was simulated using a vertical array of discrete point sources. These models account for several parameters that describe the operation—pile type, material, size, and length—the pile driving equipment, and approximate pile penetration depth. The model assumed direct contact between the representative hammers, helmets, and piles (*i.e.,* no cushioning material). For both jacket and monopile foundation models, the piles are assumed to be vertical and driven to a penetration depth of 50 m and 40 m, respectively.

Park City Wind would use at least two noise abatement systems (NAS) during all pile driving and drilling associated with foundation installations and UXO/MEC detonations, such as a double bubble curtain or single bubble curtain and an encapsulated bubble or foam sleeve, to reduce sound levels. NAS, such as bubble curtains, are sometimes used to decrease the sound levels radiated from a source. Hence, hypothetical broadband attenuation levels of 0 dB, 6 dB, 10 dB, and 12 dB were incorporated into the foundation source models to gauge effects on the ranges to thresholds given these levels of attenuation (Appendix G of the ITA application). Although four attenuation levels were evaluated, Park City Wind and NMFS anticipate that the noise attenuation system ultimately chosen will be capable of reliably reducing source levels by 10 dB; therefore, this assumption was carried forward in this analysis for monopile and jacket foundation pile driving installation, drilling activities, and UXO/MEC detonations. See the Proposed Mitigation section for more information regarding the justification for the 10-dB assumption.

In addition to considering noise abatement, the amount of sound generated during pile driving varies with the energy required to drive piles to a desired depth and depends on the sediment resistance encountered. Sediment types with greater resistance require hammers that deliver higher energy strikes and/or an increased number of strikes relative to installations in softer sediment. Maximum sound levels usually occur during the last stage of impact pile driving where the greatest resistance is encountered (Betke, 2008). Key modeling assumptions for the monopiles and pin piles are listed in Table 10 (additional modeling details and input parameters can be found in Küsel *et al.* (2022)). Hammer energy schedules for monopiles (12-m) and pin piles (4-m) are provided in Table 11, respectively, and the resulting broadband source level comparisons of the 12-m and 13-monopiles are presented in Table 12. Decidecade spectral source levels for each pile type, hammer energy, and modeled location for summer sound speed profiles can be found in Appendix A of Park City Wind's ITA application (Figures 16 to 18).

TABLE 10—KEY PILING ASSUMPTIONS USED IN THE SOURCE MODELING

Foundation type	Maximum impact hammer energy (kJ)	Wall thickness (mm)	Pile length (m)	Seabed penetration depth (m)	Number per day
12-m Monopile [1]	6,000	200	95	40	1–2
4-m Jacket Pin Pile [2 3]	3,500	100	100	50	4

[1] A 12-m monopile using 6,000 kJ was considered representative of the other monopile approaches as the 13-m is unlikely to occur.
[2] Jacket foundations each require the installation of three to four jacket securing piles, known as pin piles.
[3] The bottom-frame foundation is similar to the jacket foundation, with the same maximum 4-m pile diameter, but with shorter piles and shallower penetration and was therefore not modeled separately in the acoustic assessment. It is assumed that the potential acoustic impact of the bottom-frame foundation installation is equivalent to or less than that predicted for the jacket foundation.

TABLE 11—HAMMER ENERGY SCHEDULES FOR MONOPILES AND PIN PILES USED IN SOURCE MODELING

12-m monopile 5000 kJ hammer		13-m monopile 5000 kJ hammer		12-m monopile 6000 kJ hammer		4-m pin pile 3500 kJ hammer		13-m monopile 6000 kJ hammer [1]	
Energy level (kJ)	Strike count	Energy level (kJ)	Strike count	Energy level (kJ)	Strike count	Energy level (kJ)	Strike count	Energy level (kJ)	Strike count
1,000	690	1,000	745	1,000	750	525	875	1,000	850
1,000	1,930	1,000	2,095	2,000	1,250	525	1,925	2,000	1,375
2,000	1,910	2,000	2,100	3,000	1,000	1000	2,165	3,000	1,100
3,000	1,502	3,000	1,475	45,000	1000	3,500	3,445	4,500	1,100
5,000	398	5,000	555	6,000	500	3,500	1,395	6,000	550
Total	6,430	Total	6,970	Total	4,500	Total	9,805	Total	4,975
Strike Rate	30.0 bpm	Strike Rate	30.0 bpm	Strike Rate	25.0 bpm	Strike Rate	30.0 bpm	Strike Rate	27.6 bpm.

[1] Due to the unlikely event Park City Wind installs a 13-m pile with a 6,000 kJ hammer, source levels were modeled to estimate the distances to mitigation zones; however, exposure modeling was not conducted for this scenario.

TABLE 12—BROADBAND IMPACT PILE DRIVING SOURCE LEVEL COMPARISONS BETWEEN THE 12-m AND 13-m MONOPILES

Hammer energy level (kJ)	12-m monopile	13-m monopile	Source level difference (dB)
	Source level (dB SPL)	Source level (dB SPL)	
1,000	221.94	222.27	0.34
2,000	223.30	223.43	0.14
3,000	224.55	225.52	0.96
4,500	226.31	226.09	0.22
6,000	227.32	228.56	1.23

For vibratory pile driving and drilling, source level modeling to estimate sound exposure levels was conducted based on extrapolations of source level data from smaller piles. Received SEL levels at 10 m for smaller, round steel piles driven with vibratory hammers were plotted as a function of pile diameter and fitted with a power function and then extrapolated for a 13-m diameter pile. While this method was applied to estimate SEL, the power function fit method described above for the received SPL at 10 m is poor, so an alternative approach to estimate SPL was derived. Noting that animals are not expected to experience a behavioral response at distances greater than 50 km (Dunlop *et al.* 2017a, 2017b), Park City Wind calculated the source level necessary to produce a received level of 120 dB at 50 km assuming practical spreading loss (15logR) resulting in a source level of 190.5 dB SPL. The drilling source level was estimated based on drilling data collected in the Alaska Chukchi and Beaufort Sea (Austin *et al.,* 2018). Resulting source levels assuming 10-dB attenuation from use of noise abatement (*e.g.,* double bubble curtain) can be found in Table 13.

TABLE 13—ASSUMED SOURCE LEVELS FOR VIBRATORY PILE DRIVING AND DRILLING OF FOUNDATION PILES

Activity	Source level SEL (dB)	Source level SPL (dB)
Vibratory driving (13-m piles)	[1] 188	190.5
Drilling	N/A	[2] 183.3

[1] Extrapolation of data resulted in a source level (SEL) of 198 dB.
[2] Source level reported in Austin *et al.* (2018) is 193.3 dB SPL, based on a measured received level of 141.8 dB at 1 km.

After calculating source levels, Park City Wind used propagation models to estimate distances to NMFS' harassment thresholds. The propagation of sound through the environment can be modeled by predicting the acoustic propagation loss—a measure, in decibels, of the decrease in sound level between a source and a receiver some distance away. Geometric spreading of acoustic waves is the predominant way by which propagation loss occurs.

Propagation loss also happens when the sound is absorbed and scattered by the seawater, and absorbed, scattered, and reflected at the water surface and within the seabed. Propagation loss depends on the acoustic properties of the ocean and seabed and its value changes with frequency. Acoustic propagation modeling for impact pile driving applied JASCO's Marine Operations Noise Model (MONM) and Full Wave Range Dependent Acoustic Model (FWRAM) that combine the outputs of the source model with the spatial and temporal environmental context (*e.g.,* location, oceanographic conditions, and seabed type) to estimate sound fields. The lower frequency bands were modeled using MONM–RAM, which is based on the parabolic equation method of acoustic propagation modeling. For higher frequencies, additional losses resulting from absorption were added to the transmission loss model. See Appendix F in Park City Wind's application for a more detailed description of JASCO's propagation models.

Sounds produced by installation of the proposed monopiles were modeled at two sites (M1 and M2) for the 12-m diameter monopile foundations—M1 in the northwest section of the SWDA in 44 m water depth and M2 in the southeast section of the SWDA at 52 m water depth. Acoustic propagation modeling was conducted for 4-m diameter jacket foundation piles assuming a site in the central area of the SWDA at 53 m water depth. Modeling locations are shown in Figure 7 of the ITA application. These locations were chosen based on the phasing plans of the Project, which involves the installation of 12-m diameter monopiles in Phase 1 and 13-m diameter monopiles in Phase 2, with jacket foundations planned for both phases. The 13-m diameter piles were only considered for modeling of the source functions for comparison with the 12-m diameter piles, which showed minimal difference in the forcing function and source spectra output for the two sizes. As the 12-m monopile represents the maximum size monopile for Phase 1 of the Project and the average size monopile for Phase 2, propagation modeling continued with the 12 m monopile.

Due to seasonal changes in the water column, sound propagation is likely to differ at different times of the year. The speed of sound in seawater depends on the temperature T (degree Celsius), salinity S (parts per thousand (ppt)), and depth D (m) and can be described using sound speed profiles. Oftentimes, a homogeneous or mixed layer of constant velocity is present in the first few meters. It corresponds to the mixing of surface water through surface agitation. There can also be other features, such as a surface channel, which corresponds to sound velocity increasing from the surface down. This channel is often due to a shallow isothermal layer appearing in winter conditions, but can also be caused by water that is very cold at the surface. In a negative sound gradient, the sound speed decreases with depth, which results in sound refracting downwards, which may result in increased bottom losses with distance from the source. In a positive sound gradient, as is predominantly present in the winter season, sound speed increases with depth and the sound is, therefore, refracted upwards, which can aid in long distance sound propagation.

Acoustic propagation modeling for impact pile driving foundations was conducted using an average sound speed profile for a summer period given this would be when Park City Wind would conduct the majority, if not all of its foundation installation work. FWRAM computes pressure waveforms via Fourier synthesis of the modeled acoustic transfer function in closely spaced frequency bands. Examples of decidecade spectral levels for each foundation pile type, hammer energy, and modeled location, using average summer sound speed profile are provided in Küsel *et al.* (2022). Resulting distances to NMFS' harassment thresholds for impact driving can be found in the WTG and ESP Foundation Installation subsection below.

For vibratory pile driving and drilling during foundation installation, Park City Wind assumed a simple practical spreading loss (15logR). Resulting distances to NMFS' harassment thresholds for these activities can be found in the activity-specific subsections below.

As described previously, Park City Wind has also identified the potential need to detonate up to 10 UXOs/MECs during the first two years of construction. Park City Wind did not conduct independent acoustic and propagation modeling for this activity but instead relied on a publicly available modeling report prepared by JASCO for the Revolution Wind project (Hannay and Zykov, 2022) which is geographically adjacent to the Project area. The water depths considered in the acoustic modeling study (*i.e.,* 12 m, 20 m, 30 m, 45 m) are relevant to the Project areas that may require UXO/MEC detonation, although the export cable route for New England Wind comes to shore northeast of Cape Cod Island and not into Narragansett Bay, as was considered in the modeling study. The modeled SEL from Revolution Wind are mostly transferable to similar depth sites over the Project area, with the possible exception of the shallowest site (12 m) that is located in a constrained channel in Narragansett Bay with nearby islands blocking sound propagation in some directions. In addition, Park City Wind and NMFS acknowledge the bathymetry considered in the Revolution Wind UXO/MEC study slightly varies from the Project area; however, the effects to propagation are likely minimal. Moreover, Park City Wind would be required to conduct sound field verification during any UXO/MEC detonation and any subsequent detonations would be subject to mitigation dependent upon the results of that acoustic monitoring effort (*e.g.,* changes to mitigation zone sizes may occur). Overall, the results from Hanney and Zykov (2022) are applicable to the Park City Wind project. The resulting distances to NMFS' harassment thresholds and estimate take from UXO/MEC detonation can be found in the UXO/MEC subsection below.

To estimate the probability of exposure of animals to sound above NMFS' harassment thresholds during impact pile driving for foundation installation, JASCO's Animal Simulation Model Including Noise Exposure (JASMINE) was used to integrate the sound fields generated from the source and propagation models described above with species-typical behavioral parameters (*e.g.,* dive patterns). Sound exposure models, such as JASMINE, use simulated animals (animats) to sample the predicted 3–D sound fields with movement rules derived from animal observations. Animats that exceed NMFS' acoustic thresholds are identified and the range for the exceedances determined. The output of the simulation is the exposure history for each animat within the simulation. An individual animat's sound exposure levels are summed over a specific duration, (24 hours), to determine its total received acoustic energy (SEL) and maximum received PK and SPL. These received levels are then compared to the threshold criteria within each analysis period.

The combined history of all animats gives a probability density function of exposure during the project. The number of animals expected to exceed the regulatory thresholds is determined by scaling the number of predicted animat exposures by the species-specific density of animals in the area. By programming animats to behave like marine species that may be present near the Project area, the sound fields are sampled in a manner similar to that expected for real animals. The parameters used for forecasting realistic behaviors (*e.g.,* diving, foraging, and surface times) were determined and interpreted from marine species studies (*e.g.,* tagging studies) where available, or reasonably extrapolated from related species (Küsel *et al.,* 2022).

For modeled animals that have received enough acoustic energy to exceed a given harassment threshold, the exposure range for each animal is defined as the closest point of approach (CPA) to the source made by that animal while it moved throughout the modeled sound field, accumulating received acoustic energy. The CPA for each of the species-specific animats during a simulation is recorded and then the CPA distance that accounts for 95 percent of the animats that exceed an acoustic impact threshold is determined. The $ER_{95\%}$ (95 percent exposure radial distance) is the horizontal distance that includes 95 percent of the CPAs of animats exceeding a given impact threshold. The $ER_{95\%}$ ranges are species-specific rather than categorized only by any functional hearing group, which allows for the incorporation of more species-specific biological parameters (*e.g.,* dive durations, swim speeds, *etc.*) for assessing the potential for PTS from impact pile driving.

Park City Wind also calculated acoustic ranges which represent the distance to a harassment threshold based on sound propagation through the environment independent of any receiver. As described above, applying animal movement and behavior within the modeled noise fields allows for a more realistic indication of the distances at which PTS acoustic thresholds are reached that considers the accumulation of sound over different durations. The use of acoustic ranges ($R_{95\%}$) to the Level A harassment SEL_{cum} metric thresholds to assess the potential for PTS is considered an overly conservative method as it does not account for animal movement and behavior and therefore assumes that animals are essentially stationary at that distance for the entire duration of the pile installation, a scenario that does not reflect realistic animal behavior. The acoustic ranges to the SEL_{cum} Level A harassment thresholds for impact pile driving can be found in Park City Wind's ITA application but will not be discussed further in this analysis. However, because NMFS Level A harassment (PTS dBpeak) and Level B harassment (SPL) thresholds refer to instantaneous exposures, acoustic ranges are more relevant to the analysis. Also, because animat modeling was not conducted for vibratory pile driving or drilling, acoustic range is used to assess Level A harassment (dB SEL). Acoustic ranges to the Level A harassment (dB peak), Level A harassment (dB SEL; vibratory pile driving and drilling only), and Level B harassment threshold for each activity are provided in the WTG and ESP Foundation Installation subsection below. The differences between exposure ranges and acoustic ranges for Level B harassment are minimal given it is an instantaneous method.

Density and Occurrence

In this section, we provide the information about marine mammal density, presence, and group dynamics that informed the take calculations for all activities. Park City Wind applied the 2022 Duke University Marine Geospatial Ecology Laboratory Habitat-based Marine Mammal Density Models for the U.S. Atlantic (Duke Model, Roberts *et al.,* 2016; Roberts and Halpin, 2022) to estimate take from foundation installation, HRG surveys, and UXO/MEC detonations (please see each activity subsection below for the resulting densities). The models estimate absolute density (individuals/100 km^2) by statistically correlating sightings reported on shipboard and aerial surveys with oceanographic conditions. For most marine mammal species, densities are provided on a monthly basis. Where monthly densities are not available (*e.g.,* pilot whales), annual densities are provided. Moreover, some species are represented as guilds (*e.g.,* seals (representing *Phocidae spp.,* primarily comprised of harbor and gray seals), pilot whales (representing short-finned and long-finned pilot whales), and beaked whales (representing *Mesoplodon spp.*)).

The Duke habitat-based density models delineate species' density into 5 x 5 km (3.1 x 3.1 mi) grid cells. Park City Wind calculated monthly densities for each species using grid cells within the lease area and a perimeter around the lease area that represented the expected ensonified area to NMFS' harassment thresholds for each sound-producing activity. All 5 x 5 km grid cells in the models that fell partially or fully within the analysis polygon were considered in the calculations.

For impact pile driving, the perimeter size from the edge of the lease area was selected as the largest 10 dB-attenuated (due to use of sound attenuation device(s)) exposure range calculated based on installation of a 12-m pile using a 6,000 kJ hammer (6.2 km). For vibratory pile driving and drilling, densities from grid cells within a 50-km and 16.6-km perimeter (representing distances to the Level B harassment isopleths for each activity), respectively, were applied to the calculations. For UXO/MEC detonations, Park City Wind used the largest SEL-based TTS-onset acoustic ranges across all hearing groups and applied it to the moderate UXO/MEC risk areas, resulting in a 14.1-km perimeter for the shallow water segment of the OECC and a 13.8-km density perimeter for the deep water segment of the OECC as well as the SWDA. For HRG surveys, Park City Wind applied all grid cells within the survey corridor. No buffer was applied given the small distance to Level B harassment (<200 m) during surveys compared to the grid cell size in the Duke density models (5 x 5 km).

Densities were computed monthly for each species where monthly densities were available. For the pilot whale guild (*i.e.,* long-finned and short-finned), monthly densities are unavailable so annual mean densities were used instead. Additionally, the models provide density for pilot whales as a guild that includes both species. To obtain density estimates for long-finned and short-finned pilot whales, the guild density was scaled by the relative stock sizes based on the best available abundance estimate from NOAA Fisheries SARs (NOAA Fisheries, 2021b). Similarly, gray and harbor seal densities were scaled by each of their relative abundances, as found in the NOAA Fisheries SARs (NOAA Fisheries, 2021b). Although harp seals are not common in the project area, Park City Wind conservatively applied the resulting gray seal densities to harp seals. These scaled and surrogate densities were carried forward to the exposure and take estimates. Please see the activity-specific subsections below for resulting densities.

The equation below, using pilot whales as an example, shows how abundance scaling is applied to compute density for pilot whales and seals.

$$D_{short\text{-}finned} = D_{both} \times (N_{short\text{-}finned} / (N_{short\text{-}finned} + N_{long\text{-}finned}))$$

Where *D* represents density and *N* represents abundance.

For some species and activities, AMAPPS data from 2010–2019 shipboard distance sampling surveys (Palka *et al.,* 2021) and observational data collected during previous site assessment surveys in the project area indicate that the density-based exposure estimates may be insufficient to account for the number of individuals of a species that may be encountered during the planned activities. This is particularly true for uncommon or rare species with very low densities in the models. Hence, consideration of other data is required to ensure the potential for take is adequately assessed.

For uncommon species, the predicted densities from the Duke models are very low and the resulting density-based exposure estimate is less than a single animal or a typical group size for the species. In such cases, the take request is based on the species' average group size (Table 14). The mean group sizes used to correct Level B take estimates, as shown in Table 14, for modeled cetacean species were derived from AMAPPS data from 2010–2019 NE shipboard distance sampling surveys (Palka *et al.,* 2021) and informed by data from 2018–2021 HRG surveys conducted by the Proponent (Vineyard Wind, 2018, 2020a, 2020c, 2021a). Mean group size was calculated as the number of individuals divided by the number of groups from Table 6–5 of Palka *et al.* (2021), which summarizes the 2010–2019 AMAPPS NE shipboard distance surveys. Summer sightings (June 1 to August 31) were chosen for these calculations because many species were not observed during fall surveys, and surveys were not conducted during spring or winter. When site assessment survey data showed a larger mean group size than was shown by the AMAPPS data, the site assessment survey group size was applied to take calculations.

In cases where the exposure estimate was less than the mean group size, it was assumed that if one group member were to be exposed, then it is reasonable to expect that all animals in the same group could receive a similar level of sound exposure. Therefore, for species for which the annual number of predicted exposures above threshold was less than the mean group size, the annual number of expected takes was increased to the mean group size rounded up to the nearest integer. Correcting for group size for these species is used as a conservative measure to ensure all animals in a group are accounted for in the take request.

As described previously, density-based exposure calculations were not conducted for species considered rare in the project area. There are few to zero sightings of these species in the sources used above to calculate group size for the modeled species, so an alternative method had to be developed. Group size calculations for rare species used sighting data from the Ocean Biodiversity Information System database (OBIS, 2021). All records for each of the rare species were extracted from the OBIS database and then filtered to include only the area from approximately Cape Hatteras to the Gulf of Maine (35° N to 43° N) and from the coast (76° W) out to the continental shelf edge (66° W) to provide a more precise estimate of potential group size in the SWDA than would be expected using all OBIS records. The OBIS data were further filtered to remove stranding data, because the group size of stranded animals does not necessarily reflect the group size of free-ranging animals. The one exception to this was the hooded seal—all records of this species in this area from the OBIS database were of single, stranded individuals, and thus a group size of one was used. This number is likely reflective of any free-swimming hooded seal that would occur in the area because this is an Arctic species and only single vagrant animals would be expected. Finally, data from digital aerial surveys were filtered out of this larger dataset because, although useful in determining presence/absence, these data provide no information on group size. The ''individualCount'' variable in the OBIS data was used to calculate minimum, maximum, and average group sizes for these rare species (Table 16 in the ITA application).

For many of these rare species, in particular the delphinids, maximum group sizes can be in the hundreds or even up to thousands of animals. However, because these animals are rare in the WEA as it is not their preferred habitat, Park City Wind assumed that they would be unlikely to form such large aggregations in this area. Thus, the average group size (rounded up to a whole number) was used in the take calculations for these species. Group sizes relevant to the SWDA can be informed by PSO sightings during site characterization surveys (Table 15). For example, white-beaked dolphins were recorded in both 2019 and 2020 during HRG surveys in this area (Vineyard Wind, 2019, 2020) with the sighting of white-beaked dolphins in 2019 consisting of 30 animals. Other rare species encountered in the survey area during previous HRG surveys include false killer whales in 2019 (5 individuals) and 2021 (1 individual) (Vineyard Wind, 2020c, 2020b) and killer whales in 2022 (2 individuals; data not yet submitted). For these species the take estimates use the observed group size from PSO sightings.

Additional detail regarding the density and occurrence as well as the assumptions and methodology used to estimate take for specific activities is included in the activity-specific subsections below and in Section 6.1 of the ITA application. Average group sizes used in take estimates, where applicable, for all activities are provided in Tables 14 and 15.

TABLE 14—AVERAGE MARINE MAMMAL GROUP SIZES USED FOR COMMON AND UNCOMMON SPECIES IN TAKE ESTIMATE CALCULATIONS

Species	Number of groups (AMAPPS data) [a]	Number of animals (AMAPPS data) [a]	Mean group size (AMAPPS data) [a]	Mean group size (PSO data) [b]	Group size used in Level B take correction [c]
North Atlantic right whale [d]	2	4	2.0	1.5	2
Fin whale [d]	345	533	1.5	1.6	2
Humpback whale	157	370	2.4	1.5	3
Minke whale	32	32	1.0	1.1	2
Sei whale [d]	20	28	1.4	1.0	2
Sperm whale [d]	298	491	1.6	1.3	2
Atlantic spotted dolphin	60	1,760	29.3	Not observed	30
Atlantic white-sided dolphin	3	61	20.3	27.5	28
Bottlenose dolphin, offshore	345	3,865	11.2	17.9	18
Common dolphin	444	19,802	44.6	14.0	45
Long-finned pilot whale	41	666	16.2	5.6	17
Short-finned pilot whale	230	2,050	8.9	Not observed	9
Risso's dolphin	486	3,131	6.4	Not observed	7

TABLE 14—AVERAGE MARINE MAMMAL GROUP SIZES USED FOR COMMON AND UNCOMMON SPECIES IN TAKE ESTIMATE CALCULATIONS—Continued

Species	Number of groups (AMAPPS data) [a]	Number of animals (AMAPPS data) [a]	Mean group size (AMAPPS data) [a]	Mean group size (PSO data) [b]	Group size used in Level B take correction [c]
Harbor porpoise	4	6	1.5	1.3	2
Gray seal	145	202	1.4	1.2	2
Harbor seal	145	202	1.4	2.0	2
Harp seal	145	202	1.4	Not observed	2

[a] Mean group size for cetaceans from 2010–2019 AMAPPS NE shipboard distance sampling surveys (Table 6–5 of Palka *et al.* (2021)), and for seals from 2010–2013 AMAPPS NE aerial surveys for all seals because most were not identified to species (Table 19.1 of Palka *et al.* (2017)).
[b] Mean group size from 2018–2021 PSO sightings data from 2018–2021 HRG surveys conducted by the Proponent (Vineyard Wind, 2018, 2020a, 2020c, 2021a). Highlighted blue cells show values that were higher for PSO data than for AMAPPS data.
[c] Group size used for Level B take correction is higher of AMAPPS data and PSO data rounded up to an integer.
[d] Listed as Endangered under the ESA.

TABLE 15—AVERAGE MARINE MAMMAL GROUP SIZES USED FOR RARE SPECIES IN TAKE ESTIMATE CALCULATIONS

Species	Minimum group size (OBIS)	Maximum group size (OBIS)	Mean group size (OBIS)	Observed group size (PSO reports)	Group size used in take estimates
Blue whale [a]	1	2	1.0	NA	1
Dwarf sperm whale	1	5	1.7	NA	2
Pygmy sperm whale	1	3	1.3	NA	2
Cuvier's beaked whale	1	10	2.8	NA	3
Blainville's beaked whale	3	4	3.3	NA	4
Gervais' beaked whale	1	12	3.5	NA	4
Sowerby's beaked whale	1	10	3.5	NA	4
True's beaked whale	2	5	2.9	NA	3
Northern bottlenose whale	2	7	3.7	NA	4
Clymene dolphin	2	1,000	166.8	NA	167
False killer whale [b]	1	30	6.3	5	5
Fraser's dolphin	75	250	191.7	NA	192
Killer whale [b]	1	40	7.3	2	2
Melon-headed whale	20	210	108.8	NA	109
Pan-tropical spotted dolphin	3	300	59.3	NA	60
Pygmy killer whale	2	10	4.5	NA	5
Rough-toothed dolphin	3	45	13.1	NA	14
Spinner dolphin	1	170	50.4	NA	51
Striped dolphin	1	500	63.8	NA	64
White-beaked dolphin [b]	1	200	13.5	30	30
Hooded seal [c]	1	1	1.0	NA	1

[a] Listed as Endangered under the ESA.
[b] Mean group size for these species from 2018–2021 PSO sightings data from 2018–2021 HRG surveys conducted by the Proponent (Vineyard Wind, 2018, 2020a, 2020c, 2021a).
[c] All records of hooded seals in the OBIS database for this region were strandings of single animals.

WTG and ESP Foundation Installation

Here, we describe the results from the acoustic, exposure, and take estimate methodologies outlined above for WTG and ESP installation activities that have the potential to result in harassment of marine mammals: pile driving and drilling. We present exposure ranges to Level A harassment (SEL) from impact driving and acoustic ranges to Level A harassment and Level B harassment thresholds, densities, exposure estimates and take estimates following the aforementioned assumptions (*e.g.,* construction and hammer schedules).

As previously described, JASCO integrated the results from acoustic source and propagation modeling into an animal movement model to calculate exposure ranges for 17 marine mammal species considered common in the project area. The resulting ranges represent the distances at which marine mammals may incur Level A harassment (*i.e.,* PTS). The exposure ranges also influence the development of mitigation and harassment zone sizes. While the first year of Schedule A includes the potential installation of 13-m monopiles using a 6,000 kJ hammer, this specific configuration was not modeled beyond acoustic source modeling because initial source modeling showed minimal difference between the 12-m and 13-m monopiles. Therefore, Park City Wind modeled the 12-m monopile with 6,000 kJ hammer energy which was assumed to be a reasonable replacement in exposure calculations. Park City Wind assumed that all Phase 2 foundations are jackets as their modeling results found that jacket foundations are the most impactful in terms of the Level A cumulative sound exposure metric. Thus, the assumption of all jacket foundations provide an envelope for an up to 13-m monopile installed with a 5,000 or 6,000 kJ hammer. Table 16 provides exposure ranges for impact pile driving 12-m and 13-m monopiles and jacket foundations, assuming 10 dB attenuation (also see Tables 21–27 in Park City Wind's ITA application).

TABLE 16—EXPOSURE RANGES (ER95%, km) TO MARINE MAMMAL LEVEL A HARASSMENT (SEL) THRESHOLDS DURING IMPACT PILE DRIVING 12-m AND 13-m MONOPILES AND 4-m PIN PILES, ASSUMING 10 dB ATTENUATION [1]

Marine mammal species	12-m monopile				13-m monopile		4-m pin piles
	5,000 kJ hammer (km)		6,000 kJ hammer (km)		5,000 kJ hammer (km)		3,500 kJ hammer (km)
	one pile/day	two piles/day	one pile/day	two piles/day	one pile/day	two piles/day	four piles/day
North Atlantic right whale	1.84	2.34	2.93	3.16	2.26	2.53	2.54
Fin whale	2.37	2.79	3.31	3.90	2.56	3.14	4.07
Humpback whale	2.76	3.44	3.81	4.62	2.87	3.66	4.49
Minke whale	1.50	1.67	2.40	2.59	1.50	1.65	1.83
Sei whale	1.95	2.04	2.47	3.08	1.66	2.31	2.84
Sperm whale	0	0	0	0	0	0	<0.01
Atlantic spotted dolphin	0	0	0	0	0	0	0
Atlantic white sided dolphin	0	0	0	0	0	0	0.01
Bottlenose dolphin	0	0	0	0	0	0	0.01
Common dolphin	0	0	0	0	0	0	<0.01
Long-finned pilot whale	0	0	0	0	0	0	<0.01
Short-finned pilot whale	<0.01	0	<0.01	0	0	0	0
Risso's dolphin	0	<0.01	0.02	<0.01	<0.01	<0.01	0.01
Harbor porpoise	1.55	1.60	2.26	2.30	1.51	1.50	1.77
Gray seal	0.51	0.56	0.84	1.01	0.59	0.57	1.31
Harbor seal	0.21	0.21	0.43	0.63	0.16	0.19	0.32
Harp seal	0.15	0.31	0.25	0.41	0.09	0.32	0.28

[1] The exposure ranges presented here represent the assumption that the pile would be fully installed with an impact hammer. Hence, for piles that are set with a vibratory hammer, these distances can be considered an overestimate since fewer strikes would be required to install the pile. Park City Wind estimates approximately 70 of the 132 foundations installed would require use of a vibratory hammer to set the pile.

As described above, JASCO also calculated acoustic ranges which represent distances to NMFS' harassment isopleths independent of movement of a receiver. Acoustic ranges are a better representation of distances to NMFS' instantaneous harassment thresholds (*i.e.,* PTS dB peak, and Level B harassment) and can also be used for PTS dB SEL when animal movement modeling is not conducted. As described previously, the distances to the PTS dB SEL threshold are likely an overestimate as it assumes an animal remains at the distance for the entire duration of pile driving. Presented below are the distances to the PTS (dB peak) threshold for impact pile driving, PTS (dB peak and dB SEL) for vibratory pile driving and drilling, and Level B harassment (SPL) thresholds for all installation methods during WTG and ESP foundation installation. Table 17 identifies the inputs Park City Wind applied to the User Spreadsheet. Full details on the inputs into the User Spreadsheet can also be found in Appendix B and C in Park City Wind's Application Update Report.

TABLE 17—NMFS USER SPREADSHEET INPUTS

Spreadsheet tab used	Source A	Source B
	Vibratory pile driving	Drilling
Source Level (Single Strike/shot SEL/rms)	188	183.3 dB SPL.
Weighting Factor Adjustment (kHz)	2.5	2.5.
(a) Number of strikes in 1 h	n/a	n/a.
(b) Number of piles per day	2	n/a.
(c) Activity Duration (h) within 24-h period	24	24.
Propagation (xLogR)	15	15.
Distance of source level measurement (m)	10	10.

Acoustic ranges to the Level A harassment threshold and Level B harassment thresholds are in Tables 18 and 19, respectively. Mean monthly density estimates for pile driving and drilling, in consideration of the applicable perimeter for each type, are provided in Tables 20, 21, and 22 below.

TABLE 18—ACOUSTIC RANGES, IN METERS, TO LEVEL A HARASSMENT THRESHOLDS DURING PILE DRIVING AND DRILLING, ASSUMING 10 dB ATTENUATION

Pile installed	Install method	Hammer energy (kJ)	Activity duration (minutes)	Distances to Level A harassment thresholds (m)							
				Low-frequency cetacean		Mid-frequency cetacean		High-frequency cetaceans		Phocids	
				219 $L_{p,pk}$	199 $L_{E,24hr}$	230 $L_{p,pk}$	198 $L_{E,24hr}$	202 $L_{p,pk}$	173 $L_{E,24hr}$	218 $L_{p,pk}$	201 $L_{E,24hr}$
Drilling	Drilling	N/A	1,440 (24 hours)	7.4	174.3	....	15.4	....	257.7	....	105.9
12-m	Impact	5,000	n/a	11	....	3	....	230	....	14	....
12-m	Impact	6,000	n/a	11	....	3	....	230	....	14	....
13-m	Impact	5,000	n/a	14	....	5	....	290	....	16	....
4-m	Impact	3,500	n/a	2	....	....	....	139	....	2	....
13-m	Vibratory	N/A	60	18.4	430.9	....	38.2	....	637.1	....	261.9

TABLE 19—ACOUSTIC RANGES (R95%), IN METERS, TO LEVEL B HARASSMENT THRESHOLDS DURING PILE DRIVING AND DRILLING, ASSUMING 10 dB ATTENUATION

Pile installed	Install method	Hammer energy (kJ)	Distance to Level B harassment (km)
Drilling	Drilling	N/A	16.6
12-m	Impact	5,000	4.24
12-m	Impact	6,000	5.83
13-m	Impact	5,000	4.64
4-m	Impact	3,500	3.64
13-m	Vibratory	N/A	50

TABLE 20—MEAN MONTHLY MARINE MAMMAL DENSITY ESTIMATES (ANIMALS/100 km^2) FOR IMPACT PILE DRIVING CONSIDERING A 6.2-km BUFFER AROUND THE LEASE AREA [a]

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual mean	May–Dec mean
North Atlantic right whale [b]	0.356	0.427	0.431	0.459	0.289	0.048	0.021	0.018	0.027	0.05	0.062	0.174	0.197	0.086
Fin whale [b]	0.212	0.168	0.106	0.163	0.27	0.249	0.443	0.37	0.234	0.057	0.05	0.138	0.205	0.226
Humpback whale	0.03	0.022	0.042	0.15	0.298	0.314	0.175	0.12	0.167	0.243	0.191	0.028	0.148	0.192
Minke whale	0.108	0.134	0.132	0.798	1.717	1.63	0.689	0.468	0.529	0.474	0.051	0.073	0.567	0.704
Sei whale [b]	0.039	0.021	0.044	0.111	0.194	0.053	0.013	0.011	0.019	0.037	0.079	0.063	0.057	0.059
Sperm whale [b]	0.031	0.012	0.013	0.003	0.013	0.029	0.039	0.109	0.066	0.063	0.031	0.021	0.036	0.046
Atlantic spotted dolphin	0.001	0	0.001	0.003	0.017	0.024	0.031	0.055	0.281	0.425	0.185	0.019	0.087	0.13
Atlantic white-sided dolphin	2.093	1.248	0.853	1.315	3.362	3.041	1.392	0.728	1.655	2.486	1.786	2.473	1.869	2.115
Bottlenose dolphin, offshore	0.515	0.113	0.06	0.158	0.832	1.39	1.51	1.702	1.511	1.36	1.278	1.141	0.964	1.341
Common dolphin	7.365	2.509	1.896	3.288	6.357	14.269	10.568	14.668	26.713	23.434	11.174	10.937	11.098	14.765
Long-finned pilot whale [c]	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.142
Short-finned pilot whale [c]	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105
Risso's dolphin	0.044	0.004	0.002	0.018	0.097	0.047	0.067	0.126	0.156	0.085	0.122	0.183	0.079	0.111
Harbor porpoise	10.065	10.857	10.353	8.936	6.826	0.895	0.804	0.776	0.919	1.225	1.373	5.683	4.893	2.313
Gray seal [d]	5.756	6.123	4.627	3.434	5.122	0.757	0.076	0.083	0.214	0.505	1.844	5.002	2.795	1.7
Harbor seal [d]	12.932	13.758	10.395	7.714	11.507	1.7	0.171	0.186	0.482	1.134	4.143	11.237	6.28	3.82
Harp seal [d]	5.756	6.123	4.627	3.434	5.122	0.757	0.076	0.083	0.214	0.505	1.844	5.002	2.795	1.7

[a] Density estimates are calculated from the 2022 Duke Habitat-Based Marine Mammal Density Models (Roberts *et al.,* 2016; Roberts and Halpin, 2022).
[b] Listed as Endangered under the ESA.
[c] Long- and short-finned pilot whale densities are the annual pilot whale guild density scaled by their relative abundances.
[d] Gray and harbor seal densities are the seals guild density scaled by their relative abundances; gray seals are used as a surrogate for harp seals.

