DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 217

[Docket No. 231206–0289]

RIN 0648–BM32

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to the Maryland Offshore Wind Project Offshore of Maryland

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

ACTION: Proposed rule; request for comments.

SUMMARY: NMFS has received a request from US Wind, Inc., (US 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 Level B harassment, of small number of marine mammals over the course of 5 years (2025–2029) incidental to construction of the Maryland Offshore Wind Project offshore of Maryland within the Bureau of Ocean Energy Management (BOEM) Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS) Lease Area OCS–A 0490 (Lease Area) and associated Export Cable Routes. Project activities likely to result in incidental take include impact pile driving and site assessment surveys using high-resolution geophysical (HRG) equipment. NMFS requests comments on its 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 notice of our decision. The proposed regulations, if issued, would be effective January 1, 2025 through December 31, 2029.

DATES: Comments and information must be received no later than February 5, 2024.

ADDRESSES: Submit all electronic public comments via the Federal e-Rulemaking Portal. Go to *https://www.regulations.gov* and enter NOAA–NMFS–2023–0110 in the Search box. (note: copying and pasting the FDMS Docket Number directly from this document may not yield search results). 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 *https://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).

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

SUPPLEMENTARY INFORMATION:

Availability

A copy of US 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 Maryland Offshore Wind Project (hereafter, ''Project'') within the BOEM Renewable Energy Development Lease Area and along export cable corridors to landfall locations in Delaware. NMFS received a request from US Wind for 5-year regulations and a LOA that would authorize take of individuals of 19 species of marine mammals (5 species by Level A harassment and Level B harassment and 14 species by Level B harassment only), comprising 20 stocks, incidental to US Wind's construction activities. No mortality or serious injury is anticipated or proposed for authorization. Please see below for definitions of harassment. 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 (when applicable), 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, 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) (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; 50 CFR 216.3);
- *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 (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); 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 associated LOA. This proposed rule also establishes required mitigation, monitoring, and reporting requirements for US 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 pile driving during the months of highest North Atlantic right whale (*Eubalaena glacialis*) presence in the project area (December 1–April 30);
- Require both visual and passive acoustic monitoring by trained, NMFS-approved Protected Species Observers (PSOs) and Passive Acoustic Monitoring (PAM) operators before, during, and after impact pile driving and HRG surveys;
- Require training for all US Wind personnel that would clearly articulate all relevant responsibilities, communication procedures, marine mammal monitoring and mitigation protocols, reporting protocols, safety, operational procedures, and requirements of the ITA and ensure that all requirements are clearly understood by all participating parties;
- Require the use of sound attenuation device(s) during all foundation installation activities to reduce noise levels;
- Delay the start of foundation installation if a North Atlantic right whale is observed at any distance by a PSO or acoustically detected within certain distances;
- Delay the start of foundation installation 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;
- Shut down HRG survey equipment that may impact marine mammals if a marine mammal enters their respective shut down zones;
- Conduct sound field verification during impact pile driving to ensure in situ noise levels are not exceeding those modeled;
- Implement soft starts for impact pile driving;
- Implement ramp-up for HRG site characterization survey equipment;
- Increase awareness of North Atlantic right whale presence through monitoring of the appropriate networks and very high-frequency (VHF) 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 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 plans to adopt the BOEM 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, ''Maryland Offshore Wind Project Draft Environmental Impact Statement (DEIS) for Commercial Wind Lease OCS–A 0490'', was made available for public comment on October 6, 2023 (88 FR 69658) and is available at *https://www.boem.gov/renewable-energy/state-activities/maryland-offshore-wind.* The DEIS had a 45-day public comment period open from October 6, 2023 to November 20, 2023. Additionally, BOEM held two in-person public meetings on October 24, 2023 in Ocean City, Maryland and October 26, 2023 in Dagsboro, Delaware and two virtual public meetings on October 19, 2023 and October 30, 2023.

Information contained within US Wind's 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)).

US Wind's proposed project is listed on the Permitting Dashboard. Milestones and schedules related to the environmental review and permitting for the US Wind's Maryland Offshore Wind Project can be found at *https://www.permits.performance.gov/permitting-project/maryland-offshore-wind-project.*

Summary of Request

On August 31, 2022, NMFS received a request from US Wind, a Baltimore, Maryland-based company registered in the State of Delaware and subsidiary of Renexia SpA, 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 Project offshore of Maryland in the BOEM Lease Area OCS–A 0490 and associated export cable routes. The request was for the incidental, but not intentional, taking of a small number of 19 marine mammal species (comprising 20 stocks). Neither

US Wind nor NMFS expects serious injury or mortality to result from the specified activities nor is any proposed for authorization.

US Wind is proposing to develop the Project over the course of three construction campaigns. In total, the 3 campaigns would result in a maximum of 114 wind turbine generators (WTGs), 4 offshore substations (OSS) positions, and 1 Meteorological tower (Met tower) within the Lease Area. The initial construction campaign, MarWin, would include installation of approximately 21 WTGs, 1 OSS, and cable landing infrastructure during the first year of activities in the most eastern part of the Lease Area. The second construction campaign, Momentum Wind, would take place during the second year of construction activities and include installation of approximately 55 WTGs, 2 OSSs, and a Met tower immediately to the west of MarWin. The third construction campaign, currently unnamed and referred to as Future Development, would occur during the third year of construction activities and include the installation of approximately 38 WTGs and 1 OSS in the most western portion of the Lease Area. Four offshore export cables would transmit electricity generated by the WTGs from the Lease Area to onshore transmission systems within Delaware Seashore State Park.

In response to our comments and following extensive information exchanges with NMFS, US Wind submitted a final, revised application on March 31, 2023 that NMFS deemed adequate and complete on April 3, 2023. The final version of the application is available on NMFS' website at: *https://www.fisheries.noaa.gov/action/incidental-take-authorization-us-wind-inc-construction-and-operation-maryland-offshore-wind.* On May 2, 2023, NMFS published a notice of receipt (NOR) of the adequate and complete application in the **Federal Register** (88 FR 27463), requesting comments and soliciting information related to US Wind's request during a 30-day public comment period. During the NOR public comment period, NMFS received comment letters from 77 private citizens, 6 non-governmental organizations, and 1 state government organization (Delaware Department of Natural Resources and Environmental Control). NMFS has reviewed all submitted material and has taken these into consideration during the drafting of this proposed rule.

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 (UME). 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 US 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.

On September 6, 2023, and September 11, 2023, US Wind submitted supplemental information related to its pilot whale and seal take analyses. The corresponding memos, entitled ''US Wind NMFS Request for Information (RFI) Response Memo and Maryland Offshore Wind Project Revised Requested Take Tables'' are available on our website.

Description of the Specified Activities

Overview

US Wind has proposed to construct and operate a wind energy facility, the Project, in the Atlantic Ocean in lease area OCS–A 0490, offshore Maryland. The Project would allow the State of Maryland to advance Federal and State offshore wind targets as well as reduce greenhouse gas emissions, increase grid reliability, and support economic development growth in the region. The Project consists of three construction campaigns including MarWin, located in the southeastern portion of the Lease Area with the potential to generate approximately 300 megawatts (MW) of energy, Momentum Wind, located immediately west of MarWin with the potential to generate approximately 808 MW of energy, and Future Development, which encompasses buildout of the remainder of the Lease Area and for which generation capacity has yet to be determined. Once operational, MarWin and Momentum Wind would advance the State of Maryland's renewable energy goals of 50 percent by the year 2030, with the full buildout of the Lease Area further achieving renewable energy targets. US Wind also anticipates completing the Future Development campaign within the effective period of the proposed rule.

The Project would consist of several different types of permanent offshore infrastructure, including up to 114 WTGs (*e.g.,* 18–MW model with a 250-meter (m) rotor diameter platform), four OSSs, a Met tower, and inter-array and export cables. The Project is divided into three construction campaigns: MarWin, Momentum Wind, and Future Development (table 1). MarWin would occupy approximately 46.6 km^2 (11,515 acres) which would include approximately 21 WTGs and 1 OSS. The MarWin campaign, as well as subsequent Momentum Wind and Future Development, includes monopiles as the one potential WTG foundation type. For each campaign, the OSS would be supported by monopiles or jacket foundations with skirt piles. Skirt piles are post-piled pin piles. Jacket foundations are placed on the seabed and pin piles are driven into jacket pile guides, which are known as skirts. Table 1 provides a summary of each construction campaign.

TABLE 1—US WIND'S ANTICIPATED CONSTRUCTION CAMPAIGN SCHEDULE

Campaigns	Construction year	Number of 11-m monopiles for WTGs	Number 3-m pin piles for OSS jacket foundations [1]	Number of 1.8-m pin piles for Met tower	Onshore export cables	Offshore substations
MarWin	1 (2025)	21	4 (1 jacket)	0	4	1
Momentum	2 (2026)	55	8 (2 jackets)	3	0	2

TABLE 1—US WIND'S ANTICIPATED CONSTRUCTION CAMPAIGN SCHEDULE—Continued

Campaigns	Construction year	Number of 11-m monopiles for WTGs	Number 3-m pin piles for OSS jacket foundations [1]	Number of 1.8-m pin piles for Met tower	Onshore export cables	Offshore substations
Future Development	3 (2027)	38	4 (1 jacket)	0	0	1

[1] Potential OSS foundations could also include monopile and suction bucket jacket foundations.

Strings of WTGs will connect with the OSS via a submarine inter-array cable transmission system. Up to four high-voltage alternating current (HVAC) offshore export cables would be installed during the MarWin campaign, spanning approximately 65–97 km (40–60 miles (mi)) in length, dependent on the location of the OSS and the final routing. The Export Cable Corridor (ECC) would transmit electricity from the OSS to one or two landfall sites in Delaware Seashore State Park.

The second construction campaign, Momentum Wind, would contain approximately 55 WTGs, 2 OSSs, and 1 Met tower within an area of approximately 142.4 km^2 (35,188 acres). The Met tower would be supported by pin pile foundations. During the third construction campaign, Future Development, approximately 38 WTGs and 1 OSS would be installed within an area of approximately 80.3 km^2 (19,843 acres).

US Wind plans to install all monopile or pin pile foundations via impact pile driving. If suction bucket foundations are selected for OSS jacket foundations, impact pile driving would not be necessary. US Wind would also conduct the following supporting activities: temporary installation and subsequent removal of gravity cells to connect the offshore export cables to onshore facilities; permanently install scour protection around all foundations; permanently install and perform trenching, laying, and burial activities associated with the export cables from the OSSs to shore-based switching and sub-stations and WTG inter-array cables; and, during years 2 and 3, performance of HRG surveys using active acoustic sources with frequencies of less than 180 kilohertz (kHz). Vessels would transit within the project area and anticipated between ports (Port Norris, NJ; Lewes, DE; Ocean City, MD; Baltimore, MD; Hampton Roads, VA; and Cape Charles, VA) and the Lease Area and cable corridors to transport crew, supplies, and materials to support construction activities.

Up to four offshore export cables would be located among up to two corridors from the OSSs and connect to the planned landfall at either 3R's Beach or Tower Road within Delaware Seashore State Park. When the cables reach the landfall site, they would be pulled into a cable duct generated by horizontal directional drilling (HDD), which would route the cables under the existing beach to subterranean transition vaults. All offshore cables would be connected to onshore export cables at the sea-to-shore transition point via trenchless installation (*i.e.,* underground tunneling utilizing micro tunnel boring installation methodologies).

Fishery monitoring surveys, performed via recreational boat-based surveys and a pot-based monitoring approach using ropeless gear technology, would be conducted in conjunction with the University of Maryland Center for Environmental Science (UMCES) to enhance existing data for specific benthic and pelagic species of concern.

Dates and Duration

As described above, US Wind would conduct 3 campaigns over 3 years: MarWin, Momentum Wind, and Future Development (table 1). In case of any delays to any campaign, NMFS is proposing a 5-year effective date of the proposed regulations and LOA; however, no more work in any given year or total over 5 years other than described here would occur. US Wind anticipates that activities with the potential to result in incidental take of marine mammals would occur throughout 3 of the 5 years (2025–2027) of the proposed regulations which, if issued, would be effective from January 1, 2025 through December 31, 2029. Based on US Wind's proposed schedule, the installation of all permanent structures would be completed by the end of November 2027. More specifically, US Wind would install piles only between May 1 and November 30. Also, the installation of WTG foundations and OSS 3-m pin pile jacket foundations is expected to occur during daylight hours between May 1 and November 30 of 2025, 2026, and 2027 (table 2); however, NMFS is proposing to allow nighttime pile driving if US Wind submits, and NMFS approves, an Alternative Monitoring Plan, as discussed below. The single Met tower foundation would be installed in 2026 (table 2).

US Wind anticipates HRG surveys using sparkers and boomers to occur during 2026 and 2027. Up to 14 days of HRG survey activity are planned from April through June 2026 during the Momentum campaign. In addition, up to 14 days of HRG survey activity are planned from April through June 2027 during the Future Development campaign. No HRG surveys using equipment that has the potential to result in the harassment of marine mammals (*e.g.,* sparkers or boomers) are planned for the MarWin campaign during year 1.

TABLE 2—US WIND'S ANTICIPATED CONSTRUCTION AND OPERATIONS SCHEDULE DURING THE EFFECTIVE PERIOD OF THE LOA [1]

Project activity	Construction campaign	Expected timing [2]	Expected duration (approximate)
Scour Protection Pre-Installation	MarWin	*Year 1:* Q2 through Q3 of 2025	21 days.
	Momentum Wind	*Year 2:* Q2 through Q3 of 2026	55 days.
	Future Development	*Year 3:* Q2 through Q3 of 2027	38 days.
WTG Foundation Installation [3 5]	MarWin	*Year 1:* June through September of 2025	21 days.
	Momentum Wind	*Year 2:* May through August of 2026	55 days.
	Future Development	*Year 3:* June through August of 2027	38 days.
Scour Protection Post-Installation	MarWin	*Year 1:* Q2 through Q3 of 2025	42 days.
	Momentum Wind	*Year 2:* Q2 through Q3 of 2026	110 days.
	Future Development	*Year 3:* Q2 through Q3 of 2027	76 days.
OSS Foundation Installation [3 5]	MarWin	*Year 1:* July of 2025	1 day.

TABLE 2—US WIND'S ANTICIPATED CONSTRUCTION AND OPERATIONS SCHEDULE DURING THE EFFECTIVE PERIOD OF THE LOA [1]—Continued

Project activity	Construction campaign	Expected timing [2]	Expected duration (approximate)
	Momentum Wind	*Year 2:* July of 2026	2 days.
	Future Development	*Year 3:* July of 2027	1 day.
Met Tower Installation [3 4]	Momentum Wind	*Year 2:* June of 2026	1 day.
HRG Surveys [5]	Momentum Wind	*Year 2:* Q2 through Q3 of 2026	14 days.
	Future Development	*Year 3:* Q2 through Q3 of 2027	14 days.
Site Preparation	n/a	Not anticipated	n/a.
Inter-array Cable Installation	Marwin	*Year 1:* Q2 through Q4 of 2025	42 days.
	Momentum Wind	*Year 2:* Q2 through Q4 of 2026	110 days.
	Future Development	*Year 3:* Q2 through Q4 of 2027	76 days.
Export Cable Installation	MarWin	*Year 1:* Q1 through Q4 of 2025	60 days.
	Momentum Wind	*Year 2:* Q1 through Q4 of 2026	120 days (2 cables).
	Future Development	*Year 3:* Q1 through Q4 of 2027	60 days.
Fishery Monitoring Surveys	MarWin	Q1 through Q4 Years 1–5	16 days/year for commercial pot surveys.
	Momentum Wind		12 days/year for recreational surveys.
	Future Development		

[1] While the effective period of the proposed regulations would extend through December 31, 2029, no activities are proposed to occur in 2028 or 2029 by US Wind so these were not included in this table.
[2] Installation timing will depend on vessel availability, contractor selection, weather, and more. Year 1 is anticipated to be 2025, year 2 to be 2026, and year 3 to be 2027, although these are subject to change per the factors identified. Note: "Q1, Q2, Q3, and Q4" each refer to a quarter of the year, starting in January and comprising 3 months each. Therefore, Q1 represents January through March, Q2 represents April through June, Q3 represents July through September, and Q4 represents October through December.
[3] The months identified here represent US Wind's planned schedule; however, in case of unanticipated delays, foundation installation may occur between May 1 and November 30 annually.
[4] US Wind anticipates that all WTGs, OSS, and Met tower foundations will be installed by November 30, 2027; however, unanticipated delays may require some foundation pile driving to occur in years 4 (2028) or 5 (2029).
[5] Represents HRG surveys that may result in take of marine mammals. US Wind plans to conduct HRG surveys that do not have the potential to result in take of marine mammals during Q2 through Q3 of year 1 given those surveys would utilize equipment all operating over 180kHz or have no acoustic output.

Specific Geographic Region

US Wind's specified activities would occur within the Northeast U.S. Continental Shelf Large Marine Ecosystem (NES LME), an area of approximately 260,000 km^2 (64,247,399.2 acres) from Cape Hatteras in the south to the Gulf of Maine in the north. Specifically, the specified geographic region is the Middle-Atlantic Bight (Mid-Atlantic Bight) sub-area of the NES LME. The Mid-Atlantic Bight encompasses waters of the Atlantic Ocean 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, 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. There are some larger materials, left by retreating glaciers, along the coast of Long Island and to the north and east.

Primary productivity is highest in the nearshore and estuarine regions, with coastal phytoplankton blooms initiating in the winter and summer, although the timing and spatial extent of blooms varies from year to year. The relatively productive continental shelf supports a wide variety of fauna and flora, making it important habitat for various benthic and fish species and marine mammals, including but not limited to, fin whales, humpback whales, North Atlantic right whales, and other large whales as they migrate through the area. The Cold Pool, a bottom-trapped cold, nutrient-rich pool and distinct oceanographic feature of the Mid-Atlantic Bight, creates habitat that provides thermal refuge to cold water species in the area (Lentz, 2017). Cold Pool waters, when upwelled to the surface, promote primary productivity within this region (Voynova *et al.,* 2013).

The seafloor in the Project Area is dynamic and changes over time due to current, tidal flows, and wave conditions. As the Lease Area is located just south of the mouth of Delaware Bay, the seafloor bedforms and sediments are affected by interactions between storm-driven currents, storm discharges from Delaware Bay, and tidal flows associated with Delaware Bay (US Wind, 2023b). The Lease Area is defined by medium-coarse grained sand at the surface and sub-surface interlays of clay and gravel (Alpine, 2015). The most prominent bathymetric features of the Lease Area are ridges and swales offshore of the Delmarva Peninsula that extend seaward from Delaware Bay (US Wind, 2023b). Sand ripples are present throughout the Project area. Sediment within the onshore export cable corridor is composed of predominantly silt-sand mixed with medium-coarse grained sand (US Wind, 2023b). The bottom habitat of Indian River Bay, through which the export cable route may pass through, is relatively flat in elevation and comprises fine to course-grained sands area.

The benthic habitat of the Project Area contains a variety of seafloor substrates, physical features, and associated benthic organisms. The benthic macrofaunal community of the Lease Area is dominated by polychaetes and oligochaete worms yet may also include sand dollars, sea stars, tube anemones, hermit crabs, rock crabs, moon snails, nassa snails, surf clams, sea scallops, shrimp, and ocean quahog (Guida *et al.,* 2017).

Additional information on the underwater environment's physical resources can be found in the COP for the Maryland Offshore Wind Project (US Wind, 2023b) available at: *https://www.boem.gov/renewable-energy/state-activities/maryland-offshore-wind-construction-and-operations-plan.*

US Wind would construct the Project in Federal and State waters offshore of Maryland within the BOEM Lease Area OCS–A 0490 and associated export cable routes (figure 1). The Lease Area covers approximately 323.7 square kilometers (km^2) (80,000 acres) and is located approximately 18.5 km offshore of Maryland. The water depths in the Lease Area range from 13 m along the western lease border to 41.5 m (43 to 136.1 feet (ft)) along the southeast corner of the lease area while depths along the export cable routes range from 10 m to 45 m (33 to 148 ft). Mean sea surface temperatures range from 42 to 75.8 degrees Fahrenheit (°F; 5.56 to 24.3 degrees Celsius (°C), while the depth-average annual water temperature is 58.2 °F (14.6 °C). Cables would come ashore at 3Rs Beach or Tower Road within Delaware Seashore State Park. The Project Area is defined as the Lease Area and export cable route area.

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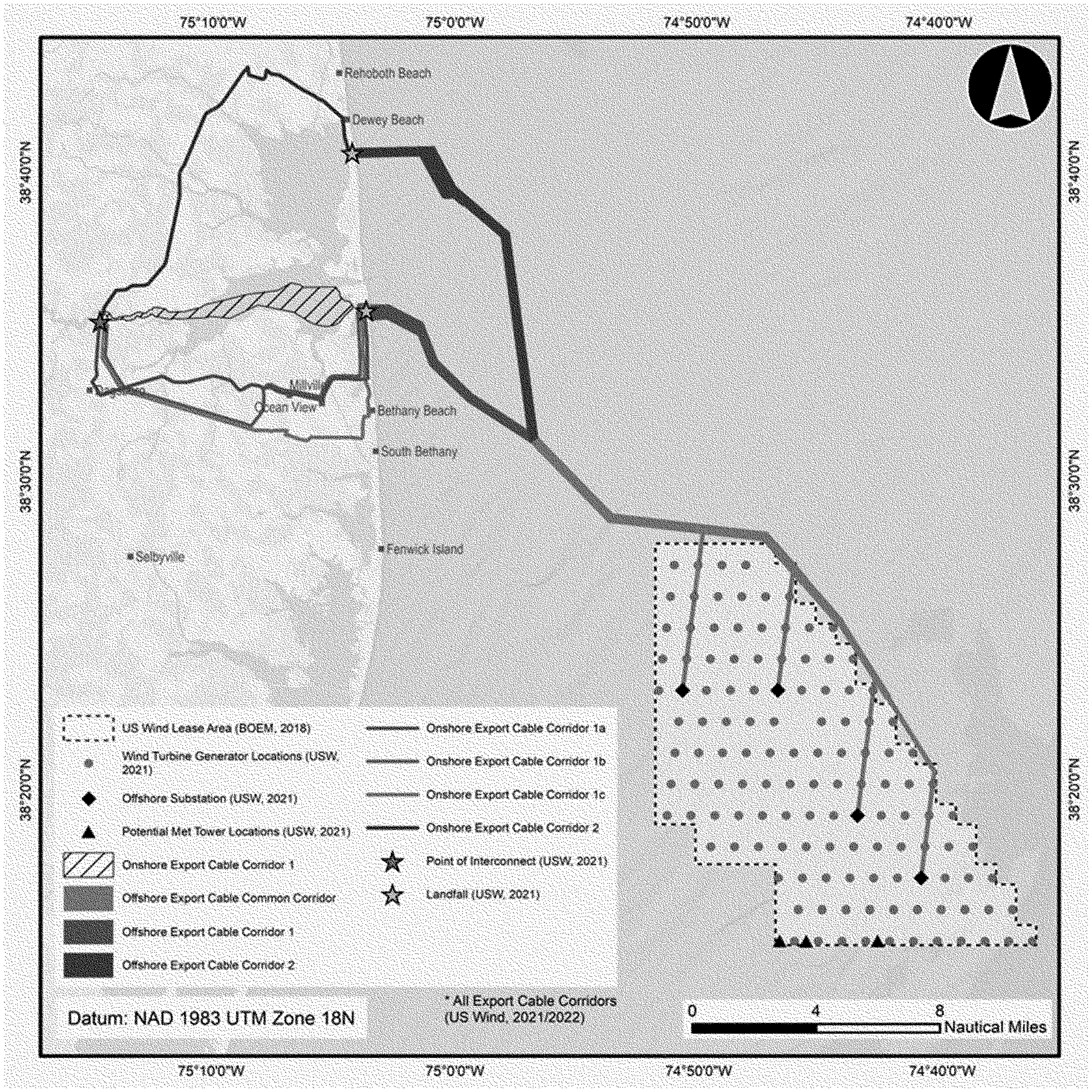

Figure 1 -- The Maryland Offshore Wind Project Area

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Detailed Description of the Specified Activity

Below, we provide detailed descriptions of US Wind's planned 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, OSS, and Met Tower Foundations

US Wind proposes to install up to 114 WTGs on monopile foundations, 4 OSSs on 3-m pin pile jacket foundations, and one Met tower on a 1.8-m pin pile foundation. US Wind is also considering monopile foundations and suction bucket jacket foundations for OSSs, although 3-m pin pile jacket foundations are the most likely foundation type. All WTG and OSS foundations would be installed between May 1 and November 30 in 2025 (MarWin), 2026 (Momentum Wind), and 2027 (Future Development) (refer back to table 1). No pile driving would occur December 1–April 30. For purposes of this proposed rule, US Wind assumed all foundations would be installed using an impact hammer, unless US Wind uses gravity suction bucket-based jacket foundations for OSSs.

A WTG monopile foundation typically consists of a coated single steel tubular section, with several sections of rolled steel plate welded together. Each monopile would have a maximum diameter of 11 m (36 ft). WTGs would be spaced approximately 0.77 nautical miles (nmi; 1.42 km) in an east-west direction and 1.02 nmi (1.89 km) in a north-south direction and driven to a maximum penetration depth of 50 m (164 ft) below the seafloor (US Wind, 2023a). Monopile foundations would consist of a monopile with an integrated or separate transition piece. US Wind would install rock scour protection around the base of the monopile foundations prior to or following installation to minimize scour around the foundation bases (US Wind, 2023). Monopile foundations would be installed using an MHU 4400 impact hammer at a maximum hammer energy of 4,400 kJ. US Wind anticipates that one monopile will be installed per day at a rate of approximately 2 hours of active pile driving time per monopile, though two or more monopile installations per day may be possible depending on operational limitations and environmental conditions (table 3).

Monopile, pin pile jacket, and gravity suction-bucket jacket foundations are technically and economically feasible for OSSs. Up to four OSSs would be installed via impact pile driving (monopile and pin pile jacket foundations) or dewatering process to sink suction buckets to the appropriate depth. Rock scour protection would be applied after foundation installation.

Monopile foundations for the OSSs would have a maximum diameter of 11 m (36 ft) and maximum pile penetration depth of 40 m (131 ft). Monopile foundations would have a separate transition piece with a number of J-tubes to support and protect cables as well as to connect the inter-array cables and the offshore export cable to the OSS. If monopiles are selected for the OSSs, monopiles would be installed through impact pile driving according to the same methods as described for WTG monopile foundations.

Jacket foundations with pin piles, if selected for OSS design, may be pre-piled or post-piled using pin piles with a maximum diameter of 3-m (9.8 ft). A pre-piled jacket would involve pin piles pre-installed in the seabed using a template. A post-piled jacket foundation is formed by a steel lattice construction (comprising tubular steel members and welded joints) secured to the seabed by means of hollow steel pin piles attached to the jacket where the pin piles have been driven through jacket skirts (skirt piles). Each jacket structure may have three, four, or six legs. A four-leg OSS with a post-piled pin pile jacket foundation is the most likely design and was selected for modeling impacts to marine mammals from OSS installation. Each jacket foundation would consist of up to four pin piles. In total, US Wind would install up to 4 OSSs for a total of 16 pin piles. Up to four 3-m pin piles would be installed per day using an impact hammer with a maximum hammer energy 1,500 kJ (table 3). Pin piles would have a maximum diameter of 3 m (9.8 ft) each and would be installed vertically.

US Wind plans to install one Met tower to serve as a permanent metocean monitoring station. The Met tower foundation would be a Braced Caisson design, in which one main steel pile would be supported laterally by two steel supporting (bracing) piles. The main steel pin pile would have a maximum diameter of 1.8 m (72 in) and the two bracing pin piles would have a maximum diameter of 1.5 m (60 in). US Wind assumed bracing pin piles would be 1.8 m in diameter for the purposes of modeling impacts of installation on marine mammals. The main caisson and bracing piles would be installed using an impact hammer with a maximum energy of 500 kJ at a rate of approximately 2 hours per pin over the course of 2 days (table 3). The Met tower would include measurement devices to record weather conditions, such as wind and waves, in the Project Area. US Wind identified three potential locations for placement of the Met tower along the southern edge of the Lease Area, as shown in figure 1–2 of the ITA application.

If US Wind installs suction bucket jacket foundations, they would have a maximum diameter of 15 m (49 ft) and pile penetration depth of 15 m (49 ft). Suction bucket jacket foundations would be installed through a dewatering process which generates pressure that draws the buckets to the desired depth. The process to install a suction bucket foundation does not produce elevated noise levels that could harass marine mammals; therefore, no take from this activity is anticipated to occur or is proposed to be authorized. Installation is not expected to result in take of marine mammals. Suction bucket foundations are not further discussed.

TABLE 3—IMPACT PILE DRIVING SCHEDULE

Pile type	Project component	Max hammer energy (kJ)[1]	Number of hammer blows	Piling time duration per pile (min)	Piling time duration per day (min)	Number piles/day
11-m monopile	WTG	1,100 2,200 3,300	600 2,400 [2] 1,800	120	120	1
3-m pin pile jacket foundations	OSS	1,500	19,200	120	480	4
1.8-m Steel Bracing Caisson pile[3]	Met tower	500	2,988	120	360	1
1.8-m Steel Bracing pile[3]						2

[1] Assumes MHU 4400 hammer.

[2] US Wind has proposed a hammer strike energy progression for impact pile driving of monopiles, beginning at a hammer energy of 1,100 kJ to an energy of 3,300 kJ, although the maximum hammer energy possible (4,400 kJ) was used and scaled in the modeling.

[3] A bracing caisson design has one main pile supported laterally by two bracing piles. The bracing caisson pile and bracing piles for the Met tower are pin piles.

While pre-piling preparatory work and post-piling activities could be ongoing at one foundation position as pile driving is occurring at another position, no concurrent/simultaneous pile driving of foundations would occur (see *Dates and Duration* section). Installation of foundations is anticipated to result in the take of marine mammals due to noise generated during pile driving. Proposed mitigation, monitoring, and reporting measures for impact pile driving are described in detail later in this document (see Proposed Mitigation and Proposed Monitoring and Reporting).

US Wind anticipates the 21 WTGs to be installed during the MarWin campaign would become operational by December 31, 2025. The 55 WTGs to be installed during the Momentum Wind campaign would become operational by December 31, 2026, and the 38 WTGs to be installed during the Future Development campaign would become operational by December 31, 2027 (table 2).

HRG Surveys

US Wind plans on conducting HRG surveys to identify any seabed debris or unexploded ordnance (UXO), confirm previously surveyed site conditions prior to cable installation, meet BOEM or other agency requirements for additional surveys, and to refine or (microsite) locations of construction footprints, WTG and OSS foundations, and cables. US Wind has committed to not detonating any UXOs. US Wind would prepare an avoidance plan for working around UXOs and conduct micro-siting surveys to identify any UXOs in the area. Only the micro-siting surveys have the potential to result in harassment of marine mammals and would be limited to the Lease Area. Pre-construction and UXO HRG surveys would utilize equipment that have operating frequencies that are above relevant marine mammal hearing thresholds or no acoustic output (*e.g.,* magnetometers). Take is not anticipated from the use of this equipment; therefore, pre-construction and UXO HRG surveys are not analyzed further.

