DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 217

RIN 0648–BL52

[Docket No. 230928–0235]

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to the Revolution Wind Offshore Wind Farm Project Offshore Rhode Island

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

ACTION: Final rule.

SUMMARY: In accordance with the regulations implementing the Marine Mammal Protection Act (MMPA), as amended, notification is hereby given that NMFS promulgates regulations to govern the incidental taking of marine mammals incidental to Revolution Wind, LLC's (Revolution Wind), a subsidiary wholly owned by Orsted Wind Power North America, LLC (Orsted), construction of the Revolution Wind Offshore Wind Energy Project (hereafter known as the ''Project'') in Federal and State waters offshore Rhode Island, specifically 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–0486 (Lease Area) and along two export cable routes to sea-to-shore transition points (collectively referred to as the ''Project Area''), over the course of 5 years (November 20, 2023 through November 19, 2028). These regulations, which allow for the issuance of a Letter of Authorization (LOA) for the incidental take of marine mammals during construction-related activities within the Project Area during the effective dates of the regulations, prescribe the permissible methods of taking and other means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat, as well as requirements pertaining to the monitoring and reporting of such taking.

DATES: This rulemaking and issued LOA are effective from November 20, 2023 through November 19, 2028.

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

SUPPLEMENTARY INFORMATION:

Availability

A copy of Revolution Wind's Incidental Take Authorization (ITA) application and supporting documents, received public comments, and the proposed rulemaking, 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 final rule, as promulgated, provides a framework under the authority of the MMPA (16 U.S.C. 1361 *et seq.*) for NMFS to authorize the take of marine mammals incidental to construction of the Project within the Project Area. NMFS received a request from Revolution Wind to incidentally take individuals of 16 species of marine mammals, comprising 16 stocks (10 stocks by Level A harassment and Level B harassment and 6 stocks by Level B harassment), incidental to Revolution Wind's 5 years of construction activities. No mortality or serious injury was requested nor is it anticipated or authorized in this final rulemaking.

Legal Authority for the Final 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). If such findings are made, NMFS must prescribe the permissible methods of taking, ''other means of effecting the least practicable adverse impact'' on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of the species or stocks for taking for certain subsistence uses (referred to as ''mitigation''); and requirements pertaining to the monitoring and reporting of such takings.

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

- *U.S. Citizens*—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(13); 50 CFR 216.3);
- *Incidental harassment, incidental taking, and incidental, but not intentional taking*—an accidental taking. This does not mean that the taking is unexpected, but rather it includes those takings that are infrequent, unavoidable or accidental (see 50 CFR 216.103);
- *Serious Injury*—any injury that will likely result in mortality (50 CFR 216.3);
- *Level A harassment*—any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild (16 U.S.C. 1362(18); 50 CFR 216.3); and
- *Level B harassment*—any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (16 U.S.C. 1362(18); 50 CFR 216.3).

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 regulations and an associated LOA(s). This final rule establishes permissible methods of taking and mitigation, monitoring, and reporting requirements for Revolution Wind's construction activities.

Summary of Major Provisions Within the Final Rule

The major provisions of this final rule are:

- The authorized take of marine mammals by Level A harassment and/or Level B harassment;
- No authorized take of marine mammals by mortality or serious injury;
- The establishment of a seasonal moratorium on impact pile driving of foundation piles during the months of

the highest presence of North Atlantic right whales (*Eubalaena glacialis*) in the Lease Area (December 1–April 30, annually), unless prior approval from NMFS for pile driving in December;