TABLE 21—MEAN MONTHLY MARINE MAMMAL DENSITY ESTIMATES (ANIMALS/100 km^2) FOR VIBRATORY PILE DRIVING CONSIDERING A 50-km PERIMETER AROUND THE LEASE AREA [a]

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual mean	May–Dec mean
North Atlantic right whale [b]	0.542	0.649	0.566	0.507	0.316	0.08	0.051	0.031	0.043	0.054	0.113	0.34	0.274	0.129
Fin whale [b]	0.196	0.159	0.138	0.168	0.259	0.247	0.39	0.322	0.243	0.088	0.059	0.13	0.2	0.217
Humpback whale	0.037	0.03	0.044	0.165	0.273	0.301	0.161	0.099	0.129	0.185	0.168	0.04	0.136	0.169
Minke whale	0.106	0.121	0.137	0.666	1.343	1.213	0.524	0.319	0.357	0.393	0.051	0.079	0.442	0.535
Sei whale [b]	0.031	0.023	0.044	0.121	0.181	0.058	0.016	0.009	0.015	0.034	0.076	0.059	0.056	0.056
Sperm whale [b]	0.031	0.018	0.017	0.004	0.014	0.029	0.039	0.111	0.054	0.04	0.029	0.027	0.035	0.043
Atlantic spotted dolphin	0.002	0	0.001	0.005	0.067	0.164	0.049	0.08	0.432	0.948	0.228	0.026	0.167	0.249
Atlantic white-sided dolphin	2.383	1.677	1.143	1.607	3.174	3.324	1.463	0.533	1.311	2.197	1.74	2.434	1.916	2.022
Bottlenose dolphin, offshore	0.666	0.208	0.121	0.276	1.081	1.8	1.871	1.902	1.94	1.896	1.825	1.421	1.251	1.717
Common dolphin	9.886	4.821	3.803	5.177	8.627	17.737	12.807	14.696	22.88	29.545	17.768	14.652	13.533	17.339
Long-finned pilot whale [c]	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165

TABLE 21—MEAN MONTHLY MARINE MAMMAL DENSITY ESTIMATES (ANIMALS/100 km²) FOR VIBRATORY PILE DRIVING CONSIDERING A 50-km PERIMETER AROUND THE LEASE AREA [a]—Continued

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual mean	May–Dec mean
Short-finned pilot whale [c]	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122
Risso's dolphin	0.102	0.021	0.008	0.038	0.214	0.207	0.272	0.446	0.587	0.294	0.182	0.215	0.215	0.302
Harbor porpoise	7.134	7.874	7.54	6.884	4.851	1.409	1.315	1.002	0.851	1.137	1.376	4.459	3.819	2.05
Gray seal [d]	5.859	5.46	4.518	4.932	7.239	5.389	1.57	1.3	1.512	2.863	3.463	5.24	4.112	3.572
Harbor seal [d]	13.164	12.268	10.15	11.081	16.265	12.108	3.528	2.921	3.397	6.432	7.781	11.773	9.239	8.026
Harp seal [d]	5.859	5.46	4.518	4.932	7.239	5.389	1.57	1.3	1.512	2.863	3.463	5.24	4.112	3.572

[a] Density estimates are calculated from the 2022 Duke Habitat-Based Marine Mammal Density Models (Roberts *et al.,* 2016; Roberts and Halpin, 2022).
[b] Listed as Endangered under the ESA.
[c] Long- and short-finned pilot whale densities are the annual pilot whale guild density scaled by their relative abundances.
[d] Gray and harbor seal densities are the seals guild density scaled by their relative abundances; gray seals are used as a surrogate for harp seals.

TABLE 22—MEAN MONTHLY MARINE MAMMAL DENSITY ESTIMATES (ANIMALS/100 km²) FOR DRILLING CONSIDERING A 16.6-km PERIMETER AROUND THE LEASE AREA [a]

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual mean	May–Dec mean
North Atlantic right whale [b]	0.419	0.497	0.48	0.484	0.29	0.05	0.023	0.019	0.029	0.052	0.076	0.227	0.221	0.096
Fin whale [b]	0.216	0.164	0.111	0.164	0.274	0.26	0.421	0.342	0.222	0.06	0.053	0.142	0.203	0.222
Humpback whale	0.032	0.025	0.043	0.147	0.284	0.297	0.166	0.116	0.16	0.222	0.184	0.032	0.142	0.183
Minke whale	0.118	0.141	0.141	0.807	1.706	1.594	0.683	0.448	0.484	0.453	0.054	0.082	0.559	0.688
Sei whale [b]	0.038	0.022	0.045	0.114	0.191	0.052	0.013	0.01	0.018	0.036	0.08	0.067	0.057	0.059
Sperm whale [b]	0.031	0.012	0.013	0.003	0.014	0.027	0.038	0.116	0.068	0.05	0.031	0.021	0.035	0.046
Atlantic spotted dolphin	0.001	0	0.001	0.003	0.02	0.029	0.032	0.054	0.27	0.48	0.178	0.019	0.09	0.135
Atlantic white-sided dolphin	2.04	1.251	0.872	1.339	3.281	3.002	1.396	0.709	1.629	2.36	1.786	2.411	1.84	2.072
Bottlenose dolphin, offshore	0.48	0.112	0.061	0.161	0.813	1.356	1.47	1.633	1.488	1.353	1.268	1.076	0.939	1.307
Common dolphin	7.13	2.538	1.988	3.375	6.36	13.828	10.656	14.298	24.73	23.023	11.7	11.063	10.891	14.457
Long-finned pilot whale [c]	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139
Short-finned pilot whale [c]	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102
Risso's dolphin	0.045	0.004	0.002	0.019	0.101	0.054	0.075	0.141	0.177	0.097	0.123	0.177	0.085	0.118
Harbor porpoise	9.722	10.5	9.999	8.702	6.457	1.041	0.988	0.95	1.043	1.274	1.435	5.798	4.826	2.373
Gray seal [d]	6.084	6.137	4.495	3.63	5.259	1.171	0.151	0.154	0.327	0.655	2.078	4.937	2.923	1.842
Harbor seal [d]	13.67	13.788	10.099	8.157	11.816	2.63	0.34	0.346	0.736	1.472	4.67	11.091	6.568	4.138
Harp seal [d]	6.084	6.137	4.495	3.63	5.259	1.171	0.151	0.154	0.327	0.655	2.078	4.937	2.923	1.842

[a] Density estimates are calculated from the 2022 Duke Habitat-Based Marine Mammal Density Models (Roberts *et al.,* 2016; Roberts and Halpin, 2022).
[b] Listed as Endangered under the ESA.
[c] Long- and short-finned pilot whale densities are the annual pilot whale guild density scaled by their relative abundances.
[d] Gray and harbor seal densities are the seals guild density scaled by their relative abundances; gray seals are used as a surrogate for harp seals.

To estimate take from foundation installation activities, Park City Wind used two pile installation construction schedules (Table 2 above; also see Tables 2 and 3 in Application Update Report). Overall, Construction Schedule A (Schedule A) assumes 52 days of foundation installation activities would occur between May and December in 2026 (Year 2) to install 89 monopiles and 2 jacket foundations and 35 days of foundation installation activities would occur in 2027 (Year 3) to install 18 monopiles and 24 jacket foundations. As previously described, Park City accounted for 133 piles to be installed in its modeling despite a maximum of 132 foundations actually being installed. In total, based on Schedule A, 87 days of foundation installation activities would occur over 2 years to complete the Project. Construction Schedule B (Schedule B) assumes 38 days of foundation installation activities would occur between May and December in 2026 (Year 2) to install 55 monopiles and 3 jacket foundations, 53 days of foundation installation activities would occur in 2027 (Year 3) to install 53 jackets, and 22 days of foundation installation activities would occur in 2028 (Year 4) to install 22 jackets. In total, based on Schedule B, 113 days of foundation installation activities would occur over 3 years to complete the Project.

Due to the extended duration of Schedule B, the total amount of Level B harassment from foundation installation activities is greater than Schedule A over the 5-year effective period of the proposed rule. The total 5-year take by Level B harassment in this proposed rule is therefore generated based on Schedule B. However, annual take estimates assume the yearly worst case scenario exposures for each species for each year from either Construction Schedule A or B. That is, annual take by Level B harassment due to foundation installation activities may use either Schedule A or B, whichever was more. As previously described, Park City accounted for 133 piles to be installed in its modeling despite a maximum of 132 foundations actually being installed to complete the Project.

Park City Wind considered three foundation installation techniques when estimating take: impact pile driving, vibratory pile driving (to set the pile), and drilling (to break up any obstacles should the pile encounter obstructions). Of these, Level A harassment (PTS) has the potential to occur from impact pile driving only. As shown in Table 18, vibratory pile driving and drilling produce very small Level A harassment zone sizes that consider static receivers over the duration of the time period considered in the model (*e.g.,* a harbor porpoise would have to remain at 637 m from the pile for 24-hours). For vibratory pile driving, the duration considered was relatively short (60 minutes); however, this represents vibratory driving over two piles in which there are several hours in between events and the resulting distances are comparatively small (*e.g.,* 460 m for low-frequency cetaceans (*i.e.,* baleen whales)). Moreover, the implementation of clearance and shut down zones would further reduce the potential for PTS from these activities. For these reasons, Park City Wind has concluded, and NMFS agrees, the potential for PTS to occur from vibratory pile driving or drilling is discountable. For this reason, Park City Wind carried forward the PTS exposure estimates from impact pile driving and no take by Level A harassment was considered for vibratory pile driving or drilling. The maximum take by Level A harassment proposed for authorization from the foundation activities (*i.e.,* impact pile driving) is in Table 23.

To estimate the amount of Level B (behavioral) harassment that may occur incidental to foundation installation, Park City Wind considered all three installation methods. As described above, Park City Wind conducted exposure modeling to estimate the number of exposures that may occur from impact pile driving. The results of the exposure modeling and amount of take Park City Wind requested from this activity is provided in sections 3 and 4 of the Application Update Report. Separately, Park City Wind applied a more traditional approach to estimate take from vibratory driving and drilling wherein:

Take = density × area ensonified × number of days of activity

As shown in Tables 20 and 21, densities for vibratory pile driving and drilling were calculated on a monthly basis. Park City Wind then considered the number of days either activity would occur per month and per schedule (see Tables 2 and 3 in Application Update Report). Take was estimated for each activity independent of each other. That is, Park City Wind calculated take for vibratory driving 70 foundations over 45 days for Schedule A and 54 days for Schedule B. The resulting monthly and annual take can be found in Tables 18–20 of Park City Wind's Application Update Report. Separately, Park City Wind calculated take considering drilling for 48 foundations over 48 days for both Schedule A and Schedule B. The resulting monthly and annual take can be found in Tables 21–23 of Park City Wind's Application Update Report.

To avoid overestimating take, the amount of take derived when considering impact driving, vibratory driving, and drilling independently were not summed to produce the amount of annual take Park City Wind requested. Instead, Park City Wind appropriately deducted the take from drilling when vibratory pile driving and drilling would occur on the same day. This is because the area for vibratory pile driving is much larger than drilling (50 km vs 16.6 km) and the amount of take estimated for vibratory pile driving adequately covers potential take from drilling activities. However, because take from impact pile driving was modeled based on the number of piles while vibratory/drilling takes were based on the number of days of activity, Park City Wind added the take estimates from impact pile driving all piles to the take estimates from vibratory pile driving/drilling (with the appropriate discounting) to produce their annual and total take requests. However, this is an overestimate of take as impact and vibratory and/or drilling could occur on the same day. That is, via this method, the amount of take requested represents take associated with more than 132 foundations. Hence, NMFS has reduced the amount of take, by Level B harassment, proposed for authorization.

The amount of Level B harassment take NMFS proposes to authorize represents the amount of take from impact driving on days when only impact driving could occur plus the amount of take from vibratory or drilling on the days that either of those activities could occur to avoid double counting. We were able to reduce the amount of take from impact pile driving by reducing the amount proportional to the percentage of days when only impact pile driving would occur. For example, Park City Wind identified that impact pile driving would occur over 52 days in Year 2 (2026) according to Schedule A. However, Park City Wind has predicted that only 7 of those 52 days (approximately 13 percent) would contain impact pile driving only (*i.e.,* no vibratory pile driving and/or drilling). Hence, for Year 2 (2026) Schedule A, NMFS only included 13 percent of the estimated impact pile driving exposures calculated. As an example, Park City Wind estimated 9 exposures of fin whales in Year 2 (2026), Schedule A from impact pile driving. NMFS carried forward 2 (13 percent of 9) exposures into the take estimates from foundation installation.

Table 24 provides the annual take by Level B harassment calculated using this method from impact pile driving for both Schedule A and, separately, Schedule B. Table 25 identifies the amount of take for vibratory pile driving and drilling foundation installation activities after removing drilling takes when drilling would occur on the same day as vibratory pile driving (to avoid double counting). The annual take amounts represent the highest value between both Schedule A and Schedule B while the maximum 3-year take estimates represent the sum of take calculated for each year in Schedule B. NMFS retained Park City Wind's request for Level A harassment from all impact pile driving activities as no Level A harassment from vibratory pile driving or drilling is anticipated (Table 23). Table 26 identifies the amount of take for all foundation installation activities combined (*i.e.,* the sum of Tables 23 through 26) that was carried forward in the take tables for this proposed rule.

TABLE 23—HIGHEST ANNUAL EXPOSURE ESTIMATES AND ANNUAL AMOUNT OF TAKE PROPOSED FOR AUTHORIZATION BY LEVEL A HARASSMENT FROM IMPACT PILE DRIVING ASSOCIATED WITH WTG AND ESP TOTAL INSTALLATION EVENTS FOR CONSTRUCTION SCHEDULE A AND B, ASSUMING 10 dB OF NOISE ATTENUATION

Species	Year 2 (2026)		Year 3 (2027)		Year 4 (2028)	
	Exposures	Proposed takes	Exposures	Proposed takes	Exposures	Proposed takes
North Atlantic right whale [a] [b]	1.94	0	3.6	0	1.68	0
Fin whale [a]	8.95	9	19.97	20	8.13	9
Humpback whale	8.11	9	15.9	16	6.85	7
Minke whale	30.92	31	84.14	85	37.2	38
Sei whale [a]	0.95	1	1.88	2	0.91	1
Sperm whale [a]	<0.01	1	<0.01	1	<0.01	1
Atlantic spotted dolphin [c]	0	0	0	0	0	0
Atlantic white sided dolphin	0.01	1	0.21	1	0.09	1
Bottlenose dolphin, offshore	0.01	1	0.2	1	0.08	1
Common dolphin	0.17	8	2.18	3	0.94	1

TABLE 23—HIGHEST ANNUAL EXPOSURE ESTIMATES AND ANNUAL AMOUNT OF TAKE PROPOSED FOR AUTHORIZATION BY LEVEL A HARASSMENT FROM IMPACT PILE DRIVING ASSOCIATED WITH WTG AND ESP TOTAL INSTALLATION EVENTS FOR CONSTRUCTION SCHEDULE A AND B, ASSUMING 10 dB OF NOISE ATTENUATION—Continued

Species	Year 2 (2026)		Year 3 (2027)		Year 4 (2028)	
	Exposures	Proposed takes	Exposures	Proposed takes	Exposures	Proposed takes
Long-finned pilot whale [d]	<0.01	1	0.03	1	0.01	1
Short-finned pilot whale	<0.01	1	<0.01	1	0	0
Risso's dolphin	0.04	1	0.04	1	0.02	1
Harbor porpoise	70.65	71	135.47	136	59.89	60
Gray seal	1.09	2	2.43	3	1.13	2
Harbor seal	2.51	3	6.82	7	3.17	4
Harp seal	1.05	2	2.13	3	0.99	1

[a] Listed as Endangered under the ESA.
[b] Level A harassment exposures were estimated for this species, but due to mitigation measures, no Level A harassment takes are expected or requested.

TABLE 24—ANNUAL AND TOTAL AMOUNT OF TAKE, BY LEVEL B HARASSMENT, PROPOSED FOR AUTHORIZATION FROM IMPACT PILE DRIVING ASSOCIATED WITH WTG AND ESP TOTAL INSTALLATION EVENTS FOR CONSTRUCTION SCHEDULE A AND B, ASSUMING 10 dB OF NOISE ATTENUATION

Species	Schedule A		Schedule B			
	Year 2 (2026)	Year 3 (2027)	Year 2 (2026)	Year 3 (2027)	Year 4 (2028)	Maximum 3-year total take, Schedule B [b]
Fin whale [a]	2.29	1.49	2.39	3.94	2.18	8.52
Minke whale	12.79	10.63	14.74	40.89	23.72	79.35
Humpback whale	1.62	1.14	1.66	2.91	1.64	6.20
North Atlantic right whale [a]	0.67	0.57	0.74	1.25	0.82	2.80
Sei whale [a]	0.40	0.34	0.37	0.62	0.55	1.54
Atlantic white sided dolphin	36.21	32.46	35.55	97.96	55.63	189.14
Atlantic spotted dolphin	4.04	3.43	5.53	6.23	8.18	19.93
Common dolphin	495.87	497.78	425.69	1,381.64	783.74	2,591.07
Bottlenose dolphin, offshore	19.52	18.29	18.42	59.98	32.45	110.85
Risso's dolphin	1.48	1.26	1.29	3.11	1.91	6.31
Long-finned pilot whale	2.56	2.29	3.13	6.85	4.64	14.62
Short-finned pilot whale	1.88	1.71	1.66	5.19	3.00	9.85
Sperm whale [a]	0.67	0.57	0.55	1.45	0.82	2.82
Harbor porpoise	28.00	25.60	25.05	61.64	35.72	122.42
Gray seal	6.86	4.80	5.53	4.36	2.73	12.61
Harbor seal	16.29	13.14	14.18	20.55	12.54	47.27
Harp seal	7.94	6.40	7.00	9.34	5.73	22.07

[a] Listed as Endangered under the ESA.
[b] As construction schedule B has the highest total take by Level B harassment for impact pile driving, this column represents the sum of the Schedule B take numbers only and not the sum of the preceding columns within this table.

TABLE 25—MAXIMUM ANNUAL AND 3-YEAR VIBRATORY PILE DRIVING AND DRILLING ESTIMATED TAKE BETWEEN CONSTRUCTION SCHEDULE A AND B, BY LEVEL B HARASSMENT, ASSUMING 10 dB OF NOISE ATTENUATION

Species	Year 2 (2026) [b]	Year 3 (2027)	Year 4 (2028) [c]	Maximum 3-year take, Schedule B [d]
North Atlantic right whale [a]	92	103	47	236
Fin whale [a]	470	567	202	1,210
Humpback whale	285	324	139	726
Minke whale	878	988	449	2,256
Sei whale [a]	47	50	27	119
Sperm whale [a]	111	137	41	277
Atlantic spotted dolphin	491	624	178	1,231
Atlantic white-sided dolphin	2,716	3,037	1,373	6,927
Bottlenose dolphin, offshore	3,269	3,931	1,404	8,419
Common dolphin	32,787	39,645	13,437	82,661
Long-finned pilot whale	291	345	126	743
Short-finned pilot whale	215	255	93	547
Risso's dolphin	622	798	235	1,612
Harbor porpoise	2,078	2,366	959	5,268
Gray seal	3,587	4,170	1,986	9,683

TABLE 25—MAXIMUM ANNUAL AND 3-YEAR VIBRATORY PILE DRIVING AND DRILLING ESTIMATED TAKE BETWEEN CONSTRUCTION SCHEDULE A AND B, BY LEVEL B HARASSMENT, ASSUMING 10 dB OF NOISE ATTENUATION—Continued

Species	Year 2 (2026) [b]	Year 3 (2027)	Year 4 (2028) [c]	Maximum 3-year take, Schedule B [d]
Harbor seal	8,058	9,366	4,462	21,755
Harp seal	3,587	4170	1,986	9,683

[a] Listed as Endangered under the ESA.
[b] Year 2 is from Construction Schedule A.
[c] Year 4 is from Construction Schedule B only, there is no third year of foundation installation under Schedule A.
[d] As construction Schedule B has the highest total take by Level B harassment for vibratory or drilling, the ''all years combined'' is the sum of the Schedule B take numbers and not the sum of the preceding columns within this table.

TABLE 26—TAKES PROPOSED FOR AUTHORIZATION FOR ALL FOUNDATION INSTALLATION ACTIVITIES COMBINED, PER YEAR, CARRIED FORWARD TO THE TOTAL TAKE ESTIMATES CONSIDERING ALL ACTIVITIES

Species	Year 2 (2026)		Year 3 (2027)		Year 4 (2028)	
	Level A harassment	Level B harassment [a c e]	Level A harassment	Level B harassment [b d f]	Level A harassment	Level B harassment [b d f]
North Atlantic right whale	[a] 0	93	[b] 0	104	[b] 0	48
Fin whale	[a] 9	472	[b] 20	571	[b] 9	204
Humpback whale	[a] 9	287	[b] 16	327	[b] 7	141
Minke whale	[a] 31	[b c e] 893	[b] 85	1029	[b] 38	473
Sei whale	[a] 1	47	[b] 2	51	[b] 1	48
Sperm whale	[a] 1	112	[b] 1	138	[b] 1	42
Atlantic spotted dolphin	[a] 0	[b c e] 497	[b] 0	630	[b] 0	186
Atlantic white sided dolphin	[a] 1	2,752	[b] 1	3,135	[b] 1	1,429
Bottlenose dolphin, offshore	[a] 1	3,289	[b] 1	3,991	[b] 1	1,436
Common dolphin	[b] 8	33,283	[b] 3	41,027	[b] 1	14,221
Long-finned pilot whale	[a] 1	[b c e] 294	[b] 1	352	[b] 1	131
Short-finned pilot whale	[a] 1	217	[a] 1	260	[b] 0	96
Risso's dolphin	[a] 1	623	[b] 1	801	[b] 1	237
Harbor porpoise	[a] 71	2,106	[b] 136	2,428	[b] 60	995
Gray seal	[a] 2	3,594	[b] 3	4,175	[b] 2	1,989
Harbor seal	[a] 3	8,074	[b] 7	9,387	[b] 4	4,475
Harp seal	[a] 2	3,595	[b] 3	4,179	[b] 1	1,992

[a] Impact pile driving, Construction Schedule A (double counting of impact and vibratory days removed for Level B harassment proposed take numbers).
[b] Impact pile driving, Construction Schedule B (double counting of impact and vibratory days removed for Level B harassment proposed take numbers).
[c] Vibratory pile setting, Construction Schedule A.
[d] Vibratory pile setting, Construction Schedule B.
[e] Drilling, Construction Schedule A (double counting of vibratory and drilling days removed).
[f] Drilling, Construction Schedule B (double counting of vibratory and drilling days removed).

UXO/MEC Detonations

Park City Wind may detonate up to 10 UXO/MECs within the proposed project area with no more than six in 2025 (Year 1) and four in 2026 (Year 2); no more than one detonation per 24-hour period would occur. Park City Wind adopted the U.S. Navy's charge weight bins (E4, E6, E8, E10, and E12—see Table 27) to determine potential impacts to marine mammals from UXO/MEC detonation. As described previously, Park City Wind applied modeling results from the Revolution Wind project to its analysis. The exact type and net explosive weight of UXO/MECs that may be detonated are not known at this time. However, based on the results of a UXO/MECs desktop study (Mills, 2021), Park City Wind does not expect that 10 of the largest charge weight (bin E12) UXO/MECs will be present, but a combination of different sizes.

Mortality and non-auditory injury to lung and gastrointestinal organs were considered in the modeling study (Hannay and Zykov, 2022). As described, peak pressure and acoustic impulse levels and effects threshold exceedance zones depend only on charge weight, water depth, animal mass, and submersion depth. The maximum distance to gastrointestinal injury (1 percent of exposed animals) due to peak pressure for detonating an E12-size UXO/MEC at all sites assuming 10 dB of attenuation is 125 m (Hannay and Zykov, 2022). The maximum distance modeled to the onset of lung injury due to detonating an E12-size UXO/MEC assuming 10 dB of attenuation is 237 m for baleen whales, 330 m for pilot and minke whales, 448 m for beaked whales, 606 m for *delphinids, Kogia,* and pinnipeds, and 648 m for harbor porpoise (Table 27). Assuming 10 dB of attenuation, the impulse-based maximum distance to the onset of mortality is 353 m (porpoises) (Table 27).

TABLE 27—UXO/MEC IMPULSE EXCEEDANCE DISTANCES (METERS) FOR MARINE MAMMALS FOR THE DETONATION OF AN E12 UXO/MEC, FOR ONSET OF LUNG INJURY AND MORTALITY AT VARIOUS DEPTHS ASSUMING 10 dB ATTENUATION

Marine mammal group	12 m water depth		20 m water depth		30 m water depth		45 m water depth	
	Calf/pup	Adult	Calf/pup	Adult	Calf/pup	Adult	Calf/pup	Adult
Onset of Lung Injury								
Baleen whales and Sperm whale	151	73	204	80	226	81	237	78
Pilot and Minke whales	192	103	272	126	310	131	330	132
Beaked whales	250	171	366	237	413	267	448	282
Dolphins, Kogia, and Pinnipeds	347	241	508	351	557	400	606	429
Porpoises	377	260	541	381	594	429	648	465
Onset of mortality								
Baleen whales and Sperm whale	90	34	105	34	109	31	108	29
Pilot and Minke whales	120	56	150	58	157	57	162	50
Beaked whales	161	105	206	127	220	132	234	135
Dolphins, Kogia, and Pinnipeds	228	154	285	198	308	211	332	224
Porpoises	248	167	307	215	330	231	353	243

Given that Park City Wind would be limited to detonating UXO/MECs during daytime and be required to employ a minimum of four PSOs to visually monitor for marine mammals, including those on an aircraft when the clearance zone is larger than 5 km, in concert with acoustic monitoring efforts, it is reasonable to assume that marine mammals would be reliably detected within the zones identified above (a maximum distance of approximately 648 m (2,126 feet) of the UXO/MEC being detonated) and that mitigation would be employed to avoid take by mortality or non-auditory injury. Therefore, the potential for mortality or non-auditory injury is *de minimis* (*i.e.,* too minimal or minor for further concern) and not discussed further.

It is not currently known how easily the size and charge weights of UXO/MECs can be identified in the field. Park City Wind must demonstrate to NMFS that it is able to accurately identify charge weights in the field prior to detonation otherwise the largest charge weight, E12, will be assumed and the appropriate associated mitigation and monitoring measures implemented. Table 28 contains the maximum (R95 percent) modeled distances by Hannay and Zykov (2022) to PTS and TTS thresholds during UXO/MEC detonation for each charge weight bin.

TABLE 28—MAXIMUM DISTANCES (R95%) IN METERS TO PTS AND TTS THRESHOLDS (SEL) DURING UXO/MEC DETONATION, ASSUMING 10 dB OF ATTENUATION [a]

Marine mammal hearing group	Charge weight bins				
	E4 (2.3 kg)	E6 (9.1 kg)	E8 (45.5 kg)	E10 (227 kg)	E12 (454 kg)
Distance to PTS-onset					
Low-frequency cetaceans	552	982	1,730	2,970	3,780
Mid-frequency cetaceans	<50	75	156	337	461
High-frequency cetaceans	1820	2,950	3,710	5,390	6,200
Phocid pinnipeds	182	357	690	1,220	1,600
Distance to TTS-onset					
Low-frequency cetaceans	2,820	4,680	7,490	10,500	11,900
Mid-frequency cetaceans	453	773	1,240	2,120	2,550
High-frequency cetaceans	6,140	7,960	10,300	12,900	14,100
Phocid pinnipeds	1,470	2,350	6,490	7.610	7,020

[a] Hannay and Zykov, 2022.

To estimate the amount of take that may occur incidental to UXO/MEC detonation, Park City Wind calculated monthly densities for each species at the shallow portion of the OECC (representing the 12 m depth location; using a 14.1-km buffer) and the combined deepwater segment of the OECC and SWDA (20 m–45 m depths; using a 13.8-km buffer). As a conservative approach, the month with the highest density among the areas of interest for each species was carried forward to the exposure calculations (*i.e.,* assumed all UXO/MECs would be detonated in the month with the greatest average monthly density). In some cases where monthly densities were unavailable, annual densities were used instead for some species (*i.e.,* blue whales, pilot whale *spp.*). Additionally, the pilot whale guild, harbor seals, gray seals, and harp seals were scaled following the same approach described above. The resulting maximum density was multiplied by the number of UXOs/MECs estimated at each of the depths to calculate total estimated exposures. Table 29 provides the maximum species-specific densities for the Project and resulting take calculations using the described approach. As described above, Park City Wind based the amount of take proposed for authorization on the number of exposures estimated assuming 10 dB attenuation using a NAS, NAS would be required during all detonations.

TABLE 29—MAXIMUM MONTHLY MARINE MAMMAL DENSITIES (INDIVIDUALS/100 km²) WITHIN THE PROJECT AREA WITH UXO/MEC DETONATION ASSOCIATED LEVEL A HARASSMENT (PTS) AND LEVEL B HARASSMENT (TTS SEL) EXPOSURE ASSUMING 10 dB ATTENUATION, AND ESTIMATED TAKE

Species	Shallow OECC maximum monthly density (individual/100 km²)	Deep OECC maximum monthly density (individual/100 km²)	2025 Estimated take		2026 Estimated take	
			Level A harassment	Level B harassment	Level A harassment	Level B harassment
North Atlantic right whale [a]	0.116	0.707	0	14	0	13
Fin whale [a]	0.007	0.425	1	7	1	7
Humpback whale	0.04	0.297	1	5	1	5
Minke whale	0.129	1.72	4	28	3	27
Sei whale [a]	0.034	0.191	1	4	1	3
Sperm whale [a]	0.002	0.112	1	1	1	1
Atlantic Spotted dolphin	0.013	0.448	1	1	1	1
Atlantic White-sided dolphin	0.051	3.278	1	3	1	3
Bottlenose dolphin, Offshore	0.158	1.631	1	2	1	2
Common dolphin	0.35	24.845	1	19	1	19
Pilot whales, Long-finned	0	0.135	1	1	1	1
Pilot whales, Short-finned	0	0.1	1	1	1	1
Risso's dolphin	0.01	0.176	1	1	1	1
Harbor porpoise	1.772	10.608	56	217	51	193
Gray seal	24.506	13.647	8	146	4	80
Harbor seal	55.059	30.662	17	328	8	179
Harp seal	24.506	13.647	8	146	4	80

[a] Denotes species listed under the Endangered Species Act.

HRG Surveys

Park City Wind's proposed HRG survey activity includes the use of impulsive sources (*i.e.,* boomers, sparkers) that have the potential to harass marine mammals. The list of equipment proposed is in Table 3 (see Detailed Description of Specific Activities).

Authorized takes would be by Level B harassment only in the form of disruption of behavioral patterns for individual marine mammals resulting from exposure to noise from certain HRG acoustic sources. Based primarily on the characteristics of the signals produced by the acoustic sources planned for use, Level A harassment is neither anticipated nor proposed to be authorized. Therefore, the potential for Level A harassment is not evaluated further in this document. Park City Wind did not request, and NMFS is not proposing to authorize, take by Level A harassment incidental to HRG surveys. No serious injury or mortality is anticipated to result from HRG survey activities.

Specific to HRG surveys, in order to better consider the narrower and directional beams of the sources, NMFS has developed a tool, available at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance,* for determining the distances at which sound pressure level (SPLrms) generated from HRG surveys reach the 160 dB threshold. The equations in the tool consider water depth, frequency-dependent absorption and some directionality to refine estimated ensonified zones. Park City Wind used NMFS' methodology with additional modifications to incorporate a seawater absorption formula and account for energy emitted outside of the primary beam of the source. For sources operating with different beam widths, the beam width associated with operational characteristics reported in Crocker and Fratantonio (2016) were used (Li and Koessler, 2022).

The isopleth distances corresponding to the Level B harassment threshold for each type of HRG equipment with the potential to result in harassment of marine mammals were calculated per NOAA Fisheries' Interim Recommendation for Sound Source Level and Propagation Analysis for High Resolution Geophysical Sources. The distances to the 160 dB RMS re 1 μPa isopleth for Level B harassment are presented in Table 30. Please refer to Appendix I in Li and Koessler (2022) for a full description of the methodology and formulas used to calculate distances to the Level B harassment threshold.

TABLE 30—DISTANCES CORRESPONDING TO THE LEVEL B HARASSMENT THRESHOLD FOR HRG EQUIPMENT

HRG survey equipment	Equipment type	Horizontal distance (m) to Level B harassment threshold	Ensonified area (km²)
Applied Acoustics AA251 Boomer	SBP: Boomer	178	28.58
GeoMarine Geo Spark 2000 (400 tip)	SBP: Sparker	141	22.62

The survey activities that have the potential to result in Level B harassment (160 dB SPL) include the noise produced by Applied Acoustics AA251 Boomer or GeoMarine Geo Spark 2000 (400 tip) (Table 30), of which the

Applied Acoustics AA251 Boomer results in the greatest calculated distance to the Level B harassment criteria at 178 m (584 ft). Park City Wind has applied the estimated distance of 178 m (584 ft) to the 160 dB_{RMS90} percent re 1 μPa Level B harassment criteria as the basis for determining potential take from all HRG sources. All noise-producing survey equipment is assumed to be operated concurrently. Three vessels are assumed to be operating concurrently.

The total area ensonified was estimated by considering the distance of the daily vessel track line (determined using the estimated average speed of the vessel and the 24-hour operational period within each of the corresponding survey segments) and the longest horizontal distance to the relevant acoustic threshold from an HRG sound source (full formula in section 6.6 of the ITA application). Using the larger distance of 178 m (164 ft) to the 160 $dB_{RMS90\ percent}$ re 1 μPa Level B harassment isopleth (Table 30), the estimated daily vessel track of approximately 80 km (49.7 mi) per vessel for 24-hour operations, inclusive of an additional circular area to account for radial distance at the start and end of a 24-hour cycle, estimates of the total area ensonified to the Level B harassment threshold per day of HRG surveys were calculated (Table 30).

Exposure calculations assumed that there would be 25 days of HRG surveying per year over each of the 5 years. As described in the ITA application, density data were mapped within the boundary of the Project Area using geographic information systems, these data were updated based on the revised data from the Duke Model. Because the exact dates of HRG surveys are unknown, the highest density month for each species was used and carried forward in the take calculations (Table 31).

The calculated exposure estimates based on the exposure modeling methodology described above were compared with the best available information on marine mammal group sizes. Group sizes used for HRG take estimates were the same as those used for impact pile driving take estimation (Section 6.1.2 in the ITA application). Park City Wind also used data collected by Protected Species Observers (PSOs) on survey vessels operating during HRG surveys in 2020–2021 from their nearby Vineyard Wind project area (Tables 14 and 15). It was determined that the calculated number of potential takes by Level B harassment based on the exposure modeling methodology above may be underestimates for some species and therefore warranted adjustment using group size to ensure conservatism in the take numbers proposed for authorization. Despite the relatively small modeled Level B harassment zone (178 m) for HRG survey activities, it was determined that adjustments to the requested numbers of take by Level B harassment for some dolphin species was warranted to be conservative (see below).