HRG micro-siting surveys would occur within the Lease Area, focusing on the inter-array cable layout, as well as along the offshore export cable corridors, if necessary. US Wind estimates approximately 14 days of HRG micro-siting survey effort per year from April through June during years 2 and 3 (Momentum Wind in 2026, Future Development in 2027) and only during daylight hours. HRG micro-siting surveys would be conducted using one vessel at a time. Up to 111.1 km of survey lines would be surveyed per vessel each survey day at approximately 7.4 km/hour (4 knots (kn)) during daylight hours. Acoustic equipment described above (multibeam echosounders, side scan sonars, and marine magnetometers) may be used during micro-siting surveys as well as non-impulsive ultra-short baseline positioning equipment (*i.e.,* Ultra-Short BaseLine (USBL) and other parametric sub-bottom profilers), shallow penetration sub-bottom profilers (SBPs) (*e.g.,* Innomar SES–2000 non-parametric SBP), and medium penetration SBPs (*e.g.,* sparkers and boomers). Take is not anticipated resulting from the use of ultra-short baseline position equipment or the Innomar SBP as these equipment types have a very narrow beam width which limits acoustic propagation, and these sources are not analyzed further.

Of the HRG equipment types proposed for use during micro-siting surveys, 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 4 provides a list of the equipment specifications for the medium penetration SBPs that may result in take of marine mammals during HRG micro-siting surveys. Equipment with operating frequencies above 180 kHz are not discussed further because they are outside the general hearing range of marine mammals and therefore do not have the potential to cause harassment. Although US Wind has proposed a beamwidth of 100 degrees for the Geo Spark sparker, NMFS has determined that a 180-degree beamwidth is more appropriate for this analysis, as sparkers are considered omnidirectional sources (Ruppel *et al.,* 2022). Additionally, US Wind proposed an RMS source level of 219 decibels (dB), based on a manufacturer specification. Because it was not clear which operating energy, tip configuration, or specific sparker model this source level was based on, and also because the manufacturer-provided source levels are not well-documented, NMFS considers the well-documented measurements for a wide variety of sparker configurations from Crocker and Fratantonio (2016) to be the best-available data for use in deriving appropriate proxy source levels. Further, the RMS source levels are given directly in Crocker and Fratantonio (2016), thus mitigating uncertainty associated with deriving RMS levels from peak levels. For these reasons, we have instead used an RMS source level of 206 dB, based on Crocker and Fratantonio (2016) and a 3 dB adjustment to account for the potential use of two 400 tip decks. Source characteristics and details of the source proxy are found in Table 4, and its footnotes below. The net result of NMFS's changes to the proposed methodology is an increase of the Level B isopleth from 50.1 m to 200 m.

Proposed mitigation, monitoring, and reporting measures for HRG micro-siting surveys are described in detail later in this document (see Proposed Mitigation and Proposed Monitoring and Reporting).

TABLE 4—SUMMARY OF REPRESENTATIVE HRG MICRO-SITING SURVEY EQUIPMENT THAT MAY RESULT IN TAKE OF MARINE MAMMALS[1]

HRG system	Representative survey equipment	Operating frequencies (kHz)	Peak source level (dB_{peak})	RMS source level (dB_{RMS})	Pulse duration (ms)	Repetition rate (Hz)	Beamwidth (degrees)
Medium- penetration SBP	Applied Acoustic S Boomer[2]	0.1–5	211	205	0.6	3	80
	AA Dura Spark 400 tip (500 J)[3]	0.3–4	214	206	2.3	2	180

dB = decibels; Hz = hertz.

[1] Of note, NMFS has performed a preliminary review of a report submitted by Rand (2023), that includes measurements of the Geo-Marine Geo-Source 400 sparker (400 tip, 800 J), and suggests that NMFS is assuming lower source and received levels than appropriate in its assessments of HRG impacts. NMFS has determined that the values in our assessment remain appropriate, based on the model methodology (*i.e.,* source level propagated using spherical spreading) here predicting a peak level 3 dB louder than the maximum measured peak levels at the closest measurement range in Rand (2023). NMFS will continue reviewing any available data relevant to these sources.

[2] Crocker and Fratantonio (2016) provide Applied Acoustics S Boomer measurements. Frequency and repetition rate of the Applied Acoustics S Boomer verified by survey contractors.

[3] AA Dura-Spark 400 tip used as a proxy due to similar configuration and energy to the Geo-spark 2000. See Table 10 in Crocker and Fratantonio (2016) source levels for 500 J setting and 400 tips. Based on previous survey experience, US Wind expects to operate the Geo-spark at 400–500 J per 400 tip deck, with the possibility of one or two total 400 tip decks (*i.e.,* 400–1000 J total energy). To account for the potential of two decks, the source level is doubled in energy, which results in the addition of approximately 3 dB (to the 206 dB RMS, as shown in Table 4).

Cable Landfall Construction

US Wind would bring up to four offshore export cables through Indian River Bay to shore to landing locations at 3Rs Beach or Tower Road within the Delaware Seashore State Park (figure 1). The US Wind export cable would be connected to the onshore transmission cable at the landfall locations using horizontal directional drilling (HDD) and a jet plow. Cables would be pulled into cable ducts that would route the cables under the beach to subterranean transition vaults, located in existing developed areas such as parking lots. US Wind evaluated cofferdams at the HDD locations and determined that the use of a gravity cell would be more appropriate for soil conditions as well as avoid the use of a vibratory hammer that would create additional underwater sound. The gravity cell would be lowered onto the seafloor and would not require the walls of the cell to be driven into the seabed (*i.e.,* no pile driving would occur). The HDD drill rig would be set up onshore in an excavated area and the drill would advance to the offshore exit point. The offshore cable would be pulled in through the HDD ducts into the cable jointing/transition vault at the landfall location. The cable installation vessel would then begin laying the cable on the seabed as described in the Cable Laying and Installation section below. Given the work is not expected to produce noise levels that could result in harassment to marine mammals, HDD and gravity cell installation is not expected to result in the take of marine mammals. US Wind did not request, and NMFS is not proposing to authorize, take associated with cable landfall construction; therefore, this activity is not discussed further.

Cable Laying and Installation

Cable burial operations would occur both in the Lease Area and ECCs from the Lease Area to shore. The inter-array cables would connect the WTGs to any one of the OSSs. All WTGs would connect to an OSS in strings of 4–6 WTGs via the inter-array cables. Cables within the ECCs would carry power from the OSSs to shore at the landfall location(s) within Delaware Seashore State Park. The offshore export cables would be buried in the seabed at a target depth of up to 1 m (3.3 ft) to 3 m (9.8 ft), although the exact depth would not exceed 4 m (13.1 ft). Inter-array cable burial operations would be installed to a target depth of 1 m (3.3 ft) to 2 m (6.6 ft), not to exceed 4 m (13.1 ft) in depth and would follow installation of the WTG and OSS foundations as the foundations must be in place to provide connection points. Offshore cable installation may occur concurrently with foundation installation.

Cable laying, cable installation, and cable burial activities planned to occur during the construction of the Project would include the following methods: offshore export cable pull through the HDD duct, simultaneous lay and burial for cable installation through the use of a jet plow, and post-lay burial for cables, as needed. Offshore export cables would be pulled through the HDD duct, as described in the Cable Landfall Construction section above. The inter-array cables would be installed from a dynamically positioned cable installation vessel. US Wind plans to use a jet plow to achieve the target inter-array and offshore cable burial depth. If necessary, post-lay cable burial would be completed through the use of a cable installation support vessel and remotely operated vehicle (ROV) system (US Wind, Inc., 2023a). Areas with cable crossings or hard bottoms may require additional protection measures, such as mattresses, rock placement, or cable protection systems. In shallow areas of cable installation, dredging may be necessary to allow access by the cable lay barge. As the noise levels generated from cable laying and installation work are low, the potential for take of marine mammals to result is discountable. US 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 and Scour Protection

Site preparation typically includes sand bedform leveling, boulder clearance, pre-lay grapnel runs, and a pre-lay survey to prepare the area for export cable installation. Route clearance activities would be conducted prior to offshore export cable installation. Project activities would include a pre-installation survey and grapnel run along the offshore export cable corridor to remove debris that could impact the cable lay and burial. US Wind does not expect pre-installation seabed preparation, such as leveling, pre-trenching, to be necessary. A pre-lay grapnel run would be conducted along the cable route to remove debris that could impact cable lay and burial.

US Wind would also deposit rock around each foundation as scour protection. Prior to or following the installation of a monopile or jacket foundation for the OSS, a first layer of scour protection rocks will be deployed in a circle around the pile location to stabilize the seabed (US Wind, Inc., 2023a). If suction bucket foundations are selected for OSSs, scour protection would be deployed after buckets reach target penetration depth. A 1–2 m (2–7 ft) thick second layer of larger rocks would be placed for stabilization once the inter-array cables have been pulled into the monopile. Scour protection may also be applied as additional protection for cables after burial.

NMFS does not expect scour protection placement or site preparation work, including pre-lay grapnel runs and pre-lay surveys, to generate noise levels that would cause take of marine mammals. Although not anticipated, any necessary dredging, bedform leveling, or boulder clearance would be extremely localized at any given time, and NMFS expects that any marine mammals would not be exposed at levels or durations likely to disrupt behavioral patterns (*i.e.,* migrating, foraging, calving, *etc.*). Therefore, the potential for the take of marine mammals to result from these activities is so low as to be discountable. US Wind did not request, and NMFS is not proposing, to authorize any takes associated with site preparation and scour protection activities; therefore, they are not analyzed further in this document.

Vessel Operation

US Wind will utilize various types of vessels over the course of the 5-year proposed regulations for surveying, foundation installation, cable installation, WTG and OSS installation, and support activities. US Wind has identified several existing port facilities located in Maryland, Virginia, Delaware, and 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 5). Details on the vessels, related work, operational speeds, and general trip behavior can be found in table 1–2 of the ITA application and table 4–1 in the COP volume 1.

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. Fall pipe vessels may use dynamic positioning thrusters during the installation of scour protection up to 24 hours per day. Jack-up cranes or floating cranes may use dynamic positioning thrusters for up to 4 hours per WTG or OSS installation. Heavy lift and general cargo vessels may use dynamic positioning thrusters for the delivery of Project components from the manufacturing location to the staging/assembly port only while maneuvering in port. Multipurpose offshore supply vessels may also use dynamic positioning thrusters throughout the day during the pre-lay grapnel run boulder clearance and cable burial. Jack-up or accommodation vessels may use dynamic positioning thrusters while constructing housing for offshore works, yet only while maneuvering to the site, which would last approximately 2 hours per WTG or OSS. Dynamic positioning thrusters may also be used by vessels throughout the day for pre-installation, geophysical and geotechnical verification surveys, cable installation, placement of scour protection and concrete mattresses, seabed preparation and leveling, and commissioning 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. US Wind did not request, and NMFS does not propose to authorize, any take associated with vessel activity.

The total vessels expected for use during the Project are provided in table 5; more details can be found in table 1–2 of the ITA application. Assuming the maximum design scenario, approximately 458 total vessel round trips are expected to occur during the MarWin construction campaign (2025), approximately 1,944 total vessel round trips are expected to occur during the Momentum Wind construction campaign (2026), and approximately 1,587 total vessel round trips are expected to occur during the Future Development construction campaign (2027). Vessels would remain on site during construction activities each year to reduce the number of transits between the Project Area and ports.

For operations and maintenance, US Wind anticipates that up to 10 vessels could be used, although not all vessels would operate at the same time or every year. A fall pipe vessel, jack-up vessel, and multi-role survey vessel only be used for non-routine maintenance activities (table 5). Crew transfer vessels would not be likely to operate on a daily basis year-round, however, to be conservative, US Wind assumed that these vessels would operate on a daily basis (table 5).

TABLE 5—TYPE AND NUMBER OF VESSELS ANTICIPATED DURING CONSTRUCTION AND OPERATIONS

Project period	Vessel types	Max number of vessels	Expected maximum annual number of trips [1]
Foundation Installation	Transport, Installation, and Support	5	10
	Crew Transfer	1	26
	Environmental Monitoring and Mitigation	4	52
WTG Installation	Transport, Installation, and Support	4	26
	Crew Transfer Vessel	0	0
Inter-array Cable Installation	Transport, Installation, and Support	4	5
	Crew Transfer Vessel	2	136
OSS Installation	Transport, Installation, and Support	9	16
	Crew Transfer Vessel	0	0
Offshore Export Cable Installation	Transport, Installation, and Support	6	25
	Crew Transfer Vessel	0	0
Operations and Maintenance [2]	Fall Pipe Vessel	1	1
	Crew Transfer Vessel (refueling) [3]	1	20
	Jack-up Vessel	1	1
	Multi-role Survey Vessel [4]	2	13
	Sportfisher Vessel	1	100
	Crew Transfer Vessel	4	365 [5]

[1] Vessels and trips provided represent the maximum number of year 2 trips for each vessel category for each activity from US Wind's OCS air permit application, appendix A.
[2] Potential operation and maintenance ports include Ocean City, MD; Baltimore, MD; and Portsmouth, VA.
[3] Only for non-routine maintenance activities
[4] One of these vessels would be for non-routine maintenance activities
[5] Expected maximum annual number of trips per year for each of the four vessels. Fourth vessel may not be necessary.

While a vessel strike could cause injury or mortality of a marine mammal, NMFS is proposing to require extensive vessel strike avoidance measures that would avoid vessel strikes from occurring (see Proposed Mitigation section). US 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 collaboration with UMCES. UMCES and US Wind would conduct pot surveys and recreational fishing surveys focusing on evaluating the extent that commercial and recreational fisheries would be impacted due to changes in black sea bass aggregation behaviors during and after Project construction activities. The program includes a trial baseline year to test deployments and collect baseline data in the Project Area as well as a data synthesis year before construction activities would begin. UMCES and US Wind would conduct additional passive acoustic monitoring research for marine mammals.

Pot surveys offshore Ocean City would be conducted monthly from March through November using ropeless fishing gear to collect data on black sea bass relative abundance in the vicinity of the proposed turbine areas. Catches and sizes of other fauna would be assessed as well. US Wind would set strings of 15 pots (six strings, up to 90 pots total) from a commercial fishing vessel, each string with a 1-day duration set period. EdgeTech ropeless gear (EdgeTech, 2023) would allow sets (trawls) of 15 pots without any rope in the water column. Approximately 300–355 m (984–1,165 ft) of 7⁄16 inch (in) main-line rope would lie on the bottom during the survey. There would also be approximately 1.5 m of 7⁄16 in line that would form the bridle connecting each pot to the main line. Each string of pots would consist of 15 black sea bass pots, an EdgeTech pot, and an anchor. The EdgeTech pot would be the release pot attached at the end of each trawl. Each survey would consist of six strings deployed for a 1-day soak time (see diagram in Proposed Rule Comment Responses Memo, October 12, 2023). After the 1-day set period, UMCES and US Wind would retrieve the pot trawls by sending a release command from the on-site research vessel to activate an acoustic release on the release pot. Upon activation, the flotation with the attached rope would ascend to the water surface. UMCES and US Wind would recover the floatation connected to the release pot as well as the rest of the pots for that trawl. The pot survey would be conducted under a NMFS Scientific LOA for black sea bass collection research, of which a similar letter was received by UMCES from NMFS Greater Atlantic Regional Fisheries Office (GARFO) for the initial trial baseline year.

UMCES and US Wind would operate the recreational fishing survey off a recreational charter vessel based in Ocean City to compare data on black sea bass and other fauna between two artificial reef/wreck sites and two turbine sites using a Before-After-Control-Impact (BACI) study design. Angling techniques, such as drop bottom fishing and jigging, would be used to collect catch data on black sea bass and other fauna. Six monthly recreational surveys spanning a 2-day window each, would be conducted annually from May through October.

Passive acoustic monitoring research would focus on using rockhopper recorders to determine occurrence and position of large whales and dolphins as well as F–POD (full waveform capture Pod) devices to detect tonal echolocation clicks of small cetaceans in the Lease Area. The goal of the research would be to distinguish changes in marine mammal behavior due to natural inter-annual variation versus behaviors influenced by wind facility operations. US Wind and UMCES would use a before-during-after gradient design involving 2 years of monitoring in each period before, during, and after Project construction, from 2023 to 2029. The Rockhopper recorder would sample at 200 kHz for baleen whales and dolphins while the F–POD would detect echolocation clicks of small cetaceans. Rockhopper recorders would include a localization array with the Lease Area to allow the positions of calling North Atlantic right whales, humpback whales, and dolphins to be detected. Innovasea receivers would also be attached at up to four mooring sites within the Lease Area to examine spatiotemporal patterns of previously tagged fish, such as Atlantic sturgeon, white sharks, and sand tiger sharks.

Given the gear used (ropeless pot and hook and line), the fishery surveys present little risk to marine mammals (although some hook and line entanglement has been documented in marine mammals). To further minimize this already low risk of interaction, US Wind has proposed, and NMFS has included in the proposed rule, mitigation and monitoring measures to avoid taking marine mammals, including, but not limited to, monitoring for marine mammals before and during fishing/survey activities, not deploying, pulling gear, or fishing in certain circumstances, limiting tow times, and fully repairing nets and lines. All vessel captains and crew would also abide by the vessel strike avoidance measures outlined in § 217.344(b) of this rule. A full description of mitigation measures can be found in the Proposed Mitigation section.

With the implementation of these measures, US Wind does not anticipate, and NMFS is not proposing to authorize, take of marine mammals incidental to research pot and recreational 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 Geographic Area

Thirty-eight marine mammal species under NMFS' jurisdiction have geographic ranges within the western North Atlantic OCS (Hayes *et al.,* 2023). However, for reasons described below, US Wind has requested, and NMFS proposes to authorize, take of only 19 species (comprising 20 stocks) of marine mammals. Sections 3 and 4 of US 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' Stock Assessment Reports (SARs; *https://www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports*) and more general information about these species (*e.g.,* physical and behavioral descriptions) may be found on NMFS' website (*https://www.fisheries.noaa.gov/find-species*).

Of the 38 marine mammal species and/or stocks with geographic ranges that include the Project Area (*i.e.,* found in the coastal and offshore waters of Maryland), 19 species are not expected to be present or are considered rare or unexpected in the Project Area based on sighting and distribution data (see table 3–1 in US Wind's ITA application). Specifically, the following cetacean species are known to occur off of Maryland but are not expected to occur in the Project Area due to the location of preferred habitat outside the Lease Area and ECCs, based on the best available information, and therefore US Wind did not request, and NMFS is not proposing to authorize take, of these species: Blue whale (*Balaenoptera musculus*), Cuvier's beaked whale (*Ziphius cavirostris*), four species of Mesoplodont beaked whales (*Mesoplodon densitostris, M. europaeus, M. mirus,* and *M. bidens*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), Clymene dolphin (*Stenella clymene*), dwarf sperm whale (*Kogia sima*), false killer whale (*Pseudorca crassidens*), Fraser's dolphin (*Lagenodelphis hosei*), melon-headed whale (*Peponocephala electra*), northern bottlenose whale (*Hyperoodon ampullatus*), pygmy killer whale (*Feresa attenuata*), pygmy sperm whale (*Kogia breviceps*), sperm whale (*Physeter macrocephalus*), spinner dolphin (*Stenella longirostris*), and white-beaked dolphin (*Lagenorhynchus albirostris*). Two species of phocid pinnipeds are also uncommon in the Project Area, including: harp seals (*Pagophilus groenlandica*) and hooded seals (*Cystophora cristata*). However, harp seals are known to strand in coastal Maryland. Therefore, NMFS is proposing to authorize take of harp seals.

In addition, the Florida manatee (*Trichechus manatus,* a sub-species of the West Indian manatee) has been previously documented as an occasional visitor to the Mid-Atlantic region during summer months (Morgan *et al.,* 2002; Cummings *et al.,* 2014). However, manatees are managed by the U.S. Fish and Wildlife Service (USFWS) and are not considered further in this document.

Table 6 lists all species or stocks for which take is expected and proposed to be authorized for this action and summarizes information related to the population or stock, including regulatory status under the MMPA and Endangered Species Act (ESA) and potential biological removal (PBR), where known. PBR is defined 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)). 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 or stocks and other threats. Take for 19 species (20 stocks) in table 6 is expected and proposed to be authorized for this activity.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock, or the total number estimated within a particular study or survey area. NMFS' stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. All managed stocks in this region are assessed in NMFS' U.S. Atlantic and Gulf of Mexico SARs. All values presented in table 6 are the most recent available at the time of publication and, unless noted otherwise, use NMFS' final 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 6—MARINE MAMMAL SPECIES THAT MAY OCCUR IN THE PROJECT AREA AND BE TAKEN, BY HARASSMENT

Common name [1]	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [2]	Stock abundance (*CV,* Nmin, most recent abundance survey) [3]	PBR	Annual M/SI [4]
Order Artiodactyla—Cetacea—Mysticeti (baleen whales)						
Family Balaenidae:						
North Atlantic right whale	*Eubalaena glacialis*	Western Atlantic	E, D, Y	338 (0; 332; 2020); 356 (346–363, 2022) [5].	0.7	[6] 31.2
Family Balaenopteridae (rorquals):						
Fin whale	*Balaenoptera physalus*	Western North Atlantic	E, D, Y	6,802 (0.24, 5573, 2016)	11	1.8
Sei whale	*Balaenoptera borealis*	Nova Scotia	E, D, Y	6,292 (1.02, 3098, 2016)	6.2	0.8
Minke whale	*Balaenoptera acutorostrata*	Canadian Eastern Coastal	-, -, N	21,968 (0.31, 17,002, 2016).	170	10.6
Humpback whale	*Megaptera novaeangliae*	Gulf of Maine	-, -, Y	1,396 (0, 1,380, 2016)	22	12.15
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Delphinidae:						
Killer whale [7]	*Orcinus orca*	Western North Atlantic	-, -, N	UNK (UNK, UNK, 2016)	UNK	0
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, 2016).	236	136
Bottlenose dolphin	*Tursiops truncatus*	Western North Atlantic Offshore	-, -, N	62,851 (0.23, 51,914, 2016).	519	28
Bottlenose dolphin	*Tursiops truncatus*	Northern Migratory Coastal	-, -, Y	6,639 (0.41, 4,759, 2016)	48	12.2–21.5
Common dolphin	*Delphinus delphis*	Western North Atlantic	-, -, N	172,897 (0.21, 145,216, 2016).	1,452	390
Atlantic spotted dolphin	*Stenella frontalis*	Western North Atlantic	-, -, N	39,921 (0.27, 32,032, 2016).	320	0
Pantropical spotted dolphin	*Stenella attenuata*	Western North Atlantic	-, D, N	6,593 (0.52, 4,367, 2016)	44	0
Risso's dolphin	*Grampus griseus*	Western North Atlantic	-, -, N	35,215 (0.19, 30,051, 2016).	301	34
Rough-toothed dolphin [7]	*Steno bredanensis*	Western North Atlantic	-, -, N	136 (1, 67, 2016)	0.7	0
Striped dolphin [7]	*Stenella coeruleoalba*	Western North Atlantic	-, -, N	67,036 (0.29, 52,939, 2016).	529	0
Family Phocoenidae (porpoises):						
Harbor porpoise	*Phocoena phocoena*	Gulf of Maine/Bay of Fundy	-, -, N	95,543 (0.31, 74,034, 2016).	851	164
Order Carnivora—Pinnipedia						
Family Phocidae (earless seals):						
Harbor seal	*Phoca vitulina*	Western North Atlantic	-, -, N	61,336 (0.08, 57,637, 2018).	1,729	339
Gray seal [8]	*Halichoerus grypus*	Western North Atlantic	-, -, N	27,300 (0.22, 22,785, 2016).	1,389	4453
Harp seal	*Pagophilus groenlandicus*	Western North Atlantic	-, -, N	7.6M (UNK, 7.1M, 2019)	426,000	178,573

[1] Information on the classification of marine mammal species can be found on the web page for The Society for Marine Mammalogy's Committee on Taxonomy (*https://www.marinemammalscience.org/science-and-publications/list-marine-mammal-species-subspecies/;* Committee on Taxonomy (2022)).

[2] 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.

[3] NMFS 2022 marine mammal stock assessment reports online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments.* CV is the coefficient of variation; Nmin is the minimum estimate of stock abundance.

[4] These values, found in NMFS's SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.,* commercial fisheries, ship strike).

[5] The current SAR includes an estimated population (N_{best} 338) based on sighting history through November 2020 (Hayes *et al.,* 2023). In October 2023, NMFS released a technical report identifying that the North Atlantic right whale population size based on sighting history through 2022 was 356 whales, with a 95 percent credible interval ranging from 346 to 363 (Linden, 2023).

[6] Total annual average observed North Atlantic right whale mortality during the period 2016–2020 was 8.1 animals and annual average observed fishery mortality was 5.7 animals. Numbers presented in this table (31.2 total mortality and 22 fishery mortality) are 2015–2019 estimated annual means, accounting for undetected mortality and serious injury.

[7] US Wind did not request take of these species; however, their exposure analysis demonstrates there is a low risk of harassment. Although these species are rare in the project area, NMFS is proposing to authorize a small amount of Level B harassment in the case of potential presence during pile driving.

[8] 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.

As indicated above, all 19 species and 20 stocks in table 6 temporally and spatially co-occur with the activity to the degree that take is reasonably likely to occur. Three of the marine mammal species for which take is requested are listed as endangered under the ESA, including North Atlantic right, fin, and sei whales. In addition to what is included in sections 3 and 4 of US Wind's ITA application (*https://www.fisheries.noaa.gov/action/incidental-take-authorization-us-wind-inc-construction-and-operation-maryland-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 UME and known important habitat areas, such as Biologically Important Areas (BIAs; *https://oceannoise.noaa.gov/biologically-important-areas*) (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 July 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. 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 Whale

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.,* 2023). 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 to 2019 (Hayes *et al.,* 2023). Since 2011, the North Atlantic right whale population has been in decline; however, the sharp decrease observed from 2015 to 2020 appears to have slowed, though the right whale population continues to experience annual mortalities above recovery thresholds (Pace *et al.,* 2017; Pace *et al.,* 2021; Linden, 2023). 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 (including 2 mortalities) followed by 15 calves during the 2021–2022 calving season and 12 births (including 1 mortality) in 2022–2023 calving season. These data demonstrate that birth rates are increasing. However, mortalities continue to outpace births. Best estimates indicate fewer than 70 reproductively active females remain in the population and adult females experience a lower average survival rate than males (Linden, 2023). In 2023, the total annual average observed North Atlantic right whale mortality increased from 8.1 (which represents 2016–2020) to 31.2 (which represents 2015–2019), however, this updated estimate also accounts for undetected mortality and serious injury (Hayes *et al.,* 2023). Although the predicted number of deaths from the population are lower in recent years (2021–2022) when compared to the high number of deaths from 2014 to 2020 suggesting a short-term increase in survival, annual mortality rates still exceed PBR (Linden, 2023).

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 (primarily moms with young calves) into feeding areas far north of the Project Area in March and April (LaBrecque *et al.,* 2015; Van Parijs, 2015). North Atlantic right whale foraging may rarely opportunistically occur around the Project Area, yet the region is not considered primary foraging habitat. Engelhaupt *et al.* (2023) documented feeding and socializing behavior off Virginia and North Carolina, just south of the Project Area, suggesting that North Atlantic right whales may use the mid-Atlantic migratory corridor for more than just migration.

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 Delaware Bay SMA overlaps with the export cable corridor of the proposed project. This SMA is currently active from November 1 through April 30 of each year and may be used by North Atlantic right whales for migrating and/or feeding. 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.

During the spring, North Atlantic right whales use the migratory corridor BIA to move north from calving grounds off Georgia and Florida to feeding grounds in New England and Canadian waters (Hayes *et al.,* 2023). 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 right whale habitat-use patterns over the same time period (Davis *et al.,* 2020; Meyer-Gutbrod *et al.,* 2022; Quintano-Rizzo *et al.,* 2021; O'Brien *et al.,* 2022; Van Parijs *et al.,* 2023) with reduced use of foraging habitats in the Great South Channel and Bay of Fundy and increased use of habitats within Cape Cod Bay and 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; Van Parijs *et al.,* 2023); these foraging habitats are all located several hundred kilometers north of the project area. 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. Observations of these transitions in right whale habitat use, variability in seasonal presence in identified core habitats, and utilization of habitat outside of previously focused survey effort prompted the formation of a NMFS' Expert Working Group, which identified current data collection efforts, data gaps, and provided recommendations for future survey and research efforts (Oleson *et al.,* 2020). 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). 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 (Gowen *et al.,* 2019).

Although North Atlantic right whales move seasonally between foraging and calving grounds, Davis *et al.* (2017) acoustically detected right whales along the coast from Cape Hatteras, NC, United States to Nova Scotia, Canada year-round, suggesting that North Atlantic right whale use of the mid-Atlantic and southeast has increased since 2010 (Davis *et al.,* 2017). North Atlantic right whale presence in the Project Area is predominately seasonal with individuals likely to be transient and migrating through the area. Bailey *et al.* (2018) acoustically detected the year-round presence of North Atlantic right whales in the vicinity of the Project Area, with a maximum abundance during the late winter and early spring. In addition, a monitoring buoy, deployed by UMCES offshore of Ocean City Maryland in 2022, acoustically detected the presence of North Atlantic right whales in the lease area from November through January, with the highest frequency of confirmed detections occurring during the months of December and January (Woods Hole Oceanographic Institute, 2022). Visual surveys also confirm a maximum abundance of North Atlantic right whales in the vicinity of the Lease Area during the winter (Barco *et al.,* 2015; Williams *et al.,* 2015). As part of the Mid-Atlantic Baseline Studies Project and Maryland Project, Williams *et al.* (2015) conducted standardized aerial and boat-based surveys of the Delaware, Maryland, Virginia Wind Energy Areas (WEAs), and visually observed North Atlantic right whales in the lease area during the months of February and March. Based upon year-round aerial surveys conducted from 2013 to 2015, Barco *et al.* (2015) observed the largest numbers of North Atlantic right whales in the Maryland WEA during the month of January, suggesting that the area may be a destination for non-breeding individuals and pulses of North Atlantic right whales may travel through the region. Barco *et al.* (2015) also documented North Atlantic right whale open mouth behavior, which is consistent with, though not necessarily indicative of, feeding. As part of the U.S. Navy's Marine Species Monitoring Program, HDR has conducted aerial and vessel-based surveys for large whales off Virginia and North Carolina since 2015. The majority of North Atlantic right whale sightings have occurred in these areas, just south of the Project Area, during the months of January–March (Aschettino *et al.,* 2023). The highest density month for North Atlantic right whales in the vicinity of the lease area is February (0.00076 individuals/km (0.54 nmi grid square)) (Roberts *et al.,* 2023).

Since 2017, 98 dead, seriously injured, or sublethally injured or ill North Atlantic right whales along the United States 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 October 30, 2023, there have been 36 confirmed mortalities (dead, stranded, or floaters) and 34 seriously injured free-swimming whales for a total of 70 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

115. 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 Whale

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 2004–2005, 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).

The Project Area does not overlap with any 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 approximately 556.2 km (345.6 mi) north of the Project Area, and thus, would not be impacted by project activities.

Humpback whale presence in the mid-Atlantic varies seasonally. Humpback whales are most typically observed in this region during the winter months (Williams *et al.,* 2015d; Barco *et al.,* 2015) and are known to be migratory off coastal Maryland, moving seasonally between northern feeding grounds in New England and southern calving grounds in the West Indies (Hayes *et al.,* 2023). However, not all humpback whales migrate to the Caribbean during the winter as individuals are sighted in mid- to high-latitude areas during this season (Swingle *et al.,* 1993; Davis *et al.,* 2020). In addition to a migratory pathway, the mid-Atlantic region also represents a supplemental winter feeding ground for juveniles and mature whales (Barco *et al.,* 2002). Records of humpback whales off the U.S. mid-Atlantic coast (New Jersey south to North Carolina) suggest that these waters are used as a winter feeding ground from December through March (Mallette *et al.,* 2017; Barco *et al.,* 2002; LaBrecque *et al.,* 2015) and represent important habitat for juveniles, in particular (Swingle *et al.,* 1993; Wiley *et al.,* 1995).

Acoustic monitoring in the vicinity of the lease area has detected the presence of humpback whales year-round, although detections exhibit similar seasonal trends as visual sightings. Humpback whale detections were lowest during the summer months (June through September), increased through the winter (January through March) and peaked in April (Bailey *et al.,* 2018). Davis *et al.* (2020) also found detections of humpback whales off the mid-Atlantic (Virginia) to peak from January through May. Density modeling (Roberts *et al.,* 2023) confirms April (0.00187 individuals per 1 km (0.54 nmi) grid cell) as the month of the highest average density of humpback whales in the vicinity of 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 October 2, 2023, 209 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. As the humpback whale population has grown, they are seen more often in the mid-Atlantic. Since January 2023, 34 humpbacks have stranded along the east coast of the United States (1 of these stranded in Maryland). These whales may have been following their prey (small fish) which were reportedly close to shore this past winter. These prey also attract fish that are targeted by recreational and commercial fishermen, which increases the number of boats in these areas. More information is available at *https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events.*

Fin Whale

Fin whales frequently occur in the waters of the U.S. Atlantic Exclusive Economic Zone (EEZ), principally from Cape Hatteras, North Carolina northward and are distributed in both continental shelf and deep-water habitats (Hayes *et al.,* 2023). Although fin whales are present north of the 35-degree latitude region in every season and are broadly distributed throughout the western North Atlantic for most of the year, densities vary seasonally (Edwards *et al.,* 2015; Hayes *et al.,* 2023). 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.,* 2023). 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).

Fin whale feeding BIAs occur offshore of Montauk Point, New York from March to October (2,933 km^2) (Hain *et al.,* 1992; LaBrecque *et al.,* 2015) and year-round in the southern Gulf of Maine (18,015 km^2). However, given the more southerly location of the Project Area (located approximately 364.8 km (226.7 mi) and 546.2 km (339.4 mi) away from these BIAs, respectively), there is no spatial overlap from with these BIAs.

Fin whales were among the most frequently observed baleen whale species during the Maryland Wind Energy Area aerial surveys conducted for the Maryland Department of Natural Resources (MD DNR) by the Virginia Aquarium and Marine Science Center Foundation (Barco *et al.,* 2015), and the most commonly detected baleen whale species during acoustic monitoring surveys from 2014 to 2017 in the Maryland WEA, although the majority of detections were offshore of the WEA (Bailey *et al.,* 2018a). Fin whale abundance in the vicinity of the Project Area peaked during the winter and early spring (Williams *et al.,* 2015d; Barco *et al.,* 2015), with the lowest occurrence documented during summer and early fall (Bailey *et al.,* 2018). Consistent with visual sightings and acoustic detections, the highest average density of fin whales in the vicinity of the proposed Project Area occurs in January (0.00214 individuals per 1 km (0.54 nmi) grid cell) (Roberts *et al.,* 2023). There is no active fin whale UME.

Minke Whale

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. Individuals have often been detected acoustically in shelf waters from spring to fall and more often detected in deeper offshore waters from winter to spring (Risch *et al.,* 2013). Minke whales are abundant in New England waters from May through September (Pittman *et al.,* 2006; Waring *et al.,* 2014), yet largely absent from these areas during the winter, suggesting the possible existence of a migratory corridor (LaBrecque *et al.,* 2015). A migratory route for minke whales transiting between northern feeding grounds and southern breeding areas may exist to the east of the Project Area, as minke whales may track warmer waters along the continental shelf while migrating (Risch *et al.,* 2014). Risch *et al.* (2014) suggests the presence of a minke whale breeding ground offshore of the southeastern US during the winter.

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 are approximately 512.1 km (318.2 mi) and 668.8 km (415.6 mi) northwest of the Project Area, respectively, and would not be impacted by the proposed project activities.

Overall, minke whale use of the Project Area is likely highest during fall, winter, and spring months based upon visual sightings and acoustic detections in the vicinity of the lease area during the months of November, January, February, and April (Bailey *et al.,* 2018a; Barco *et al.,* 2015; Williams *et al.,* 2015b). The highest average density of minke whales in the vicinity of the lease area is expected to occur in May (0.00750 individuals per 1 km (0.54 nmi)).

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 October 2, 2023, a total of 160 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). Sei whales generally occur offshore; however, 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). However, this BIA is located approximately 501.5 km (311.6 mi) north of the Project Area and not likely to be impacted by the Project activities.

Sei whales were sighted infrequently during visual surveys (Williams *et al.,* 2015d) and acoustic monitoring (WHOI, 2022; WHOI, 2023) of the Maryland WEA. The highest average density of sei whales in the vicinity of the lease area is expected to occur during the month of April (0.00061 individuals per 1 km (0.54 nmi) (Roberts *et al.,* 2023). There is no active sei whale UME.

Phocid Seals

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 to 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. 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, 2019a) recommended that marine mammals be divided into hearing groups based on directly measured (behavioral or auditory evoked potential techniques) or estimated hearing ranges (behavioral response data, anatomical modeling, *etc.*). 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 7.

TABLE 7—MARINE MAMMAL HEARING GROUPS

[NMFS, 2018]

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

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

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (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 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 Geographic Area section). Here, the potential effects of sound on marine mammals are discussed.

US 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, US Wind presented their analyses of potential impacts to marine mammals from the acoustic sources. NMFS both carefully reviewed the information provided by US 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 119 permanent foundations to support WTGs, OSSs, a Met tower, and seafloor mapping using HRG surveys. 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://www.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 hertz (Hz) or cycles per second. Wavelength is the distance between two peaks or corresponding points of a sound wave (length of one cycle). Higher frequency sounds have shorter wavelengths than lower frequency sounds, and typically attenuate (decrease) more rapidly, except in certain cases in shallower water.

The intensity (or amplitude) of sounds is measured in 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 hundred-fold increase in power and a 30-dB increase is a thousand-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 are referenced to (re) 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).

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 1 second), broadband, atonal transients (American National Standards Institute (ANSI), 1986; ANSI, 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 US 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 US 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 (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; however, 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; Nachtigall and Supin, 2015; Nachtigall *et al.,* 2016a; Nachtigall *et al.,* 2016b; Nachtigall *et al.,* 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.,* 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 and Doukara, 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 (microPascal)) 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; Dunlop *et al.,* 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 have 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 passive acoustic monitoring (PAM) data from 2010 to 2013 and aerial surveys from 2009 to 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 to 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 US 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 Maryland. However, we do not anticipate any greater severity of response due to harbor porpoise and harbor seal habitat use off Maryland 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 Maryland, harbor porpoises are transient (with higher abundances in winter when foundation installation 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 km) 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). US Wind does not anticipate, and NMFS is not proposing to authorize take of beaked whales and, moreover, the sounds produced by US 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, but 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.,* 2006; 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.,* 2018a; 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 that 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.,* 2006; 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 during 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 US 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, the detection of frequencies above those of the masking stimulus decreases. 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, 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 depend 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 sound pressure level (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 adjust 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 adjust their 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 (*e.g.,* 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 1-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 (*e.g.,* 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 the 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; 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 cubic inches (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.,* Selye, 1950; Moberg and Mench, 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; NRC, 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 US Wind (*i.e.,* pile driving) do not inherently have the potential to result in marine mammal strandings. While vessel strikes 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 or to 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 US 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-hour 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 of 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. NRC (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 US 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 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 kn.

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 kn. The majority (79 percent) of these strikes occurred at speeds of 13 kn or greater. The average speed that resulted in serious injury or death was 18.6 kn. 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 kn and exceeded 90 percent at 17 kn. 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 kn. The chances of a lethal injury decline from approximately 80 percent at 15 kn to approximately 20 percent at 8.6 kn. At speeds below 11.8 kn, the chances of lethal injury drop below 50 percent, while the probability asymptotically increases toward 100 percent above 15 kn.

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 United States. Given the extensive mitigation and monitoring measures (see the Proposed Mitigation and Proposed Monitoring and Reporting section) that would be required of US Wind, NMFS believes that a vessel strike is not likely to occur.

Potential Effects to Marine Mammal Habitat

US 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/s^2 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.,* 2013a).

As described in the Proposed Mitigation section below, US 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, 2006). It is not known if damage to auditory nerve fibers could occur, and if so, whether fibers would recover during this process. In addition, 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, 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}; 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 μPa^2·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.

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 OSS foundations may cause turbulent current wakes, which impact circulation, stratification, mixing, and sediment resuspension (Daewel *et al.,* 2022). Overall, the presence of structures such as wind turbines is, in general, likely to result in certain oceanographic effects in the marine environment and may alter marine mammal prey, such as aggregations and distribution of zooplankton through changing 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).

US Wind intends to install up to 114 WTG and 4 OSS foundations, with turbine operations commencing in 2025 and all turbines being operational in 2027. As described above, there is scientific uncertainty around the scale of oceanographic impacts (meters to kilometers) associated with turbine operation. The Project is located offshore of Maryland along the mid-Atlantic Bight, and the project area does not include key foraging grounds for marine mammals with planktonic diets (*e.g.,* North Atlantic right whale), as all known prime foraging habitat is located much further north, off southern New England and north into Canada. This foraging area is approximately 544.1 km (338.1 mi) north of the project area, and it would be highly unlikely for this foraging area to be influenced by activities related to the proposed Project.

Although the project area does not provide high-quality foraging habitat for plankton-feeding marine mammals, such as North Atlantic right whales, coastal Maryland may provide seasonal high-quality foraging habitat for piscivorous marine mammals, such as humpback whales. Generally speaking, and depending on the extent, impacts on prey could impact the distribution of marine mammals in an area, potentially necessitating additional energy expenditure to find and capture prey. However, at the temporal and spatial scales anticipated for this activity, any such impacts on prey 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.

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. In addition, 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 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, post-piled jacket, and pin pile 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, OSS, and meteorological tower 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, 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 on marine mammal habitats from the project is expected to be from pile driving, 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 are 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 US 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).

Potential Effects From Offshore Wind Farm Operational Noise

Although this proposed rulemaking primarily covers the noise produced from construction activities relevant to the Maryland Offshore Wind Project 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 Q1 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 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 foundations) 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). In addition, Madsen *et al.* (2006) 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.

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.

Recently, Holme *et al.* (2023) cautioned that Tougaard *et al.* (2020) and Stöber and Thomsen (2021) extrapolated levels for larger turbines should be interpreted with caution since both studies relied on data from smaller turbines (0.45 to 6.15 MW) collected over a variety of environmental conditions. They demonstrated that the model presented in Tougaard *et al.* (2020) tends to potentially overestimate levels (up to approximately 8 dB) measured to those in the field, especially with measurements closer to the turbine for larger turbines. Holme *et al.* (2023) measured operational noise from larger turbines (6.3 and 8.3 MW) associated with three wind farms in Europe and found no relationship between turbine activity (power production, which is proportional to the blade's revolutions per minute) and noise level, though it was noted that this missing relationship may have been masked by the area's relatively high ambient noise sound levels. Sound levels (RMS) of a 6.3-MW direct-drive turbine were measured to be 117.3 dB at a distance of 70 m. However, measurements from 8.3 MW turbines were inconclusive as turbine noise was deemed to have been largely masked by ambient noise.

Finally, operational turbine measurements are available from the Coastal Virginia Offshore Wind (CVOW) pilot pile project, where two 7.8 m monopile WTGs were installed (HDR, 2023). Compared to BIWF, levels at CVOW were higher (10–30 dB) below 120 Hz, believed to be caused by the vibrations associated with the monopile structure, while above 120 Hz levels were consistent among the two wind farms.

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 US Wind to measure operational noise levels. US 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 and HRG surveys, 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 US 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, there is a low probability that mortality or serious injury of marine mammals could occur from vessel strikes, the mitigation and monitoring measures contained within this proposed rule are expected to avoid vessel strikes (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 US Wind, as well as all other applicable information and, based on the best available science, concurs that the 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 impulsive or intermittent sources (*i.e.,* impact pile driving, some HRG acoustic sources); therefore, the 160-dB re 1 μPa (rms) threshold is applicable to our analysis.

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, US Wind's proposed activities include the use of impulsive sources. NMFS' thresholds identifying the onset of PTS are provided in table 8. The references, analysis, and methodology used in the development of the thresholds are described in NMFS' 2018 Technical Guidance, which may be accessed at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance.*

TABLE 8—PERMANENT THRESHOLD SHIFT (PTS) ONSET THRESHOLDS

[NMFS, 2018]

Hearing group	PTS onset thresholds * (received level)	
	Impulsive	Non-impulsive
Low-Frequency (LF) Cetaceans	$L_{p,0\text{-pk,flat}}$: 219 dB; $L_{E,p,\text{LF,24h}}$: 183 dB	$L_{E,p,\text{LF,24h}}$: 199 dB.
Mid-Frequency (MF) Cetaceans	$L_{p,0\text{-pk,flat}}$: 230 dB; $L_{E,p,\text{MF,24h}}$: 185 dB	$L_{E,p,\text{MF,24h}}$: 198 dB.
High-Frequency (HF) Cetaceans	$L_{p,0\text{-pk,flat}}$: 202 dB; $L_{E,p,\text{HF,24h}}$: 155 dB	$L_{E,p,\text{HF,24h}}$: 173 dB.
Phocid Pinnipeds (PW) (Underwater)	$L_{p,0\text{-pk,flat}}$: 218 dB; $L_{E,p,\text{PW,24h}}$: 185 dB	$L_{E,p,\text{PW,24h}}$: 201 dB.
Otariid Pinnipeds (OW) (Underwater)	*Cell 9:* $L_{p,0\text{-pk,flat}}$: 232 dB; $L_{E,p,\text{OW,24h}}$: 203 dB	*Cell 10:* $L_{E,p,\text{OW,24h}}$: 219 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 1μPa²s. In this table, thresholds are abbreviated to be more reflective of International Organization for Standardization standards (ISO, 2017). The subscript "flat" is 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 and OW 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.

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, OSS, and meteorological tower installation, 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 US 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 pile driving. US Wind employed Marine Acoustic, Inc., (MAI) to conduct acoustic modeling to better understand sound fields produced during these activities (see appendix A of ITA Application). The basic acoustic modeling approach is to characterize the sounds produced by the source and determine how the sounds propagate within the surrounding water column. MAI derived surrogate source spectra for each pile type and conducted sophisticated propagation modeling (as described below). To assess the potential for take from impact pile driving, MAI also conducted animal movement modeling; MAI estimated species-specific exposure probability by considering the range- and depth-dependent sound fields in relation to animal movement in simulated representative construction scenarios. More details on these acoustic source modeling, propagation modeling and exposure modeling methods are described below.

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). Therefore, variations in hammer energies must be taken into account during acoustic source modeling.

For impact pile driving, MAI derived surrogate source spectra for each impact pile driving scenario based upon available measured or modeled source spectra for hammer energies and pile diameters similar to those expected for the Project impact pile driving activities (table 9). Source spectra (or a representative of sound by frequency) were then adjusted based upon pile diameters and hammer energies that would be used by US Wind using pile driving scaling laws (Von Pein *et al.,* 2022), which are derived from a large number of measurements for wide ranges of hammer energies, pile diameters, and other parameters.

MAI used the predicted spectrum of an 11-m diameter monopile developed for the South Fork Wind Farm (Denes *et al.,* 2018; Denes *et al.,* 2021) as a surrogate source signature in modeling of the 11-m monopile for the WTG foundations for the Project. The surrogate spectrum was predicted assuming an IHC S-4000 hammer with a maximum strike energy of 4,000 kJ, while the planned scenario includes an 11-m monopile with a hammer capable of a 4,400-kJ maximum strike energy of 4,400 kJ. Hence, MAI adjusted the spectra accordingly to account for slightly higher maximum source levels. The expected difference in sound level between 4,000 and 4,400 kJ can be approximated using energy scaling laws (Von Pein *et al.,* 2022), and is estimated to be minimal (0.4 dB).

MAI used a 3-m post-piled pin pile source spectrum in the modeling for impact pile driving of OSS foundations that was based upon the mean of the measured spectra of a 6-m pile reported by Bruns *et al.* (2014) and a 3.5-m FINO2 pile reported by Matuschek and Betke (2009) (see appendix A of the LOA application for additional detail on deriving source spectra for the 3-m pin pile). The resulting representative source level for the 3-m pin pile (208 dB_{SEL}) is comparable to the estimated value for a 2.4-m diameter post-piled pin pile driven by a 1,700-kJ Menck hammer (209 dB_{SEL}) measured by Molnar *et al.* (2020). Molnar *et al.* (2020) estimated this value by back calculating the source level assuming transmission loss of 15 * $\log_{10}$ (range) based upon a measured SEL of 188 dB at a range of 25 m from the pile during uninitiated impact pile driving. This suggests that the modeling for the 3-m pin pile is representative of a post-piled pin pile.

The spectrum derived for the 3-m pin pile was scaled to represent the 1.8 m pin piles for the Met tower based upon the maximum hammer energy and pile diameter using relationships presented in Von Pein *et al.* (2022). The 3-m post-piled pin pile source levels being scaled down by 8 dB and a SEL source level of 199 dB for the 1.8-m pin pile (see section 4.4, ''Source Characterization,'' in appendix A of the ITA application for a full description of scaling) (table 11).

Once acoustic modeling for the monopile at a maximum hammer energy of 4,400 kJ was performed, the modeled sound fields were then adjusted by a broadband sound reduction to represent the lower strike energy levels (*i.e.,* 1,100 kJ, 2,200 kJ, and 3,300 kJ) planned for portions of the monopile installation. To account for the differences in hammer energies planned for use and the maximum hammer energy (4,400 kJ), the modeled spectra for the 4,400-kJ hammer was scaled using $10*\log_{10}(E_1/E_2)$ (where E_1 is the lower strike energy level and E_2 is the modeled energy level), to represent each of the lower proposed hammer energies (Von Pein *et al.,* 2022). This resulted in the application of scaling factors of −6, −3, and −1 dB to represent the 1,100 kJ, 2,200 kJ, and 3,300 kJ hammer energies, respectively, as shown in table 10. The ramp up of hammer energy is accounted for when calculating the cumulative SEL over the installation of each monopile using the number of strikes at each energy level. The broadband scaling factor (table 10) was subtracted from the modeled received levels for the indicated number of strikes before the cumulative SEL was calculated. This hammer strike energy progression for monopile installation was considered in the calculation of the acoustic ranges and acoustic exposures. Although US Wind originally considered and modeled maximum hammer strikes at an energy of 4,400 kJ, the final hammer schedule (table 10) did not include any strikes at the 4,400 kJ energy level as US Wind has indicated they do not plan to use hammer energies above 3,300 kJ. SEL acoustic ranges assume a hammer schedule up to a maximum energy of 3,300 kJ, however, peak and RMS acoustic ranges assume a hammer schedule up to a maximum energy of 4, 400 kJ (tables 14 and 15). For additional details on surrogate source spectra development and scaling, please see section 4.4, ''Source Characterization,'' in appendix A of US Wind's ITA application.

US Wind would use at least two noise abatement systems (NAS) during all pile driving associated with foundation installations, 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 often used to decrease the sound levels radiated from a source. Hence, hypothetical broadband attenuation levels of 0 dB, 10 dB, and 20 dB were incorporated into the foundation source models to gauge effects on the ranges to thresholds given these levels of attenuation (appendix A of the ITA application). Although two attenuation levels were evaluated, NMFS anticipates that the noise attenuation systems ultimately chosen will be capable of reliably reducing source levels by 10 dB; therefore, this assumption was carried forward in this analysis for monopile, jacket, and Met tower foundation pile driving installation. See the Proposed Mitigation section for more information regarding the justification for the 10-dB assumption.

Key modeling assumptions for the monopiles and pin piles are listed in table 10 (additional modeling details and input parameters can be found in appendix A of the ITA application). Hammer energy schedules for monopiles (11-m), 3-m pin piles, and 1.8-m pin piles (are also provided in table 10 and the resulting broadband source levels of the monopiles and pin piles are presented in table 11.

TABLE 9—SURROGATE SPECTRA HAMMER ENERGIES AND PILE DIAMETERS

Foundation type	Maximum hammer energy (kJ)	Representative foundation	Representative hammer energy (kJ)	Reference
11-m Monopile	[1] 4,400	11-m monopile	4,400	Denes *et al.,* 2021.
3-m Pin Pile	1,500	6-m pin pile [2]	([4])	Bruns *et al.,* 2014.
		3.5-m FINO2 pile [3]		Matuschek and Betke, 2009.
1.8-m Pin Pile	500	3-m Skirt Pile	1,500	MAI, 2022.

[1] US Wind confirmed with NMFS that their maximum hammer energy will not exceed 3,300 kJ (Jodziewicz, 2023).
[2] Measured at a distance of 15 m.
[3] Measured at a distance of 500 m.
[4] Hammer energies were not available.

TABLE 10—KEY PILING ASSUMPTIONS AND HAMMER ENERGY SCHEDULES FOR MONOPILES AND PIN PILES

Foundation type	Hammer energy (kJ)	Duration at energy level (min)	Strikes per minute	Strike count	Hammer energy scaling factor (dB)	Seabed penetration depth (m)	Piling time per day (min)	Number of piles per day
11-m Monopile [1]	1,100	30	20	600	−6	50	120	1
	2,200	60	40	2,400	−3			
	3,300	30	60	1,800	−1			
	[1] 4,400	....	....	....	0			
3-m Pin Pile	[3] 1,500	480	40	19,200	n/a	[5] 50–60	[6] 480	4
1.8-m Pin Pile	[3] 500	360	[4] 8.3	2,988	n/a	[5] 51–53	[6] 360	3

[1] While US Wind would use a hammer capable of striking the pile at 4,400 kJ, US Wind has committed to not using hammer energies about 3,300 kJ (Jodziewicz, 2023). Modeled sound fields were adjusted by broadband sound reduction to represent the lower strike energy levels planned for monopile installation.
[2] Assumed this maximum hammer energy for the duration of installation.
[3] Although the fractional number of 8.3 hammer strikes per minute is unlikely to be accomplished during installation, this number instead of the rounded, more realistic value of 8 strikes per minute is included as it results in a higher number of total hammer blows than if the rounded blows per minute value were used.
[4] Subject to final design.
[5] Piling time refers to all pin piles installed within a 24-hour period.

TABLE 11—BROADBAND SOURCE LEVELS, ASSUMING 10-dB ATTENUATION, DERIVED FROM SOURCE MODELING

Pile type	Max hammer energy (kJ) [a]	Source level (dB) at 1 m			Source
		SEL_{ss} SPL (dB) re 1µ Pa^2 m^2	Peak SPL (dB) re 1µ Pa	RMS SPL (dB) re 1µ Pa	
11-m Monopile	4,400	214	262	224	Denes *et al.* (2018; 2021).
3-m Pin Pile [b c]	1,500	198	249	208	Bruns *et al.,* 2014; Matuschek and Betke, 2009.
1.8 m Pin Pile [c]	500	189	237	199	MAI, 2022.

SELss = single strike SEL.
[a] Assumes MHU 4400 hammer.
[b] Based upon measured spectra of a 6-m pile reported by Bruns *et al.* (2014).
[c] Based upon measured spectra of a 3.5-m pile reported by Matuschek and Betke (2009).

After calculating source levels, MAI used the Navy Standard Parabolic Equation (NSPE) propagation model to estimate distances to NMFS' harassment thresholds. The NSPE is a modern iteration of the well-known Range-dependent Acoustic Model (RAM) (Collins, 1993). 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 within the water column, as well as 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.

A single representative location of intermediate water depth (27 m) was selected for the underwater acoustic propagation modeling analysis. A sensitivity analysis was conducted to assess the differences in acoustic propagation at the selected intermediate-depth model location (27 m), the deepest location (42 m), and shallowest location (13 m) within the

Project Area. The results of the sensitivity analysis indicated that although acoustic propagation was not significantly different between the sites, lower received levels were predicted at the shallowest and deepest locations relative to the intermediate depth modeling location. Therefore, of the three considered modeling locations, the intermediate depth (27 m) location was selected to provide the most conservative and representative modeling results. MAI included physical site parameters, such as bathymetry, water surface roughness, seasonal sound velocity profiles, wind speed, and sediment type/size into the acoustic propagation model. The model generated the predicted noise during impact pile driving scenarios for the 11-m monopiles, 3-m pin piles, and 1.8-m pin piles. The May sound velocity profile was selected to be representative of the proposed pile driving construction period as this profile represented the largest acoustic propagation ranges (see appendix A of the ITA application). Pile driving sources were included in the propagation model as vertical line arrays. The pile beampattern was created from a vertical line array of elements with 1-m spacing from the surface to the seafloor. This representative array was used to create a frequency-specific beampattern (see appendix A of the ITA application). MAI followed this propagation process for each one-third octave center frequency in the bands from 10 Hz to 25 kHz with radials running at 10° intervals to a range of 50 km. Based upon the source levels derived for each pile driving source (table 11), the one-third octave band source levels were added to each transmission loss value to produce a received level value at each range, depth, and bearing point. The combined sound fields for each frequency were then summed to generate a representative broadband sound field. This process was followed for each radial around each pile driving source to produce an *N* * two-dimensional grid of received sound levels in range, depth and bearing. The resulting predicted acoustic SEL field was assessed with the appropriate marine mammal weighting functions for low-frequency, mid-frequency, and high-frequency cetaceans as well as pinnipeds in water (NMFS, 2018). These weighting functions were applied to individual sound received levels to reflect the susceptibility of each hearing group to noise-induced threshold shifts.

To estimate the probability of exposure of animals to sound above NMFS' harassment thresholds during foundation installation, MAI integrated the sound fields generated from the source and propagation models described above with marine mammal species-typical behavioral parameters (*e.g.,* dive parameters, swimming speed, and course/direction changes) using the Acoustic Integration Model (AIM) (Frankel *et al.,* 2002). AIM is a Monte Carlo based statistical model in which multiple iterations of realistic predictions of acoustic source use as well as animal distribution and movement patterns are conducted to provide statistical predictions of estimated effects from exposure to underwater sound transmissions. For each species, separate AIM simulations were developed and iterated for each modeling scenario and activity location. During the simulations, animats (modeled receivers representing individual marine mammals) were randomly distributed in the model simulation area and the predicted received sound level was estimated every 30 seconds to create a history over a 24-hour period. Animats were programmed to reflect off the boundaries of the model simulation area and remain within this simulation area. The model simulation area was delineated by four boundaries consisting of lines of latitude (37.5° to 39° N) and lines of longitude (73.75° to 75.5° W). These lines extended one latitude or longitude beyond the model simulation area to ensure that the region was large enough to capture anticipated substantial behavior reactions and an adequate number of animats would be modeled in all directions. This model area box, which included the model simulation area, was approximately 20,000 km^2 in size. Animats were also pre-programmed to move every 30 seconds based upon species-specific behaviors, yet were limited in movements by the coastline and minimum occurrence depth for each species, based upon scientific literature. Animat movement behavior parameters included diving, swimming, aversion, and residency patterns based upon existing scientific literature for each species in the model (see table B–1 in appendix A of the ITA application). Animat movement behavior parameters for seals were modeled based upon harbor seal parameters (see table B–1 in appendix A of the ITA application). At the end of each 30-second interval, the received sound level (in dB RMS) for each animat was recorded.

The output of the simulation is the exposure history for each animat within the simulation, and the combined history of all animats gives a probability density function of exposure during the project. The acoustic exposure history for each animat was analyzed to produce Level A harassment and Level B harassment exposure estimates. MAI estimated the amount of potential acoustic exposures above NMFS' Level A (PTS) harassment and Level B (behavioral) harassment thresholds predicted to occur within the Project area from any pile driving event (see below in section WTG, OSS, and Met tower Foundation Installation for more details). Once an animat received an exposure from a sound field greater than the Level A harassment (PTS) threshold, the animat was eliminated from further analysis; animats not exposed to sound fields greater than the Level A harassment threshold were further analyzed to determine whether the animat would be exposed to sound fields greater than the Level B harassment (behavioral) threshold. Therefore, animats were not counted as both Level A harassment and Level B harassment exposures.

To obtain acoustic exposure estimates for each species per pile, the numbers of modeled animat sound exposures were multiplied by the ratio of the modeled animat density to the real-world marine mammal density estimate for the buffered Lease Area (Roberts *et al.,* 2023, see below for more details on how a 5.25-km buffer zone around the Lease Area was calculated and densities were estimated). The animat exposure estimates per pile are the product of the number of modeled exposures multiplied by the ratio of real-world density per month (Roberts *et al.,* 2023) to model density. The daily exposures were then multiplied by the planned number of piles driven each month and then summed for the year for each of years 1–3 when pile driving would take place. US Wind plans to install only one monopile per day, four 3-m pin piles per day, and three 1.8-m pin piles per day (for Met tower).

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. US 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 *et al.,* 2023) to estimate take from foundation installation and HRG surveys (please see each activity subsection below for the resulting densities). The models estimate absolute density (individuals/

100 km²) 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 harbor and gray seals and pilot whales (representing short-finned and long-finned pilot whales)).

The Duke habitat-based density models delineate species' density into 5 * 5 km (3.1 * 3.1 mi) grid cells. US Wind calculated mean monthly (or annual) densities for each species for each grid cell within the Lease Area and 5.25 km buffer perimeter around the Lease Area that represented the largest 10-dB attenuated expected range to NMFS' harassment thresholds. The buffer perimeter was calculated based upon the largest range to Level B harassment threshold, which was 5.25 km for impact pile driving of 11-m monopiles at a maximum hammer energy of 4,400 kJ. This distance was added as a buffer surrounding the Lease Area for all pile driving and HRG activities, and marine mammal densities were compiled for this buffered area (see figure 6–1 in the LOA application). All 5 × 5 km grid cells in the models that fell within the analysis polygon were considered in the calculations. If the centroid of the grid cell, or a minimum of half the cell, fell within the buffered lease area boundary, the cell was included in the density analysis (see section 3.2 of appendix A of the ITA application for additional information on how the centroid of each grid cell was determined).

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 and seals as guilds. To obtain density estimates for long-finned and short-finned pilot whales, US Wind scaled the guild density by the relative abundance of each species in the Project Area based upon sighting, biopsy, and stranding data (Garrison and Rosel, 2017; Palka *et al.,* 2021; Hayes *et al.,* 2023; Maryland Marine Mammal Stranding Program, 2023). Biopsy and stranding data indicated that short-finned pilot whales are more likely than long-finned pilot whales to occur along the Maryland coast (Garrison and Rosel, 2017; Hayes *et al.,* 2023). Based on these data, US Wind partitioned total pilot whale exposures based upon the assumption that 60 percent of exposures would be to short-finned pilot whales and 40 percent of exposures would be to long-finned pilot whales.