For certain species for which the density-based methodology described above may result in potential underestimates of take and Park City Wind's PSO sightings data were relatively low, adjustments to the exposure estimates were made based on the best available information on marine mammal group sizes to ensure conservatism. For species with densities too low in the region to provide meaningful modeled exposure estimates (*i.e.,* rare species), the take request is based on the average group size (Table 31). For species not considered rare in the Project Area, but AMAPP data or Park City Wind PSO data show a higher group size level than the Duke Model, then the take proposed for authorization by Level B harassment was adjusted to one group size per day of HRG surveys (Table 31).

For species considered rare but that still have the small potential for occurrence in the Project area, takes proposed for authorization by Level B harassment during HRG surveys were requested by Park City Wind. This occurred for white-beaked dolphin, killer whale, and false killer whale. Park City Wind based their takes proposed for authorization on these species by using one group size per year in 3 of 5 years for species. Group sizes used were based on PSO observations during previous HRG surveys.

TABLE 31—MARINE MAMMAL DENSITIES USED IN EXPOSURE ESTIMATES AND ESTIMATED TAKES BY LEVEL B HARASSMENT FROM HRG SURVEYS

Species	Maximum monthly density [a] (No./100 km²)	Annual exposure using the boomer [f]	Annual exposure using the sparker [g]	Requested annual take	Requested 5-year total take
North Atlantic right whale [b]	0.567	4.05	3.21	5	25
Fin whale [b]	0.436	3.11	2.47	4	20
Humpback whale	0.323	2.31	1.83	3	15
Minke whale	1.704	12.17	9.64	13	65
Sei whale [b]	0.193	1.38	1.09	2	10
Sperm whale [b h]	0.111	0.79	0.62	2	10
Atlantic spotted dolphin [h]	0.404	2.88	2.28	30	150
Atlantic white-sided dolphin [h]	3.406	24.34	19.26	28	140
Bottlenose dolphin, offshore [h]	1.753	12.53	9.92	18	90
Common dolphin [c]	28.314	202.3	160.13	203	1,015
Long-finned pilot whale [d h]	0.149	1.06	0.84	17	85
Short-finned pilot whale [d h]	0.11	0.78	0.62	9	45
Risso's dolphin [h]	0.187	1.34	1.06	7	35
False Killer whale [i]	N/A	N/A	N/A	5	15
Killer whale [i]	N/A	N/A	N/A	2	6
White-beaked dolphin [i]	N/A	N/A	N/A	30	90
Harbor porpoise	10.974	78.41	62.07	79	395
Gray seal [e]	27.901	199.35	157.8	200	1,000
Harbor seal [e]	62.687	447.89	354.54	448	2,240
Harp seal [e]	27.901	199.35	157.8	200	1,000

[a] Cetacean density values from the Duke Model.
[b] Listed as Endangered under the ESA.
[c] Take rounded up to one group size.
[d] Long- and short-finned pilot whale densities are the annual pilot whale guild density scaled by their relative abundances.

[e] Gray and harbor seal densities are the seals guild density scaled by their relative abundances; gray seals are used as a surrogate for harp seals.
[f] Applied Acoustics AA251 boomer.
[g] GeoMarine Geo Spark 2000.
[h] Annual take by Level B harassment is rounded up to one group size.
[i] Rare species total take estimates are based on the assumption that a group would be seen every other year; hence, the 5-yr total is less than the sum of each year.

Total Take Across All Activities

The amount of Level A harassment and Level B harassment NMFS proposes to authorize incidental to all Project activities combined (*i.e.,* pile driving and drilling to install WTG and ESP foundations, UXO/MEC detonations, and HRG surveys are shown in Table 32. The annual amount of take that is expected to occur in each year based on Park City Wind's current schedules is provided in Table 32. The Year 1 take estimates include HRG surveys and UXO/MEC detonations. Year 2 take includes all activities occurring: WTG and ESP foundation installation, HRG surveys, and UXO/MEC detonation. Year 3 includes WTG and ESP foundation installation and HRG surveys. Year 4 take includes WTG and ESP foundation installation (assuming construction schedule B) and HRG surveys. Year 5 take includes HRG surveys only.

For common and uncommon, though not ''rare,'' species where the exposure estimate was less than the mean group size, it was assumed that if one group member was exposed, then the entire group would be. For species where the annual number of predicted exposures was less than the mean group size, the annual take was increased to the mean group size rounded up to the nearest integer. The only species this applied to are the sei whale, Atlantic spotted dolphin, Risso's dolphin, and sperm whale. Because pile driving would occur over either 2 or 3 years, the mean group size rule was carried over from each of the annual take estimates to the total take estimates for the entire construction schedule to account for the possibility that a single exposure could occur in every year of a given construction schedule.

For species considered rare but still have the slight potential for occurrence in the Project area, Park City Wind requested an amount of annual take assuming one group size of that species may be harassed in any given year. However, a group is anticipated to occur only every other year; hence the total amount of take of the 5 years is less than the sum of the annual take across all 5-years. As described above, takes for these species are based on PSO sighting group sizes or on group size from OBIS data. NMFS concurs with this assessment and is proposing to authorize takes by Level A harassment and/or Level B harassment for these rare species (Table 32).

NMFS recognizes that schedules may shift due to a number of planning and logistical constraints such that take may be redistributed throughout the 5 years. However, the total 5-year total amount of take for each species, shown in Table 33, and the maximum amount of take in any one year (Table 34) would not be exceeded.

The amount of take that Park City Wind requested, and NMFS proposes to authorize, is considered conservative. NMFS does not typically authorize take of rare species in these circumstances; however, given the amount of foundation installation activities that Park City Wind is proposing to undertake (*i.e.,* installation of up to 130 WTG and ESP positions), the large harassment zone sizes estimated from foundation installation, the duration of the foundation installation (up to 3 years), that marine mammal distribution is changing and that foundation installation is not scheduled to begin until 2026, NMFS is proposing to issue take for rare species. The one exception is the request for take of beluga whales. There is no beluga whale stock in the U.S. Atlantic and the potential for a beluga whale to occur is incredibly unlikely. Hence, NMFS is not proposing to authorize take of beluga whales.

For the species for which modeling was conducted, the take estimates are considered conservative for a number of reasons. The amount of take proposed to be authorized assumes the worst case scenario with respect to project design and schedules. As described in the Description of Specific Activities section, Park City Wind may use suction-buckets to install bottom-frame WTG and ESP foundations. Should Park City Wind use these foundations, take would not occur as noise levels would not be elevated to the degree there is a potential for take (*i.e.,* no pile driving is involved with installing suction buckets). All calculated take incorporated the highest densities for any given species in any given month. The amount of proposed Level A harassment does not fully account for the likelihood that marine mammals would avoid a stimulus when possible before the individual accumulates enough acoustic energy to potentially cause auditory injury, or the effectiveness of the proposed monitoring and mitigation measures (with exception of North Atlantic right whales given the enhanced mitigation measures proposed for this species). Finally, the amount of take proposed to be authorized for foundation installation is primarily based on vibratory pile driving and drilling zones (50 km and 16.6 km, respectively) in which Park City Wind used simplistic calculations (density × area × number of days of activity) to estimate take that are inherently conservative.

TABLE 32—PROPOSED LEVEL A HARASSMENT AND LEVEL B HARASSMENT TAKES FOR ALL ACTIVITIES PROPOSED TO BE CONDUCTED ANNUALLY FOR THE PROJECT OVER 5 YEARS [a b]

Species	Year 1		Year 2		Year 3		Year 4		Year 5	
	Level A harassment	Level B harassment	Level A harassment	Level B harassment	Level A harassment	Level B harassment	Level A harassment	Level B harassment	Level A harassment	Level B harassment
North Atlantic right whale [c]	0	19	0	111	0	109	0	53	0	5
Blue whale [c d]	0	0	1	2	1	2	1	2	0	0
Fin whale [c]	1	1	10	483	20	575	9	208	0	4
Humpback whale	1	8	10	295	16	330	7	114	0	3
Minke whale	4	41	34	933	85	1,042	38	486	0	13
Sei whale [c]	1	6	2	52	2	53	1	30	0	2
Sperm whale [c]	1	3	2	115	1	140	1	44	0	2
Dwarf sperm whale [d]	0	0	2	2	2	2	2	2	0	0

TABLE 32—PROPOSED LEVEL A HARASSMENT AND LEVEL B HARASSMENT TAKES FOR ALL ACTIVITIES PROPOSED TO BE CONDUCTED ANNUALLY FOR THE PROJECT OVER 5 YEARS [a] [b]—Continued

Species	Year 1		Year 2		Year 3		Year 4		Year 5	
	Level A harass-ment	Level B harass-ment	Level A harass-ment	Level B harass-ment	Level A harass-ment	Level B harass-ment	Level A harass-ment	Level B harass-ment	Level A harass-ment	Level B harass-ment
Pygmy sperm whale [d]	0	0	2	2	2	2	2	2	0	0
Cuvier's beaked whale [d]	0	0	0	3	0	3	0	3	0	0
Blainville's beaked whale [d]	0	0	0	4	0	4	0	4	0	0
Gervais' beaked whale [d]	0	0	0	4	0	4	0	4	0	0
Sowerby's beaked whale [d]	0	0	0	4	0	4	0	4	0	0
True's beaked whale [d]	0	0	0	3	0	3	0	3	0	0
Northern bottlenose whale [d]	0	0	0	4	0	4	0	4	0	0
Atlantic spotted dolphin [d]	1	31	1	528	0	660	0	216	0	30
Atlantic white-sided dolphin	1	31	2	2,783	1	3,163	1	1,457	0	28
Bottlenose dolphin, offshore	1	20	2	3,309	1	4,009	1	1,454	0	18
Clymene dolphin [d]	0	0	0	167	0	167	0	167	0	0
Common dolphin	1	222	9	33,505	3	41,230	1	14,424	0	203
Long-finned pilot whale [e]	1	18	2	312	1	369	1	148	0	17
Short-finned pilot whale	1	10	2	227	1	269	0	105	0	9
Risso's dolphin	1	8	2	631	1	808	1	244	0	7
False killer whale [d]	0	5	0	10	0	10	0	10	0	5
Fraser's dolphin [d]	0	0	0	192	0	192	0	192	0	0
Killer whale [d]	0	2	0	4	0	4	0	4	0	2
Melon-headed whale [d]	0	0	0	109	0	109	0	109	0	0
Pantropical Spotted dolphin [d]	0	0	0	60	0	60	0	60	0	0
Pygmy killer whale [d]	0	0	0	5	0	5	0	5	0	0
Rough-toothed dolphin [d]	0	0	0	14	0	14	0	14	0	0
Spinner dolphin [d]	0	0	0	51	0	51	0	51	0	0
Striped dolphin [d]	0	0	0	64	0	64	0	64	0	0
White-beaked dolphin [d]	0	30	0	60	0	60	0	60	0	30
Harbor porpoise	56	296	122	2,378	136	2,507	60	1,074	0	79
Gray seal	8	346	6	3,874	3	4,375	2	2,189	0	200
Harbor seal	17	776	11	8,701	7	9,835	4	4,923	0	448
Harp seal	8	346	6	3,875	3	4,379	1	2,192	0	200
Hooded seal [d]	0	0	0	1	0	1	0	1	0	0

[a] The final rule and LOA, if issued, would be effective from March 27, 2025–March 26, 2030
[b] For days when pile installation includes both vibratory setting and drilling, only the vibratory setting Level B takes are included (because more takes are predicted for this activity) and not the drilling Level B takes to avoid double counting. For the purpose of this take request, Year 1 is assumed to be 2025. These dates reflect the currently projected construction start year and are subject to change because exact project start dates and construction schedules are not currently available.
[c] Listed as Endangered under the ESA.
[d] Rare species in the project area. Rare species total take estimates for the project are based on the assumption that a group would be seen every other year; hence, the 5-yr total is less than the sum of all years combined.
[e] Level B take estimate increased to 1 average group size in Year 1 and Year 3 for construction Schedule B.

TABLE 33—TOTAL 5-YEAR PROPOSED TAKES OF MARINE MAMMALS (BY LEVEL A HARASSMENT AND LEVEL B HARASSMENT) FOR ALL ACTIVITIES PROPOSED TO BE CONDUCTED DURING THE CONSTRUCTION OF THE PROJECT

Species	Total Level A harassment	Total Level B harassment [a]
North Atlantic right whale [b]	0	293
Blue whale [b] [c]	2	4
Fin whale [b]	37	1,256
Humpback whale	31	759
Minke whale	155	2,457
Sei whale [b]	6	140
Sperm whale [b]	3	294
Dwarf sperm whale [c]	4	4
Pygmy sperm whale [c]	4	4
Cuvier's beaked whale [c]	0	6
Blainville's beaked whale [c]	0	8
Gervais' beaked whale [c]	0	8
Sowerby's beaked whale [c]	0	8
True's beaked whale [c]	0	6
Northern bottlenose whale [c]	0	12
Atlantic spotted dolphin	2	1,406
Atlantic white-sided dolphin	3	7,263
Bottlenose dolphin, offshore	3	8,627
Clymene dolphin [c]	0	334
Common dolphin	10	86,306
Long-finned pilot whale	3	847
Short-finned pilot whale	3	607
Risso's dolphin	3	1,656
False killer whale [c]	0	25
Fraser's dolphin [c]	0	384
Killer whale [c]	0	10
Melon-headed whale [c]	0	218
Pantropical Spotted dolphin [c]	0	120

TABLE 33—TOTAL 5-YEAR PROPOSED TAKES OF MARINE MAMMALS (BY LEVEL A HARASSMENT AND LEVEL B HARASSMENT) FOR ALL ACTIVITIES PROPOSED TO BE CONDUCTED DURING THE CONSTRUCTION OF THE PROJECT—Continued

Species	Total Level A harassment	Total Level B harassment [a]
Pygmy killer whale [c]	0	10
Rough-toothed dolphin [c]	0	28
Spinner dolphin [c]	0	102
Striped dolphin [c]	0	128
White-beaked dolphin [c]	0	150
Harbor porpoise	352	6,197
Gray seal	17	10,924
Harbor seal	37	24,551
Harp seal	17	10,933
Hooded seal [c]	0	3

[a] For days when pile installation includes both vibratory setting and drilling, only the vibratory setting Level B takes are included (because more takes are predicted for this activity) and not the drilling Level B takes to avoid double counting.
[b] Listed as Endangered under the ESA.
[c] Rare species in the project area. Rare species total take estimates are based on the assumption that a group would be seen every other year during 3 years of construction. Additionally, white-beaked dolphins, false killer whale, and killer whale had one group size per year accounted for in 3 of 5 years for HRG surveys. Hence, the 5-yr total is less than the sum of all years combined, as described in Sections 6.1.2 and 6.8.2 of the ITA application.

To inform both the negligible impact analysis and the small numbers determination, NMFS assesses the maximum number of takes of marine mammals that could occur within any given year. In this calculation, the maximum estimated number of Level A harassment takes in any one year is summed with the maximum estimated number of Level B harassment takes in any one year for each species to yield the highest number of estimated take that could occur in any year (Table 34). Table 34 also depicts the number of takes proposed relative to the abundance of each stock. The takes enumerated here represent daily instances of take, not necessarily individual marine mammals taken. One take represents a day in which an animal was exposed to noise above the associated harassment threshold at least once. Some takes represent a brief exposure above a threshold, while in some cases takes could represent a longer, or repeated, exposure of one individual animal above a threshold within a 24-hour period. Whether or not every take assigned to a species represents a different individual depends on the daily and seasonal movement patterns of the species in the area. For example, activity areas with continuous activities (all or nearly every day) overlapping known feeding areas (where animals are known to remain for days or weeks on end) or areas where species with small home ranges live (*e.g.,* some pinnipeds) are more likely to result in repeated takes to some individuals. Alternatively, activities far out in the deep ocean or takes to nomadic species where individuals move over the population's range without spatial or temporal consistency represent circumstances where repeat takes of the same individuals are less likely. In other words, for example, 100 takes could represent 100 individuals each taken on one day within the year, or it could represent 5 individuals each taken on 20 days within the year, or some other combination depending on the activity, whether there are biologically important areas in the project area, and the daily and seasonal movement patterns of the species of marine mammals exposed. Where information to better contextualize the enumerated takes for a given species is available, it is discussed in the Negligible Impact Analysis and Determination and/or Small Numbers sections, as appropriate.

TABLE 34—MAXIMUM NUMBER OF PROPOSED TAKES (LEVEL A HARASSMENT AND LEVEL B HARASSMENT) THAT COULD OCCUR IN ANY ONE YEAR OF THE PROJECT RELATIVE TO STOCK POPULATION SIZE

Species	NMFS stock abundance [b]	Maximum annual Level A harassment	Maximum annual Level B harassment	Maximum annual take	Percent stock taken based on maximum annual take [a]
North Atlantic right whale [c]	338	0	111	111	32.8
Blue whale [c d]	402	1	2	3	0.7
Fin whale [c]	6,802	20	575	595	8.7
Humpback whale	1,396	16	330	346	24.8
Minke whale	21,968	85	1,042	1,127	5.1
Sei whale [c]	6,292	2	53	55	0.9
Sperm whale [c]	4,349	2	140	142	3.3
Dwarf sperm whale [d]	7,750	2	2	4	0.1
Pygmy sperm whale [d]	7,750	2	2	4	0.1
Cuvier's beaked whale [d]	5,744	0	3	3	0.1
Blainville's beaked whale [d]	10,107	0	4	4	<0.1
Gervais' beaked whale [d]	5,744	0	4	4	0.1
Sowerby's beaked whale [d]	10,107	0	4	4	<0.1
True's beaked whale [d]	10,107	0	3	3	<0.1
Northern bottlenose whale [d e]	UNK	0	4	4	UNK
Atlantic spotted dolphin	39,921	1	660	661	1.7
Atlantic white-sided dolphin	93,233	2	3,163	3,165	3.4

TABLE 34—MAXIMUM NUMBER OF PROPOSED TAKES (LEVEL A HARASSMENT AND LEVEL B HARASSMENT) THAT COULD OCCUR IN ANY ONE YEAR OF THE PROJECT RELATIVE TO STOCK POPULATION SIZE—Continued

Species	NMFS stock abundance [b]	Maximum annual Level A harassment	Maximum annual Level B harassment	Maximum annual take	Percent stock taken based on maximum annual take [a]
Bottlenose dolphin, offshore	62,851	2	4,009	4,011	6.4
Clymene dolphin [d]	4,237	0	167	167	3.9
Common dolphin	172,897	9	41,230	41,239	23.9
Long-finned pilot whale	39,215	2	369	371	0.9
Short-finned pilot whale	28,924	2	269	271	0.9
Risso's dolphin	35,215	2	808	810	2.3
False killer whale [d e]	1,791	0	10	10	0.6
Fraser's dolphin [d]	UNK	0	192	192	UNK
Killer whale [d e]	UNK	0	4	4	UNK
Melon-headed whale [d]	UNK	0	109	109	UNK
Pantropical Spotted dolphin [d]	6,593	0	60	60	0.9
Pygmy killer whale [d]	UNK	0	5	5	UNK
Rough-toothed dolphin [d]	136	0	14	14	10.3
Spinner dolphin [d]	4,102	0	51	51	1.2
Striped dolphin [d]	67,036	0	64	64	0.1
White-beaked dolphin [d e]	536,016	0	60	60	0.0
Harbor porpoise	95,543	136	2,507	2,643	2.8
Gray seal	27,300	8	4,375	4,383	16.1
Harbor seal	61,336	17	9,835	9,852	16.1
Harp seal	7,600,000	8	4,379	4,387	<0.1
Hooded seal [d]	UNK	0	1	1	<0.1

[a] The values in this column represent the assumption that each take proposed to be authorized would occur to a unique individual. Given the scope of work proposed, this is highly unlikely for species common to the project area (*e.g.,* North Atlantic right whales, humpback whales) such that the actual percentage of the population taken is less than the percentages identified here.
[b] Using the most recent stock assessment report (SAR) at time of publication, the draft 2022 (Hayes *et al.,* 2023).
[c] Listed as Endangered under the ESA.
[d] Rare species in the project area. The number of Level A harassment and Level B harassment takes calculated for rare species is based on the mean group size assuming a 3 year construction schedule (all rare species) and encounters during HRG surveys for white-beaked dolphin, killer whale, and false killer whale.
[e] Take for these species is based on PSO sighting group sizes; for all other rare species the group size is from OBIS data.

Proposed Mitigation

In order to promulgate a rulemaking under section 101(a)(5)(A) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to the activity, and other means of effecting the least practicable impact on the species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of the 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 the 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.

The mitigation strategies described below are consistent with those required and successfully implemented under previous incidental take authorizations issued in association with in-water construction activities (*e.g.,* soft-start, establishing shutdown zones). Additional measures have also been incorporated to account for the fact that the proposed construction activities would occur offshore. Modeling was performed to estimate harassment zones, which were used to inform mitigation measures for the project's activities to minimize Level A harassment and Level B harassment to the extent practicable, while providing estimates of the areas within which Level B harassment might occur.

Generally speaking, the mitigation measures considered and proposed here fall into three categories: temporal (seasonal and daily) work restrictions, real-time measures (shutdown, clearance, and vessel strike avoidance), and noise attenuation/reduction measures. Seasonal work restrictions are designed to avoid or minimize operations when marine mammals are concentrated or engaged in behaviors that make them more susceptible or make impacts more likely in order to reduce both the number and severity of potential takes, and are effective in reducing both chronic (longer-term) and acute effects. Real-time measures, such as implementation of shutdown and pre-clearance zones and vessel strike avoidance measures, are intended to reduce the probability or severity of harassment by taking steps in real time once a higher-risk scenario is identified (*e.g.,* once animals are detected within an impact zone). Noise attenuation measures, such as bubble curtains, are intended to reduce the noise at the source, which reduces both acute impacts, as well as the contribution to aggregate and cumulative noise that may result in longer term chronic impacts.

Below, we briefly describe training, coordination, and vessel strike avoidance measures that apply to all activity types, and then in the following subsections we describe the measures that apply specifically to monopile foundation and jacket foundation installation, HRG surveys, and UXO/MEC detonation. Details on specific requirements can be found in the Part 217—Regulations Governing The Taking And Importing Of Marine Mammals at the end of this proposed rulemaking.

Training and Coordination

NMFS requires the Park City Wind employees and contractors conducting activities on the water and all vessel captains and crew are trained in marine mammal detection and identification, communication protocols, and reporting to minimize impacts on marine mammals and support Park City Wind's compliance with the mitigation, monitoring, and reporting requirements. All relevant personnel and the marine mammal monitoring team(s) would be required to participate in joint, onboard briefings that would be led by Park City Wind personnel and the Lead PSO prior to the beginning of project activities. The briefing would be repeated whenever new relevant personnel (*e.g.,* new PSOs, acoustic source operators, relevant crew) join the operation before work commences. During this training, Park City Wind would be required to instruct all project personnel regarding the authority of the marine mammal monitoring team(s). For example, the HRG acoustic equipment operator, pile driving personnel, *etc.,* would be required to immediately comply with any call for a delay or shutdown by the Lead PSO. Any disagreement between the Lead PSO and the project personnel would only be discussed after delay or shutdown has occurred. More information on vessel crew training requirements can be found in the *Vessel Strike Avoidance Measures* sections below.

Protected Species Observers and PAM Operator Training

Park City Wind would employ NMFS-approved PSOs and PAM operators. The PSO field team and PAM team would have a lead member (designated as the ''Lead PSO'' or ''PAM Lead'') who would have prior experience observing or acoustically detecting, respectively, mysticetes, odontocetes, and pinnipeds in the northwestern Atlantic Ocean. Any remaining PSOs and PAM operators must have previous experience observing marine mammals and must have the ability to work with all required and relevant software and equipment. New and/or inexperienced PSOs would be paired with an experienced PSO to ensure that the quality of marine mammal observations and data recording is kept consistent. Additional information on the roles and requirements of the PAM operators (section 4.1.1.2) and PSOs (section 4.1.1.3) can be found in Park City Wind's supplemental Protected Species Mitigation and Monitoring Plan (PSMMP) on NMFS' website at *https://www.fisheries.noaa.gov/action/incidental-take-authorization-park-city-wind-llc-construction-new-england-wind-offshore-wind.* Park City Wind would be required to request PSO and PAM operator approvals 60-day prior to those personnel commencing work.

Prior to the start of activities, a briefing would be conducted between the supervisors, the crew, the PSO/PAM team, the environmental compliance monitors, and Park City Wind personnel. This briefing would be to establish the responsibilities of each participating party, to define the chains of command, to discuss communication procedures, to provide an overview of the monitoring purposes, and to review the operational procedures. The designated PSO (*i.e.,* Lead PSO) would oversee the training, the environmental compliance monitors, the PSOs, and other tasks specifically related to monitoring. For more information on the need and use of PSO and PAM personnel, please see Proposed Monitoring and Reporting.

North Atlantic Right Whale Awareness Monitoring

Park City Wind must use available sources of information on North Atlantic right whale presence, including monitoring of the Right Whale Sightings Advisory System, WhaleAlert app, and Coast Guard VHF Channel 16 throughout each day to receive notifications of any sightings, and information associated with any regulatory management actions (*e.g.,* establishment of a zone identifying the need to reduce vessel speeds). Maintaining daily awareness and coordination affords increased protection of North Atlantic right whales by understanding North Atlantic right whale presence in the area through ongoing visual and passive acoustic monitoring efforts and opportunities (outside of Park City Wind's efforts), and allows for planning reduced vessel speeds and construction activities, when practicable, to minimize potential impacts on North Atlantic right whales.

Vessel Strike Avoidance Measures

This proposed rule contains numerous vessel strike avoidance measures that reduce the risk that a vessel and marine mammal could collide. Vessel strikes are one of the most common ways that marine mammals are seriously injured or killed by human activities; therefore, enhanced mitigation and monitoring measures are required to avoid vessel strikes. While many of these measures are proactive intending to avoid the heavy use of vessels during times when marine mammals of particular concern may be in the area, several are reactive and occur when a marine mammal is sighted by project personnel. The exact requirements we propose are described generally here and, in detail, in the regulation text at the end of this proposed rule. Park City Wind will be required to comply with these measures, except under circumstances when doing so would create an imminent and serious threat to a person or vessel, or to the extent that a vessel is unable to maneuver and, because of the inability to maneuver, the vessel cannot comply.

Prior to the start of in-water construction activities, vessel operators and crews would receive training about marine mammals and other protected species known or with the potential to occur in the project area, making observations in all weather conditions, and vessel strike avoidance measures. In addition, training would include information and resources available regarding applicable Federal laws and regulations for protected species. Park City Wind would provide documentation of training to NMFS.

While underway, Park City Wind would be required to monitor for and maintain a safe distance from marine mammals, and operate vessels in a manner that reduces the potential for vessel strike. Regardless of the vessel's size, all vessel operators, crews, and dedicated visual observers (*i.e.,* PSO or trained crew member) would maintain a vigilant watch for all marine mammals and slow down, stop their vessel, or alter course (as appropriate) to avoid striking any marine mammal. The dedicated visual observer, equipped with suitable monitoring technology (*e.g.,* binoculars, night vision devices), would be located at an appropriate vantage point for ensuring vessels are maintaining required vessel separation distances from marine mammals (*e.g.,* 500 m from NARWs). All Park City Wind-related vessels would comply with existing NMFS vessel speed restrictions for NARWs (50 CFR 224.105; including in areas designated as SMAs, DMAs, or Slow Zones) and required procedures for operating vessels around NARWs and other marine mammals. If a vessel is traveling at greater than 10 kn, in addition to the required dedicated visual observer, Park City Wind would monitor the transit corridor in real-time with PAM prior to and during transits. To maintain awareness of NARW presence in the project area, vessel operators, crew members, and PSOs would monitor VHF Channel 16, WhaleAlert, the Right Whale Sighting Advisory System (RWSAS), and the PAM system. Any NARW or large whale detection would be immediately communicated to PSOs, PAM operators, and all vessel captains. All vessels would be equipped with an Automatic Identification System (AIS) and Park City Wind must report all Maritime Mobile Service Identify (MMSI) numbers to NMFS Office of Protected Resources prior to initiating in-water activities. Park City Wind would submit a NMFS-approved North Atlantic right whale vessel strike avoidance plan 180 days prior to commencement of vessel use.

Compliance with these proposed measures would reduce the likelihood of vessel strike by increasing awareness of marine mammal presence in the project area (*e.g.,* monitoring, communication), reducing vessel speed when marine mammals are detected (by PSOs, PAM, and/or through another source, *e.g.,* RWSAS), and maintaining separation distances when marine mammals are encountered. While visual monitoring is useful, reducing vessel speed is one of the most effective, feasible options available to minimize the likelihood of a vessel strike and, if a strike does occur, decrease the potential for serious injury or lethal outcomes. Numerous studies have indicated that slowing the speed of vessels reduces the risk of lethal vessel collisions, particularly in areas where right whales are abundant and vessel traffic is common and otherwise traveling at high speeds (Vanderlaan and Taggart, 2007; Conn and Silber, 2013; Van der Hoop *et al.,* 2014; Martin *et al.,* 2015; Crum *et al.,* 2019).

In 2021, NMFS released the North Atlantic Right Whale Vessel Speed Rule Assessment documenting a reduction in observed right whale serious injuries and mortalities resulting from vessel strikes since implementation of the speed rule in 2008 (50 CFR 224.105). Project vessels would be required to reduce speed in the presence of marine mammals and, because reducing speed has been shown to decrease the likelihood of vessel strike and the implementation of other measures described herein, NMFS considers the potential for vessel strike to be *de minimis.* Park City Wind has not requested, and NMFS does not propose to authorize, take from vessel strikes.

Seasonal and Daily Restrictions

As described above, an effective measure for reducing the magnitude and severity of impacts from an activity is to implement time/area restrictions in places where marine mammals are concentrated, engaged in biologically important behaviors, and/or present in sensitive life stages. The temporal restrictions proposed here are built around the protection of North Atlantic right whales. The highest densities of North Atlantic right whales in the project area are expected during the months of January through April. While lower than January through April, densities remain high in May and December. Park City Wind proposed to not conduct foundation installation during January through April 30; however, NMFS is proposing additional mitigation measures during May and December. Park City Wind did not assume any vibratory pile driving would occur in May or December when estimating take but they did not specifically propose that activity during these months would be restricted. NMFS, however, is proposing to restrict vibratory pile driving, which Park City Wind estimates to have 50-km Level B harassment zones, in May and December given that North Atlantic right whale densities remain high in the project area during this time. Foundation installation activities must not be planned in December; except for in the event of unforeseen circumstances (*e.g.,* delays resulting in a few piles needing to be installed in December to remain on schedule) and with NMFS advance approval and vibratory pile driving in May was not proposed and is restricted. As with foundation installation, NMFS is similarly proposing to restrict UXO/MEC detonations December through May; except for with NMFS' advanced approval on the condition that Park City Wind provides justification for the proposed detonation. NMFS is requiring this seasonal work restriction to minimize the North Atlantic right whales risk of exposure to noise incidental to foundation installation and UXO/MEC detonation. These seasonal work restrictions are expected to greatly reduce the number of takes of North Atlantic right whales. These seasonal restrictions also afford protection to other marine mammals that are known to use the project area with greater frequency during winter months, including other baleen whales.

On a daily basis, no more than two monopile foundations or four pin piles may be installed per day and no more than one UXO/MEC may be detonated per 24-hr period. Moreover, detonations may only occur during daylight hours. No more than one pile may be installed at a given time (*i.e.,* concurrent/simultaneous pile driving and drilling may not occur).

Park City Wind has proposed to conduct foundation installation activities that may result in the harassment of marine mammals during reduced visibility conditions and initiate pile driving during nighttime when detection of marine mammals is visually challenging. As described in the Proposed Monitoring and Reporting section, effective marine mammal detection occurs when dual monitoring methods (visual and acoustic) are employed. Park City Wind has not yet demonstrated to NMFS that the equipment (*e.g.,* night vision devices, IR/thermal camera) they propose to use during reduced visibility conditions, including nighttime, are adequate to monitor marine mammals, particularly large whales, to distances necessary to ensure mitigation measures are effective. Therefore, at this time, NMFS has not determined if initiating pile driving at night should occur. NMFS will provide Park City Wind the opportunity to submit a monitoring plan considering pile driving activities during times of reduced visibility, including nighttime (Nighttime Monitoring Plan), and NMFS will make a decision on whether to authorize Park City Wind to conduct pile driving and drilling in reduced visibility conditions, including nighttime, at the final rule stage, if issued.

Given the very small harassment zones resulting from HRG surveys and that the best available science indicates that any harassment from HRG surveys, should a marine mammal be exposed, would manifest in minor behavioral harassment only (*e.g.,* potentially some avoidance of the vessel), NMFS is not proposing any seasonal and daily restrictions for HRG surveys.

Noise Attenuation Systems

Park City Wind would employ noise abatement systems (NAS), also known as noise attenuation systems, during all foundation installation activities (*i.e.,* pile driving and drilling) to reduce the sound pressure levels that are transmitted through the water in an effort to reduce ranges to acoustic thresholds and minimize any acoustic impacts resulting from foundation installation. Park City Wind would be required to employ a big double bubble curtain, other technology capable of achieving a 10-dB sound level reduction, or a combination of two or more NAS capable of achieving a 10-dB sound level reduction during these activities as well as the adjustment of operational protocols to minimize noise levels. Noise attenuation devices would also be required during any UXO/MEC detonation.

Two categories of NAS exist: primary and secondary. A primary NAS would be used to reduce the level of noise produced by foundation installation activities at the source, typically through adjustments on to the equipment (*e.g.,* hammer strike parameters). Primary NAS are still evolving and will be considered for use during mitigation efforts when the NAS has been demonstrated as effective in commercial projects. However, as primary NAS are not fully effective at eliminating noise, a secondary NAS would be employed. The secondary NAS is a device or group of devices that would reduce noise as it was transmitted through the water away from the pile, typically through a physical barrier that would reflect or absorb sound waves and therefore, reduce the distance the higher energy sound propagates through the water column. Together, these systems must reduce noise levels to the lowest level practicable with the goal of not exceeding measured ranges to Level A harassment and Level B harassment isopleths corresponding to those modeled assuming 10-dB sound attenuation, pending results of Sound Field Verification (SFV; see *Sound Field Verification* section below and Part 217—Regulations Governing The Taking And Importing Of Marine Mammals).

Noise abatement systems, such as bubble curtains, are used to decrease the sound levels radiated from a source. Bubbles create a local impedance change that acts as a barrier to sound transmission. The size of the bubbles determines their effective frequency band, with larger bubbles needed for lower frequencies. There are a variety of bubble curtain systems, confined or unconfined bubbles, and some with encapsulated bubbles or panels. Attenuation levels also vary by type of system, frequency band, and location. Small bubble curtains have been measured to reduce sound levels but effective attenuation is highly dependent on depth of water, current, and configuration and operation of the curtain (Austin *et al.,* 2016; Koschinski and Lüdemann, 2013). Bubble curtains vary in terms of the sizes of the bubbles and those with larger bubbles tend to perform a bit better and more reliably, particularly when deployed with two separate rings (Bellmann, 2014; Koschinski and Lüdemann, 2013; Nehls *et al.,* 2016). Encapsulated bubble systems (*e.g.,* Hydro Sound Dampers (HSDs)), can be effective within their targeted frequency ranges (*e.g.,* 100–800 Hz), and when used in conjunction with a bubble curtain appear to create the greatest attenuation. The literature presents a wide array of observed attenuation results for bubble curtains. The variability in attenuation levels is the result of variation in design as well as differences in site conditions and difficulty in properly installing and operating in-water attenuation devices.

Secondary NAS that may be used by Park City Wind include a big bubble curtain (BBC), a hydro-sound damper, or an AdBm Helmholz resonator (Elzinga *et al.,* 2019). If a single system is used, it must be a double big bubble curtain (dBBC). Other dual systems (*e.g.,* noise mitigation screens, hydro-sound damper, AdBm Helmholz resonator) may also be used, although many of these are in their early stages of development and field tests to evaluate performance and effectiveness have not been completed. Should the research and development phase of these newer systems demonstrate effectiveness, as part of adaptive management, Park City Wind may submit data on the effectiveness of these systems and request approval from NMFS to use them during foundation installation and UXO/MEC detonation activities

The literature presents a wide array of observed attenuation results for bubble curtains. The variability in attenuation levels is the result of variation in design as well as differences in site conditions and difficulty in properly installing and operating in-water attenuation devices. Dähne *et al.* (2017) found that single bubble curtains that reduce sound levels by 7 to 10 dB reduced the overall sound level by approximately 12 dB when combined as a double bubble curtain for 6-m steel monopiles in the North Sea. During installation of monopiles (consisting of approximately 8-m in diameter) for more than 150 WTGs in comparable water depths (>25 m) and conditions in Europe indicate that attenuation of 10 dB is readily achieved (Bellmann, 2019; Bellmann *et al.,* 2020) using single BBCs for noise attenuation.

If a bubble curtain is used (single or double), Park City Wind would be required to maintain the following operational performance standards: the bubble curtain(s) must distribute air bubbles using a target air flow rate of at least 0.5 $m^3/(min*m)$ and must distribute bubbles around 100 percent of the piling perimeter for the full depth of the water column. The lowest bubble ring must be in contact with the seafloor for the full circumference of the ring, and the weights attached to the bottom ring must ensure 100-percent seafloor contact; no parts of the ring or other objects should prevent full seafloor contact. Park City Wind must require that construction contractors train personnel in the proper balancing of airflow to the bubble ring and must require that construction contractors submit an inspection/performance report for approval by Park City Wind within 72 hours following the performance test. Corrections to the attenuation device to meet the performance standards must occur prior to use during foundation installation activities and UXO/MEC detonation. If Park City Wind uses a noise mitigation device in addition to a BBC, similar quality control measures would be required.

Noise abatement devices are not required during HRG surveys as they are not practicable to implement nor would be effective. However, Park City Wind would be required to make efforts to minimize source levels by using the lowest energy settings on equipment that has the potential to result in harassment of marine mammals (*e.g.,* sparkers, boomers) and turn off equipment when not actively surveying. Overall, minimizing the amount and duration of noise in the ocean from any of Park City Wind's activities through use of all means necessary (*e.g.,* noise abatement, turning off power) will effect the least practicable adverse impact on marine mammals.

Clearance and Shutdown Zones

NMFS is proposing to require the establishment of both clearance and shutdown zones during all foundation installation activities that have the potential to result in harassment of marine mammals (*i.e.,* pile driving and drilling) and HRG surveys. The purpose of ''clearance'' of a particular zone is to prevent or minimize potential instances of auditory injury and more severe behavioral disturbances by delaying the commencement of an activity if marine mammals are near the activity. The purpose of a shutdown is to prevent a specific acute impact, such as auditory injury or severe behavioral disturbance of sensitive species, by halting the activity.

Prior to the start of conducting activities that can harass marine mammals (foundation installation, HRG surveys, or UXO/MEC detonation), Park City Wind would ensure designated areas are clear of marine mammals prior to commencing activities to minimize the potential for and degree of harassment. Once pile driving or drilling activity begins, any marine mammal entering the shutdown zone (Tables 35 and 36) would trigger pile driving to cease (unless shutdown is not practicable due to imminent risk of injury or loss of life to an individual or risk of damage to a vessel that creates risk of injury or loss of life for individuals). Because UXO/MEC detonations are instantaneous, no shutdown is possible; therefore, there are clearance zones but no shutdown zones for UXO/MEC detonations (Table 38).

All clearance zones during foundation installation and UXO/MEC detonations would be monitored by NMFS-approved PSOs and PAM operators. PSOs must visually monitor clearance zones for marine mammals for a minimum of 60 minutes prior to commencing the activity. During HRG surveys, PSO(s) must visually monitor clearance zones for 30 minutes prior to commencing survey activities when using sources that may result in the harassment of marine mammals (*e.g.,* sparker, boomers, CHIRPs). In addition to PSOs, at least one PAM operator must review data from at least 24 hours prior to foundation installation and UXO/MEC detonation and actively monitor hydrophones for 60 minutes prior to commencement of these activities. Prior to initiating soft-start procedures for impact pile driving, all clearance zones must be confirmed to be free of marine mammals for at least 30 minutes immediately prior to commencing activities. In addition, pile driving will be delayed upon a confirmed PAM detection of a North Atlantic right whale, if the PAM detection is confirmed to have been located within the North Atlantic right whale PAM Clearance zone (Tables 35 and 36). Any large whale sighted by a PSO within the North Atlantic right whale PSO Clearance Zone that cannot be identified to species must be treated as if it were a North Atlantic right whale.

In addition to the clearance and shutdown zones that would be monitored both visually and acoustically, NMFS is proposing to establish a minimum visibility zone during foundation installation activities to ensure both visual and acoustic methods are used in tandem to detect marine mammals resulting in maximum detection capability. No minimum visibility zone is proposed for UXO/MEC detonation as the entire visual clearance zone must be clear given the potential for lung and GI injury. The minimum visibility zone for foundation installation activities (pile driving and drilling) would extend from the location of the pile being driven out to 3.2 km (3,200 m). This value corresponds to just greater than the modeled maximum $ER_{95\ percent}$ distances to the Level A harassment threshold for North Atlantic right whales, assuming 10 dB of attenuation. The entire minimum visibility zone must be visible for a full 30 minutes immediately prior to commencing pile driving, drilling, and UXO/MEC detonation.

If a North Atlantic right whale is detected during the clearance period, regardless of distance from the pile being installed, pile driving and drilling must not begin until 30 minutes has passed since the last sighting (12,000 meters during UXO/MEC detonations, Table 38). The clearance zone may also only be declared clear if no confirmed North Atlantic right whale acoustic detections (in addition to visual) have occurred during the clearance monitoring period. Any large whale sighted by a PSO or acoustically detected by a PAM operator that cannot be identified as a non-North Atlantic right whale must be treated as if it were a North Atlantic right whale.

As described above, JASCO conducted source level monitoring for the installation of 13-m monopiles to inform the development of mitigation zones. JASCO conducted a scaling exercise in which the largest 10 dB attenuated, modeled SEL exposure ranges (between one pile per day or two piles per day results) for the 13 m monopile with a 5,000 kJ hammer scenario was scaled by the percentage increase between the largest 10 dB attenuated, modeled SEL exposure ranges of the 12 m monopile with a 5,000 kJ hammer scenario versus a 6,000 kJ hammer scenario for each hearing group:

$$\textit{Percentage increase} = (a - b)/a$$

$$\textit{Alternative mitigation zone} = (c \times \textit{Percentage increase}) + c$$

where *a* is the 12 m monopile with a 5,000 kJ hammer exposure range, *b* is the 12 m monopile with a 6,000 kJ hammer exposure range, and *c* is the 13 m monopile with a 5,000 kJ hammer exposure range. The results informed the shutdown zones in the unlikely case a 13-m pile is installed with hammer energy between 5,000 to 6,000 kJ.

Proposed clearance and shutdown zones have been developed in consideration of modeled distances to relevant PTS thresholds with respect to minimizing the potential for take by Level A harassment. All proposed clearance and shutdown zones for large whales are larger than the largest modeled exposure range ($ER_{95\ percent}$) distances to thresholds corresponding to Level A harassment (SEL and peak). If a marine mammal is observed entering or within the respective shutdown zone (Tables 35 and 36) after foundation installation has begun, the PSO will request a temporary cessation of those activities. If feasible, Park City Wind will stop those activities immediately.

In situations when shutdown is called for but it is determined that a shutdown is not practicable due to imminent risk of injury or loss of life to an individual or pile instability, reduced hammer energy must be implemented when the lead engineer determines it is practicable. Specifically, pile refusal or pile instability could result in not being able to shut down pile driving immediately. Pile refusal occurs when the pile driving sensors indicate the pile is approaching refusal, and a shut-down would lead to a stuck pile. Pile instability occurs when the pile is unstable and unable to stay standing if the piling vessel were to ''let go''. During these periods of instability, the lead engineer may determine a shutdown is not feasible because the shutdown combined with impending weather conditions may require the piling vessel to ''let go'', which then poses an imminent risk of injury or loss of life to an individual or risk of damage to a vessel that creates risk for individuals. In these situations, Park City Wind must reduce hammer energy to the lowest level practicable.

The lead engineer must evaluate the following to determine if a shutdown is safe and practicable:

a. Use of site-specific soil data and real-time hammer log information to judge whether a stoppage would risk causing piling refusal at re-start of piling;

b. Confirmation that pile penetration is deep enough to secure pile stability in the interim situation, taking into account weather statistics for the relevant season and the current weather forecast; and

c. Determination by the lead engineer on duty will be made for each pile as the installation progresses and not for the site as a whole.

If it is determined that shutdown is not feasible, the reason must be documented and reported (see regulatory text).

Subsequent restart of the equipment can be initiated if the animal has been observed exiting its respective shutdown zone within 30 minutes of the shutdown, or, after an additional time period has elapsed with no further sighting (*i.e.,* 15 minutes for small odontocetes and 30 minutes for all other species).

Foundation installation will not be initiated if the clearance zones cannot be adequately monitored (*i.e.,* if they are obscured by fog, inclement weather, poor lighting conditions) for a 30 minute period prior to the commencement of soft-start, as determined by the Lead PSO. If light is insufficient, the lead PSO will call for a delay until the Clearance zone is visible in all directions. If a soft-start has been initiated before the onset of inclement weather, pile driving activities may continue through these periods if deemed necessary to ensure human safety and/or the integrity of the Project. PAM operators would review data from at least 24 hours prior to pile driving and actively monitor hydrophones for 60 minutes immediately prior to pile driving. odontocetes and 30 minutes for all other marine mammal species).

During HRG surveys, Park City Wind would be required to implement a 30-minute clearance period of the clearance zones (Table 37) immediately prior to the commencing of the survey, or when there is more than a 30-minute break in survey activities and PSOs have not been actively monitoring. The clearance zones would be monitored by PSOs, using the appropriate visual technology. If a marine mammal is observed within a clearance zone during the clearance period, ramp-up (described below) may not begin until the animal(s) has been observed voluntarily exiting its respective clearance zone or until an additional time period has elapsed with no further sighting (*i.e.,* 15 minutes for small odontocetes and seals, and 30 minutes for all other species). In any case when the clearance process has begun in conditions with good visibility, including via the use of night vision equipment (IR/thermal camera), and the Lead PSO has determined that the clearance zones are clear of marine mammals, survey operations would be allowed to commence (*i.e.,* no delay is required) despite periods of inclement weather and/or loss of daylight.

Once the survey has commenced, Park City Wind would be required to shut down SBPs if a marine mammal enters a respective shutdown zone (Table 37). In cases when the shutdown zones become obscured for brief periods due to inclement weather, survey operations would be allowed to continue (*i.e.,* no shutdown is required) so long as no marine mammals have been detected. The use of SBPs will not be allowed to commence or resume until the animal(s) has been confirmed to have left the shutdown zone or until a full 15 minutes (for small odontocetes and seals) or 30 minutes (for all other marine mammals) have elapsed with no further sighting.

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

If a SBP is shut down for reasons other than mitigation (*e.g.,* mechanical difficulty) for less than 30 minutes, it would be allowed to be activated again without ramp-up only if PSOs maintained constant observation and no additional detections of any marine mammal occurred within the respective shutdown zones. If a SBP was shut down for a period longer than 30 minutes, then all clearance and ramp-up procedures would be required, as previously described.

TABLE 35—MONOPILE INSTALLATION CLEARANCE AND SHUTDOWN ZONES IN METERS

Species	PSO clearance zone [1]	PSO shutdown zone	PAM clearance zone	PAM shutdown zone for 12-m monopile at 5,000 kJ	PAM shutdown zone for 13-m monopile at 6,000 kJ [2]	PAM monitoring zone [4]	Vessel separation distance
Impact Pile Driving							
North Atlantic right whale	Any distance [1]	Any distance [1]	[5] 5,600	[5] 4,700	[5] 5,500	12,000	500
Other baleen whales and sperm whales	4,700	4,700	4,700	4,700	5,500	12,000	100
Small whales and dolphins [3]	200	200	200	200	200	10,000	50
Harbor porpoise	2,300	2,300	2,300	2,300	2,300	10,000	50
Seals	1,100	1,100	1,100	1,100	1,100	10,000	50
Vibratory Pile Driving and Drilling							
North Atlantic right whale	Any distance	Any distance	4,500	4,500	n/a	10,000	500
Other baleen whales and sperm whale	4,700	4,700	4,700	4,700	n/a	10,000	100
Small whales and dolphins [3]	200	200	200	200	200	10,000	50
Harbor porpoise	2,300	2,300	2,300	2,300	n/a	10,000	50
Seals	1,400	1,400	1,400	1,400	n/a	10,000	50

[1] Park City Wind has elected to set their minimum visibility for North Atlantic right whales as "any distance", above the minimum required by NMFS.
[2] In the unlikely event that a 13-m monopile would need to be installed at 6,000 kJ, the alternative PAM shutdown zone would be applied. This zone is set equal to the maximum, scaled up Level A zone for large whales during impact pile driving (see Table 16).
[3] Park City Wind had proposed a minimum clearance and shut down of 50 m in their application. However, this would likely be inside of the NAS and, due to the loud noise levels generated by foundation installation activities, NMFS has increased these distances to 200 m.
[4] The PAM Monitoring Zone represents the distance at which marine mammals must be able to be acoustically detected.
[5] For piles installed between May 1–May 15 and November 1–December 31, the PAM clearance and shutdown zone is 10km.

TABLE 36—JACKET FOUNDATION INSTALLATION CLEARANCE AND SHUTDOWN ZONES IN METERS

Species	PSO clearance zone [1]	PSO shutdown zone	PAM clearance zone	PAM shutdown zone	PAM monitoring zone	Vessel separation zone
Impact Pile Driving						
North Atlantic right whale	Any distance [1]	Any distance [1]	[1] 4,500	4,500	12,000	500
Other baleen whales and sperm whale	4,500	4,500	4,500	4,500	12,000	100
Small whales and dolphins	50	50	50	50	10,000	50
Harbor porpoise	1,800	1,800	1,800	1,800	10,000	50
Seals	1,400	1,400	1,400	1,400	10,000	50
Vibratory Pile Driving and Drilling [1]						
North Atlantic right whale	Any distance	Any distance	4,500	4,500	12,000	500
Other baleen whales and sperm whale	4,700	4,700	4,700	4,700	12,000	100
Small whales and dolphins	50	50	50	50	10,000	50
Harbor porpoise	2,300	2,300	2,300	2,300	10,000	50
Seals	1,400	1,400	1,400	1,400	10,000	50

[1] For piles installed between May 1–May 15 and November 1–December 31, the PAM clearance and shutdown zone is 10km.

TABLE 37—HRG SURVEY CLEARANCE AND SHUTDOWN ZONES IN METERS

Species	Clearance zone	Shutdown zone	Vessel separation zone
North Atlantic right whale	500	500	500
All other ESA-listed marine mammals (*e.g.,* fin, sei, sperm whale)	500	100	100
All other marine mammal species [1]	100	100	50

[1] With the exception of seals and delphinid(s) from the genera *Delphinus, Lagenorhynchus, Stenella* or *Tursiops,* as described below.

TABLE 38—UXO/MEC DETONATION VISUAL AND PAM CLEARANCE ZONES IN METERS

Species	Visual clearance zone [1]	PAM clearance zone	PAM monitoring zone
North Atlantic right whale	Any distance	Any distance	12,000
Low-Frequency Hearing Group	3,800	3,800	12,000
Mid-Frequency Hearing Group	1,000	1,000	2,600
High-Frequency Hearing Group (Harbor porpoise)	6,200	6,200	14,100
Seals	1,600	1,600	7,100

[1] The minimum visibility zone (*i.e.,* the area which must be visibly clear of marine mammals) for UXO/MEC detonation is set at no less than 5 kms.

NMFS also notes that for any UXOs/MECs that require removal, Park City Wind would be required to implement the As Low as Reasonably Practicable (ALARP) process. This process would require Park City Wind to undertake ''lift-and-shift'' (*i.e.,* physical removal) and then lead up to in situ disposal, which could include low-order (deflagration) to high-order (detonation) methods of removal. Another potential approach involves the cutting of the UXO/MEC to extract any explosive components. Implementing the ALARP approach would minimize potential impacts to marine mammals as UXOs/MECs would only be detonated as a last resort.

Soft-Start/Ramp-Up

The use of a soft-start or ramp-up procedure is believed to provide additional protection to marine mammals by warning them, or providing them with a chance to leave the area prior to the hammer operating at full capacity. Soft-start typically involves initiating hammer operation at a reduced energy level (relative to full operating capacity) followed by a waiting period. Park City Wind must utilize a soft-start protocol for impact pile driving of monopiles by performing 4–6 strikes per minute at 10 to 20 percent of the maximum hammer energy, for a minimum of 20 minutes. NMFS notes that it is difficult to specify a reduction in energy for any given hammer because of variation across drivers. For impact hammers, the actual number of strikes at reduced energy will vary because operating the hammer at less than full power results in ''bouncing'' of the hammer as it strikes the pile, resulting in multiple ''strikes''; however, as mentioned previously, Park City Wind will target less than 20 percent of the total hammer energy for the initial hammer strikes during soft-start.

Soft-start will be required at the beginning of each day's monopile installation, and at any time following a cessation of impact pile driving of 30 minutes or longer. If a marine mammal is detected within or about to enter the applicable clearance zones prior to the beginning of soft-start procedures, impact pile driving would be delayed until the animal has been visually observed exiting the clearance zone or until a specific time period has elapsed with no further sightings (*i.e.,* 15 minutes for small odontocetes and 30 minutes for all other species).

At the start or restart of the use of boomers, sparkers, and SBPs, a ramp-up procedure would be required unless the equipment operates on a binary on/off switch. A ramp-up procedure, involving a gradual increase in source level output, is required at all times as part of the activation of the acoustic source when technically feasible. Operators would ramp up sources to half power for 5 minutes and then proceed to full power. Prior to a ramp-up procedure starting, the operator would have to notify the Lead PSO of the planned start of the ramp-up. This notification time would not be less than 60 minutes prior to the planned ramp-up activities as all relevant PSOs would need the appropriate 30 minute period to monitor prior to the initiation of ramp-up.

The ramp-up procedure will not be initiated during periods of inclement conditions if the clearance zones cannot be adequately monitored by the PSOs using the appropriate visual technology (*e.g.,* reticulated binoculars, night vision equipment) for a 30-minute period. Prior to ramp-up beginning, the operator must receive confirmation from the PSO that the clearance zone is clear of any marine mammals.

All ramp-ups would be scheduled to minimize the overall time spent with the source being activated. The ramp-up procedure must be used at the beginning of HRG survey activities or after more than a 30-minute break in survey activities using the specified HRG equipment to provide additional protection to marine mammals in or near the survey area by allowing them to vacate the area prior to operation of survey equipment at full power.

Park City Wind would not initiate ramp-up until the clearance process has been completed. Ramp-up activities would be delayed if a marine mammal(s) enters its respective clearance zone. Ramp-up would only be reinitiated if the animal(s) has been observed exiting its respective shutdown zone or until additional time has elapsed with no further sighting (*i.e.,* 15 minutes for small odontocetes and seals, and 30 minutes for all other species).

Use of Protected Species Observers (PSO) and Passive Acoustic Monitoring (PAM) Operators

As described above, Park City Wind would be required to use NMFS-approved PSOs and PAM operators during all foundation installation, HRG surveys, and UXO/MEC detonation activities. NMFS requires a minimum number of PSOs to actively observe for marine mammals before, during, and after pile driving. Concurrently, NMFS requires at least one PAM operator to be actively monitoring for marine mammals before, during, and after foundation installation pile driving and drilling activities and UXO/MEC detonation. The minimum number of PSOs required is dependent upon the area to be monitored and is thus activity specific. Along with PSO qualification requirements, equipment, and placements are specified in the regulatory text. The combined use of PSOs and PAM operators during pile driving and UXO/MEC detonation maximizes the likelihood of detecting a marine mammal and thereby increasing the effectiveness of any of the prescribed mitigation measures.

During all HRG survey activities using SBPs (*e.g.,* CHIRP, boomer, sparker, *etc.*), at least one PSO would be required to monitor during daylight hours and at least two would be required to monitor during nighttime hours, per vessel. PSOs would begin visually monitoring 30 minutes prior to the initiation of the specified acoustic source (*i.e.,* ramp-up, if applicable), during the HRG activities, and through 30 minutes after the use of the specified acoustic source has ceased. PSOs would be required to monitor the appropriate clearance and shutdown zones. These zones would be based on the radial distance from the acoustic source and not from the vessel.

Fishery Monitoring Surveys

All crew undertaking the fishery monitoring survey activities would be required to receive protected species identification training prior to activities occurring and attend the aforementioned onboarding training. Marine mammal monitoring must occur prior to, during, and after haul-back and gear must not be deployed if a marine mammal is observed in the area.

Park City Wind must implement the following ''move-on'' rule. If marine mammals are sighted within 1 nm of the planned location in the 15 minutes before gear deployment, Park City Wind may decide to move the vessel away from the marine mammal to a different section of the sampling area if the animal appears to be at risk of interaction with the gear, based on best professional judgment. If, after moving on, marine mammals are still visible from the vessel, Park City Wind may decide to move again or to skip the station. Gear would not be deployed if marine mammals are observed within the area and if a marine mammal is deemed to be at risk of interaction, all gear will be immediately removed.

Park City Wind must deploy trap and trawl gear as soon as is practicable upon arrival at the sampling station and must initiate marine mammal watches (visual observation) no less than 15 minutes prior to both deployment and retrieval of the trap and trawl gear. Marine mammal watches must be conducted by scanning these surrounding waters with the naked eye and binoculars and monitoring effort must be maintained during the entire period of the time that gear is in the water (*i.e.,* throughout gear deployment, fishing, and retrieval).

If marine mammals are sighted near the vessel during the soak and are determined to be at risk of interacting with the gear, then Park City Wind must immediately retrieve the gear as quickly as possible. Park City Wind may use best professional judgment in making this decision.

To avoid entanglement with vertical lines, buoy lines will be weighted and will not float at the surface of the water and all groundlines will consist of sinking line. Buoy lines and linkages will be compliant with best practices. ''Ropeless'' gear may be tested and used. To minimize risk of entanglement in trawl nets, trawl tow times would be limited to 20-minutes with a vessel speed of no more than 3.0 knots. Trawl nets will be fully cleared and repaired if damaged before redeployment. If marine mammals are sighted before the gear is fully removed from the water, the vessel will slow its speed and maneuver the vessel away from the animals to minimize potential interactions with the observed animal. Trawl nets will be emptied immediately after retrieval within the vicinity of the deck and the fishery researchers or crew will open the codend of the trawl net close to the deck in order to avoid injury to animals that may be caught in the gear. Any marine mammal interaction would be immediately reported to NMFS.

All gear must be clearly labeled as attributed to Park City Wind's fishery surveys. All fisheries monitoring gear must be fully cleaned and repaired (if damaged) before each use. Any lost gear associated with the fishery surveys will be reported to the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division (*nmfs.gar.incidental-take@noaa.gov*) as soon as possible or within 24 hours of the documented time of missing or lost gear. This report must include information on any markings on the gear and any efforts undertaken or planned to recover the gear. Finally, all survey vessels will adhere to all vessel mitigation measures previously discussed in this section.

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 would provide the means of affecting 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 promulgate a rulemaking for an activity, section 101(a)(5)(A) 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); and/or
- Mitigation and monitoring effectiveness.

Separately, monitoring is also regularly used to support mitigation implementation, which is referred to as mitigation monitoring, and monitoring plans typically include measures that both support mitigation implementation and increase our understanding of the impacts of the activity on marine mammals.

During the proposed construction activities, visual monitoring by NMFS-approved PSOs would be conducted before, during, and after all pile driving, drilling, UXO/MEC detonations, and HRG surveys. PAM would also be conducted during all impact and vibratory pile driving, drilling, and UXO/MEC detonations. Observations and acoustic detections by PSOs would be used to support the activity-specific mitigation measures described above. Also, to increase understanding of the impacts of the activity on marine mammals, observers would record all incidents of marine mammal occurrence at any distance from the piling locations (impact, vibratory, or drilling activities), UXO/MEC detonation site, and during active HRG acoustic sources, and monitors would document all behaviors and behavioral changes, in concert with distance from an acoustic source. The required monitoring is described below, beginning with PSO measures that are applicable to all activities or monitoring, followed by activity-specific monitoring requirements.

Protected Species Observer and PAM Operator Requirements

Park City Wind would be required to employ PSOs and PAM operators. PSOs are trained professionals who are tasked with visually monitoring for marine mammals during pile driving, drilling, HRG surveys, and UXO/MEC detonation. The primary purpose of a PSO is to carry out the monitoring, collect data, and, when appropriate, call for the implementation of mitigation measures. In addition to visual observations, NMFS requires Park City Wind to conduct passive acoustic monitoring (PAM) during pile driving, drilling, and UXO/MEC detonations. The inclusion of PAM alongside visual data collection is valuable to provide the most accurate record of species presence as possible and, together, these two monitoring methods are well understood to provide best results when combined together (*e.g.,* Barlow and Taylor, 2005; Clark *et al.,* 2010; Gerrodette *et al.,* 2011; Van Parijs *et al.,* 2021). Acoustic monitoring (in addition to visual monitoring) increases the likelihood of detecting marine mammals within the shutdown and clearance zones of project activities, which when applied in combination of required shutdowns helps to further reduce the risk of marine mammals being exposed to sound levels that could otherwise result in acoustic injury or more intense behavioral harassment. PAM is to be conducted by NMFS-approved PAM operators and should follow standardized measurement, processing methods, reporting metrics, and metadata standards for offshore wind (Van Parijs *et al.,* 2021).

Park City Wind must employ 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 (visual or acoustic), collect data, and communicate with and instruct relevant Park City Wind personnel with regard to the presence of protected species and mitigation requirements, and must have successfully completed an approved PSO training course appropriate for their designated task (visual or acoustic). Acoustic monitoring PSOs (*i.e.,* PAM operators) are required to complete specialized training for operating PAM systems and should have familiarity with the vessel and associated equipment with which they will be working, PSOs can act as acoustic or visual observers (but not simultaneously) as long as they demonstrate that their training and experience are sufficient to perform each task.

Park City Wind would be required to submit names of prospective PSOs and PAM operators for review and confirmation of their approval for specific roles prior to commencement of activity requiring PSOs and/or PAM operators. NMFS must review and approve PSO and PAM operator qualifications. Resumes must include information related to relevant education, experience, and training, including dates, duration, location, and description of prior PSO experience. Resumes must be accompanied by relevant documentation of successful completion of necessary training. NMFS may approve PSOs as conditional or unconditional. A conditionally approved PSO may be one who is trained but has not yet attained the requisite experience. An unconditionally-approved PSO is one who has attained the necessary experience. For unconditional approval, the PSO must have a minimum of 90 days at sea performing the role (either visual or acoustic), with the conclusion of the most recent relevant experience not more than 18 months previous.

NMFS is also proposing requirements to ensure monitoring is conducted effectively. A minimum number of PSOs would be required to be actively observing for the presence of marine mammals during certain project activities with more PSOs required as the mitigation zone sizes increase. PSOs and PAM operators would also be required to limit watches to no more than 4 hours at a time and must not exceed a combined watch schedule of more than 12 hours in any 24-hour time period. The types of equipment required (*e.g.,* Big Eyes on the pile driving vessel) are also designed to increase marine mammal detection capabilities. Specifics on these types of requirements can be found in the regulations at the end of this document (Requirements for monitoring and reporting). In the case where Park City Wind has not fully identified the manner by which they would conduct monitoring, they would be required to submit a plan to NMFS 180 days in advance of the commencement of work. At this time, NMFS is requiring Park City Wind to submit to NMFS, for review and approval, PSO and PAM Monitoring Plan(s) and, as described previously, a Nighttime Monitoring Plan.

As described above, PSOs and PAM operators are responsible for data collection. The data collected by PSO and PAM operators and subsequent analysis provide the necessary information to inform an estimate of the amount of take that occurred during the project, better understand the impacts of the project on marine mammals, address the effectiveness of monitoring and mitigation measures, and to adaptively manage activities and mitigation in the future. Data reported includes information on marine mammal sightings, activity occurring at time of sighting, monitoring conditions, and if mitigative actions were taken. Specific data collection requirements are contained within the regulations below.

Sound Field Verification

During the installation of at least the first three monopile foundations, all piles associated with installation of the first jacket foundation and during all UXO/MEC detonations, Park City Wind must identify source levels, the ranges to the isopleths corresponding to the Level A harassment and Level B harassment thresholds, and transmission loss coefficient(s). Park City Wind may also estimate ranges to the Level A harassment and Level B harassment isopleths by extrapolating from in situ measurements conducted at several distances from the piles monitored and UXO/MEC detonations. Park City Wind must perform sound field measurements at least three distances from the pile being driven, including, but not limited to, 750 m and the modeled Level A harassment and Level B harassment zones to verify the accuracy of those modeled zones. Sound field measurements should be configured along an unobstructed radial, free of significant bathymetric features, and which represents the most efficient acoustic propagation (*i.e.,* where sound is expected to propagate the furthest), relative to all modeled radials. At each distance from the pile, one hydrophone should be placed at depths no less than one-half the water depth and another should be placed no more than 2 meters from the seabed.

The recordings will be continuous throughout the duration of all foundation installation activities of each pile monitored. The measurement systems will have a sensitivity appropriate for the expected sound levels from pile driving received at the nominal ranges throughout the installation of the pile. The frequency range of the system will cover the range of at least 20 Hz to 20 kHz. The system will be designed to have omnidirectional sensitivity and will be designed so that the predicted broadband received level of all impact pile-driving strikes exceed the system noise floor by at least 10 dB. The dynamic range of the system will be sufficient such that at each location, pile driving signals are not clipped and are not masked by noise floor.

If acoustic field measurements collected during installation of foundation piles or UXO/MEC detonations indicate ranges to the isopleths corresponding to Level A harassment and Level B harassment thresholds are greater than the ranges predicted by modeling (assuming 10 dB attenuation), Park City Wind must implement additional noise mitigation measures prior to installing the next foundation installation or UXO/MEC detonation. Initial additional measures may include improving the efficacy of the implemented noise mitigation technology (*e.g.,* bubble curtain, double bubble curtain) and/or modifying the piling schedule to reduce the sound source. Each sequential modification would be evaluated empirically by acoustic field measurements.

In the event that field measurements indicate ranges to thresholds corresponding to Level A harassment and Level B harassment thresholds are greater than the ranges predicted by modeling (assuming 10 dB attenuation), NMFS may expand the relevant harassment, clearance, and shutdown zones and associated monitoring protocols. If harassment zones are expanded, NMFS may require additional PSOs be deployed on additional platforms with each observer responsible for maintaining watch in no more than 180 degrees.

If acoustic measurements indicate that ranges to thresholds corresponding to the Level A harassment and Level B harassment thresholds are less than the ranges predicted by modeling (assuming 10 dB attenuation), Park City Wind may request a modification of the clearance and shutdown zones for foundation installation and UXO/MEC detonations if additional acoustic modeling is conducted on subsequent piles. The number of piles that would have to be monitored would be dependent upon site conditions and future turbine placement; however, a minimum of three monopiles and two jacket installations (all pin piles for each jacket) would have to be monitored. In addition, if any subsequent pile installation locations are not represented by the previously monitored locations, SFV would be required. Upon receipt of an interim SFV report, NMFS may adjust zones (*i.e.,* Level A harassment, Level B harassment, clearance, shutdown, and/or minimum visibility zone) as deemed appropriate.

Park City Wind will submit a SFV Plan to NOAA Fisheries for review and approval at least 180 days prior to planned start of pile driving and any UXO/MEC detonations. The plan must describe how Park City Wind would ensure that the first three monopile foundation installation sites and two ESP jacket foundations (all pin piles) sites selected for SFV are representative of the rest of the foundation installation sites. As described above, each UXO/MEC detonation must be acoustically monitored. The plan must also include the methodology for collecting, analyzing, and preparing SFV data for submission to NMFS. The plan must describe how the effectiveness of the sound attenuation methodology would be evaluated based on the results. Park City Wind must also provide, as soon as they are available but no later than 48 hours after each foundation installation event or UXO/MEC detonation, the initial results of the SFV measurements to NMFS in an interim report.

In addition to identifying how foundation installation and UXO/MEC detonation noise levels will be monitored, the SFV plan must also include how operational noise of the turbines would be monitored. Operational parameters (*e.g.,* direct drive/gearbox information, turbine rotation rate) as well as sea state conditions and information on nearby anthropogenic activities (*e.g.,* vessels transiting or operating in the area) must be reported.

Reporting

Prior to initiation of project activities, Park City Wind would provide a report to NMFS Office of Protected Resources documenting that all required training for Park City Wind personnel (*i.e.,* vessel crews, vessel captains, PSOs, and PAM operators) has been completed and provide the date that each in-water construction activity considered in this proposed rule (*i.e.,* foundation installation, cable landfall construction, marina activities, and HRG surveys) would occur.

NMFS would require standardized and frequent reporting from Park City Wind during the life of the proposed regulations and LOA. All data collected relating to the Project would be recorded using industry-standard software installed on field laptops and/or tablets. Park City Wind would be required to submit weekly, monthly and annual reports. For all monitoring efforts and marine mammal sightings, the species, location, time, and many other factors must be reported to NMFS. The specifics of what we require to be reported can be found in the regulatory text at the end of this proposed rule, including for all real-time acoustic detections of marine mammals which also must be reported weekly, monthly, and annually. SFV reporting, as described above, would also be required.

Weekly Report—During foundation installation activities, Park City Wind would be required to compile and submit weekly marine mammals and pile driving activity reports to NMFS Office of Protected Resources that document the daily start and stop of all pile driving activities, drilling, UXO/MEC detonations, and HRG activities, the start and stop of associated observation periods by PSOs, details on the deployment of PSOs, a record of all detections of marine mammals (acoustic and visual), any mitigation actions (or if mitigation actions could not be taken, provide reasons why), and details on the noise abatement system(s) (*e.g.,* bubble rate). Weekly reports would be due on Wednesday for the previous week (Sunday–Saturday). The weekly report would also identify which turbines become operational and when (a map must be provided). Once all foundation pile installation is complete, weekly reports would no longer be required.

Monthly Report—Park City Wind would be required to compile and submit monthly reports to NMFS Office of Protected Resources that include a summary of all information in the weekly reports, including project activities carried out in the previous month, vessel transits (number, type of vessel, and route), number of piles installed, number of UXO/MEC detonations, all detections of marine mammals, and any mitigative actions taken. Monthly reports would be due on the 15th of the month for the previous month. The monthly report would also identify which turbines become operational and when (a map must be provided). Once foundation pile installation is complete, monthly reports would no longer be required.

Annual Reporting—Park City Wind would be required to submit an annual PSO and PAM report to NMFS Office of Protected Resources no later than 90 days following the end of a given calendar year describing, in detail, all of the information required in the monitoring section above. A final annual report would be prepared and submitted within 30 calendar days following receipt of any NMFS comments on the draft report. If no comments were received from NMFS Office of Protected Resources within 60 calendar days of NMFS' receipt of the draft report, the report would be considered final.

Final 5-Year Reporting—Park City Wind must submit its draft 5-year report(s) to NMFS Office of Protected Resources on all visual and acoustic monitoring conducted under the LOA within 90 calendar days of the completion of activities occurring under the LOA. A final 5-year report must be prepared and submitted within 60 calendar days following receipt of any NMFS comments on the draft report. If no comments are received from NMFS within 60 calendar days of NMFS' receipt of the draft report, the report shall be considered final. Information contained within this report is described at the beginning of this section.

Situational Reporting—Specific situations encountered during the development of the Project would require immediate reporting. If a North Atlantic right whale is acoustical detected during PAM, the date, time, and location (*i.e.,* latitude and longitude of recorder) of the detection, as well as the recording platform that had the detection, must be reported to *nmfs.pacmdata@noaa.gov* as soon as feasible, no longer than 24 hours after the detection. Full detection data and metadata, including GPS data records, must be submitted to *nmfs.pacmdata@noaa.gov* monthly on the 15th of every month for the previous month via ISO standard metadata forms available on the NMFS North Atlantic right whale Passive Acoustic Reporting System website at *https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reporting-system-templates.*

If a North Atlantic right whale is observed at any time by PSOs or Park City Wind personnel, Park City Wind must immediately report sighting information to the NMFS North Atlantic Right Whale Sighting Advisory System (866–755–6622), to the U.S. Coast Guard via channel 16, and through the WhaleAlert app (*https://www.whalealert/org/*) as soon as feasible but no longer than 24 hours after the sighting. Information reported must include, at a minimum: time of sighting, location, and number of North Atlantic right whales observed. The specifics of what NMFS Office of Protected Resources requires to be reported is listed at the end of this proposed rule in the regulatory text.