The equation below shows how local occurrence scaling is applied to compute density for pilot whales.

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

where D represents density and N represents occurrence.

Density estimates for gray seals, harbor seals, and harp seals were not scaled by local occurrence as limited at-sea data was available for these seal species in the Project Area (*i.e.,* no local abundance estimates could be calculated). Although harp seals are considered extralimital in the Project Area, the MD DNR and National Aquarium at Baltimore (NAB) have documented harp seal strandings inshore of the Lease Area (NAB, 2023a). Over the past 10 years, stranding reports of harp seals in Maryland have become more common in areas such as Ocean City (NAB, 2023b). Although stranding records for harbor and gray seals exist as well for coastal Maryland, stranding records may not accurately reflect the numbers and distribution of seals offshore in the vicinity of the Project Area. In addition, the Roberts *et al.* (2023) density data includes all three species of seals in the seal guild. MAI conducted animat modeling using harbor seal behavior parameters (see appendix B, ''Animat Modeling Parameters,'' of appendix A of the ITA application) and, while behavioral parameters may differ slightly between seal species, NMFS concurs that harbor seal behavior is a suitable proxy for all seals as any behavioral differences between seal species are not likely to be large enough to require separate modeling. Harbor seals are likely to be the prevalent seal species in the Project Area and, given the difficulty predicting the likely proportion of exposures by species, exposure estimates for seals are presented for gray seals, harbor seals, and harp seals collectively.

The density models (Roberts *et al.,* 2023) also do not distinguish between bottlenose dolphin stocks and only provide densities for bottlenose dolphins as a species. For impact pile driving, take of each bottlenose dolphin stock was allocated based upon the progression of pile driving from the southeastern corner of Lease Area in year 1 (2025) towards the western portion of the Lease Area in years 2 and 3, as described further in the *WTG, OSS, and Met Tower Foundation Installation* section. Mean monthly density estimates are provided in table 12.

TABLE 12—MEAN MONTHLY MARINE MAMMAL DENSITY ESTIMATES (ANIMALS PER 100 km²) CONSIDERING A 5.25-km BUFFER AROUND THE LEASE AREA [1]

Species	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
North Atlantic right whale	0.075	0.076	0.063	0.045	0.008	0.003	0.001	0.001	0.002	0.004	0.011	0.036
Fin whale	0.214	0.184	0.154	0.135	0.094	0.111	0.041	0.028	0.04	0.037	0.045	0.151
Humpback whale	0.091	0.062	0.083	0.187	0.142	0.102	0.02	0.011	0.027	0.112	0.143	0.088
Minke whale	0.069	0.089	0.114	0.687	0.750	0.155	0.05	0.02	0.01	0.055	0.025	0.064
Sei whale	0.029	0.021	0.034	0.061	0.02	0.005	0.001	0	0.001	0.006	0.017	0.046
Killer whale [2]	0.002											
Atlantic spotted dolphin	0.003	0.001	0.002	0.013	0.046	0.09	0.396	1.505	0.475	0.335	0.243	0.032
Pantropical spotted dolphin [2]	0.004											
Bottlenose dolphin [3]	3.855	1.316	1.659	5.668	15.225	15.92	18.323	20.608	16.47	14.689	17.13	11.705
Short-finned pilot whale and long-finned pilot whale [4]	0.039											
Common dolphin	4.298	1.869	1.972	3.268	3.289	1.471	1.301	0.501	0.044	0.765	5.746	7.939
Risso's dolphin	0.045	0.006	0.006	0.056	0.051	0.018	0.017	0.018	0.01	0.023	0.092	0.169

TABLE 12—MEAN MONTHLY MARINE MAMMAL DENSITY ESTIMATES (ANIMALS PER 100 km^2) CONSIDERING A 5.25-km BUFFER AROUND THE LEASE AREA [1]—Continued

Species	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Rough-toothed dolphin [2]	0.002											
Striped dolphin [2]	0.004											
Harbor porpoise	3.653	3.336	2.586	3.191	0.615	0.002	0.001	0.001	0	0	0.002	2.025
Seals [4]	16.993	12.084	7.569	11.879	9.843	1.087	0.408	0.236	0.405	2.158	3.222	15.741

[1] Species that were modeled as a representative group rather than as individual species.
[2] Annual densities are shown for species with insufficient sightings to derive density estimates by month.
[3] Two stocks of common bottlenose dolphin (the western North Atlantic migratory coastal stock and the western North Atlantic offshore stock) may occur in the Project area. Both stocks are presented here.
[4] Densities are only available for the combined seal and pilot whale groups in the Roberts *et al.* (2023) dataset. Seals include harbor seals, gray seals, and harp seals were in the seal guild.
[5] Density estimates are presented yet take is not requested for these species due to low density estimates and few occurrences in the Project area.

For some species and activities, PSO survey data for the Lease Area (RPS, 2023; Smultea, 2022) and group size data compiled from RPS (2013) and DoN (2017b) 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.

In cases where the acoustic exposure estimate for a species was less than the mean group size, the take request was increased to the mean group size (in some cases multiple groups were assumed) and rounded to the nearest integer (table 13). Requested take for pile driving activities was adjusted according to average group size in table 13 and rounded to the nearest whole number.

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 table 13.

TABLE 13—AVERAGE MARINE MAMMAL GROUP SIZES USED IN TAKE ESTIMATE CALCULATIONS

Species	Mean group size	Source [1]
Fin whale [2 3]	1.64	RPS, 2023.
North Atlantic right whale [3]	2.00	RPS, 2023.
Humpback whale [3]	1.95	RPS, 2023.
Atlantic spotted dolphin [3]	5.89	RPS, 2023.
Pantropical spotted dolphin [3]	4.33	RPS, 2023.
Common dolphin [3]	7.00	RPS, 2023.
Killer whale [4]	2.5	DoN, 2017.
Long-finned pilot whale [3]	11.0	DoN, 2017.
Short-finned pilot whale [3]	16.0	DoN, 2017.
Risso's dolphin [3]	8.47	DoN, 2017.
Rough-toothed dolphin [4]	5.50	DoN, 2017.
Striped dolphin [4]	45.59	DoN, 2017.
Harbor porpoise [5]	3.00	RPS, 2023.

[1] PSO data from the Smultea Associate PSO interim report (Smultea, 2022) was not used to assess group sizes as the activity documented in the report occurred outside the pile driving and HRG micro-siting periods planned for the Project.
[2] For fin whales, US Wind adjusted take by Level A harassment according to group size for years 1 and 3.
[3] US Wind adjusted take by Level B harassment for these species according to group size.
[4] For killer whales, rough-toothed dolphins, and striped dolphins, NMFS adjusted take by Level B harassment according to the assumption that one group of each species would be encountered per year of impact pile driving.
[5] For harbor porpoises, US Wind adjusted take by Level A harassment according to group size for years 2 and 3 and take by Level B harassment according to group size for years 1 and 3.

WTG, OSS, and Met Tower Foundation Installation

Here, we describe the results from the acoustic, exposure, and take estimate methodologies outlined above for WTG, OSS, and meteorological tower installation pile driving activities that have the potential to result in harassment of marine mammals. We present 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, MAI integrated the results from acoustic source and propagation modeling into an animal movement model to calculate acoustic ranges for 16 marine mammal species considered common in the project area. The acoustic ranges represent distances to NMFS' harassment isopleths independent of movement of a receiver. The pile progression schedule (refer back to table 3) was taken into account when calculating the acoustic ranges to SEL thresholds (see appendix A of the ITA application of additional details on calculations). The modeled sound fields represented the single strike SELs at the modeled strike energies (table 11). The single strike SEL fields were converted to cumulative SEL fields based on the different strike energy levels and the number of expected hammer blows at each energy. The difference between a single strike SEL and the cumulative SEL was calculated using $10 * \log_{10}$ (number of strikes). MAI calculated acoustic ranges for the 11-m monopile assuming one monopile would be installed per day using 4,800 impact hammer strikes (table 3). For the 3-m pin piles for the OSSs scenario, MAI calculated the acoustic ranges assuming 4 pin piles would be installed per day with 19,200 hammer strikes each day (table 3). MAI calculated acoustic ranges for the 1.8-m pin piles for the Met tower foundation assuming 3 pin piles would be installed per day with an associated 2,998 impact hammer strikes that day (table 3). The maximum received level-over-depth was calculated at each range step and along each radial. The maximum and 95th percentile acoustic range to the marine mammal regulatory thresholds were then calculated for each of the modeling scenarios (table 14). The maximum acoustic range value represents the greatest distance along any single radial. The 95th percentile acoustic range ($R_{95\%}$) is an improved representation of the range to the threshold as it eliminates major outliers and better represents all the modeled radials. All acoustic ranges presented to regulatory thresholds are the 95th percentile range. PTS peak sound pressure level thresholds and the Level B behavioral harassment threshold (160-dB RMS sound pressure level) represent instantaneous exposures. 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 (however, an animal could come closer for a shorter period of time and still incur PTS or an animal could move further away and, thus, not be exposure to the entire duration of piling in a 24-hour period that would result in the exceedance of the PTS SELcum threshold). Acoustic ranges to the Level A harassment and Level B harassment thresholds are shown in tables 14 and 15, respectively.

TABLE 14—ACOUSTIC RANGES ($R_{95\%}$) IN METERS (m) TO MARINE MAMMAL LEVEL A HARASSMENT THRESHOLDS (SEL AND PEAK [1]) DURING IMPACT PILE DRIVING 11-m MONOPILES, 3-m PIN PILES, AND 1.8-m PIN PILES, ASSUMING 10-dB ATTENUATION

Pile installed	Maximum hammer energy (kJ)	Activity duration (min/day)	Distances to Level A harassment thresholds (m)							
			Low-frequency cetaceans		Mid-frequency cetaceans		High-frequency cetaceans		Phocids	
			219 $L_{p,\ pk}$	183 $L_{E,\ 24hr}$	230 $L_{p,\ pk}$	185 $L_{E,\ 24hr}$	202 $L_{p,\ pk}$	155 $L_{E,\ 24hr}$	218 $L_{p,\ pk}$	185 $L_{E,\ 24hr}$
11 m Monopile	[2] 3,300	120	<50	2,900	<50	0	200	250	<50	100
3 m Pin Piles	1,500	480	<50	1,400	<50	0	<50	100	<50	50
1.8 m Pin Pile	500	240	<50	50	<50	0	<50	0	<50	0

[1] SEL acoustic ranges assumed a maximum hammer energy of 3,300 kJ while peak acoustic ranges assumed a maximum hammer energy of 4,400 kJ. US Wind confirmed with NMFS that they would not utilize hammer energies above 3,300 kJ (Jodziewicz, 2023).

TABLE 15—ACOUSTIC RANGES ($R_{95\%}$) IN METERS (m) TO MARINE MAMMAL LEVEL B HARASSMENT THRESHOLDS (160-dB SPL) DURING IMPACT PILE DRIVING 11-m MONOPILES, 3-m PIN PILES, AND 1.8-m PIN PILES, ASSUMING 10-dB ATTENUATION

Pile installed	Hammer energy (kJ)	Distance to Level B harassment threshold (m) (160 dB)
11-m Monopile	4,400	5,250
3-m Pin Piles	1,500	500
1.8-m Pin Pile	500	100

To estimate take from foundation installation activities, US Wind used the pile installation construction schedule shown in table 16, assuming 22 total days of foundation installation activities during the MarWin campaign, 58 total days of pile installation activities during the Momentum Wind campaign, and 39 total days of pile installation during the Future Development campaign.

TABLE 16—PILE INSTALLATION CONSTRUCTION SCHEDULE USED FOR TAKE ESTIMATION

Campaign	Year	Structure	Foundation type	Number of piles	Expected number of days to install foundation type	Installation rate per day	Total number of installation days for campaign
MarWin	2025	WTG	11-m Monopile	21	21	1	22
		OSS	3-m Pin Piles	4	1	4	
Momentum Wind	2026	WTG	11-m Monopile	55	55	1	58
		OSS	3-m Pin Piles	8	2	4	
		Met tower	1.8-m Pin Piles	3	1	3	
Future Development	2027	WTG	11-m Monopile	38	38	1	39
		OSS	3-m Pin Piles	4	1	4	

To estimate the amount of Level A harassment and Level B harassment that may occur incidental to foundation installation, US Wind used the animat modeling described above to integrate the predicted received sound level fields of the impact pile driving resulting from the acoustic modeling of the impact pile driving sources (acoustic ranges) with the four-dimensional movements of marine mammals. US Wind used the modeled SEL and peak

SEL received by each individual animat over the duration of the model simulation (24 hours) to calculate the potential for that animat to have been exposed to sound levels exceeding the Level A harassment threshold. To estimate the amount of Level B (behavioral) harassment that may occur incidental to foundation installation, US Wind used the modeled root mean square (RMS) sound pressure levels to estimate the potential for marine mammal behavioral responses for animats that did not experience exposure to sound levels that exceeded Level A harassment thresholds. Modeled results for Level A harassment and Level B harassment exposure estimates were subsampled to reflect the duty cycle of each construction activity's source to create multiple estimates of sound exposure for each source and marine mammal combinations. The number of modeled exposures were multiplied by the ratio of real-world density and animat model densities to obtain per pile animat exposure estimates. US Wind calculated maximum acoustic exposure estimates on an annual basis according to the annual installation schedule (table 16) for the 11-m monopile, 3-m skirt pile, and 1.8-m pin pile, assuming a 10-dB sound level attenuation each year. As described above, MAI multiplied the final acoustic per pile exposure estimate for each modeled species by the number of piles to be installed per month to obtain a monthly exposure estimate for each species. To obtain annual exposure estimates, MAI summed the monthly exposure estimates for each modeled species for each year of pile driving (years 1–3). MAI conducted these calculations for both Level A harassment and Level B harassment exposure estimates for each modeled species. Table 17 identifies the amount of take calculated for impact installation of monopiles for WTGs, table 18 identifies the amount of take calculated for impact installation of 3-m pin piles for jacket foundations for OSSs, and table 19 identifies the amount of take calculated for impact installation of 1.8-m pin piles for the Met tower. No take by Level A harassment is anticipated or proposed for authorization during impact pile driving of 3-m pin piles for OSSs (table 18) or 1.8-m pin piles for the Met tower (table 19). Take proposed for authorization for all impact pile driving activities combined across years 1–3 and carried forward for this proposed rule as shown in table 20.

Bottlenose dolphin estimated take by Level B harassment was distributed between the coastal stock and offshore stock based upon the where impact pile driving would take place within the Lease Area throughout years 1–3 and how pile driving locations may overlap the expected ranges of the coastal and offshore stocks. North of Cape Hatteras, NC, the coastal stocks of bottlenose dolphins are expected to occur in waters less than 25 m deep and within 34 km of shore (Kenney, 1990; Torres *et al.,* 2003). Impact pile driving would progress from the southeastern corner of the Lease Area in year 1 and extend west during years 2 and 3. During year 1, impact pile driving would occur furthest offshore, with the ensonified zone above NMFS harassment threshold beyond the expected range of the coastal stock, therefore, US Wind allocated 100 percent of estimated take by Level B harassment during year 1 to the offshore stock. During years 2 and 3, pile driving would take place further west than year 1 and within the range of the coastal stock as well. As pile driving is expected to progress westward into shallower waters and further into the range of the coastal stock during years 2 and 3, estimated take by Level B harassment would increase for the coastal stock as compared to the offshore stock as the pile driving locations progress west. US Wind distributed estimated take by Level B harassment between stocks for years 2 and 3 as follows: year 2 (70 percent offshore stock, 30 percent coastal stock) and year 3 (15 percent offshore stock; 85 percent coastal stock).

For Atlantic spotted dolphins, it was expected that five groups would be observed during pile driving activities in year 1 and 10 groups would be observed in years 2 and 3 (RPS, 2023). Although acoustic exposures were calculated as zero for each species of pilot whales each year, based upon sighting data in the area (DoN, 2017), it was assumed that one pilot whale group of each species may be encountered. US Wind adjusted pilot whale requested take by Level B harassment for years 1 to 3. For Risso's dolphin, it was expected that two groups of nine would be observed for each year of pile driving (years 1 through 3) and taken by Level B harassment. Although killer whales, rough-toothed dolphins, and striped dolphins are expected to be rare in the Project Area due to habitat preferences, a very small amount of exposures (*e.g.,* 0.22) were modeled; therefore, it was assumed one group of each species may be encountered during the LOA period. For harbor porpoises, it was expected that one group of three (RPS, 2023) would be taken by Level A harassment in years 2 and 3 and one group of three would be taken by Level B harassment in years 1 and 3. US Wind adjusted requested take for harbor porpoises, accordingly. Year 2 request for take by Level B harassment for harbor porpoises during pile driving activities was not adjusted for group size as the estimated acoustic exposure was greater than the average expected group size, and the acoustic exposure estimate was rounded up to the nearest whole number. 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.

TABLE 17—MODELED LEVEL A HARASSMENT AND LEVEL B HARASSMENT EXPOSURES ASSUMING 10-dB SOUND ATTENUATION DURING IMPACT PILE DRIVING OF 11-m MONOPILE FOUNDATIONS IN THE BUFFERED LEASE AREA OVER 3 YEARS AND PROPOSED TAKE (IN PARENTHESES)

Marine mammal species	Level A harassment (SEL_{cum}) [6]			Level B harassment (160 dB_{rms})		
	Year 1 (2025) [8]	Year 2 (2026) [9]	Year 3 (2027) [10]	Year 1 (2025) [8]	Year 2 (2026) [9]	Year 3 (2027) [10]
North Atlantic right whale [1 2]	0.01 (0)	0.05 (0)	0.02 (0)	[3] 0.06 (2)	[3] 0.24 (2)	[3] 0.08 (2)
Fin whale [1]	[3] 0.39 (2)	[3] 1.16 (2)	[3] 0.68 (2)	[4] 3.94 (4)	[4] 11.57 (12)	[4] 6.83 (7)
Humpback whale	[3] 0.42 (2)	[3] 1.55 (2)	[3] 0.67 (2)	[4] 2.52 (3)	[4] 9.29 (10)	[4] 4.05 (5)
Minke whale	[4] 0.49 (1)	[4] 5.55 (6)	[4] 1.11 (2)	[4] 2.96 (3)	[4] 33.31 (34)	[4] 6.66 (7)
Sei whale [1]	[4] 0.1 (1)	[4] 0.12 (1)	[4] 0.02 (1)	[4] 0.11 (1)	[4] 0.83 (1)	[4] 0.17 (1)
Killer whale	0 (0)	0 (0)	0 (0)	[3] 0.08 (3)	[3] 0.22 (3)	[3] 0.15 (3)
Atlantic spotted dolphin	0 (0)	0 (0)	0 (0)	[3] 14.07 (24)	[3] 38.86 (54)	[3] 50.75 (54)
Bottlenose dolphin (offshore stock/coastal stock) [5]	0 (0)	0 (0)	0 (0)	[4] 846.85 (847)	[4] 2,320.67 (2,321)	[4] 1,711.04 (1,721)
Common dolphin	0 (0)	0 (0)	0 (0)	[4] 28.63 (29)	[4] 233.12 (234)	[4] 96.48 (97)
Long-finned pilot whale	0 (0)	0 (0)	0 (0)	[3] 0 (11)	[3] 0 (11)	[3] 0 (11)
Short-finned pilot whale	0 (0)	0 (0)	0 (0)	[3] 0 (16)	[3] 0 (16)	[3] 0 (16)

TABLE 17—MODELED LEVEL A HARASSMENT AND LEVEL B HARASSMENT EXPOSURES ASSUMING 10-dB SOUND ATTENUATION DURING IMPACT PILE DRIVING OF 11-m MONOPILE FOUNDATIONS IN THE BUFFERED LEASE AREA OVER 3 YEARS AND PROPOSED TAKE (IN PARENTHESES)—Continued

Marine mammal species	Level A harassment (SEL_{cum}) [6]			Level B harassment (160 dB_{rms})		
	Year 1 (2025) [8]	Year 2 (2026) [9]	Year 3 (2027) [10]	Year 1 (2025) [8]	Year 2 (2026) [9]	Year 3 (2027) [10]
Pantropical spotted dolphin	0 (0)	0 (0)	0 (0)	[3] 0.17 (5)	[3] 0.45 (5)	[3] 0.31 (5)
Risso's dolphin	0 (0)	0 (0)	0 (0)	[3] 0.79 (9)	[3] 4.33 (9)	[3] 1.94 (9)
Rough toothed dolphin	0 (0)	0 (0)	0 (0)	[3] 0.04 (6)	[3] 0.11 (6)	[3] 0.08 (6)
Striped dolphin	0 (0)	0 (0)	0 (0)	[3] 0.17 (46)	[3] 0.45 (46)	[3] 0.31 (46)
Harbor porpoise [6]	0 (0)	[3] 1.19 (3)	[3] 0.01 (3)	[3] 0.03 (3)	[3] 15.83 (16)	[3] 0.08 (3)
Gray seal [5]	0 (0)	0 (0)	0 (0)	[4] 17.87 (18)	[4] 234.31 (235)	[4] 30.02 (31)
Harbor seal [5].						
Harp seal [5].						

[1] Listed as Endangered under the Endangered Species Act (ESA)
[2] Level A harassment exposures were initially estimated for this species, but due to the mitigation measures that US Wind will be required to abide by, no Level A harassment take is expected, nor proposed to be authorized.
[3] Proposed take adjusted according to group size in table 13.
[4] Proposed take rounded to the nearest whole number.
[5] Two stocks of common bottlenose dolphin (the western North Atlantic migratory coastal stock and the western North Atlantic offshore stock) may occur in the Project area. Both stocks are presented together here.
[6] Peak levels were not considered because SEL distances were larger than peak in all cases, with the exception of harbor porpoise. Peak exposure estimates were greater than the cumulative SEL exposure estimates for harbor porpoises due to the frequency weighting of the SEL-based metric and a lower peak threshold for high-frequency cetaceans compared to other marine mammal hearing groups.
[7] Exposure estimates include harbor seals, gray seals, and harp seals combined.
[8] During the MarWin campaign in year 1, US Wind plans to install 21 11-m monopiles and 4 3-m pin piles.
[9] During the Momentum Wind campaign in year 2, US Wind plans to install 55 11-m monopiles, 8 3-m pin piles, and 3 1.8-m pin piles.
[10] During the Future Development campaign in year 3, US Wind plans to install 38 11-m monopiles and 4 3-m pin piles.

TABLE 18—MODELED LEVEL B HARASSMENT EXPOSURES (ASSUMING 10-dB SOUND ATTENUATION) DUE TO IMPACT PILE DRIVING OF 3-m PIN PILES IN THE BUFFERED LEASE AREA OVER 3 YEARS [1] AND PROPOSED TAKE [8]

Marine mammal species	Level B harassment (160 dB_{rms})					
	Year 1 (2025) [5]		Year 2 (2026) [6]		Year 3 (2027) [7]	
	Exposure estimate	Proposed take	Exposure estimate	Proposed take	Exposure estimate	Proposed take
North Atlantic right whale [2]	0	0	0	0	0	0
Fin whale [2 3]	0.03	2	0.06	2	0.03	2
Humpback whale [3]	0.01	2	0.01	2	0.01	2
Minke whale [4]	0.04	1	0.08	1	0.04	1
Sei whale [2]	0	0	0	0	0	0
Killer whale	0	0	0	0	0	0
Atlantic spotted dolphin [3]	0.17	[6]	0.35	6	0.17	6
Bottlenose dolphin (offshore stock/coastal stock) [4 5]	9.53	10	19.06	19	9.53	10
Common dolphin [3]	0.57	7	1.14	7	0.57	7
Long-finned pilot whale	0	0	0	0	0	0
Short-finned pilot whale	0	0	0	0	0	0
Pantropical spotted dolphin	0	0	0	0	0	0
Risso's dolphin [3]	0.01	9	0.03	9	0.01	9
Rough toothed dolphin	0	0	0	0	0	0
Striped dolphin	0	0	0	0	0	0
Harbor porpoise	0	0	0	0	0	0
Gray seal [6]	0.08	0	0.16	0	0.08	0
Harbor seal [6].						
Harp seal [6].						

[1] Modeled acoustic exposure estimates for all species were zero for take by Level A harassment. Therefore, no take by Level A harassment is anticipated or proposed for authorization.
[2] Listed as Endangered under the Endangered Species Act (ESA)
[3] Proposed take is adjusted according to group size in table 13.
[4] Proposed take is rounded to the nearest whole number.
[5] Two stocks of common bottlenose dolphin (the western North Atlantic migratory coastal stock and the western North Atlantic offshore stock) may occur in the Project area. Both stocks are presented together here.
[6] Exposure estimates include harbor seals, gray seals, and harp seals combined.
[7] During the MarWin campaign in year 1, US Wind plans to install 21 11-m monopiles and 4 3-m pin piles.
[8] During the Momentum Wind campaign in year 2, US Wind plans to install 55 11-m monopiles, 8 3-m pin piles, and 3 1.8-m pin piles.
[9] During the Future Development campaign in year 3, US Wind plans to install 38 11-m monopiles and 4 3-m pin piles.

TABLE 19—MODELED LEVEL B HARASSMENT EXPOSURES (ASSUMING 10-dB SOUND ATTENUATION) DUE TO IMPACT PILE DRIVING OF 1.8-m PIN PILES (ASSUME THREE TOTAL PIN PILES FOR THE MET TOWER) IN THE BUFFERED LEASE AREA DURING YEAR 2 [1] [2] AND PROPOSED TAKE [8]

Marine mammal species	Level B harassment acoustic exposure estimate (160 dB_{rms})	Level B harassment proposed take estimate
North Atlantic right whale [3]	0	0
Fin whale [3] [4]	0.01	2
Humpback whale [4]	0.01	2
Minke whale [5]	0.01	1
Sei whale [3]	0	0
Killer whale	0	0
Atlantic spotted dolphin	0	0
Bottlenose dolphin (offshore stock/coastal stock) [5] [6]	1.91	2
Common dolphin [4]	0.18	7
Long-finned pilot whale	0	0
Short-finned pilot whale	0	0
Pantropical spotted dolphin	0	0
Risso's dolphin	0	0
Rough toothed dolphin	0	0
Striped dolphin	0	0
Harbor porpoise	0	0
Gray seal [7]	0.09	0
Harbor seal [7].		
Harp seal [7].		

[1] In-water construction activities to install the Met tower would take place only during year 2.
[2] Modeled acoustic exposure estimates for all species were zero for take by Level A harassment. Therefore, no take by Level A harassment is anticipated or proposed for authorization.
[3] Listed as Endangered under the Endangered Species Act (ESA).
[4] Proposed take is adjusted according to group size in table 13.
[5] Proposed take is rounded to the nearest whole number.
[6] Two stocks of common bottlenose dolphin (the western North Atlantic migratory coastal stock and the western North Atlantic offshore stock) may occur in the Project area. Both stocks are presented together here.
[7] Exposure estimates include harbor seals, gray seals, and harp seals.
[8] During the Momentum Wind campaign in year 2, US Wind plans to install 55 11-m monopiles, 8 3-m pin piles, and 3 1.8-m pin piles.

TABLE 20—PROPOSED TAKES BY LEVEL A HARASSMENT AND LEVEL B HARASSMENT FOR ALL IMPACT PILE DRIVING ACTIVITIES IN THE BUFFERED LEASE AREA OVER 3 YEARS

Marine mammal species	Population estimate	Proposed take by Level A harassment			Proposed take by Level B harassment		
		Year 1 (2025)	Year 2 (2026)	Year 3 (2027)	Year 1 (2025)	Year 2 (2026)	Year 3 (2027)
North Atlantic right whale [1]	338	0	0	0	2	2	2
Fin whale [1] [2]	6,802	2	2	2	6	16	9
Humpback whale [2]	1,396	2	2	2	5	14	7
Minke whale	21,968	1	6	2	4	36	8
Sei whale [1]	6,292	1	1	1	1	1	1
Killer whale [3]	UNK	0	0	0	3	3	3
Atlantic spotted dolphin [4]	39,921	0	0	0	30	60	60
Bottlenose dolphin (coastal stock) [5]	6,639	0	0	0	0	703	1,462
Bottlenose dolphin (offshore stock) [5]	62,851	0	0	0	857	1,639	259
Common dolphin	172,974	0	0	0	36	248	104
Long-finned pilot whale [6]	39,215	0	0	0	11	11	11
Short-finned pilot whale [6]	28,924	0	0	0	16	16	16
Pantropical spotted dolphin	6,593	0	0	0	5	5	5
Risso's dolphin [7]	35,215	0	0	0	18	18	18
Rough toothed dolphin [3]	136	0	0	0	6	6	6
Striped dolphin [3]	67,306	0	0	0	46	46	46
Harbor porpoise [8]	95,543	0	3	3	3	16	3
Gray seal [9]	27,300	0	0	0	18	235	31
Harbor seal [9]	61,336						
Harp seal [9]	7.6M						

[1] Listed as Endangered under the Endangered Species Act (ESA).
[2] Total proposed take by Level A harassment was increased according to average group size (table 13), rounded to the nearest whole number, for years 1 and 3.
[3] Total proposed take by Level B harassment was increased according to average group size for each year of pile driving activities (table 13). It was assumed that one group would be encountered per year.
[4] Total proposed take by Level B harassment was increased according to average group size for each year of pile driving activities. Proposed takes for Atlantic spotted dolphins are based upon the assumption that 5 groups of 6 (RPS, 2023) will be observed during year 1 of pile driving activities, and 10 groups of 6 would be observed during each of years 2 and 3 pile driving activities.
[5] Bottlenose dolphin take by Level B harassment was allocated to each stock based upon the direction of the progression of pile driving throughout project years 1–3 as follows: year 1 (100 percent offshore stock); year 2 (70 percent offshore stock; 30 percent coastal stock); year 3 (15 percent offshore stock; 85 percent coastal stock).

[6] Total pilot whale acoustic exposures were low, and apportioning take as 60 percent short-finned pilot whale and 40 percent long-finned pilot whale resulted in calculated takes of less than one for both species. As these calculated acoustic exposure estimates were less than average group size for both species, requested take by Level B harassment was based upon the assumption of one group of each species being encountered during each year of pile driving activities (table 13).
[7] Total proposed take by Level B harassment was increased according to average group size for each year of pile driving activities. Proposed take by Level B harassment for Risso's dolphins is based upon the assumption that two groups of nine (DoN, 2017) would be observed during each year of pile driving.
[8] Total proposed take was increased according to average group size. It is expected that one group of harbor porpoises would be taken by Level A harassment during years 2 and 3 and by Level B harassment in years 1 and 3. Proposed take represents monopile installation only as exposure estimates for pin pile installation were zero.
[9] Total proposed take by Level B harassment for seals includes harbor seals, gray seals, and harp seals.

HRG Surveys

US 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 4 (see Detailed Description of the Specified Activity).