If a sighting of a stranded, entangled, injured, or dead marine mammal occurs, the sighting would be reported to NMFS Office of Protected Resources, the NMFS Greater Atlantic Stranding Coordinator for the New England/Mid-Atlantic area (866–755–6622 or the Dolphin and Whale 911 app), and the U.S. Coast Guard within 24 hours. If the injury or death was caused by a project activity, Park City Wind must immediately cease all activities until NMFS Office of Protected Resources is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate to ensure compliance with the terms of the LOA. NMFS Office of Protected Resources may impose additional measures to minimize the likelihood of further prohibited take and ensure MMPA compliance. Park City Wind may not resume their activities until notified by NMFS Office of Protected Resources. The specifics of what NMFS Office of Protected Resources requires to be reported is listed at the end of this proposed rule in the regulatory text.

In the event of a vessel strike of a marine mammal by any vessel associated with the Project, Park City Wind must immediately report the strike incident to the NMFS Office of Protected Resources and the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division (GARFO) within and no later than 24 hours. Park City Wind must immediately cease all on-water activities until NMFS Office of Protected Resources is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate to ensure compliance with the terms of the LOA. NMFS Office of Protected Resources may impose additional measures to minimize the likelihood of further prohibited take and ensure MMPA compliance. Park City Wind may not resume their activities until notified by NMFS. The specifics of what NMFS Office of Protected Resources requires to be reported is listed at the end of this proposed rule in the regulatory text.

In the event of any lost gear associated with the fishery surveys, Park City Wind must report to the GARFO as soon as possible or within 24 hours of the documented time of missing or lost gear. This report must include information on any markings on the gear and any efforts undertaken or planned to recover the gear.

Sound Field Verification—Park City Wind would be required to submit interim sound field verification reports after each foundation installation and UXO/MEC detonation monitored as soon as possible but within 48-hours. A final SFV report for foundation installation and UXO/MEC detonations would be required within 90 days following completion of acoustic monitoring for each activity.

Adaptive Management

The regulations governing the take of marine mammals incidental to Park City Wind's construction activities would contain an adaptive management component. The monitoring and reporting requirements in this proposed rule are designed to provide NMFS with information that helps us better understand the impacts of the activities on marine mammals and informs our consideration of whether any changes to mitigation or monitoring are appropriate. The use of adaptive management allows NMFS to consider new information from different sources to determine (with input from Park City Wind regarding practicability) on an annual or biennial basis if mitigation or monitoring measures should be modified (including additions or deletions). Mitigation measures could be modified if new data suggests that such modifications would have a reasonable likelihood of reducing adverse effects to marine mammals and if the measures are practicable.

The following are some of the possible sources of applicable data to be considered through the adaptive management process: (1) Results from monitoring reports, as required by MMPA authorizations; (2) results from general marine mammal and sound research; and (3) any information which reveals that marine mammals may have been taken in a manner, extent, or number not authorized by these regulations or subsequent LOA. During the course of the rule, Park City Wind (and other LOA-holders conducting offshore wind development activities) would be required to participate in one or more adaptive management meetings convened by NMFS and/or BOEM, in which the above information would be summarized and discussed in the context of potential changes to the mitigation or monitoring measures.

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'' by mortality, serious injury, and Level A harassment or Level B harassment, we consider other factors, such as the likely nature of any behavioral responses (*e.g.,* intensity, duration), the context of any such responses (*e.g.,* critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness of 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' 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).

In the Estimated Take of Marine Mammals section, we identified the subset of potential effects that would be expected to qualify as takes under the MMPA, and then identified the maximum number of takes by Level A harassment and Level B harassment that we estimate are likely to occur based on the methods described. The impact that any given take would have is dependent on many case-specific factors that need to be considered in the negligible impact analysis (*e.g.,* the context of behavioral exposures such as duration or intensity of a disturbance, the health of impacted animals, the status of a species that incurs fitness-level impacts to individuals, *etc.*). In this proposed rule, we evaluate the likely impacts of the enumerated harassment takes that are proposed for authorization in the context of the specific circumstances surrounding these predicted takes. We also collectively evaluate this information, as well as other more taxa-specific information and mitigation measure effectiveness, in group-specific discussions that support our negligible impact conclusions for each stock. As described above, no serious injury or mortality is expected or proposed for authorization for any species or stock.

The Description of the Specified Activities section describes the specified activities proposed by Park City Wind that may result in take of marine mammals and an estimated schedule for conducting those activities. Park City Wind has provided a realistic construction schedule although we recognize schedules may shift for a variety of reasons (*e.g.,* weather or supply delays). However, the total amount of take would not exceed the 5-year totals and maximum annual total in any given year indicated in Tables 33 and 34, respectively.

We base our analysis and negligible impact determination on the maximum number of takes that have the potential to occur and are proposed to be authorized annually and across the 5-year LOA, if issued, and extensive qualitative consideration of other contextual factors that influence the degree of impact of the takes on the affected individuals and the number and context of the individuals affected. As stated before, the number of takes, both maximum annual and 5-year total, alone are only a part of the analysis.

To avoid repetition, we provide some general analysis in this Negligible Impact Analysis and Determination section that applies to all the species listed in Table 5 given that some of the anticipated effects of Park City Wind's construction activities on marine mammals are expected to be relatively similar in nature. Then, we subdivide into more detailed discussions for mysticetes, odontocetes, and pinnipeds which have broad life history traits that support an overarching discussion of some factors considered within the analysis for those groups (*e.g.,* habitat-use patterns, high-level differences in feeding strategies).

Last, we provide a negligible impact determination for each species or stock, providing species or stock-specific information or analysis, where appropriate, for example, for North Atlantic right whales given their population status. Organizing our analysis by grouping species or stocks that share common traits or that would respond similarly to effects of Park City Wind's proposed activities, and then providing species- or stock-specific information allows us to avoid duplication while ensuring that we have analyzed the effects of the specified activities on each affected species or stock. It is important to note that in the group or species sections, we base our negligible impact analysis on the maximum annual take that is predicted under the 5-year rule; however, the majority of the impacts are associated with WTG foundation and ESP foundation installation, which would occur largely within the first 3 years. The estimated take in the other years is expected to be notably less, which is reflected in the total take that would be allowable under the rule (see Tables 32, 33, and 34).

As described previously, no serious injury or mortality is anticipated or proposed for authorization in this rule. Any Level A harassment authorized would be in the form of auditory injury (*i.e.,* PTS) and not non-auditory injury (*e.g.,* lung injury or gastrointestinal injury from UXO/MEC detonation). The amount of harassment Park City Wind has requested, and NMFS is proposing to authorize, is based on exposure models that consider the outputs of acoustic source and propagation models and other data such as frequency of occurrence or group sizes. Several conservative parameters and assumptions are ingrained into these models, such as assuming forcing functions that consider direct contact with piles (*i.e.,* no cushion allowances) and application of the highest monthly sound speed profile to all months within a given season. The exposure model results do not reflect any mitigation measures or avoidance response. The amount of take requested and proposed to be authorized also reflects careful consideration of other data (*e.g.,* PSO and group size data) and, for Level A harassment potential of some large whales, the consideration of mitigation measures. For all species, the amount of take proposed to be authorized represents the maximum amount of Level A harassment and Level B harassment that is likely to occur.

Behavioral Disturbance

In general, NMFS anticipates that impacts on an individual that has been harassed are likely to be more intense when exposed to higher received levels and for a longer duration (though this is in no way a strictly linear relationship for behavioral effects across species, individuals, or circumstances) and less severe impacts result when exposed to lower received levels and for a brief duration. However, there is also growing evidence of the importance of contextual factors such as distance from a source in predicting marine mammal behavioral response to sound—*i.e.,* sounds of a similar level emanating from a more distant source have been shown to be less likely to evoke a response of equal magnitude (*e.g.,* DeRuiter and Doukara, 2012; Falcone *et al.,* 2017). As described in the Potential Effects to Marine Mammals and their Habitat section, the intensity and duration of any impact resulting from exposure to Park City Wind's activities is dependent upon a number of contextual factors including, but not limited to, sound source frequencies, whether the sound source is moving towards the animal, hearing ranges of marine mammals, behavioral state at time of exposure, status of individual exposed (*e.g.,* reproductive status, age class, health) and an individual's experience with similar sound sources. Southall *et al.* (2021), Ellison *et al.* (2012) and Moore and Barlow (2013), among others, emphasize the importance of context (*e.g.,* behavioral state of the animals, distance from the sound source) in evaluating behavioral responses of marine mammals to acoustic sources. Harassment of marine mammals may result in behavioral modifications (*e.g.,* avoidance, temporary cessation of foraging or communicating, changes in respiration or group dynamics, masking) or may result in auditory impacts such as hearing loss. In addition, some of the lower level physiological stress responses (*e.g.,* change in respiration, change in heart rate) discussed previously would likely co-occur with the behavioral modifications, although these physiological responses are more difficult to detect and fewer data exist relating these responses to specific received levels of sound. Takes by Level B harassment, then, may have a stress-related physiological component as well; however, we would not expect Park City Wind's activities to produce conditions of long-term and continuous exposure to noise leading to long-term physiological stress responses in marine mammals that could affect reproduction or survival.

In the range of behavioral effects that might be expected to be part of a response that qualifies as an instance of Level B harassment by behavioral disturbance (which by nature of the way it is modeled/counted, occurs within 1 day), the less severe end might include exposure to comparatively lower levels of a sound, at a greater distance from the animal, for a few or several minutes. A less severe exposure of this nature could result in a behavioral response such as avoiding an area that an animal would otherwise have chosen to move through or feed in for some amount of time, or breaking off one or a few feeding bouts. More severe effects could occur if an animal gets close enough to the source to receive a comparatively higher level, is exposed continuously to one source for a longer time, or is exposed intermittently to different sources throughout a day. Such effects might result in an animal having a more severe flight response, and leaving a larger area for a day or more or potentially losing feeding opportunities for a day. However, such severe behavioral effects are expected to occur infrequently.

Many species perform vital functions, such as feeding, resting, traveling, and socializing on a diel cycle (24-hour cycle). Behavioral reactions to noise exposure, when taking place in a biologically important context, such as disruption of critical life functions, displacement, or avoidance of important habitat, are more likely to be significant if they last more than one day or recur on subsequent days (Southall *et al.,* 2007) due to diel and lunar patterns in diving and foraging behaviors observed in many cetaceans (Baird *et al.,* 2008; Barlow *et al.,* 2020; Henderson *et al.,* 2016; Schorr *et al.,* 2014). It is important to note the water depth in the Project area is shallow (ranging from 2 m in the OECC to 62 m in the lease area) and deep diving species, such as sperm whales, are not expected to be engaging in deep foraging dives when exposed to noise above NMFS harassment thresholds during the specified activities. Therefore, we do not anticipate impacts to deep foraging behavior to be impacted by the specified activities.

It is also important to identify that the estimated number of takes does not necessarily equate to the number of individual animals the Project expects to harass (which is lower), but rather to the instances of take (*i.e.,* exposures above the Level B harassment thresholds) that may occur. These instances may represent either brief exposures of seconds for UXO/MEC detonations, seconds to minutes for HRG surveys, or, in some cases, longer durations of exposure within a day (*e.g.,* pile driving). Some individuals of a species may experience recurring instances of take over multiple days throughout the year, while some members of a species or stock may experience one exposure as they move through an area, which means that the number of individuals taken is smaller than the total estimated takes. In short, for species that are more likely to be migrating through the area and/or for which only a comparatively smaller number of takes are predicted (*e.g.,* some of the mysticetes), it is more likely that each take represents a different individual, whereas for non-migrating species with larger amounts of predicted take, we expect that the total anticipated takes represent exposures of a smaller number of individuals of which some would be taken across multiple days.

For the Project, impact pile driving of foundation piles is most likely to result in a higher magnitude and severity of behavioral disturbance than other activities (*i.e.,* vibratory pile driving, drilling, UXO/MEC detonations, and HRG surveys). Impact pile driving has higher source levels and longer durations (on an annual basis) than vibratory pile driving, drilling and HRG surveys. HRG survey equipment also produces much higher frequencies than pile driving, resulting in minimal sound propagation. While UXO/MEC detonations may have higher source levels, impact pile driving is planned for longer durations (*i.e.,* a maximum of 10 UXO/MEC detonations are planned, which would result in only instantaneous exposures). While foundation installation impact pile driving is anticipated to be most impactful for these reasons, impacts are minimized through implementation of mitigation measures, including use of a sound attenuation system, soft-starts, the implementation of clearance zones that would facilitate a delay pile driving commencement, and implementation of shutdown zones. All these measures are designed to avoid or minimize harassment. For example, given sufficient notice through the use of soft-start, marine mammals are expected to move away from a sound source that is annoying prior to becoming exposed to very loud noise levels. The requirement to couple visual monitoring and PAM before and during all foundation installation and UXO/MEC detonations would increase the overall capability to detect marine mammals than one method alone. Measures such as the requirement to apply sound attention devices and implement clearance zones also apply to UXO/MEC detonation(s), which also have the potential to elicit more severe behavioral reactions in the unlikely event that an animal is relatively close to the explosion in the instant that it occurs; hence, severity of behavioral responses are expected to be lower than would be the case without mitigation.

Occasional, milder behavioral reactions are unlikely to cause long-term consequences for individual animals or populations, and even if some smaller subset of the takes are in the form of a longer (several hours or a day) and more severe response, if they are not expected to be repeated over numerous or sequential days, impacts to individual fitness are not anticipated. Also, the effect of disturbance is strongly influenced by whether it overlaps with biologically important habitats when individuals are present—avoiding biologically important habitats will provide opportunities to compensate for reduced or lost foraging (Keen *et al.,* 2021). Nearly all studies and experts agree that infrequent exposures of a single day or less are unlikely to impact an individual's overall energy budget (Farmer *et al.,* 2018; Harris *et al.,* 2017; King *et al.,* 2015; National Academy of Science (NAS), 2017; New *et al.,* 2014; Southall *et al.,* 2007; Villegas-Amtmann *et al.,* 2015).

Temporary Threshold Shift (TTS)

TTS is one form of Level B harassment that marine mammals may incur through exposure to the Project's activities and, as described earlier, the proposed takes by Level B harassment may represent takes in the form of behavioral disturbance, TTS, or both. As discussed in the Potential Effects to Marine Mammals and their Habitat section, in general, TTS can last from a few minutes to days, be of varying degree, and occur across different frequency bandwidths, all of which determine the severity of the impacts on the affected individual, which can range from minor to more severe. Impact and vibratory pile driving, drilling, and UXO/MEC detonation are broadband noise sources but generate sounds in the lower frequency ranges (with most of the energy below 1–2 kHz, but with a small amount energy ranging up to 20 kHz); therefore, in general and all else being equal, we would anticipate the potential for TTS is higher in low-frequency cetaceans (*i.e.,* mysticetes) than other marine mammal hearing groups and would be more likely to occur in frequency bands in which they communicate. However, we would not expect the TTS to span the entire communication or hearing range of any species given the frequencies produced by these activities do not span entire hearing ranges for any particular species. Additionally, though the frequency range of TTS that marine mammals might sustain would overlap with some of the frequency ranges of their vocalizations, the frequency range of TTS from the Project's pile driving, drilling, and UXO/MEC detonation activities would not typically span the entire frequency range of one vocalization type, much less span all types of vocalizations or other critical auditory cues for any given species. However, the mitigation measures proposed by the Project and proposed by NMFS, further reduce the potential for TTS in mysticetes.

Generally, both the degree of TTS and the duration of TTS would be greater if the marine mammal is exposed to a higher level of energy (which would occur when the peak dB level is higher or the duration is longer). The threshold for the onset of TTS was discussed previously (refer back to Estimated Take of Marine Mammals). However, source level alone is not a predictor of TTS. An animal would have to approach closer to the source or remain in the vicinity of the sound source appreciably longer to increase the received SEL, which would be difficult considering the proposed mitigation and the nominal speed of the receiving animal relative to the stationary sources such as impact pile driving. The recovery time of TTS is also of importance when considering the potential impacts from TTS. In TTS laboratory studies (as discussed in the Potential Effects of the Specified Activities on Marine Mammals and their Habitat section), some using exposures of almost an hour in duration or up to 217 SEL, almost all individuals recovered within 1 day (or less, often in minutes) and we note that while the pile driving activities last for hours a day, it is unlikely that most marine mammals would stay in the close vicinity of the source long enough to incur more severe TTS. UXO/MEC detonation also has the potential to result in TTS. However, given the duration of exposure is extremely short (milliseconds), the degree of TTS (*i.e.,* the amount of dB shift) is expected to be small and TTS duration is expected to be short (minutes to hours). Overall, given the small number of times that any individual might incur TTS, the low degree of TTS and the short anticipated duration, and the unlikely scenario that any TTS overlapped the entirety of a critical hearing range, it is unlikely that TTS of the nature expected to result from the project's activities would result in behavioral changes or other impacts that would impact any individual's (of any hearing sensitivity) reproduction or survival.

Permanent Threshold Shift (PTS)

Park City Wind has requested, and NMFS proposes to authorize, a very small amount of take by PTS to some marine mammal individuals. The numbers of proposed annual takes by Level A harassment are relatively low for all marine mammal stocks and species (Table 34). The only activities incidental to which we anticipate PTS may occur is from exposure to impact pile driving and UXO/MEC detonations, which produce sounds that are both impulsive and primarily concentrated in the lower frequency ranges (below 1 kHz) (David, 2006; Krumpel *et al.,* 2021).

There are no PTS data on cetaceans and only one instance of PTS being induced in an older harbor seals (Reichmuth *et al.,* 2019). However, available TTS data (of mid-frequency hearing specialists exposed to mid- or high-frequency sounds (Southall *et al.,* 2007; NMFS, 2018; Southall *et al.,* 2019)) suggest that most threshold shifts occur in the frequency range of the source up to one octave higher than the source. We would anticipate a similar result for PTS. Further, no more than a small degree of PTS is expected to be associated with any of the incurred Level A harassment, given it is unlikely that animals would stay in the close vicinity of a source for a duration long enough to produce more than a small degree of PTS.

PTS would consist of minor degradation of hearing capabilities occurring predominantly at frequencies one-half to one octave above the frequency of the energy produced by pile driving or instantaneous UXO/MEC detonation (*i.e.,* the low-frequency region below 2 kHz) (Cody and Johnstone, 1981; McFadden, 1986; Finneran, 2015), not severe hearing impairment. If hearing impairment occurs from either impact pile driving or UXO/MEC detonation, it is most likely that the affected animal would lose a few decibels in its hearing sensitivity, which in most cases is not likely to meaningfully affect its ability to forage and communicate with conspecifics. Park City Wind estimates 10 UXOs/MECs may be detonated and the exposure analysis assumes the worst-case scenario that all of the UXOs/MECs found would consist of the largest charge weight of UXO/MEC (E12; 454 kg). However, it is highly unlikely that all charges would be this maximum size; thus, the amount of Level A harassment that may occur incidental to the detonation of the UXOs/MECs would likely be less than what is estimated here. In addition, during impact pile driving, given sufficient notice through use of soft-start prior to implementation of full hammer energy during impact pile driving, marine mammals are expected to move away from a sound source that is annoying prior to it resulting in severe PTS.

Auditory Masking or Communication Impairment

The ultimate potential impacts of masking on an individual are similar to those discussed for TTS (*e.g.,* decreased ability to communicate, forage effectively, or detect predators), but an important difference is that masking only occurs during the time of the signal, versus TTS, which continues beyond the duration of the signal. Also, though, masking can result from the sum of exposure to multiple signals, none of which might individually cause TTS. Fundamentally, masking is referred to as a chronic effect because one of the key potential harmful components of masking is its duration—the fact that an animal would have reduced ability to hear or interpret critical cues becomes much more likely to cause a problem the longer it is occurring. Also inherent in the concept of masking is the fact that the potential for the effect is only present during the times that the animal and the source are in close enough proximity for the effect to occur (and further, this time period would need to coincide with a time that the animal was utilizing sounds at the masked frequency).

As our analysis has indicated, for this project we expect that impact pile driving foundations have the greatest potential to mask marine mammal signals, and this pile driving may occur for several, albeit intermittent, hours per day, for multiple days per year. Masking is fundamentally more of a concern at lower frequencies (which are pile driving dominant frequencies), because low frequency signals propagate significantly further than higher frequencies and because they are more likely to overlap both the narrower low frequency calls of mysticetes, as well as many non-communication cues related to fish and invertebrate prey, and geologic sounds that inform navigation. However, the area in which masking would occur for all marine mammal species and stocks (*e.g.,* predominantly in the vicinity of the foundation pile being driven) is small relative to the extent of habitat used by each species and stock. In summary, the nature of the Project's activities, paired with habitat use patterns by marine mammals, does not support the likelihood that the level of masking that could occur would have the potential to affect reproductive success or survival.

Impacts on Habitat and Prey

Construction activities or UXO/MEC detonation may result in fish and invertebrate mortality or injury very close to the source, and all activities (including HRG surveys) may cause some fish to leave the area of disturbance. It is anticipated that any mortality or injury would be limited to a very small subset of available prey and the implementation of mitigation measures such as the use of a noise attenuation system during pile driving, drilling, and UXO/MEC detonation would further limit the degree of impact (again noting UXO/MEC detonation would be limited to 10 events over 2 years). Behavioral changes in prey in response to construction activities could temporarily impact marine mammals' foraging opportunities in a limited portion of the foraging range but, because of the relatively small area of the habitat that may be affected at any given time (*e.g.,* around a pile being driven), the impacts to marine mammal habitat are not expected to cause significant or long-term negative consequences.

Cable presence and operation are not anticipated to impact marine mammal habitat as these would be buried, and any electromagnetic fields emanating from the cables are not anticipated to result in consequences that would impact marine mammals prey to the extent they would be unavailable for consumption.

The presence and operation of wind turbines within the lease area could have longer-term impacts on marine mammal habitat, as the project would result in the persistence of the structures within marine mammal habitat for more than 30 years. The presence and operation of an extensive number of structures such as wind turbines are, in general, likely to result in local and broader oceanographic effects in the marine environment, and may disrupt dense aggregations and distribution of marine mammal zooplankton prey through altering the strength of tidal currents and associated fronts, changes in stratification, primary production, the degree of mixing, and stratification in the water column (Chen *et al.,* 2021; Johnson *et al.,* 2021; Christiansen *et al.,* 2022; Dorrell *et al.,* 2022). However, the scale of impacts is difficult to predict and may vary from hundreds of meters for local individual turbine impacts (Schultze *et al.,* 2020) to large-scale dipoles of surface elevation changes stretching hundreds of kilometers (Christiansen *et al.,* 2022).

As discussed in the Potential Effects of the Specified Activities on Marine Mammals and their Habitat section, the Project would consist of no more than 132 foundations in the lease area. While there are likely to be oceanographic impacts from the presence and operation of the Project, meaningful oceanographic impacts relative to stratification and mixing that would significantly affect marine mammal habitat and prey over large areas in key foraging habitats during the effective period of the proposed rule are not anticipated (which considers 2–3 years of turbine operation). For these reasons, if oceanographic features are affected by wind farm operation during the course of the proposed rule, the impact on marine mammal habitat and their prey is likely to be comparatively minor.

Mitigation To Reduce Impacts on All Species

This proposed rulemaking includes a variety of mitigation measures designed to minimize impacts on all marine mammals, with a focus on North Atlantic right whales (the latter is described in more detail below). For pile driving and drilling of foundation piles (*i.e.,* foundation installation), and UXO/MEC detonations, eight overarching mitigation measures are proposed, which are intended to reduce both the number and intensity of marine mammal takes: (1) seasonal/time of day work restrictions; (2) use of multiple PSOs to visually observe for marine mammals (with any detection within designated zones triggering delay or shutdown); (3) use of PAM to acoustically detect marine mammals, with a focus on detecting baleen whales (with any detection within designated zones triggering delay or shutdown); (4) implementation of clearance zones; (5) implementation of shutdown zones; (6) use of soft-start (impact pile driving only); (7) use of noise attenuation technology; (8) maintaining situational awareness of marine mammal presence through the requirement that any marine mammal sighting(s) by Project personnel must be reported to PSOs; and (9) sound field verification monitoring.

When foundation installation or UXO/MEC detonation is conducted, Park City Wind is committed to reducing the noise levels generated to the lowest levels practicable and ensuring that they do not exceed a noise footprint above that which was modeled, assuming a 10-dB attenuation. Use of a soft-start during impact pile driving would allow animals to move away from (*i.e.,* avoid) the sound source prior to applying higher hammer energy levels needed to install the pile (Park City Wind would not use a hammer energy greater than necessary to install piles). Clearance zone and shutdown zone implementation, required when marine mammals are within given distances associated with certain impact thresholds for all activities, would reduce the magnitude and severity of marine mammal take. The use of multiple PSOs, PAM, and maintaining awareness of marine mammal sightings reported in the region would aid in detecting marine mammals triggering the implementation of the mitigation measures. Further, UXO/MEC detonation may only occur when all other possible means of removal have been deemed insufficient. The reporting requirements, including SFV reporting, will assist NMFS in identifying if impacts beyond those analyzed in this proposed rule are occurring, potentially leading to the need to enact adaptive management measures in addition to the proposed mitigation measures.

Mysticetes

Six mysticete species (comprising six stocks) of cetaceans (North Atlantic right whale, humpback whale, fin whale, sei whale, minke whale, and blue whale) may be taken by harassment. These species, to varying extents, utilize coastal New England waters, including the project area, for the purposes of migration, foraging, and socializing. Mysticetes are in the Low-Frequency hearing group.

Behavioral data on mysticete reactions to pile driving noise are scant. Kraus *et al.* (2019) predicted that the three main impacts of offshore wind farms on marine mammals would consist of displacement, behavioral disruptions, and stress. Broadly, we can look to studies that have focused on other noise sources such as seismic surveys and military training exercises, which suggest that exposure to loud signals can result in avoidance of the sound source (or displacement if the activity continues for a longer duration in a place where individuals would otherwise have been staying, which is less likely for mysticetes in this area), disruption of foraging activities (if they are occurring in the area), local masking around the source, associated stress responses, and impacts to prey, as well as TTS or PTS in some cases.

Mysticetes encountered in the Project area are expected to be migrating through and/or foraging within the project area. The extent to which an animal engages in these behaviors in the area is species-specific and varies seasonally. Many mysticetes are expected to predominantly be migrating through the project area towards or from these feeding habitats. While we have acknowledged above that mortality, hearing impairment, or displacement of mysticete prey species may result locally from impact pile driving and UXO/MEC detonations, given the very short duration of and broad availability of prey species in the area and the availability of alternative suitable foraging habitat for the mysticete species most likely to be affected, any impacts on mysticete foraging would be expected to be minor. 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 habitats. In addition, any displacement of whales or interruption of foraging bouts would be expected to be relatively temporary in nature.

The potential for repeated exposures is dependent upon the residency time of whales, with migratory animals unlikely to be exposed on repeated occasions and animals remaining in the area to be more likely exposed repeatedly. Where relatively low amounts of species-specific proposed Level B harassment are predicted (compared to the abundance of each mysticete species or stock, such as is indicated in Table 34) and movement patterns suggest that individuals would not necessarily linger in a particular area for multiple days, each predicted take likely represents an exposure of a different individual; the behavioral impacts would, therefore, be expected to occur within a single day within a year—an amount that would not be expected to impact reproduction or survival. Alternatively, species with longer residence time in the project area may be subject to repeated exposures across multiple days.

In general, for this project, the duration of exposures would not be continuous throughout any given day and pile driving would not occur on all consecutive days within a given year, due to weather delays or any number of logistical constraints Park City Wind has identified. Species-specific analysis regarding potential for repeated exposures and impacts is provided below. Overall, we do not expect impacts to whales within the project area, including fin whales foraging in the small fin whale feeding BIA that partially overlaps the project area, to affect the fitness of any large whales.

Blue, fin, humpback, minke, and sei whales are the only mysticete species for which PTS is anticipated and proposed to be authorized. As described previously, PTS for mysticetes from some project activities may overlap frequencies used for communication, navigation, or detecting prey. However, given the nature and duration of the activity, the mitigation measures, and likely avoidance behavior, any PTS is expected to be of a small degree, would be limited to frequencies where pile driving noise is concentrated (*i.e.,* only a small subset of their expected hearing range) and would not be expected to impact reproductive success or survival.

North Atlantic Right Whales

North Atlantic right whales are listed as endangered under the ESA and as both Depleted and Strategic under the MMPA. As described in the Effects to Marine Mammals and Their Habitat section, North Atlantic right whales are threatened by a low population abundance, higher than average mortality rates, and lower than average reproductive rates. Recent studies have reported individuals showing high stress levels (*e.g.,* Corkeron *et al.,* 2017) and poor health, which has further implications on reproductive success and calf survival (Christiansen *et al.,* 2020; Stewart *et al.,* 2021; Stewart *et al.,* 2022). As described below, a UME has been designated for North Atlantic right whales. Given this, the status of the North Atlantic right whale population is of heightened concern and, therefore, merits additional analysis and consideration. No serious injury or mortality, nor Level A harassment, is anticipated or proposed for authorization for this species.

The rule would allow for the authorization of up to 293 takes, by Level B harassment only, over the five-year period, with a maximum annual allowable take of 111 (equating to approximately 32.8 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HRG surveys would be occurring). The project area is known as a migratory corridor for North Atlantic right whales and given the nature of migratory behavior (*e.g.* continuous path), we anticipate that many of the instances of take would not represent repeat takes of any individual. However, changing distribution of right whales, and observations of increased residency times in the broader southern New England area indicate that some subset of the individual whales exposed could be taken up to a few times annually.

Southern New England, including the project area, may be a stopover site for migrating North Atlantic right whales moving to or from southeastern calving grounds. Qualitative observations include animals feeding and socializing (Quinatna-Rizzo et al. 2021). The right whales observed during the study period were primarily concentrated in the northeastern and southeastern sections of the MA WEA during the summer (June–August) and winter (December–February). Right whale distribution did shift to the west, closer to the project area, into the RI/MA WEA in the spring (March–May). Quintana-Rizzo et al. (2021) found that approximately 23 percent of the right whale population is present from December through May, and the mean residence time has tripled to an average of 13 days during these months.

In general, North Atlantic right whales in the project area are expected to be engaging in migratory behavior. Given the species' migratory behavior in the project area, we anticipate individual whales would be typically migrating through the area during most months when foundation installation and UXO/MEC detonation would occur (given the seasonal restrictions on foundation installation and UXO/MEC detonation, rather than lingering for extended periods of time). Other work that involves either much smaller harassment zones (*e.g.* HRG surveys) or is limited in amount (cable landfall construction) may also occur during periods when North Atlantic right whales are using the habitat for migration. It is important to note the activities occurring from December through May that may impact North Atlantic right whale would be primarily HRG surveys, which would not result in very high received levels. Across all years, if an individual were to be exposed during a subsequent year, the impact of that exposure is likely independent of the previous exposure given the duration between exposures.

North Atlantic right whales are presently experiencing an ongoing UME (beginning in June 2017). Preliminary findings support human interactions, specifically vessel strikes and entanglements, as the cause of death for the majority of North Atlantic right whales. Given the current status of the North Atlantic right whale, the loss of even one individual could significantly impact the population. No mortality, serious injury, or injury of North Atlantic right whales as a result of the project is expected or proposed to be authorized. Any disturbance to North Atlantic right whales due to Park City Wind's activities is expected to result in temporary avoidance of the immediate area of construction. As no injury, serious injury, or mortality is expected or authorized, and Level B harassment of North Atlantic right whales will be reduced to the level of least practicable adverse impact through use of mitigation measures, the authorized number of takes of North Atlantic right whales would not exacerbate or compound the effects of the ongoing UME in any way.

As described in the general *Mysticetes* section above, foundation installation is likely to result in the highest amount of annual take and is of greatest concern given loud source levels. This activity would likely be limited to up to 113 days over a maximum of 3 years, during times when, based on the best available scientific data, North Atlantic right whales are less frequently encountered and are likely to be primarily migrating. The potential types, severity, and magnitude of impacts are also anticipated to mirror that described in the general *Mysticetes* section above, including avoidance (the most likely outcome), changes in foraging or vocalization behavior, masking, a small amount of TTS, and temporary physiological impacts (*e.g.,* change in respiration, change in heart rate). Importantly, the effects of the activities proposed by Park City Wind are expected to be sufficiently low-level and localized to specific areas as to not meaningfully impact important behaviors such as migratory behavior of North Atlantic right whales. These takes are expected to result in temporary behavioral reactions, such as slight displacement (but not abandonment) of migratory habitat or temporary cessation of feeding. Further, given these exposures are generally expected to occur to different individual right whales migrating through (*i.e.,* many individuals would not be impacted on more than one day in a year), with some subset potentially being exposed on no more than a few days within the year, they are unlikely to result in energetic consequences that could affect reproduction or survival of any individuals.

Overall, NMFS expects that any harassment of North Atlantic right whales incidental to the specified activities would not result in changes to their migration patterns or foraging success, as only temporary avoidance of an area during construction is expected to occur. As described previously, North Atlantic right whales migrating through and/or foraging in these areas are not expected to remain in this habitat for extensive durations, relative to habitats to nearby or to the north such as Nantucket and Martha's Vineyard or the Great South Channel (known core foraging habitats) (Quintana-Rizzo *et al.,* 2021), and any temporarily displaced animals would be able to return to or continue to travel through and forage in these areas once activities have ceased.

Although acoustic masking may occur in the vicinity of the foundation installation activities, based on the acoustic characteristics of noise associated with pile driving (*e.g.,* frequency spectra, short duration of exposure) and construction surveys (*e.g.,* intermittent signals), NMFS expects masking effects to be minimal (*e.g.,* impact or vibratory pile driving) to none (*e.g.,* HRG surveys). In addition, masking would likely only occur during the period of time that a North Atlantic right whale is in the relatively close vicinity of pile driving, which is expected to be intermittent within a day, and confined to the months in which North Atlantic right whales are at lower densities and primarily moving through the area, anticipated mitigation effectiveness, and likely avoidance behaviors. TTS is another potential form of Level B harassment that could result in brief periods of slightly reduced hearing sensitivity affecting behavioral patterns by making it more difficult to hear or interpret acoustic cues within the frequency range (and slightly above) of sound produced during impact pile driving; however, any TTS would likely be of low amount, limited duration, and limited to frequencies where most construction noise is centered (below 2 kHz). NMFS expects that right whale hearing sensitivity would return to pre-exposure levels shortly after migrating through the area or moving away from the sound source.

As described in the Potential Effects to Marine Mammals and Their Habitat section, the distance of the receiver to the source influences the severity of response with greater distances typically eliciting less severe responses. NMFS recognizes North Atlantic right whales migrating could be pregnant females (in the fall) and cows with older calves (in spring) and that these animals may slightly alter their migration course in response to any foundation pile driving; however, as described in the Potential Effects to Marine Mammals and Their Habitat section, we anticipate that course diversion would be of small magnitude. Hence, while some avoidance of the pile driving activities may occur, we anticipate any avoidance behavior of migratory North Atlantic right whales would be similar to that of gray whales (Tyack *et al.,* 1983), on the order of hundreds of meters up to 1 to 2 km. This diversion from a migratory path otherwise uninterrupted by the Project's activities is not expected to result in meaningful energetic costs that would impact annual rates of recruitment of survival. NMFS expects that North Atlantic right whales would be able to avoid areas during periods of active noise production while not being forced out of this portion of their habitat.