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. US 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. 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. Input for HRG equipment specifications are provided in table 4. Micro-siting HRG surveys could occur throughout the Lease Area, therefore, US Wind assumed a maximum depth of 42 m (137.8 ft) which corresponds to the maximum depth of the Lease Area. The distances to the 160-dB RMS re 1 μPa isopleth for Level B harassment are presented in table 21.

TABLE 21—DISTANCES CORRESPONDING TO THE LEVEL B HARASSMENT THRESHOLD FOR HRG EQUIPMENT [1]

HRG survey equipment	Equipment type	Horizontal distance (m) to Level B harassment threshold
Applied Acoustics S Boomer	SBP: Boomer	35.2
AA Dura Spark 400 tip	SBP: Sparker	200

[1] Of note, NMFS has performed a preliminary review of a report submitted by Rand (2023), that includes measurements of the Geo-Marine Geo-Source 400 sparker (400 tip, 800 J), and suggests that NMFS is assuming lower source and received levels than appropriate in its assessments of HRG impacts. NMFS has determined that the values in our assessment remain appropriate, based on the model methodology (*i.e.,* source level propagated using spherical spreading) here predicting a peak level 3 dB louder than the maximum measured peak levels at the closest measurement range in Rand (2023). NMFS will continue reviewing Rand (2023) and other available data relevant to these sources.

The survey activities that have the potential to result in Level B harassment (160-dB SPL) include the noise produced by Applied Acoustics S Boomer or AA Dura Spark sparker (table 21), of which the Dura Spark sparker results in the greatest calculated distance to the Level B harassment criteria at 200 m (656 ft). US Wind has applied the estimated distance of 200 m (656 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. One vessel will operate at a time during HRG surveys.

The zone of influence (ZOI) is the total ensonified area around the sound source over a 24-hour period. The maximum ZOI was estimated by considering the distance of the daily vessel track line (111.2 km) and the largest distance from the sound source to the isopleth for the Level B harassment threshold (200 m for the Dura Spark sparker). US Wind calculated the distance of the daily vessel track line by multiplying the estimated average speed of the vessel (4 kn; 2.06 m/s) by a maximum of 15 hours per survey per day. The following equation was used to calculate the maximum ZOI:

$$\text{ZOI} = (\text{Distance traveled/day} * 2r) + r^2,$$

where

r is the maximum distance to the Level B threshold (200 m) and the maximum ZOI was 44.6 km^2.

Exposure calculations assumed that there would be 14 days of HRG surveying per year during years 2 (2026) and 3 (2027). As described in the ITA application, density data were mapped within the buffered Lease Area using geographic information systems, and these data were updated based upon the revised data from the Duke Model (Roberts *et al.,* 2023). Although HRG surveys are expected to occur between April and June each year, to be conservative, the maximum monthly average density for each species for an entire year was used and carried forward in the take calculations (table 21). Calculations assume a daylight-only schedule for HRG surveys. NMFS rounded exposure estimates to the nearest whole number to generate take estimates, except for species for which take is not proposed due to mitigation measures (table 22).

TABLE 22—MARINE MAMMAL DENSITIES (ANIMALS/100 km^2), EXPOSURE ESTIMATES, AND PROPOSED TAKES BY LEVEL B HARASSMENT FROM HRG SURVEYS DURING YEARS 2 AND 3 [1] [2]

Marine mammal species	Maximum monthly density (No./km^2)	Year 2		Year 3	
		Exposure estimate	Proposed take	Exposure estimate	Proposed take
North Atlantic right whale [3]	0.00076	0.5	[4] 2	0.5	[4] 2
Fin whale [3]	0.214	1.3	[4] 2	1.3	[4] 2
Humpback whale	0.187	1.2	[4] 02	1.2	[4] 2
Minke whale	0.75	4.7	5	4.7	5
Sei whale [3]	0.061	0.4	0	0.4	0
Killer whale	0.002	0.01	0	0.01	0
Atlantic spotted dolphin	1.505	9.4	9	9.4	9
Bottlenose dolphin [5]	20.608	128.7	129	128.7	129
Common dolphin	7.939	49.6	50	49.6	50
Pilot whale species [6]	0.039	0.2	0	0.2	0
Pantropical spotted dolphin	0.004	0.02	0	0.02	0
Risso's dolphin	0.169	1.1	[4] 8	1.1	[4] 8
Rough-toothed dolphin	0.002	0.01	0	0.01	0
Striped dolphin	0.004	0.02	0	0.02	0
Harbor porpoise	3.653	22.8	23	22.8	23
Gray seal [7]	16.993	106.1	106	106.1	106
Harbor seal [7]					
Harp seal [7]					

[1] Density estimates are calculated from the 2022 Duke Habitat-Based Marine Mammal Density Models (Roberts *et al.,* 2016; Roberts *et al.,* 2023). Maximum monthly average density for each marine mammal species was used for take calculations.
[2] The survey area accounts for waters within and around the Lease Area.
[3] Listed as Endangered under the ESA.
[4] Proposed take adjusted for group size. See table 13 for average group size estimates.
[5] Two stocks of common bottlenose dolphin (the western North Atlantic migratory coastal stock and the western North Atlantic offshore stock) may occur in the Project area. Both stocks are presented here.
[6] Densities are only available for the combined seal and pilot whale groups in the Roberts *et al.* (2023) dataset.
[7] Proposed take by Level B harassment is for harbor seals, gray seals, and harp seals.

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 to install WTG, OSS, and Met tower foundations, and HRG surveys are shown in table 24. The annual amount of take that is expected to occur in each year based on US Wind's current schedules is provided in table 24. The year 1 proposed take includes impact pile driving of monopiles for WTGs and 3-m pin piles for the OSSs. Proposed take during year 2 includes all activities occurring: WTG, OSS, and Met tower foundation installation and HRG surveys. Year 3 proposed take includes WTG and OSS foundation installation and HRG surveys. As mentioned above, the timing of installation activities and HRG surveys would depend upon vessel availability, contractor selection, weather, and additional factors. However, in the event that activities are delayed or spread over 4–5 years (instead of 3 years), the maximum annual amount of take for each species would not exceed the numbers listed in table 25.

For each species, if the acoustic exposure (for pile driving activities or HRG surveys) was less than the average group size (table 13), the average group size was rounded to the nearest integer and used as the proposed take estimate by Level A harassment or Level B harassment. If the acoustic exposure was greater than the average group size (table 13), the acoustic exposure was rounded to the nearest integer and used as the proposed take estimate by Level A harassment or Level B harassment.

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 most impactful scenario with respect to project design and schedules. As described in the Description of Specified Activity section, US Wind may use suction-buckets to install OSS foundations. Should US Wind use suction-bucket foundations, take would not occur from OSS foundation installation 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. In addition, 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).

TABLE 23—PROPOSED TAKES BY LEVEL A HARASSMENT AND LEVEL B HARASSMENT FOR ALL ACTIVITIES PROPOSED TO BE CONDUCTED ANNUALLY OVER 3 YEARS [1]

Marine mammal species	Year 1		Year 2		Year 3	
	Level A harassment	Level B harassment	Level A harassment	Level B harassment	Level A harassment	Level B harassment
North Atlantic right whale [2] [3]	0	2	0	4	0	4
Fin whale [2] [3]	2	6	2	18	2	11

TABLE 23—PROPOSED TAKES BY LEVEL A HARASSMENT AND LEVEL B HARASSMENT FOR ALL ACTIVITIES PROPOSED TO BE CONDUCTED ANNUALLY OVER 3 YEARS [1]—Continued

Marine mammal species	Year 1		Year 2		Year 3	
	Level A harassment	Level B harassment	Level A harassment	Level B harassment	Level A harassment	Level B harassment
Humpback whale [3]	2	5	2	16	2	9
Minke whale [3]	1	4	6	41	2	13
Sei whale [3]	1	1	1	1	1	1
Killer whale [3]	0	3	0	3	0	3
Atlantic spotted dolphin [3]	0	30	0	69	0	69
Coastal bottlenose dolphin [4]	0	0	0	703	0	1,462
Offshore bottlenose dolphin [4]	0	857	0	1,639	0	259
Bottlenose dolphin [5]	0	0	0	129	0	129
Common dolphin	0	36	0	298	0	154
Long-finned pilot whale [3]	0	16	0	16	0	16
Short-finned pilot whale [3]	0	11	0	11	0	11
Pantropical spotted dolphin [3]	0	5	0	5	0	5
Risso's dolphin	0	18	0	26	0	26
Rough-toothed dolphin [3]	0	6	0	6	0	6
Striped dolphin [3]	0	46	0	46	0	46
Harbor porpoise [3]	0	3	3	39	3	26
Gray seal [6]	0	18	0	341	0	147
Harbor seal [6]						
Harp seal [6]						

[1] The final rule and LOA, if issued, would be effective from January 1, 2025 through December 31, 2029.
[2] Listed as Endangered under the ESA.
[3] Average group size applied to the proposed take estimate.
[4] Proposed take represents take from impact pile driving activities.
[5] Proposed take numbers represent requested take from HRG survey activities. Assumes take from the coastal and offshore stock of bottlenose dolphins.
[6] Proposed take includes harbor seals, gray seals, and harp seals.

TABLE 24—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 AND OVER THE COURSE OF THE RULE

Marine mammal species	Total proposed take by Level A harassment	Total proposed take by Level B harassment
North Atlantic right whale [1,2]	0	10
Fin whale [1,2]	6	35
Humpback whale [2]	6	30
Minke whale [2]	9	58
Sei whale [2]	3	3
Killer whale [3]	0	9
Atlantic spotted dolphin [2]	0	168
Coastal bottlenose dolphin [3]	0	2,165
Offshore bottlenose dolphin [3]	0	2,755
Bottlenose dolphin [4]	0	258
Common dolphin	0	488
Long-finned pilot whale [2]	0	48
Short-finned pilot whale [2]	0	33
Pantropical spotted dolphin [2]	0	15
Risso's dolphin	0	70
Rough-toothed dolphin [3]	0	18
Striped dolphin [3]	0	138
Harbor porpoise [2]	6	68
Gray seal [5]	0	496
Harbor seal.[5]		
Harp seal.[5]		

[1] The final rule and LOA, if issued, would be effective from January 1, 2025 through December 31, 2029.
[2] Listed as Endangered under the ESA.
[3] Total 3-year proposed take by Level B harassment includes impact pile driving activities only.
[4] Total 3-year proposed take by Level B harassment includes HRG survey activities for both stocks combined.
[5] Proposed take includes harbor seals, gray seals, and harp seals.

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 25). Table 25 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 that are not occurring on consecutive days for the duration of the project (*e.g.,* foundation installation) or occurring in an area where animals are migratory and not expected to remain for multiple days, represent circumstances where repeat takes of the same individuals are less likely. 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. The combination of number of individuals each taken and number of days on which take would occur would depend upon the activity, the presence of biologically important areas in the project area, and the movement patterns of the marine mammal species 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 25—MAXIMUM NUMBER OF PROPOSED TAKES (BY LEVEL A HARASSMENT AND LEVEL B HARASSMENT) THAT COULD OCCUR IN ANY ONE YEAR OF THE PROJECT RELATIVE TO STOCK POPULATION SIZE [1]

Marine mammal species	NMFS stock abundance	Maximum annual Level A harassment	Maximum annual Level B harassment	Maximum annual take	Maximum proposed take (instances) as a percentage of stock abundance) [1 2]
North Atlantic right whale [3 4]	338	0	4	4	1.18
Fin whale [3 4]	6,802	2	18	20	0.29
Humpback whale [4]	1,396	2	16	18	1.29
Minke whale	21,968	6	41	47	0.21
Sei whale [3 4]	6,292	1	1	2	0.03
Killer whale [4]	UNK	0	3	3	UNK
Atlantic spotted dolphin [4]	39,921	0	69	69	0.17
Coastal bottlenose dolphin [5]	6,639	0	1,591	1,591	24.0
Offshore bottlenose dolphin [5]	62,851	0	1,768	1,768	2.81
Common dolphin	172,974	0	298	298	0.17
Long-finned pilot whale [4]	39,215	0	16	16	0.04
Short-finned pilot whale [4]	28,924	0	11	11	0.04
Pantropical spotted dolphin [4]	6,593	0	5	5	0.08
Risso's dolphin [4]	35,215	0	26	26	0.07
Rough-toothed dolphin [4]	136	0	6	6	4.41
Striped dolphin [4]	67,036	0	46	46	0.07
Harbor porpoise [4]	95,543	3	39	42	0.04
Gray seal [6]	27,300	0	341	341	1.25
Harbor seal [6]	61,336				0.56
Harp seal [6]	7.6M				0.0004

[1] Year 2 (2026) represents the most impactful year overall.
[2] 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.
[3] Listed as Endangered under the ESA.
[4] Proposed take is based on average group size.
[5] Maximum proposed take for each bottlenose dolphin species includes the maximum proposed take by Level B harassment of any year for HRG surveys.
[6] Assumes 100 percent of the take by Level B harassment is from either the gray seal stock, harbor seal stock, or harp seal stock.

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 adverse 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 to be required 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 clearance zones, as well as 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 the required 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 foundation installation, nearshore installation and removal activities for cable laying, and HRG surveys. Details on specific requirements can be found in Part 217—Regulations Governing The Taking And Importing Of Marine Mammals at the end of this proposed rulemaking.

Training and Coordination

NMFS requires all US Wind's employees and contractors conducting activities on the water, including, but not limited to, all vessel captains and crew, to be trained in marine mammal detection and identification, communication protocols, and all required measures to minimize impacts on marine mammals and support US Wind's compliance with the LOA, if issued. Additionally, all relevant personnel and the marine mammal species monitoring team(s) are required to participate in joint, onboard briefings prior to the beginning of project activities. The briefing must be repeated whenever new relevant personnel (*e.g.,* new PSOs, construction contractors, relevant crew) join the project before work commences. During this training, US Wind is 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.,* are required to immediately comply with any call for a delay or shut down by the Lead PSO. Any disagreement between the Lead PSO and the project personnel must only be discussed after delay or shutdown has occurred. In particular, all captains and vessel crew must be trained in marine mammal detection and vessel strike avoidance measures to ensure marine mammals are not struck by any project or project-related vessel.

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. US Wind will provide documentation of training to NMFS.

North Atlantic Right Whale Awareness Monitoring

US Wind would be required to use available sources of information on North Atlantic right whale presence, including daily monitoring of the Right Whale Sightings Advisory System, monitoring of U.S. Coast Guard very high-frequency (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 US Wind's efforts), and allows for planning of 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. While the likelihood of a vessel strike is generally low, they 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, to the extent practicable. 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 project personnel sights a marine mammal. The mitigation requirements we propose are described generally here and in detail in the regulation text at the end of this proposed rule (see 50 CFR 217.264(b)). US Wind would 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.

While underway, US Wind's personnel would be required to monitor for and maintain a minimum separation 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) 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. The dedicated visual observer, equipped with suitable monitoring technology (*e.g.,* binoculars, night vision devices), must be located at an appropriate vantage point for ensuring vessels are maintaining required vessel separation distances from marine mammals (*e.g.,* 500 m from North Atlantic right whales).

All project vessels, regardless of size, must maintain the following minimum separation zones: 500 m from North Atlantic right whales; 100 m from sperm whales and non-North Atlantic right whale baleen whales; and 50 m from all delphinid cetaceans and pinnipeds (an exception is made for those species that approach the vessel such as bow-riding dolphins) (table 26). All reasonable steps must be taken to not violate minimum separation distances. If any of these species are sighted within their respective minimum separation zone, the underway vessel must shift its engine to neutral (if safe to do so) and the engines must not be engaged until the animal(s) have been observed to be outside of the vessel's path and beyond the respective minimum separation zone. If a North Atlantic right whale is observed at any distance by any project personnel or acoustically detected, project vessels must reduce speeds to 10 kn. Additionally, in the event that any project-related vessel, regardless of size, observes any large whale (other than a North Atlantic right whale) within 500 m of an underway vessel, the vessel is required to immediately reduce speeds to 10 kn or less. The 10 kn speed restriction will remain in effect as outlined in 50 CFR 217.344(b).

TABLE 26—HRG VESSEL STRIKE AVOIDANCE SEPARATION ZONES

Marine mammal species	Vessel separation zone (m)
North Atlantic right whale	500
Other ESA-listed species and large whales	100
Other marine mammals [1]	50

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

All of the project-related vessels would be required to comply with existing NMFS vessel speed restrictions for North Atlantic right whales and the measures within this rulemaking for operating vessels around North Atlantic right whales and other marine mammals. When NMFS vessel speed restrictions are not in effect and a vessel is traveling at greater than 10 kn, in addition to the required dedicated visual observer, US Wind would be required to monitor the crew transfer vessel transit corridor (the path crew transfer vessels take from port to any work area) in real-time with PAM prior to and during transits. To maintain awareness of North Atlantic right whale presence, vessel operators, crew members, and the marine mammal monitoring team will monitor U.S. Coast Guard VHF Channel 16, WhaleAlert, the Right Whale Sighting Advisory System (RWSAS), and the PAM system. Any marine mammal observed by project personnel must be immediately communicated to any on-duty PSOs, PAM operator(s), and all vessel captains. Any North Atlantic right whale or large whale observation or acoustic detection by PSOs or PAM operators must be conveyed to all vessel captains. All vessels would be equipped with an AIS and US Wind must report all Maritime Mobile Service Identity (MMSI) numbers to NMFS Office of Protected Resources prior to initiating in-water activities. US Wind will submit a NMFS-approved North Atlantic Right Whale Vessel Strike Avoidance Plan at least 90 days prior to commencement of vessel use.

US Wind's compliance with these proposed measures would reduce the likelihood of vessel strike to the extent practicable. These measures increase awareness of marine mammals in the vicinity of project vessels and require project vessels to reduce speed when marine mammals are detected (by PSOs, PAM, and/or through another source, *e.g.,* RWSAS) and maintain 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 reduce the likelihood of and effects from a vessel strike. 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).

Seasonal and Daily Restrictions

Temporal restrictions in places where marine mammals are concentrated, engaged in biologically important behaviors, and/or present in sensitive life stages are effective measures for reducing the magnitude and severity of human impacts. The temporal restrictions required here are built around North Atlantic right whale protection. Based upon the best scientific information available (Roberts *et al.,* 2023), the highest densities of North Atlantic right whales in the specified geographic region are expected during the months of January through April, with an increase in density starting in December. However, North Atlantic right whales may be present in the specified geographic region throughout the year.

NMFS is proposing to require seasonal work restrictions to minimize risk of noise exposure to the North Atlantic right whales incidental to certain specified activities to the extent practicable. 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.

As described previously, no impact pile driving activities may occur December 1 through April 30. NMFS is not proposing any seasonal restrictions to HRG surveys; however, US Wind has planned a limited amount of surveys (over 14 days) during daylight within the proposed effective period of these regulations.

NMFS is also proposing temporal restrictions for some activities. Within any 24-hour period, NMFS proposes to limit installing up to one monopile foundation or four 3-m pin piles during daylight hours only unless US Wind requests to install additional piles per day in order to complete construction more quickly, provided the modeling information necessary to adaptively manage mitigation zone sizes as well as information identifying the change to the pile driving schedule would not result in more take (annual or 5-year total) than analyzed in the final rule or authorized in any associated LOA, and such request is approved by NMFS. US Wind does not plan to initiate pile driving later than 1.5 hours after civil sunset or continue pile driving after or1 hour before civil sunrise. However, if US Wind determines that they may initiate pile driving after the aforementioned time frame, they must submit a sufficient nighttime pile driving plan for NMFS review and approval to do so. A sufficient nighttime pile driving plan would demonstrate that proposed detection systems would be capable of detecting marine mammals, particularly large whales, at distances necessary to ensure mitigation measures are effective. US Wind would also be encouraged to investigate and test advanced technology to support their request. NMFS proposes to condition the LOA such that nighttime pile driving would only be allowed if US Wind submitted an Alternative Monitoring Plan to NMFS for approval that proved the efficacy of their night vision devices (*e.g.,* mounted thermal/infrared (IR) camera systems, hand-held or wearable night vision devices (NVDs), IR spotlights) in detecting protected marine mammals. If the plan did not include a full description of the proposed technology, monitoring methodology, and data supporting that marine mammals could reliably and effectively be detected within the clearance and shutdown zones for monopiles and pin piles before and during impact pile driving, nighttime pile driving (unless a pile was initiated 1.5 hours prior to civil sunset) would not be allowed. The Plan should identify the efficacy of the technology at detecting marine mammals in the clearance and shutdown zones under all of the various conditions anticipated during construction, including varying weather conditions, sea states, and in consideration of the use of artificial lighting. Given the very small Level B harassment zone associated with HRG survey activities and no anticipated or authorized Level A harassment, NMFS is not proposing any daily restrictions for HRG surveys.

More information on activity-specific seasonal and daily restrictions can be found in the regulatory text at the end of this proposed rulemaking.

Noise Attenuation Systems

US Wind would be required to employ noise abatement systems (NAS), also known as noise attenuation systems, during all foundation installation (*i.e.,* impact pile driving) activities to reduce the sound pressure levels that are transmitted through the water in an effort to reduce acoustic ranges to the Level A harassment and Level B harassment acoustic thresholds and minimize, to the extent practicable, any acoustic impacts resulting from these activities. US Wind would be required to use at least two NAS to ensure that measured sound levels do not exceed the levels modeled for a 10-dB sound level reduction for foundation installation, which is likely to include a double big bubble curtain combined with another NAS (other available NAS technologies are the hydro-sound damper, or an AdBm Helmholz resonator), as well as the adjustment of operational protocols to minimize noise levels. A single bubble curtain, alone or in combination with another NAS device, may not be used for pile driving as received SFV data reveals this approach is unlikely to attenuate sound sufficiently to be consistent with the modeling underlying our take analysis here, which incorporates expected ranges to the Level A and Level B harassment isopleths assuming 10 dB of attenuation and appropriate NAS use. Should the research and development phase of newer systems demonstrate effectiveness, as part of adaptive management, US Wind may submit data on the effectiveness of these systems and request approval from NMFS to use them during foundation installation activities.

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 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 those not exceeding modeled ranges to Level A harassment and Level B harassment isopleths corresponding to those modeled assuming 10-dB sound attenuation, pending results of 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 (*i.e.,* 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.

For example, 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 big bubble curtains (BBCs) for noise attenuation. When a double big bubble curtain is used (noting a single bubble curtain is not allowed), US Wind would be required to maintain numerous operational performance standards. These standards are defined in the regulatory text at the end of this proposed rulemaking and include but are not limited to construction contractors must train personnel in the proposed balancing of airflow to the bubble ring and US Wind would be required to submit a performance test and maintenance report to NMFS within 72 hours following the performance test. Corrections to the attenuation device to meet regulatory requirements must occur prior to use during foundation installation activities. In addition, a full maintenance check (*e.g.,* manually clearing holes) must occur prior to each pile being installed. If US Wind uses a noise mitigation device in addition to a double big bubble curtain, similar quality control measures are required.

US Wind would be required to conduct SFV and submit an SFV plan to NMFS for approval at least 180 days prior to installing foundations. They would also be required to submit interim and final SFV data results to NMFS and make corrections to the noise attenuation systems in the case that any SFV measurements demonstrate noise levels are above those modeled assuming 10 dB of attenuation. These frequent and immediate reports would allow NMFS to better understand the sound fields to which marine mammals are being exposed and require immediate corrective action should they be misaligned with anticipated noise levels within our analysis.

Noise abatement devices are not required during HRG surveys. NAS cannot practicably be employed around a moving survey ship, but US 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 the project'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 project activities that have the potential to result in harassment of marine mammals. The purpose of ''clearance'' of a particular zone is to 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.

All relevant clearance and shutdown zones during project activities would be monitored by NMFS-approved PSOs and/or PAM operators (as described in the regulatory text at the end of this proposed rulemaking). At least one PAM operator must review data from at least 24 hours prior to foundation installation and actively monitor hydrophones for 60 minutes prior to commencement of these activities. Any sighting or acoustic detection of a North Atlantic right whale triggers a delay to commencing pile driving and shutdown.

Prior to the start of certain specified activities (foundation installation and HRG surveys), US Wind would be required to ensure designated areas (*i.e.,* clearance zones, tables 26, 27, and 28) are clear of marine mammals prior to commencing activities to minimize the potential for and degree of harassment. For foundation installation, PSOs must visually monitor clearance zones for marine mammals for a minimum of 60 minutes, where the zone must be confirmed free of marine mammals at least 30 minutes directly prior to commencing these activities. For monopile foundation installation, the minimum visibility zone, defined as the area over which PSOs must be able to visually detect marine mammals, would extend 2,900 m (9,514 ft) for monopile installation, 1,400 m for 3-m pin pile installation, and 200 m for 1.8-m pin pile installation (table 26). Clearance zones are defined and provided in table 26 for all species.

For any other in-water construction heavy machinery activities (*e.g.,* trenching, cable laying, *etc.*), if a marine mammal is on a path towards or comes within 10 m (32.8 ft) of equipment, US Wind would be required to 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.

Once an activity begins, any marine mammal entering their respective shutdown zone would trigger the activity to cease. In the case of pile driving, the shutdown requirement may be waived if 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 if the lead engineer determines there is pile refusal or pile instability.

In situations when shutdown is called for, but US Wind determines shutdown is not practicable due to aforementioned emergency reasons, 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 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. 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 shut-down is not feasible because the shut-down 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. US Wind must document and report to NMFS all cases where the emergency exemption is taken.

After shutdown, impact pile driving may be reinitiated once all clearance zones are clear of marine mammals for the minimum species-specific periods, or, if required to maintain pile stability, impact pile driving may be reinitiated but must be used to maintain stability. If pile driving has been shut down due to the presence of a North Atlantic right whale, pile driving must not restart until the North Atlantic right whale has not been visually or acoustically detected for 30 minutes. Upon re-starting pile driving, soft-start protocols must be followed if pile driving has ceased for 30 minutes or longer.

The clearance and shutdown zone sizes vary by species and are shown in tables 27 and 28. US Wind would be allowed to request modification to these zone sizes pending results of sound field verification (see regulatory text at the end of this proposed rulemaking). Any changes to zone size would be part of adaptive management and would require NMFS' approval.

TABLE 27—MINIMUM VISIBILITY, CLEARANCE, SHUTDOWN, AND LEVEL B HARASSMENT ZONES DURING IMPACT PILE DRIVING, ASSUMING 10 dB OF ATTENUATION

Monitoring zone	North Atlantic right whales	Other large whales	Delphinids and pilot whales	Harbor porpoises	Seals
Minimum Visibility Zone [1]	Monopiles: 2,900 m. 3-m pin piles: 1,400 m. 1.8-m pin piles: 200 m.				
Clearance Zone	Any distance (visual) or within PAM Monitoring Zone.	Monopiles: 5,250 m 3-m pin piles: 1,400 m 1.8-m Pin piles: 200 m [2].	Monopiles: 500 m. 3-m pin piles: 200 m. 1.8 m pin piles: 200 m [3].		
Shutdown Zone	Any distance (visual) or within PAM Monitoring Zone.	Monopiles: 2,900 m 3-m pin piles: 1,400 m 1.8-m Pin piles: 100 m [4].	Monopiles: 250 m. 3-m pin piles, 1.8-m pin piles: 100 m [5].		
PAM Monitoring Zone [6]	10,000 m				
Level B Harassment (Acoustic Range, $R_{95\%}$)	Monopiles: 5,250 m. 3-m pin piles: 500 m. 1.8-m pin piles: 100 m.				

[1] The minimum visibility zone is equal to the modeled maximum $R_{95\ percent}$ distances to the Level A harassment threshold for low-frequency cetaceans for monopiles and 3-m pin piles. The minimum visibility zone for 1.8-m pin piles is equal to the clearance zone, which is double the modeled maximum $R_{95\ percent}$ distance to the Level B harassment threshold (100 m) and four times the modeled maximum $R_{95\ percent}$ distance to the Level A harassment threshold (50 m) for low-frequency cetaceans. NMFS increased the 1.8-m pin pile minimum visibility zone given the very small zone sizes from this short (3 piles total) activity.

[2] The clearance zone for other large whales from monopile installation is equal to the modeled maximum $R_{95\ percent}$ distance to the Level B harassment threshold (5,250 m). The clearance zone for other large whales from 3-m pin pile installation is equal to the modeled maximum $R_{95\ percent}$ distance to the Level A harassment threshold (1,400 m), given the Level B harassment zone (500 m) is less than this distance. The clearance zone for other large whales from 1.8-m pin pile installation is equal to twice the modeled maximum $R_{95\ percent}$ distance to the Level B harassment threshold given the very small Level B harassment zone (100 m), which could be encompassed by the bubble curtains.

[3] The clearance zone for non-large whales (*i.e.,* delphinids and pilot whales, harbor porpoises, and seals) from monopile and 3-m pin pile installation is equal to double the modeled maximum $R_{95\ percent}$ distances to the Level A harassment threshold for harbor porpoise (the most sensitive species). The clearance zone for 1.8-m pin pile installation is equal to double the modeled maximum $R_{95\ percent}$ distance to the Level B harassment threshold given Level A harassment thresholds were not exceeded for this activity (*i.e.,* 0 m). US Wind requested the clearance zone for non-large whales be identical for PSO implementation ease.

[4] The shutdown zones for other large whales from monopiles and 3-m pin piles are equal to the modeled maximum $R_{95\ percent}$ distances to the Level A harassment threshold for low-frequency cetaceans. The shutdown zone for other large whales from 1.8-m pin piles is equal to two times the modeled maximum $R_{95\ percent}$ distance to the Level A harassment threshold for low-frequency cetaceans.

[5] The shutdown zones for non-large whales from monopile and 3-m pin pile installation are equal to the modeled maximum $R_{95\ percent}$ distances to the Level A harassment threshold for harbor porpoise (the most sensitive species). The shutdown zone for non-large whales from 1.8-m pin pile installation is equal to the modeled maximum $R_{95\ percent}$ distance to the Level B harassment threshold, given the Level A harassment thresholds were not exceeded for this activity (*i.e.,* 0 m). US Wind requested the shutdown zone for non-large whales be identical for PSO implementation ease.

[6] The PAM system must be capable of detecting baleen whales at 10,000 m during pile driving. The system should also be designed to detect other marine mammals; however, it is not required these other species be detected out to 10,000 m given higher frequency calls and echolocation clicks are not typically detectable at large distances.

TABLE 28—HRG SURVEY CLEARANCE AND SHUTDOWN ZONES

Marine mammal species	Clearance zone (m^2)	Shutdown zone (m)
North Atlantic right whale	500	500
Other ESA-listed species (*i.e.,* fin, sei, sperm whale)	500	100
Other marine mammals [1]	200	100

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

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 or HRG equipment 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. US Wind would be required to utilize a soft-start protocol for impact pile driving of monopiles, 3-m pin piles, and 1.8-m pin piles by performing four to six 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 and installation conditions. US Wind will reduce energy based on consideration of site-specific soil properties and other relevant operational considerations. HRG survey operators would be required to ramp-up sources when the acoustic sources are used unless the equipment operates on a binary on/off switch. The ramp up would involve starting from the smallest setting to the operating level over a period of approximately 30 minutes.

Soft-start and ramp up would be required at the beginning of each day's activity and at any time following a cessation of activity of 30 minutes or longer. Prior to soft-start or ramp up beginning, the operator must receive confirmation from the PSO that the clearance zone is clear of any marine mammals.

Fishery Monitoring Surveys

While the likelihood of US Wind's fishery monitoring surveys impacting marine mammals is minimal, NMFS proposed to require US Wind to adhere to gear and vessel mitigation measures to reduce potential impacts to the extent practicable. In addition, 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. The specific requirements that NMFS would set for the fishery monitoring surveys can be found in the regulatory text at the end of this proposed rulemaking.

Based on our evaluation of the mitigation measures, NMFS has preliminarily determined that these proposed measures would provide the means of affecting 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.

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 planned activities, visual monitoring by NMFS-approved PSOs would be conducted before, during, and after all impact pile driving and HRG surveys. PAM would also be conducted during impact pile driving. Visual observations and acoustic detections would be used to support the activity-specific mitigation measures (*e.g.,* clearance zones). To increase understanding of the impacts of the activity on marine mammals, PSOs must record all incidents of marine mammal occurrence at any distance from the piling locations, near the HRG acoustic sources. PSOs 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 the aforementioned activities, followed by activity-specific monitoring requirements.

Protected Species Observer and PAM Operator Requirements

US Wind would be required to employ NMFS-approved PSOs and PAM operators. PSOs are trained professionals who are tasked with visual monitoring for marine mammals during pile driving and HRG surveys. 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 would require US Wind to conduct PAM using PAM operators during impact pile driving and vessel transit.

The inclusion of PAM, which would be conducted by NMFS-approved PAM operators, following a standardized measurement, processing methods, reporting metrics, and metadata standards for offshore wind alongside visual data collection is valuable to provide the most accurate record of species presence as possible, together with visual monitoring, and 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 with 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.

The exact configuration and number of PAM systems depends on the size of the zone(s) being monitored, the amount of noise expected in the area, and the characteristics of the signals being monitored. More closely spaced hydrophones would allow for more directionality, and perhaps, range to the vocalizing marine mammals; although, this approach would add additional costs and greater levels of complexity to the project. Larger baleen cetacean species (*i.e.,* mysticetes), which produce loud and lower-frequency vocalizations, may be able to be heard with fewer hydrophones spaced at greater distances. However, smaller cetaceans (such as mid-frequency delphinids or odontocetes) may necessitate more hydrophones and to be spaced closer together given the shorter range of the shorter, mid-frequency acoustic signals (*e.g.,* whistles and echolocation clicks). As there are no ''perfect fit'' single-optimal-array configurations, NMFS will consider and approve these set-ups, as appropriate, on a case-by-case basis. Specifically, US Wind will be required to provide a plan that describes an optimal configuration for collecting the required marine mammal data, based on the real-world circumstances in the project area, recognizing that we will continue to learn more as monitoring results from other wind projects are submitted.

NMFS does not formally administer any PSO or PAM operator training program or endorse specific providers but will approve PSOs and PAM operators that have successfully completed courses that meet the curriculum and trainer requirements referenced below and further specified in the regulatory text at the end of this proposed rulemaking.

NMFS will provide PSO and PAM operator approvals in the context of the need to ensure that PSOs and PAM operators have the necessary training and/or experience to carry out their duties competently. In order for PSOs and PAM operators to be approved, NMFS must review and approve PSO and PAM operator resumes indicating successful completion of an acceptable training course. 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. NMFS may approve PSOs and PAM operators as conditional or unconditional. Conditional approval may be given to one who is trained but has not yet attained the requisite experience. Unconditional approval is given to one who is trained and has attained the necessary experience. The specific requirements for conditional and unconditional approval can be found in the regulatory text at the end of this proposed rulemaking.

Conditionally approved PSOs and PAM operators would be paired with an unconditionally approved PSO (or PAM operator, as appropriate) to ensure that the quality of marine mammal observations and data recording is kept consistent. Additionally, activities requiring PSO and/or PAM operator monitoring must have a lead on duty. The visual PSO field team, in conjunction with the PAM team (*i.e.,* marine mammal monitoring team) would have a lead member (designated as the ''Lead PSO'' or ''Lead PAM operator'') who would be required to meet the unconditional approval standard.

Although PSOs and PAM operators must be approved by NMFS, third-party observer providers and/or companies seeking PSO and PAM operator staffing should expect that those having satisfactorily completed acceptable training and with the requisite experience (if required) will be quickly approved. US Wind is required to request PSO and PAM operator approvals 60 days prior to those personnel commencing work. An initial list of previously approved PSO and PAM operators must be submitted by US Wind at least 30 days prior to the start of the project. Should US Wind require additional PSOs or PAM operators throughout the project, US Wind must submit a subsequent list of pre-approved PSOs and PAM operators to NMFS at least 15 days prior to planned use of that PSO or PAM operator. A PSO may be trained and/or experienced as both a PSO and PAM operator and may perform either duty, pursuant to scheduling requirements (and vice versa).

A minimum number of PSOs would be required to actively observe for the presence of marine mammals during certain project activities with more PSOs required as the mitigation zone sizes increase. A minimum number of PAM operators would be required to actively monitor for the presence of marine mammals during foundation installation. The types of equipment required (*e.g.,* Big Eye binoculars 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 proposed rulemaking. At least three PSOs and one PAM operator per acoustic data stream (equivalent to the number of acoustic buoys) must be on-duty and actively monitoring per platform during foundation installation; and at least one PSO must be on-duty during HRG surveys conducted during daylight hours.

In addition to monitoring duties, 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 at the end of this proposed rulemaking.

US Wind would be required to submit a Pile Driving Marine Mammal Monitoring Plan to NMFS 180 days in advance of foundation installation activities. The Plan must include details regarding PSO and PAM monitoring protocols and equipment proposed for use. More specifically, the PAM portion of the plan must include a description of all proposed PAM equipment, address how the proposed passive acoustic monitoring must follow standardized measurement, processing methods, reporting metrics, and metadata standards for offshore wind as described in *NOAA and BOEM Minimum Recommendations for Use of Passive Acoustic Listening Systems in Offshore Wind Energy Development Monitoring and Mitigation Programs* (Van Parijs *et al.,* 2021). NMFS must approve the plan prior to the commencement of foundation installation activities. Specific details on NMFS' PSO or PAM operator qualifications and requirements can be found in Part 217—Regulations Governing The Taking And Importing Of Marine Mammals at the end of this proposed rulemaking. Additional information can be found in US Wind Marine Mammal Monitoring and Mitigation Plan (appendix B) on the NMFS' website at *https://www.fisheries.noaa.gov/action/incidental-take-authorization-us-wind-inc-construction-and-operation-maryland-offshore-wind.*

Sound Field Verification

US Wind would be required to conduct SFV measurements during all impact pile driving activities associated with the installation of, at minimum, the first three monopile foundations. SFV measurements must continue until at least three consecutive monopiles and three entire jacket foundations demonstrate noise levels are at or below those modeled, assuming 10-dB of attenuation. Subsequent SFV measurements would also be required should larger piles be installed or if additional piles are driven that are anticipated to produce louder sound fields than those previously measured (*e.g.,* higher hammer energy, greater number of strikes, *etc.*). The measurements and reporting associated with SFV can be found in the regulatory text at the end of this proposed rulemaking. The proposed requirements are extensive to ensure monitoring is conducted appropriately and the reporting frequency is such that US Wind would be required to make adjustments quickly (*e.g.,* add additional sound attenuation) to ensure marine mammals are not experiencing noise levels above those considered in this analysis. For recommended SFV protocols for impact pile driving, please consult International Organization for Standardization (ISO) 18406 *Underwater acoustics—Measurement of radiated underwater sound from percussive pile driving* (2017).

Reporting

Prior to any construction activities occurring, US Wind would provide a report to NMFS Office of Protected Resources that demonstrates that all US Wind personnel, which includes the vessel crews, vessel captains, PSOs, and PAM operators have completed all required trainings.

NMFS would require standardized and frequent reporting from US Wind during the life of the regulations and LOA. All data collected relating to the Project would be recorded using industry-standard software (*e.g.,* Mysticetus or a similar software) installed on field laptops and/or tablets. US Wind would be required to submit weekly, monthly, annual, and situational reports. The specifics of what we require to be reported can be found in the regulatory text at the end of this proposed rulemaking.

Weekly Report—During foundation installation activities, US Wind would be required to compile and submit weekly marine mammal monitoring reports for foundation installation pile driving to NMFS Office of Protected Resources that document the daily start and stop of all pile driving 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.,* system type, distance deployed from the pile, bubble rate, *etc.*). Weekly reports will be due on Wednesday for the previous week (Sunday to Saturday). The weekly reports are also required to 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—US 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, 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 all foundation pile installation is complete, monthly reports would no longer be required.

Annual Reporting—US Wind would be required to submit an annual marine mammal monitoring (both 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 must be prepared and submitted within 30 calendar days following receipt of any NMFS comments on the draft report.

Final 5-Year Reporting—US Wind would be required to 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. 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. For instance, if a North Atlantic right whale is observed at any time by PSOs or project personnel, the sighting must be immediately (if not feasible, as soon as possible, and no longer than 24 hours after the sighting) reported to NMFS. If a North Atlantic right whale is acoustically detected at any time via a project-related PAM system, the detection must be reported as soon as possible and no longer than 24 hours after the detection to NMFS via the 24-hour North Atlantic right whale Detection Template (*https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reporting-system-templates*). Calling the hotline is not necessary when reporting PAM detections via the template.

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), and the U.S. Coast Guard within 24 hours. If the injury or death was caused by a project activity, US Wind would be required to 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 consistent with the adaptive management provisions described below and codified at § 217.307. US Wind could not resume their activities until notified by NMFS Office of Protected Resources.

In the event of a vessel strike of a marine mammal by any vessel associated with the Project, US Wind must immediately report the strike incident. If the strike occurs in the Greater Atlantic Region (Maine to Virginia), US Wind must call the NMFS Office of Protected Resources and GARFO. US Wind would be required to 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. US Wind may, consistent with the adaptive management provisions described below and codified at § 217.307, not resume their activities until notified by NMFS.

In the event of any lost gear associated with the fishery surveys, US 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.

The specifics of what NMFS Office of Protected Resources requires to be reported is listed at the end of this proposed rulemaking in the regulatory text.

Sound Field Verification—US Wind would be required to submit interim SFV reports after each foundation installation within 48 hours. A final SFV report for all monopile, jacket foundation, and pin pile installation monitoring would be required within 90 days following completion of acoustic monitoring.

Adaptive Management

The regulations governing the take of marine mammals incidental to US Wind construction activities contain an adaptive management component. Our understanding of the effects of offshore wind construction activities (*e.g.,* acoustic stressors) on marine mammals continues to evolve, which makes the inclusion of an adaptive management component both valuable and necessary within the context of 5-year regulations.

The monitoring and reporting requirements in this final rule provide NMFS with information that helps us to better understand the impacts of the project's activities on marine mammals and informs our consideration of whether any changes to mitigation and monitoring are appropriate. The use of adaptive management allows NMFS to consider new information and modify mitigation, monitoring, or reporting requirements, as appropriate, with input from US Wind regarding practicability, if such modifications will have a reasonable likelihood of more effectively accomplishing the goal of the measures.

The following are some of the possible sources of new information to be considered through the adaptive management process: (1) results from monitoring reports, including the weekly, monthly, situational, and annual reports required; (2) results from 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, US Wind (and other LOA Holders conducting offshore wind development activities) are required to participate in one or more adaptive management meetings convened by NMFS and/or BOEM, in which the above information will 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, Level A harassment and 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 section, we estimated the maximum number of takes by Level A harassment and Level B harassment that could occur from US Wind's specified activities 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 to be authorized 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 to be authorized for any species or stock.

The Description of the Specified Activities section describes US Wind specified activities proposed for the project that may result in take of marine mammals and an estimated schedule for conducting those activities. US 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 3-year totals and maximum annual total in any given year indicated in tables 24 and 25, respectively.

We base our analysis and preliminary negligible impact determination on the maximum number of takes that could occur and are proposed to be authorized annually and across the effective period of these regulations, 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 6 given that some of the anticipated effects of US 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 the population status. Organizing our analysis by grouping species or stocks that share common traits or that would respond similarly to effects of US Wind's 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, Met tower, and OSS foundation installation, which are schedule to occur within the first 1 to 3 years (2025 through 2027) (tables 23, 24, and 25).

As described previously, no serious injury or mortality is anticipated or proposed to be authorized in this rule. Any Level A harassment proposed to be 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 detonations). The amount of harassment US Wind has requested, and NMFS proposes 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, modeling the impact installation of all piles at a maximum hammer energy and application of the May sound speed profile to all months within a given season. The exposure model results do not reflect any mitigation measures (other than 10-dB sound attenuation) or avoidance response. The amount of take requested and proposed to be authorized also reflects careful consideration of other data (*e.g.,* 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 could 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 (DeRuiter and Doukara, 2012; Falcone *et al.,* 2017). As described in the Potential Effects of Specified Activities on Marine Mammals and their Habitat section, the intensity and duration of any impact resulting from exposure to US 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. Take by Level B harassment, then, may have a stress-related physiological component as well; however, we would not expect US 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 1 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 up to 10–45 m in the ECRs, and 13 to 41.5 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 US Wind 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 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 US Wind, impact pile driving of foundation piles is most likely to result in a higher magnitude and severity of behavioral disturbance than HRG surveys. Impact pile driving has higher source levels and longer durations (on an annual basis) than HRG surveys. HRG survey equipment also produces much higher frequencies than pile driving, resulting in minimal sound propagation. While impact pile driving for foundation installation 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 to 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 disturbing prior to becoming exposed to very loud noise levels. The requirement to couple visual monitoring and PAM before and during all foundation installation will increase the overall capability to detect marine mammals compared to one method alone.

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 is 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, 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 US Wind'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 of Specified Activities on 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 pile driving is a broadband noise sources but generates 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 that 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 US Wind's pile driving 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. In addition, the proposed mitigation measures 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). 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 Potential Effects of Specified Activities on Marine Mammals and Their Habitat), 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. Overall, given the small number of instances 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)

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 23). The only activities incidental to which we anticipate PTS may occur is from exposure to impact pile driving, which produces 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 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 (*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 impact pile driving, 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. 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 disturbing 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. 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. As mentioned above, the Project Area does not overlap critical habitat for any species, and temporary avoidance of the pile driving area by marine mammals would likely displace animals to areas of sufficient habitat. In summary, the nature of US Wind'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. Therefore, we are not predicting take due to masking effects, and are not proposing to authorize such take.

Impacts on Habitat and Prey

Construction activities may result in fish and invertebrate mortality or injury very close to the source, and all of US Wind's activities 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 impact pile driving would further limit the degree of impact. 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) and the temporary nature of the disturbance on prey species, the impacts to marine mammal habitat are not expected to cause significant or long-term negative consequences.

Cable presence is 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. Although many species of marine mammal prey can detect electromagnetic fields, previous studies have shown little impacts on habitat use (Hutchinson *et al.,* 2018). Burying the cables and the inclusion of protective shielding on cables will also minimize any impacts of electromagnetic fields on marine mammal prey.

The presence 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 of structures such as wind turbines is, in general, likely to result in certain oceanographic effects in the marine environment, and may alter aggregations and distribution of marine mammal zooplankton prey through changing the strength of tidal currents and associated fronts, changes in stratification, primary production, the degree of mixing, and stratification in the water column (Schultze *et al.,* 2020; Chen *et al.,* 2021; Johnson *et al.,* 2021; Christiansen *et al.,* 2022; Dorrell *et al.,* 2022).

As discussed in the Potential Effects of Specified Activities on Marine Mammals and their Habitat section, the project would consist of no more than 119 foundations (114 WTGs, 4 OSSs, 1 Met tower) in the Lease Area, which will gradually become operational following construction completion. While there are likely to be oceanographic impacts from the presence of operating turbines, meaningful oceanographic impacts relative to stratification and mixing that would significantly affect marine mammal foraging and prey over large areas in key foraging habitats are not anticipated from the US Wind activities covered under these proposed regulations, nor is the Project area located in the vicinity of any key marine mammal foraging areas. For these reasons, if oceanographic features are affected by the project during the effective period of the proposed regulations, 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 impact pile driving of foundation piles, nine 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 specifically designated zones triggering a 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; (7) use of noise attenuation technology; (8) maintaining situational awareness of marine mammal presence through the requirement that any marine mammal sighting(s) by US Wind's personnel must be reported to PSOs; (9) sound field verification monitoring; and (10) Vessel Strike Avoidance measures to reduce the risk of a collision with a marine mammal and vessel. For HRG surveys, we are requiring six measures: (1) measures specifically for Vessel Strike Avoidance; (2) specific requirements during daytime HRG surveys; (3) implementation of clearance zones; (4) implementation of shutdown zones; (5) use of ramp-up of acoustic sources; and (6) maintaining situational awareness of marine mammal presence through the requirement that any marine mammal sighting(s) by US Wind's personnel must be reported to PSOs.

NMFS prescribes mitigation measures based on the following rationale. For activities with large harassment isopleths, US Wind would be required to reduce the noise levels generated to the lowest levels practicable and would be required to ensure 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 will allow animals to move away from (*i.e.,* avoid) the sound source prior to applying higher hammer energy levels needed to install the pile (US Wind would not use a hammer energy greater than necessary to install piles). Similarly, ramp-up during HRG surveys would allow animals to move away and avoid the acoustic sources before they reach their maximum energy level. For all activities, clearance zone and shutdown zone implementation, which are 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. Additionally, the use of multiple PSOs (WTG, OSS, and Met tower foundation installation; HRG surveys), PAM (for impact foundation installation), and maintaining awareness of marine mammal sightings reported in the region (WTG, OSS, and Met tower foundation installation; HRG surveys) would aid in detecting marine mammals that would trigger the implementation of the mitigation measures. The reporting requirements, including SFV reporting (for foundation installation and foundation operation), 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 or in the place of the proposed mitigation measures.

Mysticetes

Five mysticete species (comprising five stocks) of cetaceans (North Atlantic right whale, humpback whale, fin whale, sei whale, and minke whale) may be taken by harassment. These species, to varying extents, utilize the specified geographic region, 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 primarily be migrating and, to a lesser degree, may be engaged in foraging behavior. 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 feeding grounds located further north (*e.g.,* southern New England region, Gulf of Maine, Canada). While we acknowledged above that mortality, hearing impairment, or displacement of mysticete prey species may result locally from impact pile driving, 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 is expected to be minor. Whales temporarily displaced from the Project Area are 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 found further north. 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. For mysticetes, where relatively low amounts of species-specific take by Level B harassment are predicted (compared to the abundance of each mysticete species or stock, such as is indicated in table 25) 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 NMFS would not expect to impact reproduction or survival. 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 US Wind has identified. Species-specific analysis regarding potential for repeated exposures and impacts is provided below.

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 Whale

North Atlantic right whales are listed as endangered under the ESA and as both depleted and strategic stocks under the MMPA. As described in the Potential Effects of the Specified Activities on 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 injury or mortality is anticipated or proposed for authorization for this species.

For North Atlantic right whales, this proposed rule would allow for the authorization of up to ten takes, by Level B harassment only, over the 5-year period, with a maximum annual allowable take by Level B harassment of four (equating to approximately 1.18 percent of the stock abundance, if each take were considered to be of a different individual). 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), as well as the low number of total takes, we anticipate that few, if any, of the instances of take would represent repeat takes of any individual, though it could occur if whales are engaged in opportunistic foraging behavior. Barco *et al.* (2015) observed North Atlantic right whales engaging in open mouth behavior, which is suggestive, though not necessarily indicative, of feeding. While opportunistic foraging may occur in the Project area, the area does not support prime foraging habitat.

The highest density of North Atlantic right whales in the Project Area occurs in the winter (table 12). The Mid-Atlantic, including the Project Area, may be a stopover site for migrating North Atlantic right whales moving to or from southeastern calving grounds. North Atlantic right whales have been acoustically detected in the vicinity of the Project Area year-round (Bailey *et al.,* 2018) with the highest occurrences documented during late winter/early spring. Similarly, the waters off the coast of Maryland, including those surrounding the Project Area in the Maryland Wind Energy Area (MD WEA), have documented North Atlantic right whale presence as the area is an important migratory route for the species to the northern feeding areas near the Gulf of Maine and Georges Banks and to their southern breeding and calving grounds off the southeastern U.S. (CETAP, 1982; LaBrecque *et al.,* 2015; Salisbury *et al.,* 2016; Davis *et al.,* 2017). However, comparatively, the Project Area is not known as an important area for feeding, breeding, or calving.

North Atlantic right whales range outside the Project Area for their main feeding, breeding, and calving activities (Hayes *et al.,* 2023). Additional qualitative observations include animals feeding and socializing in New England waters, north of the MD WEA (Quintana-Rizzo *et al.,* 2021). The North Atlantic right whales observed north of the MD WEA were primarily concentrated in the northeastern and southeastern sections of the Massachusetts WEA (MA WEA) during the summer (June–August) and winter (December–February). North Atlantic right whale distribution did shift to the west into the Rhode Island/Massachusetts (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. The MD WEA is not in or near these areas important to feeding, breeding, and calving activities.

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 would occur (given the seasonal restrictions on foundation installation, rather than lingering for extended periods of time). Other work that involves much smaller harassment zones (*e.g.,* HRG surveys) 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 HRG surveys which are planned to take place during years 2 and 3 for only 14 days each year from April through June and 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.

As described in the Description of Marine Mammals in the Geographic Area of Specified Activities, 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 US 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 proposed to be 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 proposed number of takes of North Atlantic right whales would not exacerbate or compound the effects of the ongoing UME.

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 119 days (114 for WTG monopile foundations, 4 days for OSS jacket foundations, and 1 day for Met tower pin pile foundations) over a maximum of 3 years, during times when, based on the best available scientific data, North Atlantic right whales are less frequently encountered due to their migratory behavior. 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 proposed activities 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.,* most individuals would not be expected to be impacted on more than 1 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 behavioral 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 the Project Area are not expected to remain in this habitat for extensive durations, 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 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 of Specified Activities on 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 of Specified Activities on 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 proposed 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, US Wind has proposed, and NMFS is proposing in this rule, 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 vessel 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, US 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 Geographic Area of Specified Activities section, the Project 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 area over which North Atlantic right whales may be harassed is relatively small compared to the width of the migratory corridor. The width of the migratory corridor in this area is approximately 163.8 km while the width of the Lease Area, at the longest point, is approximately 33.1 km. North Atlantic right whales may be displaced from their normal path and preferred habitat in the immediate activity area (primarily from pile driving activities), however, we do not anticipate displacement to be of high magnitude (*e.g.,* beyond a few kilometers); thereby, any associated bio-energetic expenditure is anticipated to be small. There are no known North Atlantic right whale feeding, breeding, 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 December 1 through April 30, 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). 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 may only begin in the absence of North Atlantic right whales (based on visual and passive acoustic monitoring). If pile driving has 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 noise, it is unlikely a North Atlantic right whale would approach the sound source locations to the degree that they would expose themselves to very high noise levels. This is because typical observed whale behavior demonstrates likely avoidance of harassing levels of sound where possible (Richardson *et al.,* 1985). 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, US Wind proposed, and NMFS is proposing to require, the combination of PAM and visual observers. 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.

For HRG surveys, the maximum distance to the Level B harassment threshold is 200 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 that 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 shut down 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.

As described above, no serious injury or mortality, or Level A harassment, of North Atlantic right whale is anticipated or proposed for authorization. Extensive North Atlantic right whale-specific mitigation measures (beyond the robust suite required for all species) are expected to further minimize the amount and severity of Level B harassment. Given the documented habitat use within the area, the majority of the individuals predicted to be taken (including no more than ten instances of take, by Level B harassment only, over the course of the 5-year rule, with an annual maximum of no more than four) would be impacted on only 1, or maybe 2, days in a year as North Atlantic right whales utilize this area for migration and would be transiting rather than residing in the area for extended periods of time. Further, any impacts to North Atlantic right whales are expected to be in the form of lower-level behavioral disturbance.

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, US 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.

Fin Whale

The fin whale is listed as Endangered under the ESA, and the western North Atlantic stock is considered 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 proposed rule would allow for the authorization of up to 41 takes, by Level A harassment and Level B harassment, over the 5-year period. The maximum annual allowable take by Level A harassment and Level B harassment, would be 2 and 18, respectively (combined, this annual take (n=20) equates to approximately 0.29 percent of the stock abundance if each take were considered to be of a different individual). The Project Area does not overlap with any known areas of specific biological importance to fin whales. It is possible 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 one-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. If TTS is incurred, hearing sensitivity would likely return to pre-exposure levels relatively shortly after exposure ends. Any masking or physiological responses would also be of low magnitude and severity for reasons described above. 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. There is no known foraging habitat for fin whales within the Project Area. Any fin whales in the Project Area would be expected to be migrating through the area and would have sufficient space to move away from Project activities.

Fin whales are frequently observed in the waters off of Maryland and are one of the most commonly detected large baleen whales in continental shelf waters, principally from Cape Hatteras in the Mid-Atlantic northward to Nova Scotia, Canada (CETAP, 1982; Hain *et al.,* 1992; BOEM 2012; Barco *et al.,* 2015; Edwards *et al.,* 2015; Bailey *et al.,* 2018; Hayes *et al.,* 2023). Fin whales have high relative abundance in the Mid-Atlantic and Project Area, and most observations occur in the winter and early spring months (Williams *et al.,* 2015d; Barco *et al.,* 2015), with larger group sizes occurring during the winter months (Barco *et al.,* 2015). However, fin whales typically feed in waters off of New England and within the Gulf of Maine, areas north of the Project Area, as New England and Gulf of St. Lawrence waters represent major feeding ground for fin whales (Hayes *et al.,* 2023). Hain *et al.* (1992) based on an analysis of neonate stranding data, suggested that calving takes place during October to January in latitudes of the U.S. mid-Atlantic region; however, it is unknown where calving, mating, and wintering occur for most of the population (Hayes *et al.,* 2023).

Given the documented habitat use within the area, some of the individuals taken may be exposed on multiple days. However, as described, the project area does not include areas where fin whales are known to concentrate for feeding or reproductive behaviors and the predicted takes are expected to be in the form of lower-level impacts. Given the magnitude and severity of the impacts discussed above (including no more than 18 takes, by Level A harassment and Level B harassment, over the course of the 5-year rule, and a maximum annual allowable take by Level A harassment and Level B harassment, of 2 and 18 respectively), and in consideration of the proposed mitigation and other information presented, US Wind's proposed 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 A harassment and Level B harassment) anticipated and proposed to be authorized would have a negligible impact on the western North Atlantic stock of fin whales.

Humpback Whale

The West Indies DPS of humpback whales is not listed as threatened or endangered under the ESA, but the Gulf of Maine stock, which includes individuals from the West Indies DPS, is considered Strategic under the MMPA. However, as described in the Description of Marine Mammals in the Geographic Area of Specified Activities, 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 (vessel strike or entanglement). The

UME does not yet provide cause for concern regarding population-level impacts and take from vessel 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 proposed rule would allow for the authorization of up to 36 takes, by Level A harassment and Level B harassment, over the 5-year period. The maximum annual allowable take by Level A harassment and Level B harassment would be 2 and 16, respectively (combined, this maximum annual take (n=18) equates to approximately 1.29 percent of the stock abundance if each take were considered to be of a different individual). Given that humpback whales are known to forage in areas just south of Maryland during the winter and could potentially be foraging off Maryland during this time as well, 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 (n=2) humpback whales. The maximum amount of annual take proposed to be authorized (n=14), by Level B harassment, is highest for impact pile driving.

As described in the Description of Marine Mammals in the Geographic Area of Specified Activities section, humpback whales are known to occur regularly throughout the Mid-Atlantic Bight, including Maryland waters, with strong seasonality of peak occurrences during winter and spring (Barco *et al.,* 2015; Bailey *et al.,* 2018; Hayes *et al.,* 2023).

In the western North Atlantic, humpback whales feed during spring, summer, and fall over a geographic range encompassing the eastern coast of the United States. Feeding is generally considered to be focused in areas north of the Project Area, including a feeding BIA in the Gulf of Maine/Stellwagen Bank/Great South Channel, but has been documented farther south and off the coast of Virginia. When foraging, humpback whales tend to remain in the area for extended durations to capitalize on the food sources.

Assuming humpback whales who are feeding in waters within or surrounding the Project Area behave similarly, we expect that the predicted instances of disturbance could be comprised of some individuals that may be exposed on multiple days if they are utilizing the area as foraging habitat. Also similar to other baleen whales, if migrating, individuals would likely be exposed to noise levels from the project above the harassment thresholds only 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 one-half or one octave above the frequency band of pile driving noise (most sound is below 2 kHz) which is lower than the full predicted hearing range of humpback whales. If TTS is incurred, hearing sensitivity would likely return to pre-exposure levels relatively shortly after exposure ends. Any masking or physiological responses would also be of low magnitude and severity for reasons described above. Limited foraging habitat exists for humpback whales within the Project Area as their main foraging habitat is located further north. Any humpback whales in the Project Area would more likely be migrating through the area.

Given the magnitude and severity of the impacts discussed above (including no more than 36 humpback whale takes over the course of the 5-year rule, a maximum annual allowable take by Level A harassment and Level B harassment, of 2 and 16, respectively), and in consideration of the proposed mitigation measures and other information presented, US 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 anticipated and proposed to be authorized would have a negligible impact on the Gulf of Maine stock of humpback whales.

Minke Whale

Minke whales are not listed under the ESA, and the Canadian east coast stock is neither considered Depleted nor Strategic under the MMPA. There are no known areas of specific biological importance in or adjacent to the Project Area. As described in the Description of Marine Mammals in the Geographic Area of Specified Activities, a UME has been designated for this species but is pending closure. No serious injury or mortality is anticipated or proposed for authorization for this species.

The proposed rule would allow for the authorization of up to 67 minke whale takes, by Level A harassment and Level B harassment, over the 5-year period. The maximum annual allowable take by Level A harassment and Level B harassment, would be 6 and 41, respectively (combined, this annual take (n=47) equates to approximately 0.21 percent of the stock abundance if each take were considered to be of a different individual). As described in the Description of Marine Mammals in the Geographic Area of Specified Activities section, minke whales are common offshore the U.S. eastern seaboard with a strong seasonal component in the continental shelf and in deeper, off-shelf waters (CETAP, 1982; Hayes *et al.,* 2023). In the Project Area, minke whales are predominantly migratory and their known feeding areas are north, including a feeding BIA in the southwestern Gulf of Maine and George's Bank. Therefore, 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.

As described in the Description of Marine Mammals in the Geographic Area of Specified Activities section, there is a UME for minke whales along the Atlantic Coast from Maine through South Carolina, with the highest number of deaths in Massachusetts, Maine, and New York, and preliminary findings in several of the whales have shown evidence of human interactions or infectious diseases. However, we note that the population abundance is greater than 21,000 and the take proposed for authorization through this action is not expected to exacerbate the UME in any way.

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 one-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. If TTS is incurred, hearing sensitivity would likely return to pre-exposure levels relatively shortly after exposure ends. Any masking or physiological responses would also be of low magnitude and severity for reasons described above. 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. Limited foraging habitat for minke whales exists in the Project Area as major foraging habitats are located further north near New England. Any minke whales in the Project Area would be expected to migrate through the area and would have sufficient space to move away from Project activities.