North Atlantic right whale presence in the project area is year-round. However, abundance during summer months is lower compared to the winter months with spring and fall serving as ''shoulder seasons'' wherein abundance waxes (fall) or wanes (spring). Given this year-round habitat usage, in recognition that where and when whales may actually occur during project activities is unknown as it depends on the annual migratory behaviors, Park City Wind has proposed and NMFS is proposing to require a suite of mitigation measures designed to reduce impacts to North Atlantic right whales to the maximum extent practicable. These mitigation measures (*e.g.,* seasonal/daily work restrictions, vessel separation distances, reduced vessel speed) would not only avoid the likelihood of ship strikes but also would minimize the severity of behavioral disruptions by minimizing impacts (*e.g.,* through sound reduction using attenuation systems and reduced temporal overlap of project activities and North Atlantic right whales). This would further ensure that the number of takes by Level B harassment that are estimated to occur are not expected to affect reproductive success or survivorship by detrimental impacts to energy intake or cow/calf interactions during migratory transit. However, even in consideration of recent habitat-use and distribution shifts, Park City Wind would still be installing foundations when the presence of North Atlantic right whales is expected to be lower.

As described in the Description of Marine Mammals in the Area of Specified Activities section, Park City Wind would be constructed within the North Atlantic right whale migratory corridor BIA, which represent areas and months within which a substantial portion of a species or population is known to migrate. The Project lease area is relatively small compared with the migratory BIA area (approximately 411 km^2 for OCS–A 0534 and 262 km^2 in OCS–A 0501 versus the size of the full North Atlantic right whale migratory BIA, 269,448 km^2). Because of this, overall North Atlantic right whale migration is not expected to be impacted by the proposed activities. There are no known North Atlantic right whale mating or calving areas within the project area. Prey species are mobile (*e.g.,* calanoid copepods can initiate rapid and directed escape responses) and are broadly distributed throughout the project area (noting again that North Atlantic right whale prey is not particularly concentrated in the project area relative to nearby habitats). Therefore, any impacts to prey that may occur are also unlikely to impact marine mammals.

The most significant measure to minimize impacts to individual North Atlantic right whales is the seasonal moratorium on all foundation installation activities from January 1 through April 30 (with no impact pile driving or drilling scheduled in December and no vibratory pile driving in May and December) when North Atlantic right whale abundance in the project area is expected to be highest. NMFS also expects this measure to greatly reduce the potential for mother-calf pairs to be exposed to impact pile driving noise above the Level B harassment threshold during their annual spring migration through the project area from calving grounds to primary foraging grounds (*e.g.,* Cape Cod Bay). UXO/MEC detonations would also be restricted from December through May. Further, NMFS expects that exposures to North Atlantic right whales would be reduced due to the additional proposed mitigation measures that would ensure that any exposures above the Level B harassment threshold would result in only short-term effects to individuals exposed.

Pile driving, drilling, and UXO/MEC detonations may only begin in the absence of North Atlantic right whales (based on visual and passive acoustic monitoring). If pile driving, drilling, or UXO/MEC detonations have commenced, NMFS anticipates North Atlantic right whales would avoid the area, utilizing nearby waters to carry on pre-exposure behaviors. However, foundation installation activities must be shut down if a North Atlantic right whale is sighted at any distance unless a shutdown is not feasible due to risk of injury or loss of life. Shutdown may occur anywhere if North Atlantic right whales are seen within or beyond the Level B harassment zone, further minimizing the duration and intensity of exposure. NMFS anticipates that if North Atlantic right whales go undetected and they are exposed to foundation installation or UXO/MEC detonation noise, it is unlikely a North Atlantic right whale would approach the sound source locations to the degree that they would purposely expose themselves to very high noise levels. These measures are designed to avoid PTS and also reduce the severity of Level B harassment, including the potential for TTS. While some TTS could occur, given the proposed mitigation measures (*e.g.,* delay pile driving upon a sighting or acoustic detection and shutting down upon a sighting or acoustic detection), the potential for TTS to occur is low.

The proposed clearance and shutdown measures are most effective when detection efficiency is maximized, as the measures are triggered by a sighting or acoustic detection. To maximize detection efficiency, Park City

Wind proposed, and NMFS is proposing to require, the combination of PAM and visual observers. Park City Wind proposed, and NMFS is proposing to require, communication protocols with other Project vessels, and other heightened awareness efforts (*e.g.,* daily monitoring of North Atlantic right whale sighting databases) such that as a North Atlantic right whale approaches the source (and thereby could be exposed to higher noise energy levels), PSO detection efficacy would increase, the whale would be detected, and a delay to commencing foundation installation or shutdown (if feasible) would occur. In addition, the implementation of a soft-start for impact pile driving would provide an opportunity for whales to move away from the source if they are undetected, reducing received levels. The UXO/MEC detonations mitigation measures described above would further reduce the potential to be exposed to high received levels.

For HRG surveys, the maximum distance to the Level B harassment threshold is 178 m. The estimated take, by Level B harassment only, associated with HRG surveys is to account for any North Atlantic right whale sightings PSOs may miss when HRG acoustic sources are active. However, because of the short maximum distance to the Level B harassment threshold, the requirement that vessels maintain a distance of 500 m from any North Atlantic right whales, the fact whales are unlikely to remain in close proximity to an HRG survey vessel for any length of time, and that the acoustic source would be shutdown if a North Atlantic right whale is observed within 500 m of the source, any exposure to noise levels above the harassment threshold (if any) would be very brief. To further minimize exposures, ramp-up of sub-bottom profilers must be delayed during the clearance period if PSOs detect a North Atlantic right whale (or any other ESA-listed species) within 500 m of the acoustic source. With implementation of the proposed mitigation requirements, take by Level A harassment is unlikely and, therefore, not proposed for authorization. Potential impacts associated with Level B harassment would include low-level, temporary behavioral modifications, most likely in the form of avoidance behavior. Given the high level of precautions taken to minimize both the amount and intensity of Level B harassment on North Atlantic right whales, it is unlikely that the anticipated low-level exposures would lead to reduced reproductive success or survival.

Given the documented habitat use within the area, the majority of the individuals taken would be impacted on only one day in a year, with a small subset potentially impacted on no more than a few days a year and, further, low level impacts are generally expected from any North Atlantic right whale exposure. The magnitude and severity of harassment are not expected to result in impacts on the reproduction or survival of any individuals, let alone have impacts on annual rates of recruitment or survival of this stock.

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, Park City Wind's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take (by Level B harassment only) anticipated and proposed for authorization would have a negligible impact on the North Atlantic right whale.

Blue Whale

The blue whale, including the Western North Atlantic stock, is listed as Endangered under the ESA, and as both Depleted and Strategic under the MMPA. There are no known areas of specific biological importance in or around the project area, nor are there any UMEs. The actual abundance of the stock is likely significantly greater than what is reflected in each SAR because, as noted in the SARs, the most recent population estimates are primarily based on surveys conducted in U.S. waters and the stock's range extends well beyond the U.S. EEZ. No serious injury or mortality is anticipated or proposed for authorization for this species.

The rule would allow for the authorization of up to 6 takes, by harassment only, over the five-year period. The maximum annual allowable take by Level A harassment and Level B harassment, would be 1 and 2, respectively (combined, this annual take (n=3) equates to approximately 0.7 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HR surveys would be occurring). Based on the migratory nature of blue whales and the fact that there are neither feeding nor reproductive areas documented in or near the project area, and in consideration of the very low number of predicted annual takes, it is unlikely that the predicted instances of takes would represent repeat takes of any individual—in other words, each take likely represents one whale exposed on one day within a year.

With respect to the severity of those individual takes by behavioral Level B harassment, we would anticipate impacts to be limited to low-level, temporary behavioral responses with avoidance and potential masking impacts in the vicinity of the turbine installation to be the most likely type of response. Any potential PTS or TTS would be concentrated at half or one octave above the frequency band of pile driving noise (most sound is below 2 kHz) which does not include the full predicted hearing range of sei whales. Any hearing ability temporarily impaired from TTS is anticipated to return to pre-exposure conditions shortly after the exposures cease (*e.g.,* if the animal moves away or the source stops). Any avoidance of the project area due to the Project's activities would be expected to be temporary.

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, Park City Wind's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take (by harassment only) anticipated and proposed for authorization would have a negligible impact on the Western North Atlantic stock of blue whales.

Fin Whales

The fin whale, including the Western North Atlantic stock, is listed as Endangered under the ESA, and as both Depleted and Strategic under the MMPA. No UME has been designated for this species or stock. No serious injury or mortality is anticipated or proposed for authorization for this species.

The rule would allow for the authorization of up to 1,293 takes, by harassment only, over the five-year period. The maximum annual allowable take by Level A harassment and Level B harassment, would be 20 and 575, respectively (combined, this annual take (n=595) equates to approximately 8.7 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HR surveys would be occurring).

Given the project overlaps a small portion of a fin whale feeding BIA active in the months of the project, and the New England is generally considered a feeding area, it is likely that some subset of the individual whales exposed could be taken several times annually.

Level B harassment is expected to be in the form of behavioral disturbance, primarily resulting in avoidance of the project area where foundation installation is occurring, and some low-level TTS and masking that may limit the detection of acoustic cues for relatively brief periods of time. Any potential PTS would be minor (limited to a few dB) and any TTS would be of short duration and concentrated at half or one octave above the frequency band of pile driving noise (most sound is below 2 kHz) which does not include the full predicted hearing range of fin whales.

As described previously, the project area slightly overlaps a small fin whale feeding BIA that is active from March to October. Foundation installations and UXO/MEC detonations have seasonal work restrictions such that the temporal overlap between these project activities and the active BIA timeframe would exclude the months of March or April. We anticipate that if foraging is occurring in the project area and foraging whales are exposed to noise levels of sufficient strength, they could temporarily cease foraging and move elsewhere.

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, Park City Wind's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take (by harassment only) anticipated and proposed for authorization would have a negligible impact on the Western North Atlantic stock of fin whales.

Humpback Whales

Humpback whales potentially impacted by the Project's activities do not belong to a DPS that is listed as threatened or endangered under the ESA, but are designated as Strategic under the MMPA. However, humpback whales along the Atlantic Coast have been experiencing an active UME as elevated humpback whale mortalities have occurred along the Atlantic coast from Maine through Florida since January 2016. Of the cases examined, approximately 40 percent had evidence of human interaction (ship strike or entanglement). The UME does not yet provide cause for concern regarding population-level impacts, and take from ship strike and entanglement is not proposed to be authorized. Despite the UME, the relevant population of humpback whales (the West Indies breeding population, or DPS of which the Gulf of Maine stock is a part) remains stable at approximately 12,000 individuals.

The rule would allow for the authorization of up to 790 takes, by harassment only, over the five-year period. The maximum annual allowable take by Level A harassment and Level B harassment, would be 16 and 330, respectively (combined, this annual take (n=346) equates to approximately 24.8 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HR surveys would be occurring). Given that feeding is considered the principal activity of humpback whales in New England waters, it is likely that some subset of the individual whales exposed could be taken several times annually.

Among the activities analyzed, impact pile driving is likely to result in the highest amount of Level A harassment annual take of humpback whales (16 takes by Level A harassment for construction schedule B; 3 annual takes by Level A harassment for UXO/MEC detonations). The maximum amount of annual take proposed to be authorized, by Level B harassment, is highest for vibratory pile driving under construction schedule B (295).

Humpback whales, similar to other baleen whales, use southern New England waters for foraging. Foraging animals tend to remain in the area for extended durations to capitalize on the food sources. For example, Brown *et al.* (2022) examined humpback whale occurrence in the New York Bight area, which is located south of the project area but provides similar foraging grounds, and demonstrated that humpback whales exhibit extended occupancy (mean 37.6 days) in the Bight area and were likely to return from one year to the next (mean 31.3 percent). Whales were also seen at a variety of other sites in the New York Bight within the same year, suggesting that they may occupy this broader area throughout the feeding season. Assuming humpback whales who are foraging in southern New England waters within the project area behave similarly, we expect that the maximum annual instances of predicted take by Level A harassment and Level B harassment, respectively, would consist of individuals exposed on multiple days if they are utilizing the area as foraging habitat. Also similar to other baleen whales, if migrating, we expect that individuals exposed to noise levels from the Project above the harassment thresholds once during migration through the project area.

For all the reasons described in the *Mysticetes* section above, we anticipate any potential PTS and TTS would be concentrated at half or one octave above the frequency band of pile driving noise (most sound is below 2 kHz) which does not include the full predicted hearing range of baleen whales. If TTS is incurred, hearing sensitivity would likely return to pre-exposure levels shortly after exposure ends. Any masking or physiological responses would also be of low magnitude and severity for reasons described above.

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, Park City Wind's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take (by harassment only) anticipated and proposed for authorization would have a negligible impact on the Gulf of Maine stock of humpback whales.

Minke Whales

The minke whale, including the Canadian East Coast stock, is not listed under the ESA, nor as Depleted under the MMPA. There are no known areas of specific biological importance in or adjacent to the project area, and no UME has been designated for this species or stock. No serious injury or mortality is anticipated or proposed for authorization for this species.

The rule would allow for the authorization of up to 2,612 takes, by harassment only, over the five-year period. The maximum annual allowable take by Level A harassment and Level B harassment, would be 85 and 1,042, respectively (combined, this annual take (n=1,127) equates to approximately 5.1 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HR surveys would be occurring). Because minke whales are migratory and their known feeding areas are east and north of the project area, they would be more likely to be moving through (with each take representing a separate individual), though it is possible that some subset of the individual whales exposed could be taken up to a few times annually.

There is a feeding BIA from March through November to the north and east of the project area (Southwestern Gulf of Maine and George's Bank, 54,341 km^2). The BIA does not overlap with the project area. 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. Full or partial necropsy examinations were conducted on more than 60 percent of the whales. Preliminary findings in several of the whales have shown evidence of human interactions or infectious diseases. This event does not provide cause for concern regarding population level impacts, as the likely population abundance is greater than 21,000 whales.

We anticipate the impacts of this harassment to follow those described in the general *Mysticetes* section above.

Any potential PTS would be minor (limited to a few dB) and any TTS would be of short duration and concentrated at half or one octave above the frequency band of pile driving noise (most sound is below 2 kHz) which does not include the full predicted hearing range of minke whales. Level B harassment would be temporary, with primary impacts being temporary displacement of the project area but not abandonment of any migratory or foraging behavior. For these reasons, we have preliminarily determined, in consideration of all of the effects of the Project's activities combined, that the proposed authorized take would have a negligible impact on the Canadian East Coast stock of minke whales.

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, Park City Wind's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take (by harassment only) anticipated and proposed for authorization would have a negligible impact on the Canadian Eastern Coastal stock of minke whales.

Sei Whales

The sei whale, including the Nova Scotia stock, is listed as Endangered under the ESA, and as both Depleted and Strategic under the MMPA. There are no known areas of specific biological importance in or adjacent to the project area, nor has a UME been designated for this species or stock. No serious injury or mortality is anticipated or proposed for authorization for this species.

The rule would allow for the authorization of up to 146 takes, by harassment only, over the five-year period. The maximum annual allowable take by Level A harassment and Level B harassment, would be 2 and 53, respectively (combined, this annual take (n=55) equates to approximately 0.9 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HR surveys would be occurring). Because sei whales are migratory and their known feeding areas are east and north of the project area, they would be more likely to be moving through (with each take representing a separate individual), though it is possible that some subset of the individual whales exposed could be taken up to a few times annually.

There is a feeding BIA (Gulf of Maine, 56,609 km^2) to the far east and to the north of the project area from May-November, the project area does not overlap with the BIA. There are no UMEs. The actual abundance of this stock is likely significantly greater than what is reflected in each SAR because, as noted in the SARs, the most recent population estimate is primarily based on surveys conducted in U.S. waters and the stock's range extends well beyond the U.S. Exclusive Economic Zone (EEZ).

To a small degree, sei whales may forage in the project area, although the currently identified foraging habitats (BIAs) are significantly further away from the project area by a few hundred kilometers (LaBrecque *et al.,* 2015). With respect to the severity of those individual takes by behavioral Level B harassment, we would anticipate impacts to be limited to low-level, temporary behavioral responses with avoidance and potential masking impacts in the vicinity of the turbine installation to be the most likely type of response. Any potential PTS and TTS would likely be concentrated at half or one octave above the frequency band of pile driving noise (most sound is below 2 kHz) which does not include the full predicted hearing range of sei whales. Moreover, any TTS would be temporary. Any avoidance of the project area due to the Project's activities would be expected to be temporary.

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, Park City Wind's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take (by harassment only) anticipated and proposed for authorization would have a negligible impact on the Nova Scotia stock of sei whales.

Odontocetes

In this section, we include information here that applies to all of the odontocete species and stocks addressed below. Odontocetes include dolphins, porpoises, and all other whales possessing teeth and we further divide them into the following subsections: sperm whales, small whales and dolphins, and harbor porpoise. These sub-sections include more specific information, as well as conclusions for each stock represented.

All of the takes of odontocetes proposed for authorization incidental to the Project's specified activities are by pile driving, drilling, UXO/MEC detonations, and HRG surveys. No serious injury or mortality is anticipated or proposed. We anticipate that, given ranges of individuals (*i.e.,* that some individuals remain within a small area for some period of time), and non-migratory nature of some odontocetes in general (especially as compared to mysticetes), these takes are more likely to represent multiple exposures of a smaller number of individuals than is the case for mysticetes, though some takes may also represent one-time exposures to an individual.

Foundation installation is likely to disturb odontocetes to the greatest extent, compared to UXO/MEC detonations and HRG surveys. While we do expect animals to avoid the area during foundation installation and UXO/MEC detonations, their habitat range is extensive compared to the area ensonified during these activities. In addition, as described above, UXO/MEC detonations are instantaneous; therefore, any disturbance would be very limited in time.

As described earlier, Level B harassment may include direct disruptions in behavioral patterns (*e.g.,* avoidance, changes in vocalizations (from masking) or foraging), as well as those associated with stress responses or TTS. Odontocetes are highly mobile species and, similar to mysticetes, NMFS expects any avoidance behavior to be limited to the area near the sound source. While masking could occur during foundation installation, it would only occur in the vicinity of and during the duration of the activity, and would not generally occur in a frequency range that overlaps most odontocete communication or any echolocation signals. The mitigation measures (*e.g.,* use of sound attenuation systems, implementation of clearance and shutdown zones) would also minimize received levels such that the severity of any behavioral response would be expected to be less than exposure to unmitigated noise exposure.

Any masking or TTS effects are anticipated to be of low-severity. First, the frequency range of pile driving, the most impactful activity conducted by Park City Wind in terms of response severity, falls within a portion of the frequency range of most odontocete vocalizations. However, odontocete vocalizations span a much wider range than the low frequency construction activities proposed for the Project. As described above, recent studies suggest odontocetes have a mechanism to self-mitigate (*i.e.,* reduce hearing sensitivity) the impacts of noise exposure, which could potentially reduce TTS impacts. Any masking or TTS is anticipated to be limited and would typically only interfere with communication within a portion of an odontocete's range and as discussed earlier, the effects would only be expected to be of a short duration and, for TTS, a relatively small degree.

Furthermore, odontocete echolocation occurs predominantly at frequencies significantly higher than low frequency construction activities. Therefore, there is little likelihood that threshold shift would interfere with feeding behaviors. For HRG surveys, the sources operate at higher frequencies than foundation installation activities and UXO/MEC detonations. However, sounds from these sources attenuate very quickly in the water column, as described above. Therefore, any potential for PTS and TTS and masking is very limited. Further, odontocetes (*e.g.,* common dolphins, spotted dolphins, bottlenose dolphins) have demonstrated an affinity to bow-ride actively surveying HRG surveys. Therefore, the severity of any harassment, if it does occur, is anticipated to be minimal based on the lack of avoidance previously demonstrated by these species.

The waters off the coast of Massachusetts are used by several odontocete species. However, none except the sperm whale are listed under the ESA and there are no known habitats of particular importance. In general, odontocete habitat ranges are far-reaching along the Atlantic coast of the U.S., and the waters off of New York, including the project area, do not contain any particularly unique odontocete habitat features.

Sperm Whales

The sperm whale, including the North Atlantic stock, is listed as endangered under the ESA, and as both Depleted and Strategic under the MMPA. The North Atlantic stock of sperm whales spans the East Coast out into oceanic waters well beyond the U.S. EEZ. Although listed as endangered, the primary threat faced by the sperm whale across its range (*i.e.,* commercial whaling) has been eliminated. Additionally, sperm whales in the western North Atlantic were little affected by modern whaling (Taylor *et al.,* 2008). Current potential threats to the species globally include vessel strikes, entanglement in fishing gear, anthropogenic noise, exposure to contaminants, climate change, and marine debris. There is no currently reported trend for the stock and, although the species is listed as endangered under the ESA, there are no specific issues with the status of the stock that cause particular concern (*e.g.,* no UMEs). There are no known areas of biological importance (*e.g.,* critical habitat or BIAs) in or near the project area. No mortality or serious injury is anticipated or proposed to be authorized for this species.

The rule would allow for the authorization of up to 297 takes, by harassment only, over the five-year period. The maximum annual allowable take by Level A harassment and Level B harassment, would be 2 and 140, respectively (combined, this annual take (n=142) equates to approximately 3.3 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HR surveys would be occurring). Given sperm whale's preference for deeper waters, especially for feeding, it is unlikely that individuals would remain in the project area for multiple days, and therefore the estimated takes likely represent exposures of different individuals on one day each annually.

If sperm whales do happen to be present in the project area during any activities related to the Project, they would likely be only transient visitors and not engaging in any significant behaviors. Further, the potential for PTS and TSS is low for reasons described in the general Odontocete section but, if it does occur, any hearing shift would be small and, in the case of TTS, would be of a short duration. Because whales are not expected to be foraging in the project area, any TTS is not expected to interfere with foraging behavior.

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, Park City Wind's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take (by harassment only) anticipated and proposed for authorization would have a negligible impact on the North Atlantic stock of sperm whales.

Dolphins and Small Whales (Including Delphinids, Beaked Whales, and Dwarf and Pygmy Sperm Whales)

The twenty-six species and stocks included in this group (which are indicated in Table 5 in the Delphinidae, Ziphiidae, and Kogiidae families) are not listed under the ESA, however, Pantropical spotted dolphins and spinner dolphins are listed as Depleted under the MMPA and Short-finned pilot whales are listed as Strategic under the MMPA. There are no known areas of specific biological importance in or around the project area for any of these species, nor has a UME been designated for any. No serious injury or mortality is anticipated or proposed for authorization for this species.

The eighteen Delphinid species with take proposed for authorization for the Project are Atlantic spotted dolphin, Atlantic white-sided dolphin, bottlenose dolphin, Clymene dolphin, common dolphin, long-finned pilot whale, short-finned pilot whale, Risso's dolphin, false killer whale, Fraser's dolphin, killer whale, melon-headed whale, pantropical spotted dolphin, pygmy killer whale, rough-toothed dolphin, spinner dolphin, striped dolphin, and white-beaked dolphin.

Many of these Delphinid species are rare for the project area and whose preferred habitat is at much deeper water depths or different water temperatures than what are found within the project area. For instance, the Clymene dolphin, false killer whale, Fraser's dolphin, melon-headed whale, pantropical spotted dolphin, pygmy killer whale, rough-toothed dolphin, and spinner dolphin prefer tropical to subtropical waters but have, on occasion, been sighted in deep waters at or beyond the continental shelf break in the New England area during the summer months (Hayes *et al.,* 2019; Hayes *et al.,* 2020). Striped dolphins are found in warm-temperate to tropical waters but prefer continental slope waters offshore to the Gulf Stream, when in the New England area they have only been sighted at water depths deeper than 900 m (Hayes *et al.,* 2020). White-beaked dolphins prefer colder waters and are found more northerly than the project area in the western Gulf of Maine and around Cape Cod (Hayes et. al, 2020). Killer whales, a rarity in the New England area, prefer much deeper and colder waters than those in the New England area (Waring *et al.,* 2015).

For these eighteen Delphinid species, the rule would allow for the authorization of up to between 10 and 86,316 takes (depending on species), by harassment only, over the five-year period. The maximum annual allowable take for these species by Level A harassment and Level B harassment, would range from 0 to 9 and 4 to 41,230, respectively (combined, this annual take (n= 4 to 41,239) equates to approximately <0.1 to 23.9 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HR surveys would be occurring).

For common dolphins, given the higher number of takes relative to the stock abundance, while some of the takes likely represent exposures of different individuals on one day a year, it is likely that some subset of the individuals exposed could be taken several times annually. For Atlantic spotted dolphin, Atlantic white-sided dolphin, Bottlenose dolphin, Long and Short-finned pilot whale, and Risso's dolphin, given the number of takes, while many of the takes likely represent exposures of different individuals on one day a year, some subset of the individuals exposed could be taken up to a few times annually. For the remaining Delphinids, given they are considered rare or uncommon in the area, it is unlikely that individuals would remain in the project area for multiple days, and therefore the estimated takes likely represent exposures of different individuals on one day each annually.

The six *Ziphiidae* species with take proposed for authorization for the Project are Cuvier's beaked whale, Blainville's beaked whale, Gervais' beaked whale, Sowerby's beaked whale, True's beaked whale, and Northern bottlenose whale. The two species of *Kogiidae* with take proposed for authorization for the Project are the dwarf sperm whale and pygmy sperm whale. These species are rare for the project area and prefer habitat at much deeper water depths than what are found within the project area. For instance, the beaked whales and *Kogiidae* species have been sighted in deep waters at or beyond the continental shelf break in the New England area (Hayes *et al.,* 2020). The Northern bottlenose whales are extremely uncommon or rare in waters of the U.S. and are rarely in waters less than 2,000 m deep (Waring *et al.,* 2015).

For these eight species, the rule would allow for the authorization of up to between 6 and 12 takes for each species, by harassment only, over the 5-year period. The maximum annual allowable take for these species by Level A harassment and Level B harassment, would range from 0 to 2 and 2 to 4, respectively (combined, this annual take (n=3 to 4) equates to approximately <0.1 percent of the stock abundance for each species, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HR surveys would be occurring). Given this species is considered rare in the area and prefers deeper waters, especially for feeding, it is unlikely that individuals would remain in the project area for multiple days, and therefore the estimated takes likely represent exposures of different individuals on one day each annually.

The number of takes, likely movement patterns of the affected species, and the intensity of any Level A or B harassments, combined with the availability of alternate nearby foraging habitat suggests that the likely impacts would not impact the reproduction or survival of any individuals. Some species, such as the common dolphin, are gregarious in nature (*i.e.,* travel in large groups) with high densities in the project area, which results in a relatively higher amount of take. While delphinids may be taken on several occasions, none of these species are known to have small home ranges within the project area or known to be particularly sensitive to anthropogenic noise. The potential for PTS in dolphins and small whales is very low and, if PTS does occur, would occur to a limited number of individuals, be of small degree, and would be limited to the frequency ranges of the activity which does not span across most of their hearing range. Some TTS can also occur but, again, it would be limited to the frequency ranges of the activity and any loss of hearing sensitivity is anticipated to return to pre-exposure conditions shortly after the animals move away from the source or the source ceases. Beaked whales are known to be particularly sensitive to anthropogenic noise (*e.g.,* Southall *et al.,* 2017; Clowewiak *et al.,* 2017); however, the project area does not contain primary beaked whale habitat and only 2–3 groups of beaked whales could be harassed by Project activities. Further, beaked whales are deep diver foragers and the shallow-water project area does not contain suitable beaked whale foraging habitat. Hence, no foraging impacts are anticipated.

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, Park City Wind's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take (by harassment only) anticipated and proposed for authorization would have a negligible impact on all of the species and stocks addressed in this section.

Harbor Porpoises

The Gulf of Maine/Bay of Fundy stock of harbor porpoises, which is not listed as Threatened or Endangered under the ESA or as Depleted under the MMPA, is found predominantly in northern U.S. coastal waters (less than 150 m depth) and up into Canada's Bay of Fundy (between New Brunswick and Nova Scotia). Although the population trend is not known, there are no UMEs or other factors that cause particular concern for this stock. No mortality or non-auditory injury are anticipated or proposed for authorization for this stock.

The rule would allow for the authorization of up to 6,549 takes, by harassment only, over the five-year period. The maximum annual allowable take by Level A harassment and Level B harassment, would be 136 and 2,507, respectively (combined, this annual take (n=2,643) equates to approximately 2.8 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HR surveys would be occurring). Given the number of takes, while many of the takes likely represent exposures of different individuals on one day a year, some subset of the individuals exposed could be taken up to a few times annually.

Regarding the severity of takes by behavioral Level B harassment, because harbor porpoises are particularly sensitive to noise, it is likely that a fair number of the responses could be of a moderate nature, particularly to pile driving. In response to pile driving, harbor porpoises are likely to avoid the area during construction, as previously demonstrated in Tougaard *et al.* (2009) in Denmark, in Dahne *et al.* (2013) in Germany, and in Vallejo *et al.* (2017) in the United Kingdom, although a study by Graham *et al.* (2019) may indicate that the avoidance distance could decrease over time. However, foundation installation is scheduled to occur off the coast of Massachusetts and, given alternative foraging areas, any avoidance of the area by individuals is not likely to impact the reproduction or survival of any individuals. Given only 1 UXO/MEC would be detonated on any given day and only up to 10 UXO/MEC could be detonated under the requested LOA, any behavioral response would be brief and of a low severity.

With respect to PTS and TTS, the effects on an individual are likely relatively low given the frequency bands of pile driving (most energy below 2 kHz) compared to harbor porpoise hearing (150 Hz to 160 kHz peaking around 40 kHz). Specifically, TTS is unlikely to impact hearing ability in their more sensitive hearing ranges, or the frequencies in which they communicate and echolocate. We expect any PTS that may occur to be within the very low end of their hearing range where harbor porpoises are not particularly sensitive and any PTS would be of small magnitude. As such, any PTS would not interfere with key foraging or reproductive strategies necessary for reproduction or survival.

While harbor porpoises are likely to avoid the area during any of the Project's construction activities, as demonstrated during European wind farm construction, the time of year in which work would occur is when harbor porpoises are not in highest abundance (May through December), and any work that does occur would not result in the species' abandonment of the waters off of Massachusetts.

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, Park City Wind's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take (by harassment only) anticipated and proposed for authorization would have a negligible impact on the Gulf of Maine/Bay of Fundy stock of harbor porpoises.

Phocids (Harbor Seals, Gray Seals, Harp Seals, and Hooded Seal)

The harbor seal, gray seal, harp seal, and hooded seal are not listed under the ESA, nor designated as depleted under the MMPA. There are no known areas of specific biological importance in or around the project area. A UME been designated for harbor seals and gray seals and is described further below. No serious injury or mortality is anticipated or proposed for authorization for this species.

For the four seal species, the rule would allow for the authorization of up to between 3 and 24,588 takes for each species, by harassment only, over the 5-year period. The maximum annual allowable take for these species by Level A harassment and Level B harassment, would range from 0 to 17 and 1 to 9,835, respectively (combined, this annual take (n=1 to 9,852) equates to approximately <0.1 to 16.1 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HR surveys would be occurring). Though gray seals and harbor seals are considered migratory and no specific feeding areas have been designated in the area, the higher number of takes relative to the stock abundance suggests that while some of the takes likely represent exposures of different individuals on one day a year, it is likely that some subset of the individuals exposed could be taken several times annually. Similarly, while harp seals are considered migratory and no specific feeding areas have been designated in the area, the comparatively higher number of takes suggests that takes while many of the takes likely represent exposures of different individuals on one day a year, some subset of the individuals exposed could be taken up to a few times annually. For hooded seals, given this species is considered rare in the area, it is unlikely that individuals would remain in the project area for multiple days, and therefore the estimated takes likely represent exposures of different individuals on one day each annually.

Harbor, gray, and harp seals occur in Massachusetts waters most often in winter (December through May), when most foundation installation and UXO/MEC detonations would not occur due to seasonal restrictions on conducting these activities).

Seals are also more likely to be close to shore (*e.g.,* closer to the edge of the area ensonified above NMFS' harassment threshold), such that exposure to foundation installation would be expected to be at comparatively lower levels. Take of these species is noise from pile driving, drilling, UXO/MEC detonations, and HRG surveys. As described in the Potential Effects to Marine Mammals and Their Habitat section, construction of wind farms in Europe resulted in pinnipeds temporarily avoiding construction areas but returning within short time frames after construction was complete (Carroll *et al.,* 2010; Hamre *et al.,* 2011; Hastie *et al.,* 2015; Russell *et al.,* 2016; Brasseur *et al.,* 2010). Effects on pinnipeds that are taken by Level B harassment in the project area would likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring). Most likely, individuals would simply move away from the sound source and be temporarily displaced from those areas (Lucke *et al.,* 2006; Edren *et al.,* 2010; Skeate *et al.,* 2012; Russell *et al.,* 2016). Given the low anticipated magnitude of impacts from any given exposure (*e.g.,* temporary avoidance), even repeated Level B harassment across a few days of some small subset of individuals, which could occur, is unlikely to result in impacts on the reproduction or survival of any individuals. Moreover, pinnipeds would benefit from the mitigation measures described in the Proposed Mitigation section.

As described above, noise from UXO/MEC detonation is low frequency and, while any PTS and TTS that does occur would fall within the lower end of pinniped hearing ranges (50 Hz to 86 kHz), PTS and TTS would not occur at frequencies where pinniped hearing is most sensitive. In summary, any PTS and TSS would be of small degree and not occur across the entire, or even most sensitive, hearing range. Hence, any impacts from PTS and TTS are likely to be of low severity and not interfere with behaviors critical to reproduction or survival.

Elevated numbers of harbor seal and gray seal mortalities were first observed in July 2018 and occurred across Maine, New Hampshire, and Massachusetts until 2020. Based on tests conducted so far, the main pathogen found in the seals belonging to that UME was phocine distemper virus, although additional testing to identify other factors that may be involved in this UME are underway. Currently, the only active UME is occurring in Maine with some harbor and gray seals testing positive for highly pathogenic avian influenza (HPAI) H5N1. Although elevated strandings continue, neither UME (alone or in combination) provide cause for concern regarding population-level impacts to any of these stocks. For harbor seals, the population abundance is over 61,000 and annual M/SI (339) is well below PBR (1,729) (Hayes *et al.,* 2020). The population abundance for gray seals in the United States is over 27,000, with an estimated overall abundance, including seals in Canada, of approximately 450,000. In addition, the abundance of gray seals is likely increasing in the U.S. Atlantic, as well as in Canada (Hayes *et al.,* 2020). For harp seals (no recent UME), the total U.S. fishery-related mortality and serious injury for this stock is very low relative to the stock size and can be considered insignificant and approaching zero mortality and serious injury rate (Hayes *et al.,* 2022). The harp seal stock abundance appears to have stabilized (Hayes *et al.,* 2022).

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, Park City Wind's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take (by harassment only) anticipated and proposed for authorization would have a negligible impact on harbor, gray, harp, or hooded seals.

Preliminary Negligible Impact Determination

No mortality or serious injury is anticipated to occur or proposed to be authorized. As described in the preliminary analysis above, the impacts resulting from the Project's activities cannot be reasonably expected to, and are not reasonably likely to, adversely affect any of the species or stocks for which take is proposed for authorization through effects on annual rates of recruitment or survival. Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed mitigation and monitoring measures, NMFS preliminarily finds that the marine mammal take from all of Park City Wind's specified activities combined will have a negligible impact on all affected marine mammal species or stocks.

Small Numbers

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

NMFS proposes to authorize incidental take (by Level A harassment and/or Level B harassment) of 38 species of marine mammal (with 38 managed stocks). The maximum number of instances of takes by combined Level A and Level B harassments possible within any one year and proposed for authorization relative to the best available population abundance is less than one-third for all species and stocks potentially impacted (Table 34). Specific to North Atlantic right whales, NMFS is proposing to authorize an amount of annual take (n=111), which, if one assumes each estimated instance of take represents a different individual, is close to, but does not exceed small numbers. While migratory behavior in the project area suggests that many of the predicted instances of take of North Atlantic right whales would be to different individual whales (and each of those whales would be taken on one day annually), given changing distribution of right whales, and observations of increased residency times in the broader area, some subset of the individual whales exposed could be taken up to a few times annually, further lower the percentage of the population actually taken.

For five species, there are no current abundance estimates available; hence the percentage of the population taken is unknown. However, these constitute rare species and only a small amount of take is proposed for authorization each year. For three of these species, no more than 5 takes per year are proposed for authorization. For the melon-headed whale and Fraser's dolphin, a maximum of 109 and 192 exposures may occur. This represents one average group size; and it is reasonable to assume that 3 or more groups could occur in the North Atlantic (one group is ⅓ of 3 groups). Hence, the amount of take for all rare species with unknown populations can reasonably be considered a small number.

Based on the analysis contained herein of the proposed activities (including the proposed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals would 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 (ESA)

Section 7(a)(2) of the Endangered Species Act of 1973 (ESA; 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 promulgation of rulemakings, NMFS consults internally whenever we propose to authorize take for endangered or threatened species, in this case with the NMFS Greater Atlantic Regional Field Office (GARFO).

NMFS is proposing to authorize the take of five marine mammal species which are listed under the ESA: the North Atlantic right, sei, fin, blue, and sperm whales. The Permit and Conservation Division requested initiation of Section 7 consultation on May 9, 2023, with GARFO for the issuance of this proposed rulemaking. NMFS will conclude the Endangered Species Act consultation prior to reaching a determination regarding the proposed issuance of the authorization. The proposed regulations and any subsequent LOA(s) would be conditioned such that, in addition to measures included in those documents, Park City Wind would also be required to abide by the reasonable and prudent measures and terms and conditions of a Biological Opinion and Incidental Take Statement, issued by NMFS, pursuant to section 7 of the Endangered Species Act.

Proposed Promulgation

As a result of these preliminary determinations, NMFS proposes to promulgate a LOA to Park City Wind authorizing take, by Level A harassment and Level B harassment, incidental to construction activities associated with the New England Wind project offshore of Massachusetts for a 5-year period from March 27, 2025, through March 26, 2030, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Request for Additional Information and Public Comments

NMFS requests interested persons to submit comments, information, and suggestions concerning Park City Wind's request and the proposed regulations (see **ADDRESSES**). All comments will be reviewed and evaluated as we prepare the final rule and make final determinations on whether to issue the requested authorization. This proposed rule and referenced documents provide all environmental information relating to our proposed action for public review.

Recognizing, as a general matter, that this action is one of many current and future wind energy actions, we invite comment on the relative merits of the IHA, single-action rule/LOA, and programmatic multi-action rule/LOA approaches, including potential marine mammal take impacts resulting from this and other related wind energy actions and possible benefits resulting from regulatory certainty and efficiency.

Classification

Pursuant to the procedures established to implement Executive Order 12866, the Office of Management and Budget has determined that this proposed rule is not significant.

Pursuant to section 605(b) of the Regulatory Flexibility Act (RFA), the Chief Counsel for Regulation of the Department of Commerce has certified to the Chief Counsel for Advocacy of the Small Business Administration that this proposed rule, if adopted, would not have a significant economic impact on a substantial number of small entities. Park City Wind is the sole entity that would be subject to the requirements in these proposed regulations, and Park City Wind is not a small governmental jurisdiction, small organization, or small business, as defined by the RFA. Under the RFA, governmental jurisdictions are considered to be small if they are governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than 50,000. Because of this certification, a regulatory flexibility analysis is not required and none has been prepared.

Notwithstanding any other provision of law, no person is required to respond to nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act (PRA) unless that collection of information displays a currently valid Office of Management and Budget (OMB) control number. These requirements have been approved by OMB under control number 0648–0151 and include applications for regulations, subsequent LOA, and reports. Send comments regarding any aspect of this data collection, including suggestions for reducing the burden, to NMFS.

The Coastal Zone Management Act (CZMA) requires Federal actions within and outside the coastal zone that have reasonably foreseeable effects on any coastal use or natural resource of the coastal zone be consistent with the enforceable policies of a State's federally approved coastal management program. 16 U.S.C. 1456(c). Additionally, regulations implementing the CZMA require non-Federal applicants for Federal licenses or permits to submit a consistency certification to the State that declares that the proposed activity complies with the enforceable policies of the State's federally approved coastal management program and will be conducted in a manner consistent with such program.

In June 2020, Park City Wind submitted Federal consistency certifications to the Massachusetts Coastal Zone Management's (MA CZM) and to the Rhode Island Coastal Resources Management Council (CRMC) seeking concurrence that the construction, operations, and decommissioning activities of the proposed Project is consistent with the enforceable policies of each State's federally-approved coastal management program. A revised draft of the consistency certifications dated June 2022 were prepared and submitted to the states and is appended into Park City Wind's Construction and Operation Plan.

NMFS has determined that Park City Wind's application for an authorization to allow the incidental, but not intentional, take of small numbers of marine mammals on the outer continental shelf of the Atlantic Ocean is an unlisted activity and, thus, is not, at this time, subject to Federal consistency requirements in the absence of the receipt and prior approval of an unlisted activity review request from the State by the Director of NOAA's Office for Coastal Management. This determination does not excuse Park City Wind from responsibility to seek concurrence from the State on other Federal permits, approvals, or actions that might be subject to consistency review pursuant to the CZMA.

List of Subjects in 50 CFR Part 217

Administrative practice and procedure, Endangered and threatened species, Fish, Fisheries, Marine mammals, Penalties, Reporting and recordkeeping requirements, Wildlife.

Dated: May 30, 2023.

Samuel D. Rauch, III,

Deputy Assistant Administrator for Regulatory Programs, National Marine Fisheries Service.

Accordingly, NOAA proposes to amend 50 CFR part 217 as follows:

PART 217—REGULATIONS GOVERNING THE TAKING AND IMPORTING OF MARINE MAMMALS

■ 1. The authority citation for part 217 continues to read as follows:

Authority: 16 U.S.C. 1361 *et seq.,* unless otherwise noted.

■ 2. Add subpart GG, consisting of §§ 217.320 through 217.329, to read as follows:

Subpart GG—Taking Marine Mammals Incidental to the New England Wind Project Offshore of Massachusetts

Subpart GG—Taking Marine Mammals Incidental to the New England Wind Project Offshore of Massachusetts

§ 217.320 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to the taking of marine mammals that occurs incidental to activities associated with construction of the New England Wind project (hereafter referred to as the ''Project'') by Park City Wind LLC (hereafter referred to as the ''LOA Holder''), and those persons it authorizes or funds to conduct activities on its behalf in the area outlined in paragraph (b) of this section.

(b) The taking of marine mammals by the LOA Holder may be authorized in a Letter of Authorization (LOA) only if it occurs in the Bureau of Ocean Energy Management (BOEM) Lease Area Outer Continental Shelf (OCS)–A 0534 and portions of OCS–A 0501 Commercial

Lease of Submerged Lands for Renewable Energy Development, along export cable routes, and at the sea-to-shore transition points south of Martha's Vineyard and Barnstable, Massachusetts.

(c) The taking of marine mammals by the LOA Holder is only authorized if it occurs incidental to the following activities associated with the Project: installation of up to 129 wind turbine generator (WTG) and up to 5 electrical service platform (ESP) foundations by impact and vibratory pile driving and drilling, 10 unexploded ordnances or munitions and explosives of concern (UXO/MEC) detonations, and high-resolution geophysical (HRG) site characterization surveys.

§ 217.321 Effective dates.

Regulations in this subpart are effective from March 27, 2025, through March 26, 2030.

§ 217.322 Permissible methods of taking.

Under an LOA, issued pursuant to §§ 216.106 of this chapter and 217.326, the LOA Holder, and those persons it authorizes or funds to conduct activities on its behalf, may incidentally, but not intentionally, take marine mammals within the area described in § 217.320(b) in the following ways, provided the LOA Holder is in complete compliance with all terms, conditions, and requirements of the regulations in this subpart and the appropriate LOA:

(a) By Level B harassment associated with the acoustic disturbance of marine mammals by impact and vibratory pile driving and drilling (foundation installation), UXO/MEC detonations, and HRG site characterization surveys;

(b) By Level A harassment associated with the acoustic disturbance of marine mammals by impact pile driving of WTG and ESP foundations and UXO/MEC detonations;

(c) Take by mortality or serious injury of any marine mammal species is not authorized; and

(d) The incidental take of marine mammals by the activities listed in paragraphs (a) and (b) of this section is limited to the following species:

TABLE 1 TO PARAGRAPH (d)

Marine mammal species	Scientific name	Stock
Atlantic spotted dolphin	*Stenella frontalis*	Western North Atlantic.
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Western North Atlantic.
Blainsville's beaked whale	*Mesoplodon densirostris*	Western North Atlantic.
Blue whale	*Balaenoptera musculus*	Western North Atlantic.
Bottlenose dolphin	*Tursiops truncatus*	Western North Atlantic, offshore.
Clymene dolphin	*Stenella clymene*	Western North Atlantic.
Cuvier's beaked whale	*Ziphius cavirostris*	Western North Atlantic.
Dwarf sperm whale	*Kogia sima*	Western North Atlantic.
False killer whale	*Pseudorca crassidens*	Western North Atlantic.
Fin whale	*Balaenoptera physalus*	Western North Atlantic.
Fraser's dolphin	*Lagenodelphis hosei*	Western North Atlantic.
Gervais' beaked whale	*Mesoplodon europaeus*	Western North Atlantic.
Gray seal	*Halichoerus grypus*	Western North Atlantic.
Harbor porpoise	*Phocoena phocoena*	Gulf of Maine/Bay of Fundy.
Harbor seal	*Phoca vitulina*	Western North Atlantic.
Harp seal	*Pagophilus groenlandicus*	Western North Atlantic.
Hooded seal	*Cystophora cristata*	Western North Atlantic.
Humpback whale	*Megaptera novaeangliae*	Gulf of Maine.
Killer whale	*Orcinus orca*	Western North Atlantic.
Long-finned pilot whale	*Globicephala melas*	Western North Atlantic.
Melon-headed whale	*Peponocephala electra*	Western North Atlantic.
Minke whale	*Balaenoptera acutorostrata*	Canadian Eastern Coastal.
North Atlantic right whale	*Eubalaena glacialis*	Western North Atlantic.
Northern bottlenose whale	*Hyperoodon ampullatus*	Western North Atlantic.
Pantropical spotted dolphin	*Stenella attenuata*	Western North Atlantic.
Pygmy killer whale	*Feresa attenuata*	Western North Atlantic.
Pygmy sperm whale	*Kogia breviceps*	Western North Atlantic.
Risso's dolphin	*Grampus griseus*	Western North Atlantic.
Rough-toothed dolphin	*Steno bredanensis*	Western North Atlantic.
Sei whale	*Balaenoptera borealis*	Nova Scotia.
Short-beaked common dolphin	*Delphinus delphis*	Western North Atlantic.
Short-finned pilot whale	*Globicephala macrorhynchus*	Western North Atlantic.
Sowerby's beaked whale	*Mesoplodon bidens*	Western North Atlantic.
Sperm whale	*Physeter macrocephalus*	North Atlantic.
Spinner dolphin	*Stenella longirostris*	Western North Atlantic.
Striped dolphin	*Stenella coeruleoalba*	Western North Atlantic.
True's beaked whale	*Mesoplodon mirus*	Western North Atlantic.
White-beaked dolphin	*Lagenorhynchus albirostris*	Western North Atlantic.

§ 217.323 Prohibitions.

Except for the takings described in § 217.322 and authorized by an LOA issued under § 217.326 or § 217.327, it is unlawful for any person to do any of the following in connection with the activities described in this subpart:

(a) Violate, or fail to comply with, the terms, conditions, and requirements of this subpart or an LOA issued under §§ 217.326 and 217.327;

(b) Take any marine mammal not specified in § 217.322(d);

(c) Take any marine mammal specified in the LOA in any manner other than as specified in the LOA; or

(d) Take any marine mammal specified in § 217.322(d), after NMFS Office of Protected Resources determines such taking results in more than a negligible impact on the species or stocks of such marine mammals.

§ 217.324 Mitigation requirements.

When conducting the activities identified in §§ 217.320 and 217.322, the LOA Holder must implement the mitigation measures contained in this section and any LOA issued under §§ 217.326 and 217.327. These mitigation measures include, but are not limited to:

(a) *General conditions.* The following measures apply to the Project:

(1) A copy of any issued LOA must be in the possession of the LOA Holder and its designees, all vessel operators, visual protected species observers (PSOs), passive acoustic monitoring (PAM) operators, pile driver operators, and any other relevant designees operating under the authority of the issued LOA;

(2) The LOA Holder must conduct briefings between construction supervisors, construction crews, and the PSO and PAM team prior to the start of all in-water construction activities and when new personnel join the work, in order to explain responsibilities, communication procedures, marine mammal monitoring and reporting protocols, and operational procedures. A simple guide must be included with the Marine Mammal Monitoring Plan to aid personnel in identifying species if they are observed in the vicinity of the project area;

(3) Prior to and when conducting any in-water activities and vessel operations, the LOA Holder personnel and contractors (*e.g.,* vessel operators, PSOs) must use available sources of information on North Atlantic right whale presence in or near the project area including daily monitoring of the Right Whale Sightings Advisory System, and monitoring of Coast Guard VHF Channel 16 throughout the day to receive notification of any sightings and/or information associated with any Slow Zones (*i.e.,* Dynamic Management Areas (DMAs) and/or acoustically-triggered slow zones) to provide situational awareness for both vessel operators, PSO(s), and PAM operators;

(4) The LOA Holder must ensure that any visual observations of an Endangered Species Act (ESA)-listed marine mammal are communicated to on-duty PSOs, PAM operator(s), and vessel captains during the concurrent use of multiple project-associated vessels (of any size; *e.g.,* construction surveys, crew/supply transfers, *etc.*);

(5) The LOA Holder must establish and implement clearance and shutdown zones as described in the LOA;

(6) The LOA Holder must instruct all vessel personnel regarding the authority of the PSO(s). Any disagreement between the Lead PSO and the vessel operator would only be discussed after shutdown has occurred;

(7) If an individual from a species for which authorization has not been granted, or a species for which authorization has been granted but the authorized take number has been met, is observed entering or within the relevant Level B harassment zone for a specified activity, pile driving (*e.g.,* impact and vibratory), drilling, and HRG acoustic sources must shut down immediately, unless shutdown would result in imminent risk of injury or loss of life to an individual, pile refusal, or pile instability, or be delayed if the activity has not commenced. Pile driving, drilling, UXO/MEC detonations, and initiation of HRG acoustic sources must not commence or resume until the animal(s) has been confirmed to have left the Level B harassment zone or the observation time has elapsed with no further sightings;

(8) Foundation Installation (*i.e.,* impact and vibratory pile driving, drilling), UXO/MEC detonation, and HRG survey activities shall only commence when visual clearance zones are fully visible (*e.g.,* not obscured by darkness, rain, fog, *etc.*) and clear of marine mammals, as determined by the Lead PSO, for at least 30 minutes immediately prior to initiation of equipment (*i.e.,* vibratory and impact pile driving, drilling, UXO/MEC detonations, and HRG surveys that use boomers, sparkers, and Compressed High-Intensity Radiated Pulses (CHIRPs));

(9) In the event that a large whale is sighted or acoustically detected that cannot be confirmed as a non-North Atlantic right whale, it must be treated as if it were a North Atlantic right whale;

(10) For in-water construction heavy machinery activities other than foundation installation, if a marine mammal is on a path towards or comes within 10 meters (m) of equipment, the LOA Holder must cease operations until the marine mammal has moved more than 10 m on a path away from the activity to avoid direct interaction with equipment;

(11) All vessels must be equipped with a properly installed, operational Automatic Identification System (AIS) device and the LOA Holder must report all Maritime Mobile Service Identify (MMSI) numbers to NMFS Office of Protected Resources prior to initiating in-water activities; and

(12) Confirmation of all required training must be documented on a training course log sheet and reported to NMFS Office of Protected Resources.

(b) *Vessel strike avoidance measures.* The following measures apply to all vessels associated with the Project:

(1) Prior to the start of the Project's activities involving vessels, all vessel operators and crew must receive a protected species identification training that covers, at a minimum:

(i) Identification of marine mammals and other protected species known to occur or which have the potential to occur in the LOA Holder's project area;

(ii) Training on making observations in both good weather conditions (*i.e.,* clear visibility, low winds, low sea states) and bad weather conditions (*i.e.,* fog, high winds, high sea states, with glare);

(iii) Training on information and resources available to the project personnel regarding the applicability of Federal laws and regulations for protected species; and

(iv) Training related to vessel strike avoidance measures must be conducted for all vessel operators and crew prior to the start of in-water construction activities.

(2) All vessel operators and crews, regardless of their vessel's size, must maintain a vigilant watch for all marine mammals and slow down, stop their vessel, or alter course, as appropriate, to avoid striking any marine mammal;

(3) All transiting vessels operating at any speed must have a dedicated visual observer on duty at all times to monitor for marine mammals within a 180 degree direction of the forward path of the vessel (90 degrees port to 90 degree starboards) located at the best vantage point for ensuring vessels are maintaining appropriate separation distances from marine mammals. Visual observers must be equipped with binoculars and alternative monitoring technology for periods of low visibility (*e.g.,* darkness, rain, fog, *etc.*). The dedicated visual observer must receive prior training on protected species detection and identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. Visual observers may be NMFS-approved PSOs or crew members. Observer training related to these vessel strike avoidance measures must be conducted for all vessel operators and crew prior to the start of vessel use;

(4) Year-round and when a vessel is in transit, all vessel operators must continuously monitor U.S. Coast Guard VHF Channel 16, over which North Atlantic right whale sightings are broadcasted. At the onset of transiting

and at least once every 4 hours, vessel operators and/or trained crew members must monitor the project's Situational Awareness System, WhaleAlert, and the Right Whale Sighting Advisory System (RWSAS) for the presence of North Atlantic right whales. Any observations of any large whale by any of the LOA Holder's staff or contractors, including vessel crew, must be communicated immediately to PSOs, PAM operator, and all vessel captains to increase situational awareness. Conversely, any large whale observation or detection via a sighting network (*e.g.,* Mysticetus) by PSOs or PAM operators must be conveyed to vessel operators and crew;

(5) Any observations of any large whale by any LOA Holder staff or contractor, including vessel crew, must be communicated immediately to on-duty PSOs, PAM operators, and all vessel captains to increase situational awareness;

(6) Nothing in this subpart exempts vessels from applicable speed regulations at 50 CFR 224.105;

(7) All vessels must transit active Slow Zones (*i.e.,* Dynamic Management Areas (DMAs) or acoustically-triggered slow zone), and Seasonal Management Areas (SMAs) at 10 knots or less;

(8) All vessels, regardless of vessel size, must immediately reduce speed to 10 knots or less when any large whale, mother/calf pairs, or large assemblages of non-delphinid cetaceans are observed (within 500 m) of an underway vessel;

(9) All vessels, regardless of size, must immediately reduce speed to 10 knots or less when a North Atlantic right whale is sighted, at any distance, by anyone on the vessel;

(10) All vessels must comply with North Atlantic right whale approach restrictions at 50 CFR 224.103(c).

(11) All vessels must maintain a minimum separation distance of 100 m from sperm whales and baleen whales other than North Atlantic right whales. If one of these species is sighted within 100 m of a transiting vessel, that vessel must shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 100 m;

(12) All vessels must maintain a minimum separation distance of 50 m from all delphinoid cetaceans and pinnipeds with an exception made for those that approach the vessel (*i.e.,* bow-riding dolphins). If a delphinid cetacean or pinniped is sighted within 50 m of a transiting vessel, that vessel must shift the engine to neutral, with an exception made for those that approach the vessel (*e.g.,* bow-riding dolphins). Engines must not be engaged until the animal(s) has moved outside of the vessel's path and beyond 50 m;

(13) When a marine mammal(s) is sighted while a vessel is transiting, the vessel must take action as necessary to avoid violating the relevant separation distances (*e.g.,* attempt to remain parallel to the animal's course, avoid excessive speed or abrupt changes in direction until the animal has left the area). If a marine mammal(s) is sighted within the relevant separation distance, the vessel must shift the engine to neutral and not engage the engine(s) until the animal(s) is outside and on a path away from the separation area. This does not apply to any vessel towing gear or any situation where respecting the relevant separation distance would be unsafe (*i.e.,* any situation where the vessel is navigationally constrained);

(14) All vessels underway must not divert or alter course to approach any marine mammal. If a separation distance is triggered, any vessel underway must avoid abrupt changes in course direction and transit at 10 knots or less until the animal is outside the relevant separation distance; and

(15) The LOA Holder must submit a North Atlantic right whale Vessel Strike Avoidance Plan 180 days prior to the commencement of vessel use. This plan must describe, at a minimum, how PAM, in combination with visual observations, would be conducted to ensure the transit corridor is clear of right whales and would also provide details on the vessel-based observer.

(c) *WTG and ESP foundation installation.* The following requirements apply to impact and vibratory pile driving and drilling activities associated with the installation of WTG and ESP foundations:

(1) Impact pile driving, vibratory pile driving, and drilling (*i.e.,* foundation installation) must not occur January 1 through April 30; Vibratory pile driving must not occur in May and December. Impact pile driving and drilling must not be planned in December; however, it may occur in the case of unforeseen circumstances and with approval by NMFS;

(2) Monopiles must be no larger than 13-m in diameter. Pin piles must be no larger than 4 m in diameter. During all monopile and pin pile installation, the minimum amount of hammer energy necessary to effectively and safely install and maintain the integrity of the piles must be used. Hammer energies must not exceed 6,000 kilojoules (kJ) for monopile installations and 3,500 kJ for pin pile installation. No more than two monopiles or four pin piles may be installed per day;

(3) The LOA Holder must utilize a soft-start protocol for each impact pile driving event of all foundations by performing 4–6 strikes per minute at 10 to 20 percent of the maximum hammer energy, for a minimum of 20 minutes;

(4) Soft-start must occur at the beginning of monopile and pin pile impact driving and at any time following a cessation of impact pile driving of 30 minutes or longer;

(5) At least four PSOs must be actively observing marine mammals before, during, and after installation of foundation piles (*i.e.,* monopiles and pin piles). At least two PSOs must be stationed and observing on the pile driving vessel and at least two PSOs must be stationed on a secondary, PSO-dedicated vessel. Concurrently, at least one PAM operator must be actively monitoring for marine mammals with PAM before, during, and after impact pile driving;

(6) PSOs must visually clear (*i.e.,* confirm no marine mammals are present) the entire minimum visibility zone and the entire clearance zone (when conditions all for visibility of the entire clearance zone) for a full 30 minutes immediately prior to commencing pile driving or drilling;

(7) If a marine mammal is detected, visually or acoustically, within or about to enter the applicable clearance zones, prior pile driving or drilling, activities must be delayed until the animal has been visually observed exiting the clearance zone or until a specific time period has elapsed with no further sightings. The specific time periods are 15 minutes for small odontocetes and pinnipeds and 30 minutes for all other species;

(i) For piles installed between May 1–May 14 and November 1–December 30, if a North Atlantic right whale is observed or acoustically detected within 10 km of the pile being driven, pile driving must be delayed or stopped (unless activities must proceed for human safety or installation feasibility concerns) and may not resume until the following day or until the animal is confirmed to have exited the zone via aerial or additional vessel surveys;

(ii) [Reserved]

(8) The LOA Holder must deploy dual noise abatement systems that are capable of achieving, at a minimum, 10 decibel (dB) of sound attenuation, during all pile driving and drilling of monopiles and pin piles and comply with the following requirements related noise abatement:

(i) A single bubble curtain must not be used unless paired with another noise attenuation device;

(ii) A big double bubble curtain may be used without being paired with another noise attenuation device;

(iii) The bubble curtain(s) must distribute air bubbles using an air flow rate of at least 0.5 m^3/(min*m). The bubble curtain(s) must surround 100 percent of the piling perimeter throughout the full depth of the water column. In the unforeseen event of a single compressor malfunction, the offshore personnel operating the bubble curtain(s) must make appropriate adjustments to the air supply and operating pressure such that the maximum possible sound attenuation performance of the bubble curtain(s) is achieved;

(iv) The lowest bubble ring must be in contact with the seafloor for the full circumference of the ring, and the weights attached to the bottom ring must ensure 100-percent seafloor contact;

(v) No parts of the ring or other objects may prevent full seafloor contact;

(vi) Construction contractors must train personnel in the proper balancing of airflow to the ring. Construction contractors must submit an inspection/performance report for approval by the LOA Holder within 72 hours following the performance test. The LOA Holder must then submit that report to NMFS Office of Protected Resources; and

(vii) Corrections to the bubble ring(s) to meet the performance standards in this paragraph (c)(8) must occur prior to impact pile driving of monopiles and pin piles. If the LOA Holder uses a noise mitigation device in addition to the bubble curtain, the LOA Holder must maintain similar quality control measures as described in this paragraph (c)(8).

(9) At least one PAM operator must review data from at least 24 hours prior to pile driving and actively monitor hydrophones for 60 minutes prior to pile driving. All clearance zones must be acoustically confirmed to be free of marine mammals for 60 minutes before activities can begin immediately prior to starting a soft-start of impact pile driving. PAM operators will continue to monitor for marine mammals for at least 30 minutes after pile driving or drilling concludes;

(10) For North Atlantic right whales, any visual observation or acoustic detection must trigger a delay to the commencement of pile driving. The clearance zone may only be declared clear if no confirmed North Atlantic right whale acoustic detections (in addition to visual) have occurred within the PAM clearance zone during the 60-minute monitoring period. Any large whale sighting by a PSO or detected by a PAM operator that cannot be identified by species must be treated as if it were a North Atlantic right whale;

(11) If a marine mammal is observed entering or within the respective shutdown zone after pile driving has begun, the PSO must call for a shutdown of pile driving or drilling. The LOA Holder must stop pile driving or drilling immediately unless shutdown is not practicable due to imminent risk of injury or loss of life to an individual or risk of damage to a vessel that creates risk of injury or loss of life for individuals or the lead engineer determines there is pile refusal or pile instability. In any of these situations, the LOA Holder must reduce hammer energy to the lowest level practicable and the reason(s) for not shutting down must be documented and reported to NMFS;

(12) If pile driving has been shut down due to the presence of a North Atlantic right whale, pile driving may not restart until the North Atlantic right whale is no longer observed or 30 minutes has elapsed since the last detection;

(13) If pile driving has been shut down due to the presence of a marine mammal other than a North Atlantic right whale, pile driving must not restart until either the marine mammal(s) has voluntarily left the specific clearance zones and has been visually or acoustically confirmed beyond that clearance zone, or, when specific time periods have elapsed with no further sightings or acoustic detections have occurred. The specific time periods are 15 minutes for small odontocetes and 30 minutes for all other marine mammal species. In cases where these criteria are not met, pile driving may restart only if necessary to maintain pile stability at which time the LOA Holder must use the lowest hammer energy practicable to maintain stability;

(14) The LOA Holder must conduct sound field verification (SFV) during all foundation installation activities:

(i) The LOA Holder must conduct SFV during all activities associated with the first three monopile foundations and the first two jacket foundations installed. Subsequent SFV is required should additional piles be driven that are anticipated to produce louder sound fields than those previously measured;

(ii) The LOA Holder must conduct SFV during drilling the first time it occurs;

(iii) The LOA Holder must determine source levels, spectra, the ranges to the isopleths corresponding to Level A harassment and Level B harassment thresholds, and transmission loss coefficient(s);

(iv) The LOA Holder must perform sound field measurements at a minimum of four distances from the pile being driven in one direction (towards deepest waters), including, but not limited to, 750 m and the modeled Level B harassment zones assuming 10 dB attenuation to verify the accuracy of those modeled zones and contribute to improvement of the models. At least one additional measurement at a different azimuth must be taken to capture sound propagation variability;

(v) The recordings must be continuous throughout the duration of all pile driving and drilling of each foundation monitored;

(vi) The measurement systems must have a sensitivity appropriate for the expected sound levels from pile driving received at the nominal ranges throughout the installation of the pile;

(vii) The frequency range of the system must cover the range of at least 20 hertz (Hz) to 20 kilohertz (kHz);

(viii) The system must be designed to have omnidirectional sensitivity and so that the broadband received level of all pile driving and drilling activities exceeds the system noise floor by at least 10 dB. The dynamic range of the system must be sufficient such that at each location, pile driving signals are not clipped and are not masked by noise floor;

(ix) If acoustic field measurements collected during installation of foundation piles indicate ranges to the isopleths, corresponding to Level A harassment and Level B harassment thresholds, are greater than the ranges predicted by modeling (assuming 10 dB attenuation), the LOA Holder must implement additional noise mitigation measures prior to installing the next foundation. Additional acoustic measurements must be taken after each modification;

(x) In the event that field measurements indicate ranges to isopleths, corresponding to Level A harassment and Level B harassment thresholds, are greater than the ranges predicted by modeling (assuming 10 dB attenuation) after implementing additional noise mitigation measures, NMFS Office of Protected Resources may expand the relevant harassment, clearance, and shutdown zones and associated monitoring protocols;

(xi) If acoustic measurements indicate that ranges to isopleths corresponding to the Level A harassment and Level B harassment thresholds are less than the ranges predicted by modeling (assuming 10 dB attenuation), the LOA Holder may request to NMFS Office of Protected

Resources a modification of the clearance and shutdown zones. For NMFS Office of Protected Resources to consider a modification request for reduced zone sizes, the LOA Holder must have had to conduct SFV on an additional three foundations and that subsequent foundations would be installed under conditions that are predicted to produce smaller harassment zones than those measured;

(xii) The LOA Holder must conduct SFV after construction is complete to estimate turbine operational source levels based on measurements in the near and far-field at a minimum of three locations from each foundation monitored. These data must be used to also identify estimated transmission loss rates; and

(xiii) The LOA Holder must submit an SFV plan to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of foundation installation activities.

(d) *UXO/MEC detonations.* The following requirements apply to Unexploded Ordnances and Munitions and Explosives of Concern (UXO/MEC) detonations:

(1) Upon encountering a UXO/MEC, the LOA Holder may only resort to high-order removal (*i.e.,* detonation) if all other means of removal are impracticable and this determination must be documented and submitted to NMFS;

(2) UXO/MEC detonations must not occur from December 1 through May 31, annually; however, the LOA Holder may detonate a UXO/MEC in December or May with NMFS' approval on a case-by-case basis;

(3) UXO/MEC detonations must only occur during daylight hours;

(4) No more than one detonation can occur within a 24-hour period;

(5) The LOA Holder must deploy dual noise abatement systems during all UXO/MEC detonations and comply with the following requirements related to noise abatement:

(i) A single bubble curtain must not be used unless paired with another noise attenuation device;

(ii) A big double bubble curtain may be used without being paired with another noise attenuation device;

(iii) The bubble curtain(s) must distribute air bubbles using an air flow rate of at least 0.5 $m^3/(min*m)$. The bubble curtain(s) must surround 100 percent of the UXO/MEC detonation perimeter throughout the full depth of the water column. In the unforeseen event of a single compressor malfunction, the offshore personnel operating the bubble curtain(s) must make appropriate adjustments to the air supply and operating pressure such that the maximum possible sound attenuation performance of the bubble curtain(s) is achieved;

(iv) The lowest bubble ring must be in contact with the seafloor for the full circumference of the ring, and the weights attached to the bottom ring must ensure 100-percent seafloor contact;

(v) No parts of the ring or other objects may prevent full seafloor contact;

(vi) Construction contractors must train personnel in the proper balancing of airflow to the ring. Construction contractors must submit an inspection/performance report for approval by the LOA Holder within 72 hours following the performance test. The LOA Holder must then submit that report to NMFS Office of Protected Resources; and

(vii) Corrections to the bubble ring(s) to meet the performance standards in this paragraph (d)(5) must occur prior to UXO/MEC detonations. If the LOA Holder uses a noise mitigation device in addition to the bubble curtain, the LOA Holder must maintain similar quality control measures as described in this paragraph (d)(5);

(6) The LOA Holder must conduct SFV during all UXO/MEC detonations at a minimum of three locations (at two water depths at each location) from each detonation in a direction toward deeper water in accordance with the following requirements:

(i) The LOA Holder must empirically determine source levels (peak and cumulative sound exposure level), the ranges to the isopleths corresponding to the Level A harassment and Level B harassment thresholds in meters, and the transmission loss coefficient(s). The LOA Holder may estimate ranges to the Level A harassment and Level B harassment isopleths by extrapolating from in situ measurements conducted at several distances from the detonation location monitored;

(ii) The measurement systems must have a sensitivity appropriate for the expected sound levels from detonations received at the nominal ranges throughout the detonation;

(iii) The frequency range of the system must cover the range of at least 20 Hz to 20 kHz; and

(iv) The system will be designed to have omnidirectional sensitivity and will be designed so that the predicted broadband received level of all UXO/MEC detonations exceeds the system noise floor by at least 10 dB. The dynamic range of the system must be sufficient such that at each location, pile driving signals are not clipped and are not masked by noise floor.

(7) The LOA Holder must submit an SFV plan to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of detonation activities;

(8) LOA Holder must establish and implement clearance zones for UXO/MEC detonation using both visual and acoustic monitoring, as described in the LOA;

(9) LOA Holder must use at least two visual PSOs on a platform (*e.g.,* vessels, plane) and one PAM operator to monitor for marine mammals in the clearance zones prior to detonation. If the clearance zone is larger than 2 km (based on charge weight), LOA Holder must deploy a secondary PSO vessel or aircraft. If the clearance is larger than 5 km (based on charge weight), an aerial survey must be conducted;

(10) At least four PSOs must be actively observing marine mammals before and after any UXO/MEC detonation. At least two PSOs must be stationed and observing on a vessel as close as possible to the detonation site and at least two PSOs must be stationed on a secondary, PSO-dedicated vessel or aerial platform. Concurrently, at least one acoustic monitoring PSO (*i.e.,* passive acoustic monitoring (PAM) operator) must be actively monitoring for marine mammals with PAM before, during, and after detonation;

(11) At least one PAM operator must review data from at least 24 hours prior to a detonation and actively monitor hydrophones for 60 minutes prior to detonation. All clearance zones must be acoustically confirmed to be free of marine mammals for 60 minutes prior to commencing a detonation. PAM operators will continue to monitor for marine mammals at least 30 minutes after a detonation;

(12) All clearance zones must be visually confirmed to be free of marine mammals for 30 minutes before a detonation can occur. All PSOs will also maintain watch for 30 minutes after the detonation event;

(13) If a marine mammal is observed entering or within the relevant clearance zone prior to the initiation of a detonation, detonation must be delayed and must not begin until either the marine mammal(s) has voluntarily left the specific clearance zones and have been visually and acoustically confirmed beyond that clearance zone, or, when specific time periods have elapsed with no further sightings or acoustic detections. The specific time periods are 15 minutes for small odontocetes and 30 minutes for all other marine mammal species; and

(14) For North Atlantic right whales, any visual observation or acoustic

detection must trigger a delay to the detonation of a UXO/MEC. Any large whale sighting by a PSO or detected by a PAM operator that cannot be identified by species must be treated as if it were a North Atlantic right whale.