Given the magnitude and severity of the impacts discussed above (including no more than 67 takes over the course of the 5-year rule, and a maximum annual allowable take by Level A harassment and Level B harassment, of 6 and 41, respectively), and in consideration of the proposed mitigation measures and other information presented, US 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 anticipated and proposed to be authorized would have a negligible impact on the Canadian eastern coastal stock of minke whales.

Sei Whale

Sei whales are listed as Endangered under the ESA, and the Nova Scotia stock is considered both Depleted and Strategic 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 proposed rule would allow for the authorization of up to six takes, by Level A harassment and Level B harassment, over the 5-year period. The maximum annual allowable take by Level A harassment and Level B harassment, would be one and one, respectively (combined, this annual take (n=2) equates to approximately 0.03 percent of the stock abundance, if each take were considered to be of a different individual). As described in the Description of Marine Mammals in the Geographic Area of Specified Activities section, most of the sei whale distribution is concentrated in Canadian waters and seasonally in northerly United States waters, though they are uncommonly observed in the waters off of Maryland. Because sei whales are migratory and their known feeding areas are east and north of the Project Area (*e.g.,* there is a feeding BIA in the Gulf of Maine), they would be more likely to be moving through and, considering this and the very low number of total takes, it is unlikely that any individual would be exposed more than once within a given 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 and TTS would likely be concentrated at one-half or one octave above the frequency band of pile driving noise (most sound is below 2 kHz) which is below the full predicted hearing range of sei whales. Moreover, any TTS would be of a small degree. Any avoidance of the Project Area due to the Project's activities would be expected to be temporary. There is no known foraging habitat that exists in the Project Area for sei whales. Any sei whales in the Project Area would be expected to be migrating through the area.

Given the magnitude and severity of the impacts discussed above (including no more than six takes over the course of the 5-year rule, and a maximum annual allowable take by Level A harassment and Level B harassment, of one and one, respectively), and in consideration of the proposed mitigation measures and other information presented, US 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 anticipated and proposed to be authorized 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 US Wind's specified activities are by pile driving 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 HRG surveys. While we expect animals to avoid the area during foundation installation, their habitat range is extensive compared to the area ensonified during these activities.

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 proposed to be conducted 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. 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 during HRG surveys, if it does occur, is anticipated to be very low in severity based on the lack of avoidance previously demonstrated by these species.

The waters off the coast of Maryland are used by several odontocete species. None of these species 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 United States, and the waters off of Maryland, including the Project Area, do not contain any unique odontocete habitat features.

Dolphins and Small Whales (Including Delphinids)

The 10 species and 11 stocks included in this group for which NMFS is proposing to authorize take are not listed under the ESA; however, 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 and no UMEs have been designated for any of these species. No serious injury, mortality, or take by Level A harassment is anticipated or proposed for authorization for these species.

The 10 delphinid species for which NMFS proposes to authorize take are: Atlantic spotted dolphin, Pantropical spotted dolphin, common bottlenose dolphin (coastal and northern migratory stocks), common dolphin, long-finned pilot whale, short-finned pilot whale, killer whale, rough-toothed dolphin, striped dolphin, and Risso's dolphin. The proposed rule would allow for the authorization of up to between 3 and 3,013 takes (depending on species), by Level B harassment only, over the 5-year period. The maximum annual allowable take for these species by Level B harassment, would range from 3 to 1,762, respectively (this annual take equates to approximately 0.07 to 24.0 percent of the stock abundance, depending on each species, if each take were considered to be of a different individual).

For both stocks of bottlenose dolphins, given the comparatively higher number of total annual takes (1,591 for coastal and 1,768 for offshore) and the relative number of takes as compared to the stock abundance (24.0 and 2.81, respectively), primarily due to the progression of the location of impact pile driving each year, while some of the takes likely represent exposures of different individuals on 1 day a year, it is likely that some subset of the individuals exposed could be taken several times annually. For Atlantic spotted dolphins, Pantropical spotted dolphins, common dolphins, long- and short-finned pilot whales, killer whales, rough-toothed dolphins, striped dolphins, and Risso's dolphins, given the number of takes, while many of the takes likely represent exposures of different individuals on 1 day a year, some subset of the individuals exposed could be taken up to a few times annually.

Dolphins and small delphinids engage in social, reproductive, and foraging behavior in the waters offshore of Maryland. However, the number of takes, likely movement patterns of the affected species, and the intensity of any Level B harassment, combined with the availability of alternate nearby habitat that supports the aforementioned behaviors suggests that the likely impacts would not impact the reproduction or survival of any individuals. 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. No Level A harassment (PTS) is anticipated or proposed to be authorized. Some TTS could occur, but 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.

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, US 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 anticipated and proposed for authorization would have a negligible impact on all of the species and stocks addressed in this section.

Harbor Porpoise

Harbor porpoises are not listed as Threatened or Endangered under the ESA, and the Gulf of Maine/Bay of Fundy stock is neither considered Depleted or Strategic under the MMPA. The stock 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 proposed rule would allow for the authorization of up to 74 takes, by Level A harassment and Level B harassment, over the 5-year period. The maximum annual allowable take by Level A harassment and Level B harassment, would be 3 and 39, respectively (combined, this annual take (n=42) equates to approximately 0.04 percent of the stock abundance if each take were considered to be of a different individual). Given the number of takes, many of the takes likely represent exposures of different individuals on 1 day a year.

Regarding the severity of takes by 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. Given that foundation installation is scheduled to occur off the coast of Maryland and, given alternative foraging areas nearby, any avoidance of the area by individuals is not likely to impact the reproduction or survival of any individuals.

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 affect a relatively small portion of the individual's hearing range. As such, any PTS would not interfere with key foraging or reproductive strategies necessary for reproduction or survival.

Harbor porpoises are seasonally distributed (Hayes *et al.,* 2023). During fall (October through December) and spring (April through June), harbor porpoises are widely dispersed from

New Jersey to Maine, with lower densities farther north and south. During winter (January to March), intermediate densities of harbor porpoises can be found in waters off New Jersey to North Carolina, and lower densities are found in waters off New York to New Brunswick, Canada. In non-summer months they have been seen from the coastline to deep waters (>1,800 m; Westgate *et al.,* 1998), although the majority are found over the continental shelf. 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, and any work that does occur would not result in the species' abandonment of the waters off of Maryland.

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, US 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 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, and Harp Seals)

The harbor seal, gray seal, and harp seal are not listed under the ESA, and these stocks are not considered Depleted or Strategic under the MMPA. There are no known areas of specific biological importance in or around the Project Area. As described in the Description of Marine Mammals in the Geographic Area of Specified Activities section, a UME has 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 any seal species.

As limited occurrence data for seals are available for the Project Area, take estimates for harbor seals, gray seals, and harp seals are presented as one estimate. For the three seal species, the proposed rule would allow for the total authorization of up to 496 seals by Level B harassment, over the 5-year period. The maximum annual allowable take for these species, by Level B harassment, would be 341 seals. If all of the allocated take was attributed to gray seals, this take would equate to 1.25 percent of the gray seal stock abundance, if each take were considered to be of a different individual. If all of the allocated take was attributed to harbor seals, this take would equate to 0.56 percent of the harbor seal stock abundance, if each take were considered to be of a different individual. If all of the allocated take was attributed to harp seals, this take would equate to 0.004 percent of the harp seal stock abundance. Gray seals, harbor seals, and harp seals are considered migratory and none of these species have specific feeding areas that have been designated in the area, therefore, it is likely that takes of seals would represent exposures of different individuals throughout the project duration.

Harp seals are considered extralimital in the Project Area, however, harp seal strandings have been documented in Maryland during the winter and spring (Hayes *et al.,* 2023; NAB, 2023a; NAB, 2023b). Harbor and gray seals occur in Maryland waters most often from late winter to early spring, with harbor seal occurrences being more common than gray seals (Hayes *et al.,* 2023). Seals are 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 and HRG surveys would be expected to be at comparatively lower levels. Although a gray seal rookery may occur off the coast of Cape Henlopen, north of the Project Area, based on the distance of this area from the Project Area it is not expected that in-air sounds produced would cause the take of hauled out pinnipeds. As this is the closest documented pinniped haul-out to the Project Area, NMFS does not expect any harassment to occur, nor have we proposed to authorize any take from in-air impacts on hauled out seals.

As described in the Potential Effects of Specified Activities on 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 potential 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 50 CFR part 217—Regulations Governing the Taking and Importing of Marine Mammals Incidental to Specified Activities.

As described above, noise from pile driving is mainly low-frequency and, while any TTS that does occur would fall within the lower end of pinniped hearing ranges (50 Hz to 86 kHz), TTS would not occur at frequencies around 5 kHz, where pinniped hearing is most susceptible to noise-induced hearing loss (Kastelein *et al.,* 2018). No Level A harassment (PTS) is anticipated or proposed to be authorized. In summary, any TTS would be of small degree and not occur across the entire, or even most sensitive, hearing range. Hence, any impacts from 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) provides cause for concern regarding population-level impacts to any of these stocks. For harbor seals, the population abundance is over 61,000 and annual mortality/serious injury (M/SI) (n=339) is well below PBR (1,729) (Hayes *et al.,* 2023). 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.,* 2023).

Given the magnitude and severity of the impacts discussed above, and in consideration of the proposed mitigation and other information presented, US 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 anticipated and proposed for authorization would have a negligible impact on harbor, gray, and harp 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 US 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 estimated to be 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 19 species of marine mammal (with 20 managed stocks). The maximum number of instances of takes by combined Level A harassment and Level B harassment 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.

For 13 of these species (13 stocks), less than 1 percent of the stock abundance is proposed to be authorized for take by Level A and/or Level B harassment. For five stocks, less than 5 percent is proposed, and for one stock less than 25 percent is proposed (coastal stock of bottlenose dolphins), assuming that each instance of take represents a different individual. Specific to the North Atlantic right whale, the maximum amount of take in any given year, which is by Level B harassment only, is four, or 1.18 percent of the stock abundance, assuming that each instance of take represents a different individual. Please see table 25 for information relating to this small numbers analysis.

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.

Classification

Endangered Species Act (ESA)

Section 7(a)(2) of the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*) requires that each Federal agency ensure 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 NOAA GARFO.

The NMFS Office of Protected Resources is proposing to authorize the take of three marine mammal species which are listed under the ESA: North Atlantic right, fin, and sei whales. The Permit and Conservation Division requested initiation of section 7 consultation on December 5, 2023, with GARFO for the promulgation of the rulemaking. NMFS will conclude the ESA 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, US Wind would also be required to abide by the reasonable and prudent measures and terms and conditions of the Biological Opinion and Incidental Take Statement, as issued by NMFS, pursuant to section 7 of the ESA.

Executive Order 12866

The Office of Management and Budget has determined that this proposed rule is not significant for purposes of Executive Order 12866.

Regulatory Flexibility Act (RFA)

Pursuant to the RFA (5 U.S.C. 601 *et seq.*), 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. US Wind is the sole entity that would be subject to the requirements in these proposed regulations, and US Wind is not a small governmental jurisdiction, small organization, or small business, as defined by the RFA. Because of this certification, a regulatory flexibility analysis is not required and none has been prepared.

Paperwork Reduction Act (PRA)

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 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.

Coastal Zone Management Act (CZMA)

The 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)). NMFS has determined that US Wind's application for incidental take regulations is not an activity listed by the MD DNR pursuant to 15 CFR 930.53 and, thus, is not 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. Consistent with 15 CFR 930.54, NMFS published Notice of Receipt of US Wind's application for this incidental take regulation in the **Federal Register** on May 2, 2023 (88 FR 27453) and is now publishing the proposed rule. The State of Maryland did not request approval from the Director of NOAA's Office for Coastal Management to review US Wind's application as an unlisted activity, and the time period for making such request has expired. Therefore, NMFS has determined the incidental take authorization is not subject to Federal consistency review.

Proposed Promulgation

As a result of these preliminary determinations, NMFS proposes to promulgate an LOA to US Wind authorizing take, by Level A harassment and Level B harassment, incidental to construction activities associated with the Maryland Offshore Wind Project offshore of Maryland for a 5-year period from January 1, 2025, through December 31, 2029, 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 US 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.

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: December 6, 2023.

Samuel D. Rauch III,

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

For reasons set forth in the preamble, NMFS proposes to amend 50 CFR part 217 to read as follows:

PART 217—REGULATIONS GOVERNING THE TAKING AND IMPORTING OF MARINE MAMMALS INCIDENTAL TO SPECIFIED ACTIVITIES

■ 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 II, consisting of §§ 217.340 through 217.349, to read as follows:

Subpart II—Taking Marine Mammals Incidental to the Maryland Offshore Wind Project Offshore of Maryland

Sec.

Subpart II—Taking Marine Mammals Incidental to the Maryland Offshore Wind Project Offshore of Maryland

§ 217.340 Specified activity and specified geographical region.

(a) Regulations in this subpart apply to activities associated with the Maryland Offshore Wind Project (hereafter referred to as the ''Project'') by US Wind, Inc. (hereafter referred to as ''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. Requirements imposed on LOA Holder must be implemented by those persons it authorizes or funds to conduct activities on its behalf.

(b) The specified geographical region is the Mid-Atlantic Bight, which includes, but is not limited to, the Bureau of Ocean Energy Management (BOEM) Lease Area Outer Continental Shelf (OCS)-A 0490 Commercial Lease of Submerged Lands for Renewable Energy Development, along the relevant Export Cable Corridors (ECCs), and at the sea-to-shore transition points located within Delaware Seashore State Park.

(c) The specified activities are impact pile driving of wind turbine generator (WTG), offshore substation (OSS), and a meteorological tower (Met tower) foundations; high-resolution geophysical (HRG) site characterization surveys; vessel transit within the specified geographical region to transport crew, supplies, and materials; WTG and OSS operation; fishery and ecological monitoring surveys; placement of scour protection; and trenching, laying, and cable burial activities.

§ 217.341 Effective dates.

The regulations in this subpart are effective from January 1, 2025, through December 31, 2029.

§ 217.342 Permissible methods of taking.

Under the LOA, issued pursuant to §§ 216.106 of this chapter and 217.346, 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 vicinity of BOEM Lease Area OCS–A 0490 Commercial Lease of Submerged Lands for Renewable Energy Development, 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 pile driving (WTG, OSS, and Met tower foundation installation) and HRG site characterization surveys;

(b) By Level A harassment associated with the acoustic disturbance of marine mammals by impact pile driving of WTG foundations;

(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
North Atlantic right whale	*Eubalaena glacialis*	Western Atlantic.
Fin whale	*Balaenoptera physalus*	Western North Atlantic.
Humpback whale	*Megaptera novaeangliae*	Gulf of Maine.
Minke whale	*Balaenoptera acutorostrata*	Canadian Eastern Coastal.
Sei whale	*Balaenoptera borealis*	Nova Scotia.
Killer whale	*Orcinus orca*	Western North Atlantic.
Atlantic spotted dolphin	*Stenella frontalis*	Western North Atlantic.
Pantropical spotted dolphin	*Stenella attenuata*	Western North Atlantic.
Bottlenose dolphin	*Tursiops truncatus*	Western North Atlantic—Offshore. Northern Migratory Coastal.
Common dolphin	*Delphinus delphis*	Western North Atlantic.
Long-finned pilot whale	*Globicephala melas*	Western North Atlantic.
Short-finned pilot whale	*Globicephala macrorhynchus*	Western North Atlantic.
Risso's dolphin	*Grampus griseus*	Western North Atlantic.
Rough-toothed dolphin	*Steno bredanensis*	Western North Atlantic.
Striped dolphin	*Stenella coeruleoalba*	Western North Atlantic.
Harbor porpoise	*Phocoena phocoena*	Gulf of Maine/Bay of Fundy.
Gray seal	*Halichoerus grypus*	Western North Atlantic.
Harbor seal	*Phoca vitulina*	Western North Atlantic.
Harp seal	*Pagophilus groenlandicus*	Western North Atlantic.

§ 217.343 Prohibitions.

Except for the takings described in § 217.342 and authorized by the LOA issued under this subpart, 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 the LOA issued under this subpart;

(b) Take any marine mammal not specified in § 217.342(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 § 217.342(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.

§ 217.344 Mitigation requirements.

When conducting the activities identified in § 217.340(c) within the area described in § 217.340(b), LOA Holder must implement the mitigation measures contained in this section and any LOA issued under §§ 217.346 and 217.347. These mitigation measures include, but are not limited to:

(a) *General conditions.* LOA Holder must comply with the following general measures:

(1) A copy of any issued LOA must be in the possession of 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) LOA Holder must conduct training for construction, survey, and vessel personnel and the marine mammal monitoring team (PSO and PAM operators) prior to the start of all in-water construction activities in order to explain responsibilities, communication procedures, marine mammal detection and identification, mitigation, monitoring, and reporting requirements, safety and operational procedures, and authorities of the marine mammal monitoring team(s). This training must be repeated for new personnel who join the work during the project. A description of the training program must be provided to NMFS at least 60 days prior to the initial training before in-water activities begin. Confirmation of all required training must be documented on a training course log sheet and reported to NMFS Office of Protected Resources prior to initiating project activities;

(3) Prior to and when conducting any in-water activities and vessel operations, 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 U.S. 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 operator(s); The marine mammal monitoring team must monitor these systems no less than every 4 hours;

(4) Any marine mammal observed by project personnel must be immediately communicated to any on-duty PSOs, PAM operator(s), and all vessel captains. Any large whale observation or acoustic detection by PSOs or PAM operators must be conveyed to all vessel captains;

(5) For North Atlantic right whales, any visual detection or acoustic detection within the PAM monitoring zone must trigger a delay to the commencement of pile driving. Any visual detection within 500 m must trigger a delay to the commencement of HRG surveys;

(6) 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 for purposes of mitigation;

(7) If a delay to commencing an activity is called for by the Lead PSO or PAM operator, LOA Holder must take the required mitigative action. If a delay or shutdown of an activity is called for by the Lead PSO or PAM operator, LOA Holder must take the required mitigative action unless shutdown would result in imminent risk of injury or loss of life to an individual, pile refusal, or pile instability. Any disagreements between the Lead PSO, PAM operator, and the activity operator regarding delays or shutdowns would only be discussed after the mitigative action has occurred;

(8) 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 prior to

beginning a specified activity, the activity must be delayed. If the activity is ongoing, it must be shut down immediately, unless shutdown would result in imminent risk of injury or loss of life to an individual, pile refusal, or pile instability. The activity must not commence or resume until the animal(s) has been confirmed to have left and is on a path away from the Level B harassment zone or after 15 minutes for small odontocetes and pinnipeds, and 30 minutes for all other species with no further sightings;

(9) For in-water construction heavy machinery activities listed in § 217.340(c), if a marine mammal is on a path towards or comes within 10 meters (m) (32.8 feet (ft)) of equipment, 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;

(10) All vessels must be equipped with a properly installed, operational Automatic Identification System (AIS) device and LOA Holder must report all Maritime Mobile Service Identity (MMSI) numbers to NMFS Office of Protected Resources;

(11) By accepting the issued LOA, LOA Holder consents to on-site observation and inspections by Federal agency personnel (including NOAA personnel) during activities described in this subpart, for the purposes of evaluating the implementation and effectiveness of measures contained within the LOA and this subpart;

(12) It is prohibited to assault, harm, harass (including sexually harass), oppose, impede, intimidate, impair, or in any way influence or interfere with a PSO, PAM Operator, or vessel crew member acting as an observer, or attempt the same. This prohibition includes, but is not limited to, any action that interferes with an observer's responsibilities, or that creates an intimidating, hostile, or offensive environment. Personnel may report any violations to the NMFS Office of Law Enforcement; and

(13) The LOA Holder must also abide by the reasonable and prudent measures and terms and conditions of the Biological Opinion and Incidental Take Statement, as issued by NMFS, pursuant to section 7 of the Endangered Species Act.

(b) *Vessel strike avoidance measures.* LOA Holder must comply with the following vessel strike avoidance measures, unless a situation presents a threat to the health, safety, or life of a person or when a vessel, actively engaged in emergency rescue or response duties, including vessel-in-distress or environmental crisis response, requires speeds in excess of 10 kn to fulfill those responsibilities, while in the specified geographical region:

(1) Prior to the start of the Project's activities involving vessels, all vessel personnel must receive a protected species training that covers, at a minimum, identification of marine mammals that have the potential to occur where vessels would be operating; detection observation methods 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); sighting communication protocols; all vessel speed and approach limit mitigation requirements (*e.g.,* vessel strike avoidance measures); and information and resources available to the project personnel regarding the applicability of Federal laws and regulations for protected species. This training must be repeated for any new vessel personnel who join the Project. Confirmation of the observers' training and understanding of the Incidental Take Authorization (ITA) requirements must be documented on a training course log sheet and reported to NMFS;

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

(3) LOA Holder's underway vessels (*e.g.,* transiting, surveying) operating at any speed must have a dedicated visual observer on duty at all times to monitor for marine mammals within a 180° direction of the forward path of the vessel (90° port to 90° starboard) located at an appropriate vantage point for ensuring vessels are maintaining appropriate separation distances. Visual observers must be equipped with alternative monitoring technology (*e.g.,* night vision devices, infrared cameras) 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 in this subpart. Visual observers may be third-party observers (*i.e.,* NMFS-approved PSOs) or trained crew members, as defined in paragraph (b)(1) of this section;

(4) LOA Holder must continuously monitor the U.S. Coast Guard VHF Channel 16 at the onset of transiting through the duration of transiting, 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 member(s) must also monitor the project's Situational Awareness System, WhaleAlert, and relevant NOAA information systems such as the Right Whale Sighting Advisory System (RWSAS) for the presence of North Atlantic right whales;

(5) All LOA Holder's vessels must transit at 10 kn or less within any active North Atlantic right whale Slow Zone (*i.e.,* Dynamic Management Areas (DMAs) or acoustically-triggered slow zone);

(6) LOA Holder's vessels, regardless of size, must immediately reduce speed to 10 kn or less for at least 24 hours when a North Atlantic right whale is sighted at any distance by any project-related personnel or acoustically detected by any project-related PAM system. Each subsequent observation or acoustic detection in the Project area shall trigger an additional 24-hour period. If a North Atlantic right whale is reported via any of the monitoring systems (refer back to (b)(4) of this section) within 10 kilometers (km; 6.2 miles (mi)) of a transiting vessel(s), that vessel must operate at 10 knots (kn; 11.5 miles per hour (mph)) or less for 24 hours following the reported detection;

(7) LOA Holder's vessels, regardless of size, must immediately reduce speed to 10 kn or less when any large whale (other than a North Atlantic right whale) is observed within 500 m (1,640 ft) of an underway vessel;

(8) If LOA Holder's vessel(s) are traveling at speeds greater than 10 kn (*i.e.,* no speed restrictions are enacted) in a transit corridor from a port to the Lease Area, in addition to the required dedicated visual observer, LOA Holder must monitor the transit corridor in real-time with PAM prior to and during transits. If a North Atlantic right whale is detected via visual observation or PAM within or approaching the transit corridor, all crew transfer vessels must travel at 10 kn or less for 24 hours following the detection. Each subsequent detection shall trigger a 24-hour reset. A slowdown in the transit corridor expires when there has been no further visual or acoustic detection in the transit corridor in the past 24 hours;

(9) LOA Holder's vessels must maintain a minimum separation distance of 500 m from North Atlantic right whales. If underway, all vessels must steer a course away from any sighted North Atlantic right whale at 10 kn or less such that the 500-m minimum separation distance requirement is not violated. If a North Atlantic right whale is sighted within 500 m of an underway vessel, that vessel must reduce speed

and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 500 m. If a whale is observed but cannot be confirmed as a species other than a North Atlantic right whale, the vessel operator must assume that it is a North Atlantic right whale and take the vessel strike avoidance measures described in this paragraph (b)(9);

(10) LOA Holder's vessels must maintain a minimum separation distance of 100 m (328 ft) from sperm whales and non-North Atlantic right whale baleen whales. If one of these species is sighted within 100 m of a transiting vessel, LOA Holder's vessel must reduce speed and 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;

(11) LOA Holder's vessels must maintain a minimum separation distance of 50 m (164 ft) 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, LOA Holder's 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;

(12) When a marine mammal(s) is sighted while LOA Holder's vessel(s) 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, slow down, and avoid abrupt changes in direction until the animal has left the area). This measure 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);

(13) LOA Holder's vessels underway must not divert or alter course to approach any marine mammal;

(14) LOA Holder is required to abide by other speed and approach regulations. Nothing in this subpart exempts vessels from any other applicable marine mammal speed and approach regulations;

(15) LOA Holder must check, daily, for information regarding the establishment of mandatory or voluntary vessel strike avoidance areas (*i.e.,* DMAs, SMAs, Slow Zones) and any information regarding North Atlantic right whale sighting locations;

(16) LOA Holder must submit a North Atlantic Right Whale Vessel Strike Avoidance Plan to NMFS Office of Protected Resources for review and approval at least 180 days prior to the planned start of vessel activity. The plan must provide details on the vessel-based observer and PAM protocols for transiting vessels. If a plan is not submitted or approved by NMFS prior to vessel operations, all project vessels transiting, year-round, must travel at speeds of 10 kn or less. LOA Holder must comply with any approved North Atlantic Right Whale Vessel Strike Avoidance Plan; and

(17) Speed over ground will be used to measure all vessel speed restrictions.

(c) *WTG, OSS, Met tower foundation installation.* The following requirements apply to impact pile driving activities associated with the installation of WTG, OSS, and Met tower foundations:

(1) Impact pile driving must not occur December 1 through April 30.

(2) Monopiles must be no larger than 11 m in diameter. Hammer energies must not exceed 4,400 kilojoules (kJ) for monopile installation. No more than one monopile may be installed per day, unless otherwise approved by NMFS. Pin piles for the OSSs must be no larger than 3 m in diameter. Hammer energies must not exceed 1,500 kJ for 3-m pin pile installation. No more than four 3-m pin piles may be installed per day. Met tower pin piles must be no larger than 1.8 m in diameter, and hammer energies must not exceed 500 kJ for Met tower pin pile installation. No more than two 1.8-m pin piles may be installed per day.

(3) LOA Holder must not initiate pile driving earlier than 1 hour prior to civil sunrise or later than 1.5 hours prior to civil sunset, unless the LOA Holder submits, and NMFS approves, an Alternative Monitoring Plan as part of the Pile Driving and Marine Mammal Monitoring Plan that reliably demonstrates the efficacy of their night vision devices.

(4) Soft-start must occur at the beginning of impact driving and at any time following a cessation of impact pile driving of 30 minutes or longer. Soft-start would involve initiating hammer operation at a reduced energy level (relative to full operating capacity) followed by a waiting period. For impact pile driving of monopiles and pin piles, the LOA Holder must utilize a soft-start protocol by performing four to six strikes per minute at 10 to 20 percent of the maximum hammer energy, for a minimum of 20 minutes.

(5) LOA Holder must establish clearance and shutdown zones, which must be measured using the radial distance around the pile being driven. 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 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.

(6) For North Atlantic right whales, any visual observation or acoustic detection within the PAM monitoring zone must trigger a delay to the commencement of pile driving. The clearance zone may only be declared clear if no North Atlantic right whale acoustic or visual detections have occurred within the clearance zone during the 60-minute monitoring period.

(7) LOA Holder must deploy at least two functional noise abatement systems that reduce noise levels to the modeled harassment isopleths, assuming 10-dB attenuation, during all impact pile driving and comply with the following measures:

(i) A single bubble curtain must not be used;

(ii) Any bubble curtain(s) must distribute air bubbles using an air flow rate of at least 0.5 m^3/(minute*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 adjust the air supply and operating pressure such that the maximum possible sound attenuation performance of the bubble curtain(s) is achieved;

(iii) 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;

(iv) No parts of the ring or other objects may prevent full seafloor contact with a bubble curtain ring;

(v) Construction contractors must train personnel in the proper balancing of airflow to the bubble curtain ring. LOA Holder must provide NMFS Office of Protected Resources with a bubble curtain performance test and maintenance report to review within 72 hours after each pile using a bubble curtain is installed. Additionally, a full maintenance check (*e.g.,* manually clearing holes) must occur prior to each pile being installed; and

(vi) 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, 3-m pin piles, and 1.8-m pin piles. If LOA

Holder uses a noise mitigation device in addition to the bubble curtain, LOA Holder must maintain similar quality control measures as described in this paragraph (c)(7).

(8) LOA Holder must utilize NMFS-approved PAM systems, as described in paragraph(c)(16) of this section. The PAM system components (*i.e.,* acoustic buoys) must not be placed closer than 1 km to the pile being driven so that the activities do not mask the PAM system. LOA Holder must provide a demonstration of and justification for the detection range of the system they plan to deploy while considering potential masking from concurrent pile driving and vessel noise. The PAM system must be able to detect a vocalization of North Atlantic right whales up to 10 km (6.2 mi).

(9) LOA Holder must utilize PSO(s) and PAM operator(s), as described in § 217.345(c), to monitor the clearance and shutdown zones. At least three on-duty PSOs must be on the pile driving platform and any additional platforms used.

(10) If a marine mammal is detected (visually or acoustically) entering or within the respective shutdown zone after pile driving has begun, the PSO or PAM operator must call for a shutdown of pile driving and LOA Holder must stop pile driving 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. If pile driving is not shut down in one of these situations, 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 Office of Protected Resources within the applicable monitoring reports (*e.g.,* weekly, monthly).

(11) A visual observation by PSOs at any distance or acoustic detection within the PAM monitoring zone of a North Atlantic right whale triggers shutdown requirements as per paragraph 10 of this section. 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 has neither been visually or acoustically detected for 30 minutes.

(12) 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 pinnipeds 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 LOA Holder must use the lowest hammer energy practicable to maintain stability.

(13) Pile driving sound levels must not exceed modeled distances to NMFS marine mammal Level A harassment and Level B harassment thresholds assuming 10-dB attenuation.

(14) LOA Holder must conduct sound field verification (SFV) measurements during pile driving activities associated with the installation of, at minimum, the first three monopile foundations and the first three full jacket foundations (inclusive of all pin piles for a specific jacket foundation) for each of the three construction campaigns. SFV measurements must continue until at least three consecutive monopiles and three entire jacket foundations demonstrate noise levels are at or below those modeled, assuming 10-decibels (dB) of attenuation. Subsequent SFV measurements are also required should larger piles be installed or if additional piles are driven that may produce louder sound fields than those previously measured (*e.g.,* higher hammer energy, greater number of strikes, *etc.*). SFV measurements must be conducted as follows:

(i) Measurements must be made at a minimum of four distances from the pile(s) being driven, along a single transect, in the direction of lowest transmission loss (*i.e.,* projected lowest transmission loss coefficient), including, but not limited to, 750 m (2,460 ft) and three additional ranges selected such that measurement of Level A harassment and Level B harassment isopleths are accurate, feasible, and avoids extrapolation. At least one additional measurement at an azimuth 90 degrees from the array at 750 m must be made. At each location, there must be a near bottom and mid-water column hydrophone (measurement systems);

(ii) The recordings must be continuous throughout the duration of all pile driving of each foundation;

(iii) The SFV 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. The frequency range of SFV measurement systems must cover the range of at least 20 hertz (Hz) to 20 kilohertz (kHz). The SFV measurement systems must be designed to have omnidirectional sensitivity so that the broadband received level of all pile driving exceeds the system noise floor by at least 10 dB. The dynamic range of the SFV measurement system must be sufficient such that at each location, the signals prevent poor signal-to-noise ratios for low amplitude signals and avoid clipping, nonlinearity, and saturation for high amplitude signals;

(iv) All hydrophones used in SFV measurements systems are required to have undergone a full system, traceable laboratory calibration conforming to International Electrotechnical Commission (IEC) 60565, or an equivalent standard procedure, from a factory or accredited source to ensure the hydrophone receives accurate sound levels, at a date not to exceed 2 years before deployment. Additional in-situ calibration checks using a pistonphone are required to be performed before and after each hydrophone deployment. If the measurement system employs filters via hardware or software (*e.g.,* high-pass, low-pass, *etc.*), which is not already accounted for by the calibration, the filter performance (*i.e.,* the filter's frequency response) must be known, reported, and the data corrected before analysis;

(v) LOA Holder must be prepared with additional equipment (hydrophones, recording devices, hydrophone calibrators, cables, batteries, *etc.*), which exceeds the amount of equipment necessary to perform the measurements, such that technical issues can be mitigated before measurement;

(vi) LOA Holder must submit interim SFV reports within 48 hours after each foundation is measured (see § 217.345(g) for interim and final reporting requirements);

(vii) If any of the interim SFV measurement reports submitted for the first three monopiles exceed the modeled distances to NMFS marine mammal Level A harassment and Level B harassment thresholds assuming 10-dB attenuation, then LOA Holder must implement additional sound attenuation measures on all subsequent foundations. LOA Holder must also increase clearance and shutdown zone sizes to those identified by NMFS until SFV measurements on at least three additional foundations demonstrate acoustic distances to harassment thresholds meet or are less than those modeled assuming 10 dB of attenuation. LOA Holder must optimize the sound attenuation systems (*e.g.,* ensure hose maintenance, pressure testing, *etc.*) to meet noise levels modeled, assuming

10-dB attenuation, within three piles or else foundation installation activities must cease until NMFS and LOA Holder can evaluate the situation and ensure future piles do not exceed noise levels modeled assuming 10-dB attenuation;

(viii) If, after additional measurements conducted pursuant to requirements of paragraph (14)(vii) of this section, 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), LOA Holder may request a modification of the clearance and shutdown zones from the NMFS Office of Protected Resources. For NMFS Office of Protected Resources to consider a modification request for reduced zone sizes, LOA Holder must have conducted SFV measurements on an additional three foundations (for either/or monopile and jackets) and ensure that subsequent foundations would be installed under conditions that are predicted to produce smaller harassment zones than those modeled assuming 10 dB of attenuation;

(ix) LOA Holder must conduct SFV measurements as described in c(14) upon commencement of turbine operations to estimate turbine operational source levels, in accordance with a NMFS-approved Foundation Installation Pile Driving SFV Plan. SFV must be conducted in the same manner as previously described in § 217.304(c)(14), with appropriate adjustments to measurement distances, number of hydrophones, and hydrophone sensitivities being made, as necessary; and

(x) LOA Holder must submit a SFV Plan to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of foundation installation activities and abide by the Plan if approved. At minimum, the SFV Plan must describe how LOA Holder would ensure that the first three monopile foundation/entire jacket foundation (inclusive of all pin piles for a jacket foundation) installation sites selected for SFV measurements are representative of the rest of the monopile and/or jacket foundation installation sites such that future pile installation events are anticipated to produce similar sound levels to those piles measured. In the case that these sites/scenarios are not determined to be representative of all other pile installation sites, LOA Holder must include information in the SFV Plan on how additional sites/scenarios would be selected for SFV measurements. The SFV Plan must also include methodology for collecting, analyzing, and preparing SFV measurement data for submission to NMFS Office of Protected Resources and describe how the effectiveness of the sound attenuation methodology would be evaluated based on the results. SFV for pile driving may not occur until NMFS approves the SFV Plan for this activity.

(15) LOA Holder must submit a Foundation Installation Pile Driving Marine Mammal Monitoring Plan to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of pile driving and abide by the Plan if approved. LOA Holder must obtain both NMFS Office of Protected Resources and NMFS Greater Atlantic Regional Fisheries Office Protected Resources Division's concurrence with this Plan prior to the start of any pile driving. The Plan must include a description of all monitoring equipment and PAM and PSO protocols (including number and location of PSOs) for all pile driving. No foundation pile installation can occur without NMFS' approval of the Plan.

(16) LOA Holder must submit a Passive Acoustic Monitoring Plan (PAM Plan) to NMFS Office of Protected Resources for review and approval at least 180 days prior to the planned start of foundation installation activities (impact pile driving) and abide by the Plan if approved. The PAM Plan must include a description of all proposed PAM equipment, address how the proposed passive acoustic monitoring must follow standardized measurement, processing methods, reporting metrics, and metadata standards for offshore wind as described in ''NOAA and BOEM Minimum Recommendations for Use of Passive Acoustic Listening Systems in Offshore Wind Energy Development Monitoring and Mitigation Programs'' (2021). The Plan must describe all proposed PAM equipment, procedures, and protocols including proof that vocalizing North Atlantic right whales will be detected within the clearance and shutdown zones. No pile installation can occur if LOA Holder's PAM Plan does not receive approval from NMFS Office of Protected Resources and NMFS Greater Atlantic Regional Fisheries Office Protected Resources Division.

(d) *HRG surveys.* The following requirements apply to HRG surveys operating sub-bottom profilers (SBPs) (*i.e.,* boomers, sparkers, and Compressed High Intensity Radiated Pulse (CHIRPS)):

(1) LOA Holder must establish and implement clearance and shutdown zones for HRG surveys using visual monitoring, as described in paragraph (d) of this section;

(2) LOA Holder must utilize PSO(s), as described in § 217.345(f);

(3) SBPs (hereinafter referred to as ''acoustic sources'') must be deactivated when not acquiring data or preparing to acquire data, except as necessary for testing. Acoustic sources must be used at the lowest practicable source level to meet the survey objective, when in use, and must be turned off when they are not necessary for the survey;

(4) LOA Holder is required to ramp-up acoustic sources prior to commencing full power, unless the equipment operates on a binary on/off switch, and ensure visual clearance zones are observable (*e.g.,* not obscured from observation 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. 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;

(5) Prior to a ramp-up procedure starting or activating acoustic sources, the acoustic source operator (operator) must notify a designated PSO of the planned start of ramp-up as agreed upon with the Lead PSO. The notification time should not be less than 60 minutes prior to the planned ramp-up or activation in order to allow the PSOs time to monitor the clearance zone(s) for 30 minutes prior to the initiation of ramp-up or activation (pre-start clearance). During this 30-minute pre-start clearance period, the entire applicable clearance zones must be visible, except as indicated in paragraph (d)(11) of this section;

(6) Ramp-ups must be scheduled so as to minimize the time spent with the source activated;

(7) A PSO conducting pre-start clearance observations must be notified again immediately prior to reinitiating ramp-up procedures and the operator must receive confirmation from the PSO to proceed;

(8) 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;

(9) 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 pinnipeds, and 30 minutes for all other species;

(10) 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. Ramp-up may occur at times of poor visibility, including nighttime, if appropriate visual monitoring has occurred with no detections of marine mammals in the 30 minutes prior to beginning ramp-up;

(11) Once the survey has commenced, LOA Holder must shut down acoustic sources 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 (d)(11) is detected in the shutdown zone;

(12) If an acoustic source has been shut down due to the presence of a marine mammal, the use of an acoustic source 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;

(13) LOA Holder must immediately shut down any 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 (d)(11) of this section is detected in the shutdown zone; and

(14) If an acoustic source is shut down for a period longer than 30 minutes, all clearance and ramp-up procedures must be initiated. If an acoustic source is shut down for reasons other than mitigation (*e.g.,* mechanical difficulty) for less than 30 minutes, acoustic sources may be activated again without ramp-up only if PSOs have maintained constant observation and no additional detections of any marine mammal occurred within the respective shutdown zones.

(e) *Fisheries monitoring surveys.* The following measures apply to fishery monitoring surveys:

(1) Survey gear must be deployed as soon as possible once the vessel arrives on station. Gear must not be deployed if there is a risk of interaction with marine mammals. Gear may be deployed after 15 minutes of no marine mammal sightings within 1 nautical mile (nmi; 1,852 m) of the sampling station;

(2) LOA Holder and 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 LOA Holder and 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, LOA Holder and its cooperating institutions, contracted vessels, or commercially hired captains must move again or skip the station;

(3) If a marine mammal is at risk of interacting with or becoming entangled in the gear after the gear is deployed or 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 must slow its speed and maneuver the vessel away from the animals to minimize potential interactions with the observed animal;

(4) LOA Holder must maintain visual marine mammal monitoring effort during the entire period of time that gear is in the water (*i.e.,* throughout gear deployment, fishing, and retrieval);

(5) All fisheries monitoring gear must be fully cleaned and repaired (if damaged) before each use/deployment;

(6) 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;

(7) All gear must be emptied as close to the deck/sorting area and as quickly as possible after retrieval;

(8) During any survey that uses vertical lines, buoy lines must be weighted and must not float at the surface of the water and all groundlines must consist of sinking lines. All groundlines must be composed entirely of sinking lines. 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;

(9) All in-water survey gear, including buoys, must be properly labeled with the scientific permit number or identification as LOA Holder's research gear. All labels and markings on the gear, buoys, and buoy lines must also be compliant with the Atlantic Large Whale Take Reduction Plan regulations at 50 CFR 229.32, and all buoy markings must comply with instructions received by the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division;

(10) All survey gear must be removed from the water whenever not in active survey use (*i.e.,* no wet storage); and

(11) All reasonable efforts, that do not compromise human safety, must be undertaken to recover gear.

§ 217.345 Monitoring and reporting requirements.

(a) *Protected species observer (PSO) and passive acoustic monitoring (PAM) operator qualifications.* LOA Holder must implement the following measures applicable to PSOs and PAM operators:

(1) LOA Holder must use independent, NMFS-approved 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 crew with regard to the presence of protected species and mitigation requirements;

(2) All 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 must 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;

(3) 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 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;

(4) All PSOs must be trained in northwestern Atlantic Ocean 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 (as described in paragraphs (b)(6) and (7) of this section;

(5) All PSOs and PAM operators must successfully complete a relevant training course within the last 5 years, including obtaining a certificate of course completion;

(6) PSOs and PAM operators are responsible for obtaining NMFS' approval. NMFS may approve PSOs and PAM operators as conditional or unconditional. A conditionally approved PSO or PAM operator may be one who has completed training in the last 5 years but has not yet attained the requisite field experience. An unconditionally approved PSO or PAM operator is one who has completed training within the last 5 years and attained the necessary experience (*i.e.,* demonstrate experience with monitoring for marine mammals at clearance and shutdown zone sizes similar to those produced during the respective activity). Lead PSO or PAM operators must be unconditionally approved and have a minimum of 90 days in a northwestern Atlantic Ocean offshore environment performing the role (either visual or acoustic), with the conclusion of the most recent relevant experience not more than 18 months previous. A conditionally approved PSO or PAM operator must be paired with an unconditionally approved PSO or PAM operator;

(7) PSOs for HRG surveys may be unconditionally or conditionally approved. PSOs and PAM operators for foundation installation activities must be unconditionally approved;

(8) At least one on-duty PSO and PAM operator, where applicable, for each activity (*e.g.,* impact pile driving, vibratory pile driving, and HRG surveys) must be designated as the Lead PSO or Lead PAM operator;

(9) LOA Holder must submit NMFS previously approved PSOs and PAM operators to NMFS Office of Protected Resources for review and confirmation of their approval for specific roles at least 30 days prior to commencement of the activities requiring PSOs/PAM operators or 15 days prior to when new PSOs/PAM operators are required after activities have commenced;

(10) For prospective PSOs and PAM operators not previously approved, or for PSOs and PAM operators whose approval is not current, LOA Holder must submit resumes for approval at least 60 days prior to PSO and PAM operator use. Resumes must include information related to relevant education, experience, and training, including dates, duration, location, and description of prior PSO or PAM operator experience. Resumes must be accompanied by relevant documentation of successful completion of necessary training;

(11) PAM operators are responsible for obtaining NMFS approval. To be approved as a PAM operator, the person must meet the following qualifications: The PAM operator must demonstrate that they have prior experience with real-time acoustic detection systems and/or have completed specialized training for operating PAM systems and detecting and identifying Atlantic Ocean marine mammals sounds, in particular: North Atlantic right whale sounds, humpback whale sounds, and how to deconflict them from similar North Atlantic right whale sounds, and other co-occurring species' sounds in the area including sperm whales; must be able to distinguish between whether a marine mammal or other species sound is detected, possibly detected, or not detected, and similar terminology must be used across companies/projects; Where localization of sounds or deriving bearings and distance are possible, the PAM operators need to have demonstrated experience in using this technique; PAM operators must be independent observers (*i.e.,* not construction personnel); PAM operators must demonstrate experience with relevant acoustic software and equipment; PAM operators must have the qualifications and relevant experience/training to safely deploy and retrieve equipment and program the software, as necessary; PAM operators must be able to test software and hardware functionality prior to operation; and PAM operators must have evaluated their acoustic detection software using the PAM Atlantic baleen whale annotated data set available at National Centers for Environmental Information (NCEI) and provide evaluation/performance metric;

(12) PAM operators must be able to review and classify acoustic detections in real-time (prioritizing North Atlantic right whales and noting detection of other cetaceans) during the real-time monitoring periods;

(13) PSOs may work as PAM operators and vice versa, pending NMFS-approval; however, they may only perform one role at any time and must not exceed work time restrictions, which must be tallied cumulatively; and

(14) All PSOs and PAM operators must complete a Permits and Environmental Compliance Plan training and a 2-day refresher session that must be held with the PSO provider and Project compliance representative(s) prior to the start of in-water project activities (*e.g.,* HRG survey, foundation installation, *etc.*).

(b) *General PSO and PAM operator requirements.* The following measures apply to PSOs and PAM operators and must be implemented by LOA Holder:

(1) PSOs must monitor for marine mammals prior to, during, and following impact pile driving and HRG surveys that use sub-bottom profilers (with specific monitoring durations and needs described in paragraphs (c) through (f) of this section, respectively).

Monitoring must be done while free from distractions and in a consistent, systematic, and diligent manner;

(2) For foundation installation, PSOs must visually clear (*i.e.,* confirm no observations of marine mammals) the entire minimum visibility zone for a full 30 minutes immediately prior to commencing activities. For HRG surveys, which do not have a minimum visibility zone, the entire clearance zone must be visually cleared and as much of the Level B harassment zone as possible;

(3) All PSOs must be located at the best vantage point(s) on any platform, as determined by the Lead PSO, 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. PAM operators may be located on a vessel or remotely on-shore, the PAM operator(s) must assist PSOs in ensuring full coverage of the clearance and shutdown zones. The PAM operator must monitor to and past the clearance zone for large whales;

(4) All on-duty PSOs must remain in real-time contact with the on-duty PAM operator(s), PAM operators must immediately communicate all acoustic detections of marine mammals to PSOs, including any determination regarding species identification, distance, and bearing (where relevant) relative to the pile being driven and the degree of confidence (*e.g.,* possible, probable detection) in the determination. All on-duty PSOs and PAM operator(s) must remain in contact with the on-duty construction personnel responsible for implementing mitigations (*e.g.,* delay to pile driving) 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;

(5) 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 must be responsible for requesting that the designated crewmember implement the necessary mitigation procedures (*i.e.,* delay);

(6) PSOs must use high magnification (25x) binoculars, standard handheld (7x) binoculars, and the naked eye to search continuously for marine mammals. During foundation installation, at least two PSOs on the pile driving vessel must be equipped with functional Big Eye binoculars (*e.g.,* 25 * 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. PAM operators must have the appropriate equipment (*i.e.,* a computer station equipped with a data collection software system available wherever they are stationed) and use a NMFS-approved PAM system to conduct monitoring. PAM systems are approved through the PAM Plan as described in § 217.344(c)(17); and

(7) 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. If the schedule includes PSOs and PAM operators on-duty for 2-hour shifts, a minimum 1-hour break between watches must be allowed.

(c) *PSO and PAM operator requirements during WTG, OSS, and Met Tower foundation installation.* The following measures apply to PSOs and PAM operators during WTG, OSS, and Met tower foundation installation and must be implemented by LOA Holder:

(1) PSOs and PAM operator(s), using a NMFS-approved PAM system, must monitor for marine mammals 60 minutes prior to, during, and 30 minutes following all pile driving activities. If PSOs cannot visually monitor the minimum visibility zone prior to impact pile driving at all times using the equipment described in paragraphs (b)(6) and (7) of this section, pile driving operations must not commence or must shutdown if they are currently active;

(2) At least three on-duty PSOs must be stationed and observing from the activity platform during impact pile driving and at least three on-duty PSOs must be stationed on each dedicated PSO vessel. Concurrently, at least one PAM operator per acoustic data stream (equivalent to the number of acoustic buoys) must be actively monitoring for marine mammals 60 minutes before, during, and 30 minutes after impact pile driving in accordance with a NMFS-approved PAM Plan; and

(3) LOA Holder must conduct PAM for at least 24 hours immediately prior to pile driving activities. The PAM operator must review all detections from the previous 24-hour period immediately prior to pile driving activities.

(d) *PSO requirements during HRG surveys.* The following measures apply to PSOs during HRG surveys using acoustic sources that have the potential to result in harassment and must be implemented by LOA Holder:

(1) 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 two PSOs during nighttime surveying (if it occurs);

(2) PSOs on HRG vessels must begin monitoring 30 minutes prior to activating acoustic sources, during the use of these acoustic sources, and for 30 minutes after use of these acoustic sources has ceased;

(3) Any observations of marine mammals must be communicated to PSOs on all nearby survey vessels during concurrent HRG surveys; and

(4) During daylight hours when survey equipment is not operating, 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.

(e) *Monitoring requirements during fisheries monitoring surveys.* The following measures apply during fisheries monitoring surveys and must be implemented by LOA Holder:

(1) All captains and crew conducting fishery surveys must be trained in marine mammal detection and identification; and

(2) Marine mammal monitoring must be conducted within 1 nmi from the planned survey location by the trained captain and/or a member of the scientific crew for 15 minutes prior to deploying gear, throughout gear deployment and use, and for 15 minutes after haul back.

(f) *Reporting.* LOA Holder must comply with the following reporting measures:

(1) Prior to initiation of any on-water project activities, LOA Holder must demonstrate in a report submitted to NMFS Office of Protected Resources that all required training for LOA Holder personnel (including the vessel crews, vessel captains, PSOs, and PAM operators) has been completed.

(2) 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. Unless stated otherwise, all reports must be submitted to NMFS Office of Protected Resources (*PR.ITP.MonitoringReports@noaa.gov*), dates must be in MM/DD/YYYY format, and location information must be provided in Decimal Degrees and with the coordinate system information (*e.g.,* NAD83, WGS84, *etc.*).

(3) For all visual monitoring efforts and marine mammal sightings, the

following information must be collected and reported to NMFS Office of Protected Resources: the date and time that monitored activity begins or ends; the construction activities occurring during each observation period; the watch status (*i.e.,* sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/platform); the PSO who sighted the animal; the time of sighting; the weather parameters (*e.g.,* wind speed, percent cloud cover, visibility); the 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); the pace of the animal(s); the estimated number of animals (minimum/maximum/high/low/best); the estimated number of animals by cohort (*e.g.,* adults, yearlings, juveniles, calves, group composition, *etc.*); the 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); the 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; the 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); the activity at time of sighting (*e.g.,* 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.*); the marine mammal occurrence in Level A harassment or Level B harassment zones; the 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; other human activity in the area, and; other applicable information, as required in any LOAs issued under § 217.346.

(4) LOA Holder must compile and submit weekly reports during foundation installation to NMFS Office of Protected Resources that document the daily start and stop of all pile driving 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 to 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). Once all foundation pile installation is completed, weekly reports are no longer required by LOA Holder.

(5) LOA Holder must compile and submit monthly reports to NMFS Office of Protected Resources during foundation installation 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, MMIS number, 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). Full PAM detection data and metadata must also 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.*

(6) 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. LOA Holder must provide a final report within 30 days following resolution of NMFS' comments on the draft report. The draft and final reports must detail the following: 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 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 pile driving); summarized information related to situational reporting; and any other important information relevant to the Project, including additional information that may be identified through the adaptive management process.

(7) 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. At a minimum, the draft and final 5-year report must include: the total number (annually and across all 5 years) of marine mammals of each species/stock detected and how many were detected 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; a summary table(s) indicating the amount of each activity type (*e.g.,* pile installation, HRG) completed in each of the 5 years and total; GIS shapefile(s) of the final location of all piles, cable routes, and other permanent structures including an indication of what year installed and began operating; GIS shapefile of all North Atlantic right whale sightings, including dates and group sizes; a 5-year summary and evaluation of all SFV data collected; a 5-year summary and evaluation of all PAM data collected; a 5-year summary and evaluation of marine mammal behavioral observations; a 5-year summary and evaluation of mitigation and monitoring implementation and effectiveness; a list of recommendations to inform environmental compliance assessments for future offshore wind actions. 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.

(8) For those foundation piles requiring SFV measurements, 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 event as soon as they are available and prior to a subsequent foundation installation, but no later than 48 hours after each completed foundation installation event. The report must include, at minimum: hammer energies/schedule used during

pile driving, including, the total number of strikes and the maximum hammer energy; the model-estimated acoustic ranges ($R_{95\%}$) to compare with the real-world sound field measurements; peak sound pressure level (SPL_{pk}), root-mean-square sound pressure level that contains 90 percent of the acoustic energy (SPL_{rms}), and sound exposure level (SEL, in single strike for pile driving, $SEL_{ss,}$), for each hydrophone, including at least the maximum, arithmetic mean, minimum, median (L50) and L5 (95 percent exceedance) statistics for each metric; estimated marine mammal Level A harassment and Level B harassment isopleths, calculated using the maximum-over-depth L5 (95 percent exceedance level, maximum of both hydrophones) of the associated sound metric; comparison of modeled results assuming 10-dB attenuation against the measured marine mammal Level A harassment and Level B harassment acoustic isopleths; estimated transmission loss coefficients; pile identifier name, location of the pile and each hydrophone array in latitude/longitude; depths of each hydrophone; one-third-octave band single strike SEL spectra; if filtering is applied, full filter characteristics must be reported; and hydrophone specifications including the type, model, and sensitivity. LOA Holder must also report any immediate observations which are suspected to have a significant impact on the results including but not limited to: observed noise mitigation system issues, obstructions along the measurement transect, and technical issues with hydrophones or recording devices. If any in-situ calibration checks for hydrophones reveal a calibration drift greater than 0.75 dB, pistonphone calibration checks are inconclusive, or calibration checks are otherwise not effectively performed, LOA Holder must indicate full details of the calibration procedure, results, and any associated issues in the 48-hour interim reports.

(9) The final results of SFV measurements from each foundation installation must be submitted as soon as possible, but no later than 90 days following completion of each event's SFV measurements. The final reports must include all details prescribed above for the interim report as well as, at minimum, the following: the peak sound pressure level (SPL_{pk}), the root-mean-square sound pressure level that contains 90 percent of the acoustic energy (SPL_{rms}), the single strike sound exposure level (SEL_{ss}), the integration time for SPL_{rms}, the spectrum, and the 24-hour cumulative SEL extrapolated from measurements at all hydrophones. The final report must also include at least the maximum, mean, minimum, median (L_{50}) and L_5 (95 percent exceedance) statistics for each metric; the SEL and SPL power spectral density and/or 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, arithmetic mean, and L_5 (95 percent exceedance) (*i.e.,* average in linear space), and in dB; range of transmission loss coefficients; the 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 locations; the extents of the measured Level A harassment and Level B harassment zone(s); hammer energies required for pile installation and the number of strikes per pile; the hydrophone equipment and methods (*i.e.,* recording device, bandwidth/sampling rate; distance from the pile where recordings were made; the depth of recording device(s)); a description of the SFV measurement 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; the spatial configuration of the noise attenuation device(s) relative to the pile; a description of the noise abatement system and operational parameters (*e.g.,* bubble flow rate, distance deployed from the pile, *etc.*), and any action taken to adjust the noise abatement system. A discussion which includes any observations which are suspected to have a significant impact on the results including but not limited to: observed noise mitigation system issues, obstructions along the measurement transect, and technical issues with hydrophones or recording devices.

(10) If at any time during the project LOA Holder becomes aware of any issue or issues which may (to any reasonable subject-matter expert, including the persons performing the measurements and analysis) call into question the validity of any measured Level A harassment or Level B harassment isopleths to a significant degree, which were previously transmitted or communicated to NMFS Office of Protected Resources, LOA Holder must inform NMFS Office of Protected Resources within 1 business day of becoming aware of this issue or before the next pile is driven, whichever comes first.

(11) If a North Atlantic right whale is acoustic detected at any time by a project-related PAM system, LOA Holder must ensure the detection is reported as soon as possible to NMFS, but no longer than 24 hours after the detection via the ''24-hour North Atlantic right whale Detection Template'' (*https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reporting-system-templates*). Calling the hotline is not necessary when reporting PAM detections via the template.

(12) Full detection data, metadata, and location of recorders (or GPS tracks, if applicable) from all real-time hydrophones used for monitoring during construction must be submitted within 90 calendar days after pile driving has ended and instruments have been pulled from the water. Reporting must use the webform templates on the NMFS Passive Acoustic Reporting System website at *https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reporting-system-templates.* Submit the completed data templates to *nmfs.nec.pacmdata@noaa.gov.* The full acoustic recordings from all real-time hydrophones must also be sent to the National Centers for Environmental Information (NCEI) for archiving within 90 calendar days following completion of activities requiring PAM for mitigation. Submission details can be found at: *https://www.ncei.noaa.gov/products/passive-acoustic-data.*

(13) LOA Holder must submit situational reports if the following circumstances occur (including all instances wherein an exemption is taken must be reported to NMFS Office of Protected Resources within 24 hours):

(i) If a North Atlantic right whale is observed at any time by PSOs or project personnel, LOA Holder must ensure the sighting is immediately (if not feasible, as soon as possible, and no longer than 24 hours after the sighting) reported to NMFS and the Right Whale Sightings Advisory System (RWSAS). If in the Northeast Region (Maine to Virginia/North Carolina border) call (866–755–6622). If in the Southeast Region (North Carolina to Florida) call (877–WHALE–HELP or 877–942–5343). If calling NMFS is not possible, reports can also be made to the U.S. Coast Guard via channel 16 or through the WhaleAlert app (*https://www.whalealert.org*). The sighting report must include the time, date, and location of the sighting, number of whales, animal description/certainty of sighting (provide photos/video if taken), Lease Area/project name, PSO/personnel name, PSO provider company (if applicable), and reporter's contact information.

(ii) If a North Atlantic right whale is observed at any time by PSOs or project personnel, LOA Holder must submit a summary report to NMFS GARFO (*nmfs.gar.incidental-take@noaa.gov*) and NMFS Office of Protected Resources, and NMFS Northeast Fisheries Science Center (NEFSC; *ne.rw.survey@noaa.gov*) within 24 hours with the above information and the vessel/platform from which the sighting was made, activity the vessel/platform was engaged in at time of sighting, project construction and/or survey activity at the time of the sighting (*e.g.,* pile driving, cable installation, HRG survey), distance from vessel/platform to sighting at time of detection, and any mitigation actions taken in response to the sighting.

(iii) If an observation of a large whale occurs during vessel transit, LOA Holder must report the time, date, and location of the sighting; the vessel's activity, heading, and speed (knots); Beaufort sea state, water depth (meters), and visibility conditions; marine mammal species identification to the best of the observer's ability and any distinguishing characteristics; 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.

(iv) In the event that personnel involved in the Project discover a stranded, entangled, injured, or dead marine mammal, LOA Holder must immediately report the observation to NMFS. If in the Greater Atlantic Region (Maine to Virginia) call the NMFS Greater Atlantic Stranding Hotline (866–755–6622); if in the Southeast Region (North Carolina to Florida), call the NMFS Southeast Stranding Hotline (877–942–5343). Separately, LOA Holder must report the incident to NMFS Office of Protected Resources (*PR.ITP.MonitoringReports@noaa.gov*) and, if in the Greater Atlantic region (Maine to Virginia), NMFS GARFO (*nmfs.gar.incidental-take@noaa.gov, nmfs.gar.stranding@noaa.gov*) or, if in the Southeast region (North Carolina to Florida), NMFS Southeast Regional Office (SERO; *secmammalreports@noaa.gov*) as soon as feasible. The report (via phone or email) must include contact (name, phone number, *etc.*), the time, date, and location 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.

(v) In the event of a vessel strike of a marine mammal by any vessel associated with the Project or if other project activities cause a non-auditory injury or death of a marine mammal, LOA Holder must immediately report the incident to NMFS. If in the Greater Atlantic Region (Maine to Virginia) call the NMFS Greater Atlantic Stranding Hotline (866–755–6622) and if in the Southeast Region (North Carolina to Florida) call the NMFS Southeast Stranding Hotline (877–942–5343). Separately, LOA Holder must immediately report the incident to NMFS Office of Protected Resources (*PR.ITP.MonitoringReports@noaa.gov*) and, if in the Greater Atlantic region (Maine to Virginia), NMFS GARFO (*nmfs.gar.incidental-take@noaa.gov, nmfs.gar.stranding@noaa.gov*) or, if in the Southeast region (North Carolina to Florida), NMFS SERO (*secmammalreports@noaa.gov*). The report must include the time, date, and location of the incident; species identification (if known) or description of the animal(s) involved; vessel size and motor configuration (inboard, outboard, jet propulsion); 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). LOA Holder must immediately cease all on-water activities until the 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. LOA Holder may not resume their activities until notified by NMFS Office of Protected Resources.

(14) LOA Holder must report any lost gear associated with the fishery surveys to the NOAA GARFO 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.

§ 217.346 Letter of Authorization.

(a) To incidentally take marine mammals pursuant to this subpart, LOA Holder must apply for and obtain an LOA.

(b) The LOA, unless suspended or revoked, may be effective for a period of time not to exceed December 31, 2029, the expiration date of this subpart.

(c) In the event of projected changes to the activity or to mitigation and monitoring measures required by the LOA, LOA Holder must apply for and obtain a modification of the LOA as described in § 217.347.

(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 the LOA must be published in the **Federal Register** within 30 days of a determination.

§ 217.347 Modifications of Letter of Authorization.

(a) The LOA issued under §§ 217.342 and 217.346 or this section for the activity identified in § 217.340 shall be modified upon request by 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 includes 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), the LOA shall be modified, provided that:

(1) NMFS Office of Protected Resources determines that the changes to the activity or the mitigation, monitoring, or reporting do not change the findings made for the regulations in this subpart and do not result in more than a minor change in the total estimated number of takes (or distribution by species or years); and

(2) NMFS Office of Protected Resources may, if appropriate, 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) The LOA issued under §§ 217.342 and 217.346 or this section for the activities identified in § 217.340 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 delete, modify, or add to) 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 the LOA include, but are not limited to:

(A) Results from LOA Holder's monitoring;

(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 §§ 217.342 and 217.346 or this section, the 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.

§§ 217.348–217.349 [Reserved]

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