(e) *HRG surveys.* The following requirements apply to HRG surveys operating sub-bottom profilers (SBPs) (*i.e.,* boomers, sparkers, and CHIRPS):

(1) The LOA Holder is required to have at least one PSO on active duty per HRG vessel during HRG surveys that are conducted during daylight hours (*i.e.,* from 30 minutes prior to civil sunrise through 30 minutes following civil sunset) and at least two PSOs on active duty per vessel during HRG surveys that are conducted during nighttime hours;

(2) The LOA Holder must deactivate acoustic sources during periods where no data are being collected, except as determined to be necessary for testing. Unnecessary use of the acoustic source(s) is prohibited;

(3) The LOA Holder is required to ramp-up SBPs prior to commencing full power, unless the equipment operates on a binary on/off switch, and ensure visual clearance zones are fully visible (*e.g.,* not obscured by darkness, rain, fog, *etc.*) and clear of marine mammals, as determined by the Lead PSO, for at least 30 minutes immediately prior to the initiation of survey activities using acoustic sources specified in the LOA;

(4) Prior to a ramp-up procedure starting or activating SBPs, the operator must notify the Lead PSO of the planned start time. This notification time must not be less than 60 minutes prior to the planned ramp-up or activation as all relevant PSOs must monitor the clearance zone for 30 minutes prior to the initiation of ramp-up or activation;

(5) Prior to starting the survey and after receiving confirmation from the PSOs that the clearance zone is clear of any marine mammals, the LOA Holder must ramp-up sources to half power for 5 minutes and then proceed to full power, unless the source operates on a binary on/off switch in which case ramp-up is not required. Ramp-up and activation must be delayed if a marine mammal(s) enters its respective shutdown zone. Ramp-up and activation may only be reinitiated if the animal(s) has been observed exiting its respective shutdown zone or until 15 minutes for small odontocetes and pinnipeds, and 30 minutes for all other species, has elapsed with no further sightings;

(6) The LOA Holder must implement a 30-minute clearance period of the clearance zones immediately prior to the commencing of the survey or when there is more than a 30 minute break in survey activities or PSO monitoring. A clearance period is a period when no marine mammals are detected in the relevant zone;

(7) If a marine mammal is observed within a clearance zone during the clearance period, ramp-up or acoustic surveys may not begin until the animal(s) has been observed voluntarily exiting its respective clearance zone or until a specific time period has elapsed with no further sighting. The specific time period is 15 minutes for small odontocetes and seals, and 30 minutes for all other species;

(8) Any large whale sighted by a PSO within 1 km of the SBP that cannot be identified by species must be treated as if it were a North Atlantic right whale and the LOA Holder must apply the mitigation measure applicable to this species;

(9) In any case when the clearance process has begun in conditions with good visibility, including via the use of night vision equipment (infrared (IR)/thermal camera), and the Lead PSO has determined that the clearance zones are clear of marine mammals, survey operations would be allowed to commence (*i.e.,* no delay is required) despite periods of inclement weather and/or loss of daylight;

(10) Once the survey has commenced, the LOA Holder must shut down SBPs if a marine mammal enters a respective shutdown zone, except in cases when the shutdown zones become obscured for brief periods due to inclement weather, survey operations would be allowed to continue (*i.e.,* no shutdown is required) so long as no marine mammals have been detected. The shutdown requirement does not apply to small delphinids of the following genera: *Delphinus, Stenella, Lagenorhynchus,* and *Tursiops.* If there is uncertainty regarding the identification of a marine mammal species (*i.e.,* whether the observed marine mammal belongs to one of the delphinid genera for which shutdown is waived), the PSOs must use their best professional judgment in making the decision to call for a shutdown. Shutdown is required if a delphinid that belongs to a genus other than those specified in this paragraph (e)(10) is detected in the shutdown zone;

(11) If SBPs have been shut down due to the presence of a marine mammal, the use of SBPs may not commence or resume until the animal(s) has been confirmed to have left the Level B harassment zone or until a full 15 minutes (for small odontocetes and seals) or 30 minutes (for all other marine mammals) have elapsed with no further sighting;

(12) The LOA Holder must immediately shutdown any SBP acoustic source if a marine mammal is sighted entering or within its respective shutdown zones. If there is uncertainty regarding the identification of a marine mammal species (*i.e.,* whether the observed marine mammal belongs to one of the delphinid genera for which shutdown is waived), the PSOs must use their best professional judgment in making the decision to call for a shutdown. Shutdown is required if a delphinid that belongs to a genus other than those specified in paragraph (f)(12) is detected in the shutdown zone;

(13) If a SBP is shut down for reasons other than mitigation (*e.g.,* mechanical difficulty) for less than 30 minutes, it would be allowed to be activated again without ramp-up only if:

(i) PSOs have maintained constant observation; and

(ii) No additional detections of any marine mammal occurred within the respective shutdown zones.

(f) *Fisheries monitoring surveys.* The following measures apply to fishery monitoring surveys using trap and trawl gear:

(1) All captains and crew conducting fishery surveys must be trained in marine mammal detection and identification. Marine mammal monitoring will be conducted by the trained captain and/or a member of the scientific crew before (within 1 nautical mile (nmi) and 15 minutes prior to deploying gear), during, and for 15 minutes after haul back;

(2) Survey gear will be deployed as soon as possible once the vessel arrives on station;

(3) The LOA Holder and/or its cooperating institutions, contracted vessels, or commercially-hired captains must implement the following ''move-on'' rule: If marine mammals are sighted within 1 nmi of the planned location and 15 minutes before gear deployment, then the LOA Holder and/or its cooperating institutions, contracted vessels, or commercially-hired captains, as appropriate, must move the vessel away from the marine mammal to a different section of the sampling area. If, after moving on, marine mammals are still visible from the vessel, the LOA Holder and/or its cooperating institutions, contracted vessels, or commercially-hired captains must move again or skip the station;

(4) If a marine mammal is deemed to be at risk of interaction after the gear is set, all gear must be immediately removed from the water. If marine mammals are sighted before the gear is fully removed from the water, the vessel will slow its speed and maneuver the

vessel away from the animals to minimize potential interactions with the observed animal;

(5) The LOA Holder must maintain visual monitoring effort during the entire period of time that gear is in the water (*i.e.,* throughout gear deployment, fishing, and retrieval);

(6) All fisheries monitoring gear must be fully cleaned and repaired (if damaged) before each use;

(7) The LOA Holder's fixed gear must comply with the Atlantic Large Whale Take Reduction Plan regulations at 50 CFR 229.32 during fisheries monitoring surveys;

(8) Trawl tows will be limited to a 20-minute trawl time at 3.0 knots;

(9) All gear, trawl or otherwise, will be emptied immediately after retrieval within the vicinity of the deck;

(10) During trawl surveys, vessel crew will open the codend of the trawl net close to the deck in order to avoid injury to animals that may be caught in the gear;

(11) During any survey that uses vertical lines, buoy lines will be weighted and will not float at the surface of the water and all groundlines will consist of sinking line. All groundlines must be composed entirely of sinking line. Buoy lines must utilize weak links. Weak links must break cleanly leaving behind the bitter end of the line. The bitter end of the line must be free of any knots when the weak link breaks. Splices are not considered to be knots. The attachment of buoys, toggles, or other floatation devices to groundlines is prohibited;

(12) All in-water survey gear will be properly labeled with the scientific permit number or identification as LOA Holder-related research gear. All labels and markings on the buoys and buoy lines will also be compliant with the applicable regulations, and all buoy markings will comply with instructions received by the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division; and

(13) All survey gear will be removed from the water whenever not in active survey use (*i.e.,* no wet storage). All reasonable efforts, that do not compromise human safety, must be undertaken to recover gear. All lost gear must be reported to NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division (*nmfs.gar.incidental-take@noaa.gov*) within 24 hours of the documented time of missing or lost gear. This report must include information on any markings on the gear and any efforts undertaken or planned to recover the gear.

§ 217.325 Requirements for monitoring and reporting.

(a) *Protected species observer (PSO) and passive acoustic monitoring (PAM) operator qualifications.* The LOA Holder must implement the following measures applicable to PSOs and PAM operators:

(1) The LOA Holder must use independent, dedicated, qualified PSOs and PAM operators, meaning that the PSOs and PAM operators 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 protected species and mitigation requirements;

(2) PSOs and PAM operators must have successfully attained a bachelor's degree from an accredited college or university with a major in one of the natural sciences, a minimum of 30 semester hours or equivalent in the biological sciences, and at least one undergraduate course in math or statistics. The educational requirements may be waived if the PSO or PAM operator has acquired the relevant skills through a suitable amount of alternate experience. Requests for such a waiver shall be submitted to NMFS Office of Protected Resources and must include written justification containing alternative experience. Alternate experience that may be considered includes, but is not limited to: previous work experience conducting academic, commercial, or government sponsored marine mammal visual and/or acoustic surveys; or previous work experience as a PSO/PAM operator; and the PSO/PAM operator should demonstrate good standing and consistently good performance of PSO/PAM duties;

(3) PSOs and PAM operators must successfully complete the required training within the last 5 years, including obtaining a certificate of course completion;

(4) PSOs must have visual acuity in both eyes (with correction of vision being permissible) sufficient enough to discern moving targets on the water's surface with the ability to estimate the target size and distance (binocular use is allowable); ability to conduct field observations and collect data according to the assigned protocols; sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations; writing skills sufficient to document observations, including but not limited to, the number and species of marine mammals observed, the dates and times of when in-water construction activities were conducted, the dates and time when in-water construction activities were suspended to avoid potential incidental take of marine mammals from construction noise within a defined shutdown zone, and marine mammal behavior; and the ability to communicate orally, by radio, or in-person, with project personnel to provide real-time information on marine mammals observed in the area;

(5) All PSOs and PAM operators must be approved by the NMFS Office of Protected Resources. The LOA Holder must submit PSO resumes for NMFS Office of Protected Resources review and approval at least 90 days prior to commencement of in-water construction activities requiring PSOs and PAM operators. Resumes must include dates of training and any prior NMFS Office of Protected Resources approval, as well as dates and description of last experience, and must be accompanied by information documenting successful completion of an acceptable training course. NMFS Office of Protected Resources shall be allowed 3 weeks to approve PSOs from the time that the necessary information is received by NMFS Office of Protected Resources, after which PSOs meeting the minimum requirements will automatically be considered approved;

(6) All PSOs must be trained in marine mammal identification and behaviors and must be able to conduct field observations and collect data according to assigned protocols. Additionally, PSOs must have the ability to work with all required and relevant software and equipment necessary during observations;

(7) At least one PSO on active duty for each activity (*i.e.,* foundation installation, UXO/MEC detonation activities, and HRG surveys) must be designated as the ''Lead PSO''. The Lead PSO must have a minimum of 90 days of at-sea experience working in an offshore environment and is required to have no more than 18 months elapsed since the conclusion of their last at-sea experience;

(8) PAM operators must complete specialized training for operating PAM systems and must demonstrate familiarity with the PAM system on which they must be working; and

(9) PSOs may work as PAM operators and vice versa, pending NMFS-approval; however, they may only perform one role at any one time and must not exceed work time restrictions, which will be tallied cumulatively.

(b) *General PSO and PAM operator requirements.* The following measures apply to PSOs and PAM operators and must be implemented by the LOA Holder:

(1) PSOs must monitor for marine mammals prior to, during, and following pile driving, drilling, UXO/MEC detonation activities, and during HRG surveys that use sub-bottom profilers (with specific monitoring durations and needs described in paragraphs (c) through (e) of this section, respectively).

(2) PAM operator(s) must acoustically monitor for marine mammals prior to, during, and following all pile driving, drilling, and UXO/MEC detonation activities. PAM operators may be located on a vessel or remotely on-shore but must have the appropriate equipment (*i.e.,* computer station equipped with a data collection software system available wherever they are stationed) and be in real-time communication with PSOs and transiting vessel captains;

(3) All PSOs must be located at the best vantage point(s) on any platform, in order to obtain 360 degree visual coverage of the entire clearance and shutdown zones around the activity area, and as much of the Level B harassment zone as possible;

(4) All on-duty visual PSOs must remain in contact with the on-duty PAM operator, who would monitor the PAM systems for acoustic detections of marine mammals in the area, regarding any animal detection that might be approaching or found within the applicable zones no matter where the PAM operator is stationed (*e.g.,* onshore or on a vessel);

(5) During all visual observation periods during the Project, PSOs must use high magnification (25x) binoculars, standard handheld (7x) binoculars, and the naked eye to search continuously for marine mammals. During all pile driving and drilling, at least one PSO on the primary pile driving vessel must be equipped with functional Big Eye binoculars (*e.g.,* 25 x 150; 2.7 view angle; individual ocular focus; height control); these must be pedestal mounted on the deck at the best vantage point that provides for optimal sea surface observation and PSO safety;

(6) During all acoustic monitoring periods during the Project, PAM operators must use PAM systems as approved by NMFS;

(7) During periods of low visibility (*e.g.,* darkness, rain, fog, poor weather conditions, *etc.*), PSOs must use alternative technology (*i.e.,* infrared or thermal cameras) to monitor the clearance and shutdown zones as approved by NMFS;

(8) PSOs and PAM operators must not exceed 4 consecutive watch hours on duty at any time, must have a 2-hour (minimum) break between watches, and must not exceed a combined watch schedule of more than 12 hours in a 24-hour period;

(9) Any PSO or PAM operator has the authority to call for a delay or shutdown of project activities;

(10) PSOs must remain in real-time contact with the PAM operators and construction personnel responsible for implementing mitigation (*e.g.,* delay to pile driving or UXO/MEC detonation) to ensure communication on marine mammal observations can easily, quickly, and consistently occur between all on-duty PSOs, PAM operator(s), and on-water Project personnel; and

(11) The LOA Holder is required to use available sources of information on North Atlantic right whale presence to aid in monitoring efforts. These include daily monitoring of the Right Whale Sightings Advisory System, consulting of the WhaleAlert app, and monitoring of the Coast Guard's VHF Channel 16 throughout the day to receive notifications of any sightings and information associated with any Dynamic Management Areas, to plan construction activities and vessel routes, if practicable, to minimize the potential for co-occurrence with North Atlantic right whales.

(c) *PSO and PAM operator requirements during WTG and ESP foundation installation.* The following measures apply to PSOs and PAM operators during WTG and ESP foundation installation and must be implemented by the LOA Holder:

(1) If PSOs cannot visually monitor the minimum visibility zone at all times using the equipment described in paragraphs (b)(3) and (4) of this section, pile driving operations must not commence or must shutdown if they are currently active;

(2) All PSOs must begin monitoring 60 minutes prior to pile driving, during, and for 30 minutes after the activity. Pile driving must only commence when the minimum visibility zone is fully visible (*e.g.,* not obscured by darkness, rain, fog, *etc.*) and the clearance zones are clear of marine mammals for at least 30 minutes, as determined by the Lead PSO, immediately prior to the initiation of pile driving. PAM operators must assist the visual PSOs in monitoring by conducting PAM activities 60 minutes prior to any pile driving, during, and after for 30 minutes for the appropriate size PAM clearance zone (dependent on season). The entire minimum visibility zone must be clear for at least 30 minutes, with no marine mammal detections within the visual or PAM clearance zones prior to the start of pile driving;

(3) The LOA Holder must conduct PAM for at least 24 hours immediately prior to pile driving activities;

(4) During use of any real-time PAM system, at least one PAM operator must be designated to monitor each system by viewing data or data products that would be streamed in real-time or in near real-time to a computer workstation and monitor;

(5) The PAM operator must inform the Lead PSO(s) on duty of animal detections approaching or within applicable ranges of interest to the pile driving activity via the data collection software system (*i.e.,* Mysticetus or similar system) who will be responsible for requesting that the designated crewmember implement the necessary mitigation procedures (*i.e.,* delay or shutdown); and

(6) The LOA Holder must prepare and submit a Marine Mammal Monitoring Plan to NMFS Office of Protected Resources for review and approval at least 180 days before the start of any pile driving. The plan must include final pile driving project design (*e.g.,* number and type of piles, hammer type, noise abatement systems, anticipated start date, *etc.*) and all information related to PAM and PSO monitoring protocols for foundation installation activities.

(d) *PSO requirements during UXO/MEC detonations.* The following measures apply to PSOs during HRG surveys using SBPs and must be implemented by the LOA Holder:

(1) All on-duty visual PSOs must remain in contact with the on-duty PAM operator, who would monitor the PAM systems for acoustic detections of marine mammals in the area, regarding any animal detection that might be approaching or found within the applicable zones no matter where the PAM operator is stationed (*e.g.,* onshore or on a vessel);

(2) If PSOs cannot visually monitor the minimum visibility zone at all times using the equipment described in paragraphs (b)(3) and (4) of this section; UXO/MEC operations must not commence or must shutdown if they are currently active;

(3) All PSOs must begin monitoring 60 minutes prior to UXO/MEC detonation, during, and for 30 minutes after the activity. UXO/MEC detonation must only commence when the minimum visibility zone is fully visible (*e.g.,* not obscured by darkness, rain, fog, *etc.*) and the clearance zones are clear of marine mammals for at least 30 minutes, as determined by the Lead PSO, immediately prior to the initiation of detonation. PAM operators must assist the visual PSOs in monitoring by

conducting PAM activities 60 minutes prior to any UXO/MEC detonation, during, and after for 30 minutes for the appropriate size PAM clearance zone. The entire minimum visibility zone must be clear for at least 30 minutes, with no marine mammal detections within the visual or PAM clearance zones prior to the initiation of detonation;

(4) For North Atlantic right whales, any visual or acoustic detection must trigger a delay to the commencement of UXO/MEC detonation. In the event that a large whale is sighted or acoustically detected that cannot be confirmed by species, it must be treated as if it were a North Atlantic right whale;

(5) The LOA Holder must conduct PAM for at least 24 hours immediately prior to foundation installation and UXO/MEC detonation activities;

(6) During use of any real-time PAM system, at least one PAM operator must be designated to monitor each system by viewing data or data products that would be streamed in real-time or in near real-time to a computer workstation and monitor;

(7) The LOA Holder must use a minimum of one PAM operator to actively monitor for marine mammals before, during, and after UXO/MEC detonation. The PAM operator must assist visual PSOs in ensuring full coverage of the clearance and shutdown zones. The PAM operator must inform the Lead PSO(s) on duty of animal detections approaching or within applicable ranges of interest to the activity occurring via the data collection software system (*i.e.,* Mysticetus or similar system) who will be responsible for requesting that the designated crewmember implement the necessary mitigation procedures (*i.e.,* delay or shutdown);

(8) PAM operators must be on watch for a maximum of 4 consecutive hours, followed by a break of at least 2 hours between watches, and may not exceed a combined watch schedule of more than 12 hours in a single 24-hour period;

(9) The LOA Holder must prepare and submit a Marine Mammal Monitoring Plan to NMFS Office of Protected Resources for review and approval at least 180 days before the start of any detonation. The plan must include final UXO/MEC detonation project design (*e.g.,* number and type of UXO/MECs, removal method(s), charge weight(s), anticipated start date, *etc.*) and all information related to PAM and PSO monitoring protocols for UXO/MEC activities; and

(10) A Passive Acoustic Monitoring Plan (''PAM Plan'') must be submitted to NMFS Office of Protected Resources for review and approval at least 180 days prior to the planned start of foundation installation and prior to the start of any UXO/MEC detonation(s). The authorization to take marine mammals would be contingent upon NMFS Office of Protected Resources approval of the PAM Plan.

(e) *PSO requirements during HRG surveys.* The following measures apply to PSOs during HRG surveys using SBPs and must be implemented by the LOA Holder:

(1) Between four and six PSOs must be present on every 24-hour survey vessel and two to three PSOs must be present on every 12-hour survey vessel;

(2) At least one PSO must be on active duty monitoring during HRG surveys conducted during daylight (*i.e.,* from 30 minutes prior to civil sunrise through 30 minutes following civil sunset) and at least two PSOs must be on activity duty monitoring during HRG surveys conducted at night;

(3) PSOs on HRG vessels must begin monitoring 30 minutes prior to activating SBPs during the use of these acoustic sources, and for 30 minutes after use of these acoustic sources has ceased;

(4) During daylight hours when survey equipment is not operating, the LOA Holder must ensure that visual PSOs conduct, as rotation schedules allow, observations for comparison of sighting rates and behavior with and without use of the specified acoustic sources. Off-effort PSO monitoring must be reflected in the monthly PSO monitoring reports; and

(5) Any acoustic monitoring would complement visual monitoring efforts and would cover an area of at least the Level B harassment zone around each acoustic source.

(f) *Reporting.* The LOA Holder must comply with the following reporting measures:

(1) Prior to initiation of in-water project activities, the LOA Holder must demonstrate in a report submitted to NMFS Office of Protected Resources that all required training for the LOA Holder personnel (including the vessel crews, vessel captains, PSOs, and PAM operators) has been completed;

(2) The LOA Holder must use a standardized reporting system during the effective period of the LOA. All data collected related to the Project must be recorded using industry-standard software that is installed on field laptops and/or tablets.

(3) For all monitoring efforts and marine mammal sightings, the following information must be collected and reported:

(i) Date and time that monitored activity begins or ends; Construction activities occurring during each observation period; Watch status (*i.e.,* sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/ platform); PSO who sighted the animal; Time of sighting; Weather parameters (*e.g.,* wind speed, percent cloud cover, visibility); Water conditions (*e.g.,* Beaufort sea state, tide state, water depth); All marine mammal sightings, regardless of distance from the construction activity; Species (or lowest possible taxonomic level possible); Pace of the animal(s); Estimated number of animals (minimum/maximum/high/ low/best); Estimated number of animals by cohort (*e.g.,* adults, yearlings, juveniles, calves, group composition, *etc.*); Description (*i.e.,* as many distinguishing features as possible of each individual seen, including length, shape, color, pattern, scars or markings, shape and size of dorsal fin, shape of head, and blow characteristics); Description of any marine mammal behavioral observations (*e.g.,* observed behaviors such as feeding or traveling) and observed changes in behavior, including an assessment of behavioral responses thought to have resulted from the specific activity; Animal's closest distance and bearing from the pile being driven or specified HRG equipment and estimated time entered or spent within the Level A harassment and/or Level B harassment zone(s); Activity at time of sighting (*e.g.,* vibratory installation/ removal, impact pile driving, construction survey), use of any noise attenuation device(s), and specific phase of activity (*e.g.,* ramp-up of HRG equipment, HRG acoustic source on/off, soft-start for pile driving, active pile driving, *etc.*); Marine mammal occurrence in Level A harassment or Level B harassment zones; Description of any mitigation-related action implemented, or mitigation-related actions called for but not implemented, in response to the sighting (*e.g.,* delay, shutdown, *etc.*) and time and location of the action; and other human activity in the area.

(ii) [Reserved]

(4) If a marine mammal is acoustically detected during PAM monitoring, the following information must be recorded and reported to NMFS Office of Protected Resources:

(i) Location of hydrophone (latitude & longitude; in Decimal Degrees) and site name; Bottom depth and depth of recording unit (in meters); Recorder (model & manufacturer) and platform type (*i.e.,* bottom-mounted, electric glider, *etc.*), and instrument ID of the hydrophone and recording platform (if applicable); Time zone for sound files and recorded date/times in data and metadata (in relation to Universal Coordinated Time (UTC); *i.e.,* Eastern Standard Time (EST) time zone is UTC–5); Duration of recordings (start/end dates and times; in International Organization for Standardization (ISO) 8601 format, yyyy-mm-ddTHH:MM:SS.sssZ); Deployment/retrieval dates and times (in ISO 8601 format); Recording schedule (must be continuous); Hydrophone and recorder sensitivity (in dB re 1 microPascal (μPa)); Calibration curve for each recorder; Bandwidth/sampling rate (in Hz); Sample bit-rate of recordings; and Detection range of equipment for relevant frequency bands (in meters).

(ii) [Reserved]

(5) Information required for each detection, the following information must be noted:

(i) Species identification (if possible); Call type and number of calls (if known); Temporal aspects of vocalization (date, time, duration, *etc.;* date times in ISO 8601 format); Confidence of detection (detected, or possibly detected); Comparison with any concurrent visual sightings; Location and/or directionality of call (if determined) relative to acoustic recorder or construction activities; Location of recorder and construction activities at time of call; Name and version of detection or sound analysis software used, with protocol reference; Minimum and maximum frequencies viewed/monitored/used in detection (in Hz); and Name of PAM operator(s) on duty.

(ii) [Reserved]

(6) The LOA Holder must compile and submit weekly reports to NMFS Office of Protected Resources that document the daily start and stop of all pile driving, UXO/MEC detonations, and HRG survey associated with the Project; the start and stop of associated observation periods by PSOs; details on the deployment of PSOs; a record of all detections of marine mammals (acoustic and visual); any mitigation actions (or if mitigation actions could not be taken, provide reasons why); and details on the noise attenuation system(s) used and its performance. Weekly reports are due on Wednesday for the previous week (Sunday–Saturday) and must include the information required under this section. The weekly report must also identify which turbines become operational and when (a map must be provided). This weekly report must also identify when, what charge weight size, and where UXO/MECs are detonated (a map must also be provided). Once all foundation pile installation and UXO/MEC detonations are completed, weekly reports are no longer required by the LOA Holder;

(7) The LOA Holder must compile and submit monthly reports to NMFS Office of Protected Resources that include a summary of all information in the weekly reports, including project activities carried out in the previous month, vessel transits (number, type of vessel, and route), number of piles installed, all detections of marine mammals, and any mitigative action taken. Monthly reports are due on the 15th of the month for the previous month. The monthly report must also identify which turbines become operational and when (a map must be provided). This weekly report must also identify when, what charge weight size, and where UXO/MECs are detonated (a map must also be provided). Once foundation installation and UXO/MEC detonations are completed, monthly reports are no longer required;

(8) The LOA Holder must submit a draft annual report to NMFS Office of Protected Resources no later than 90 days following the end of a given calendar year. The LOA Holder must provide a final report within 30 days following resolution of comments on the draft report. The draft and final reports must detail the following information:

(i) The total number of marine mammals of each species/stock detected and how many were within the designated Level A harassment and Level B harassment zone(s) with comparison to authorized take of marine mammals for the associated activity type; Marine mammal detections and behavioral observations before, during, and after each activity; What mitigation measures were implemented (*i.e.,* number of shutdowns or clearance zone delays, *etc.*) or, if no mitigative actions was taken, why not; Operational details (*i.e.,* days and duration of impact and vibratory pile driving, days and duration of drilling, days and number of UXO/MEC detonations, days and amount of HRG survey effort, *etc.*); Any PAM systems used; The results, effectiveness, and which noise attenuation systems were used during relevant activities (*i.e.,* impact and vibratory pile driving, drilling, and UXO/MEC detonations); Summarized information related to situational reporting; Any other important information relevant to the Project, including additional information that may be identified through the adaptive management process; and

(ii) The final annual report must be prepared and submitted within 30 calendar days following the receipt of any comments from NMFS Office of Protected Resources on the draft report. If no comments are received from NMFS Office of Protected Resources within 60 calendar days of NMFS Office of Protected Resources' receipt of the draft report, the report must be considered final.

(9) The LOA Holder must submit its draft 5-year report to NMFS Office of Protected Resources on all visual and acoustic monitoring conducted within 90 calendar days of the completion of activities occurring under the LOA. A 5-year report must be prepared and submitted within 60 calendar days following receipt of any NMFS Office of Protected Resources comments on the draft report. If no comments are received from NMFS Office of Protected Resources within 60 calendar days of NMFS Office of Protected Resources receipt of the draft report, the report shall be considered final;

(10) The LOA Holder must submit a SFV plan at least 180 days prior to the planned start of vibratory and impact pile driving, drilling, and UXO/MEC detonations. At minimum, the plan must describe how the LOA Holder would ensure that the first three monopile and two jacket (using pin piles) foundation installation sites selected for SFV are representative of the rest of the monopile and pin pile installation sites. In the case that these sites/scenarios are not determined to be representative of all other monopile/pin pile installation sites, the LOA Holder must include information on how additional sites/scenarios would be selected for SFV. The plan must also include methodology for collecting, analyzing, and preparing SFV data for submission to NMFS Office of Protected Resources. The plan must describe how the effectiveness of the sound attenuation methodology would be evaluated based on the results. The LOA Holder must also provide, as soon as they are available but no later than 48 hours after each installation, the initial results of the SFV measurements to NMFS Office of Protected Resources in an interim report after each monopile for the first three piles, after two jacket foundation using pin piles are installed, and after each UXO/MEC detonation; and

(i) The SFV plan must also include how operational noise would be monitored. These data must be used to identify estimated transmission loss rates. Operational parameters (*e.g.,* direct drive/gearbox information, turbine rotation rate), characteristics about the UXO/MEC (*e.g.,* charge weight, size, type of charge), as well as sea state conditions and information on nearby anthropogenic activities (*e.g.,* vessels transiting or operating in the area) must be reported;

(ii) The LOA Holder must provide the initial results of the SFV measurements to NMFS Office of Protected Resources in an interim report after each foundation installation for the first three monopile foundation piles and two jacket foundations (all pin piles), and for each UXO/MEC detonated, as soon as they are available, but no later than 48 hours after each completed installation event and/or detonation. The LOA Holder must also provide interim reports on any subsequent SFV on foundation piles within 48 hours. The interim pile driving SFV report must include hammer energies used during pile driving, peak sound pressure level (SPL_{pk}) and median, mean, maximum, and minimum root-mean-square sound pressure level that contains 90 percent of the acoustic energy (SPL_{rms}) and single strike sound exposure level (SEL_{ss}); and

(iii) The final results of SFV of foundation installations and UXO/MEC detonations must be submitted as soon as possible, but no later than within 90 days following completion of all foundation installation of monopiles and jackets (pin piles) and all necessary detonation events. The final report must include, at minimum, the following:

(A) Peak sound pressure level (SPL_{pk}), root-mean-square sound pressure level that contains 90 percent of the acoustic energy (SPL_{rms}), single strike sound exposure level (SEL_{ss}), integration time for SPL_{rms}, spectrum, and 24-hour cumulative SEL extrapolated from measurements at specified distances (*e.g.,* 750 m) in mean, median, maximum and minimum levels;

(B) The SEL and SPL power spectral density and one-third octave band levels (usually calculated as decidecade band levels) at the receiver locations should be reported; The sound levels reported must be in median and linear average (*i.e.,* average in linear space), and in dB;

(C) Local environmental conditions, such as wind speed, transmission loss data collected on-site (or the sound velocity profile), baseline pre- and post-activity ambient sound levels (broadband and/or within frequencies of concern); A description of depth and sediment type, as documented in the Construction and Operation Plan (COP), at the recording and foundation installation and UXO/MEC detonation locations;

(D) The extents of the Level A harassment and Level B harassment zone(s); Hammer energies required for pile installation and the number of strikes per pile; and Charge weights and other relevant characteristics of UXO/MEC detonations;

(E) Hydrophone equipment and methods (*i.e.,* recording device, bandwidth/sampling rate, distance from the monopile/pin pile and/or UXO/MEC where recordings were made; depth of recording device(s)); Description of the SFV PAM hardware and software, including software version used, calibration data, bandwidth capability and sensitivity of hydrophone(s), any filters used in hardware or software, any limitations with the equipment, and other relevant information; and

(F) Spatial configuration of the noise attenuation device(s) relative to the pile and/or UXO/MEC charge; A description of the noise abatement system and operational parameters (*e.g.,* bubble flow rate, distance deployed from the pile and/or UXO/MEC, *etc.*) and any action taken to adjust the noise abatement system.

(11) The LOA Holder must submit situational reports if the following circumstances occur:

(i) If a North Atlantic right whale is observed at any time by PSOs or personnel on or in the vicinity of any project vessel, or during vessel transit, the LOA Holder must immediately report sighting information to the NMFS North Atlantic Right Whale Sighting Advisory System (866) 755–6622, through the WhaleAlert app (*https://www.whalealert.org/*), and to the U.S. Coast Guard via channel 16, as soon as feasible but no later than 24 hours after the sighting. Information reported must include, at a minimum: time of sighting, location, and number of North Atlantic right whales observed;

(ii) When an observation of a large whale occurs during vessel transit, the following information must be recorded and reported to NMFS Office of Protected Resources:

(A) Time, date, and location (latitude/longitude; in Decimal Degrees); The vessel's activity, heading, and speed; Beaufort sea state, water depth (meters), and visibility; Marine mammal identification to the best of the observer's ability (*e.g.,* North Atlantic right whale, whale, dolphin, seal); Initial distance and bearing to marine mammal from vessel and closest point of approach; and Any avoidance measures taken in response to the marine mammal sighting.

(B) [Reserved]

(iii) If a North Atlantic right whale is detected via PAM, the date, time, location (*i.e.,* latitude and longitude of recorder) of the detection as well as the recording platform that had the detection must be reported to *nmfs.pacmdata@noaa.gov* as soon as feasible, but no longer than 24 hours after the detection. Full detection data and metadata must be submitted monthly on the 15th of every month for the previous month via the webform on the NMFS North Atlantic Right Whale Passive Acoustic Reporting System website at *https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reporting-system-templates;*

(iv) In the event that the personnel involved in the Project discover a stranded, entangled, injured, or dead marine mammal, the LOA Holder must immediately report the observation to the NMFS Office of Protected Resources, the NMFS Greater Atlantic Stranding Coordinator for the New England/Mid-Atlantic area (866–755–6622), and the U.S. Coast Guard within 24 hours. If the injury or death was caused by a project activity, the LOA Holder must immediately cease all activities until NMFS Office of Protected Resources is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate to ensure compliance with the terms of the LOA. NMFS Office of Protected Resources may impose additional measures to minimize the likelihood of further prohibited take and ensure MMPA compliance. The LOA Holder may not resume their activities until notified by NMFS Office of Protected Resources. The report must include the following information:

(A) Time, date, and location (latitude/longitude; in Decimal Degrees) 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.

(B) [Reserved]

(v) In the event of a vessel strike of a marine mammal by any vessel associated with the Project, the LOA Holder must immediately report the strike incident to the NMFS Office of Protected Resources and the NMFS Greater Atlantic Regional Fisheries Office within and no later than 24 hours. The LOA Holder must immediately cease all on-water activities until NMFS Office of Protected Resources is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate to ensure compliance with the terms of the LOA. NMFS Office of Protected Resources may impose additional measures to minimize the likelihood of further prohibited take and ensure MMPA compliance. The LOA Holder may not resume their activities until notified by NMFS Office of Protected Resources. The report must include the following information:

(A) Time, date, and location (latitude/longitude; in Decimal Degrees) of the incident; Species identification (if known) or description of the animal(s) involved; Vessel's speed leading up to and during 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).

(B) [Reserved]

(12) LOA Holder must report any lost gear associated with the fishery surveys to the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division (*nmfs.gar.incidental-take@noaa.gov*) as soon as possible or within 24 hours of the documented time of missing or lost gear. This report must include information on any markings on the gear and any efforts undertaken or planned to recover the gear.

§ 217.326 Letter of Authorization.

(a) To incidentally take marine mammals pursuant to this subpart, the LOA Holder must apply for and obtain an LOA.

(b) An LOA, unless suspended or revoked, may be effective for a period of time not to exceed March 26, 2030, the expiration date of this subpart.

(c) In the event of projected changes to the activity or to mitigation and monitoring measures required by an LOA, the LOA Holder must apply for and obtain a modification of the LOA as described in § 217.327.

(d) The LOA must set forth:

(1) Permissible methods of incidental taking;

(2) Means of effecting the least practicable adverse impact (*i.e.,* mitigation) on the species, its habitat, and on the availability of the species for subsistence uses; and

(3) Requirements for monitoring and reporting.

(e) Issuance of the LOA must be based on a determination that the level of taking must be consistent with the findings made for the total taking allowable under the regulations of this subpart.

(f) Notice of issuance or denial of an LOA must be published in the **Federal Register** within 30 days of a determination.

§ 217.327 Modifications of Letter of Authorization.

(a) An LOA issued under §§ 217.322 and 217.326 or this section for the activity identified in § 217.320(a) shall be modified upon request by the LOA Holder, provided that:

(1) The proposed specified activity and mitigation, monitoring, and reporting measures, as well as the anticipated impacts, are the same as those described and analyzed for this subpart (excluding changes made pursuant to the adaptive management provision in paragraph (c)(1) of this section); and

(2) NMFS Office of Protected Resources determines that the mitigation, monitoring, and reporting measures required by the previous LOA under this subpart were implemented.

(b) For a LOA modification request by the applicant that include changes to the activity or the mitigation, monitoring, or reporting (excluding changes made pursuant to the adaptive management provision in paragraph (c)(1) of this section) that do not change the findings made for the regulations in this subpart or result in no more than a minor change in the total estimated number of takes (or distribution by species or years), NMFS Office of Protected Resources may publish a notice of proposed LOA in the **Federal Register**, including the associated analysis of the change, and solicit public comment before issuing the LOA.

(c) An LOA issued under §§ 217.322 and 217.326 or this section for the activities identified in § 217.320(a) may be modified by NMFS Office of Protected Resources under the following circumstances:

(1) Through adaptive management, NMFS Office of Protected Resources may modify (including augment) the existing mitigation, monitoring, or reporting measures (after consulting with the LOA Holder regarding the practicability of the modifications), if doing so creates a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring;

(i) Possible sources of data that could contribute to the decision to modify the mitigation, monitoring, or reporting measures in an LOA are:

(A) Results from the LOA Holder's monitoring from the previous year(s);

(B) Results from other marine mammals and/or sound research or studies; and

(C) Any information that reveals marine mammals may have been taken in a manner, extent, or number not authorized by the regulations in this subpart or subsequent LOA.

(ii) If, through adaptive management, the modifications to the mitigation, monitoring, or reporting measures are substantial, NMFS Office of Protected Resources shall publish a notice of proposed LOA in the **Federal Register** and solicit public comment.

(2) If NMFS Office of Protected Resources determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in the LOA issued pursuant to §§ 217.322 and 217.326 or this section, an LOA may be modified without prior notice or opportunity for public comment. Notice would be published in the **Federal Register** within 30 days of the action.

§§ 217.328–217.329 [Reserved]

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