- A requirement for unexploded ordnance or munitions and explosives of concern (UXO/MEC) detonations to only occur during hours of daylight and not during hours of darkness;
- A requirement for both visual and passive acoustic monitoring (PAM) to occur by trained, NOAA Fisheries-approved Protected Species Observers (PSOs) and PAM operators (where required) before, during, and after select activities;
- A requirement for training for all Revolution Wind personnel to ensure marine mammal protocols and procedures are understood;
- The establishment of clearance and shutdown zones for all in-water construction activities to prevent or reduce the risk of Level A harassment and to minimize the risk of Level B harassment;
- A requirement to use sound attenuation device(s) during all foundation impact pile driving installation activities and UXO/MEC detonations to reduce noise levels to those modeled assuming 10 decibels (dB);
- A delay to the start of foundation installation and UXO/MEC detonations if a North Atlantic right whale is observed at any distance by PSOs or acoustically detected within certain distances;
- A delay to the start of foundation installation and UXO/MEC detonations if other marine mammals are observed entering or within their respective clearance zones;
- A requirement to shut down impact pile driving (if feasible) if a North Atlantic right whale is observed or if any other marine mammals are observed entering their respective shut down zones;
- A requirement to implement sound field verification during impact pile driving of foundation piles and during UXO/MEC detonations to measure *in situ* noise levels for comparison against the modeled results;
- A requirement to implement soft-starts during impact pile driving using the least amount of hammer energy necessary for installation;
- A requirement to implement ramp-up during the use of high-resolution geophysical (HRG) marine site characterization survey equipment;
- A requirement for PSOs to continue to monitor for 30 minutes after any impact pile driving for foundation installation and after any UXO/MEC detonations;
- A requirement for the increased awareness of North Atlantic right whale presence through monitoring of the appropriate networks and Channel 16, as well as reporting any sightings to the sighting network;
- A requirement to implement various vessel strike avoidance measures;
- A requirement to implement measures during fisheries monitoring surveys, such as removing gear from the water if marine mammals are considered at-risk or are interacting with gear; and
- A requirement for frequently 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.

NMFS must withdraw or suspend an LOA issued under these regulations, after notice and opportunity for public comment, if it finds the methods of taking or the mitigation, monitoring, or reporting measures are not being substantially complied with (16 U.S.C. 1371(a)(5)(B); 50 CFR 216.206(e)). Additionally, failure to comply with the requirements of the LOA may result in civil monetary penalties and knowing violations may result in criminal penalties (16 U.S.C. 1375; 50 CFR 216.106(g)).

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)).

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

Summary of Request

On October 8, 2021, Revolution Wind submitted a request for the promulgation of regulations and issuance of an associated LOA to take marine mammals incidental to construction activities associated with the Project in the Project Area. The request was for the incidental, but not intentional, taking of a small number of 16 marine mammal species (comprising 16 stocks) by Level B harassment (all 16 stocks) and by Level A harassment (10 species or stocks). Revolution Wind did not request and NMFS neither expects nor authorizes incidental take by serious injury or mortality.

In response to our questions and comments, and following extensive information exchange between Revolution Wind and NMFS, Revolution Wind submitted a final version of the revised application on February 23, 2022. NMFS deemed it adequate and complete on February 28, 2022. This final application is available on NMFS' website at: *https://www.fisheries.noaa.gov/action/incidental-take-authorization-revolution-wind-llc-construction-revolution-wind-energy*.

On March 21, 2022, NMFS published a notice of receipt (NOR) of Revolution Wind's adequate and complete application in the **Federal Register** (87 FR 15942), requesting public comments and information on Revolution Wind's request during a 30-day public comment period. During the NOR public comment period, NMFS received comment letters from two environmental non-governmental organizations: Oceana and the Rhode Island Saltwater Anglers Association (RISSA).

On December 23, 2022, NMFS published the proposed rule for the Revolution Wind Project in the **Federal Register** (87 FR 79072). In the proposed rule, NMFS synthesized all of the information provided by Revolution Wind, all best available scientific information and literature relevant to the proposed project, outlined, in detail, proposed mitigation designed to effect the least practicable adverse impacts on marine mammal species and stocks as well as proposed monitoring and reporting measures, and made preliminary negligible impact and small numbers determinations. The public comment period on the proposed rule was open for 45-days on *https://www.regulations.gov* starting on December 23, 2022 and closed after February 6, 2023. Specific details on the public comments received during this 45-day period are described in the Comments and Responses section.

NMFS has previously issued four Incidental Harassment Authorizations (IHAs) to Orsted, Revolution Wind's

parent company, for high resolution geophysical marine site characterization surveys of Revolution Wind's BOEM Lease Area OCS–A 0486, two other BOEM lease areas (OCS–A 0487, OCS–A 0500), and along potential export cable routes (see 84 FR 52464, October 2, 2019; 85 FR 63508, October 8, 2020; 87 FR 13975, March 11, 2022; and 87 FR 61575, October 12, 2022). To date, Orsted has complied with all IHA requirements (*e.g.,* mitigation, monitoring, and reporting) of the previous IHAs and information regarding their monitoring results may be found in the Estimated Take section. These monitoring reports can be found on NMFS' website: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-other-energy-activities-renewable*.

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

Description of the Specified Activities

Overview

Revolution Wind plans to construct and operate the Project, a 704 megawatt (MW) offshore wind farm in the Project Area. The Project will allow the states of Rhode Island and Connecticut to meet their renewable energy goals. The Project, which includes the Revolution Wind Farm (RWF) and Revolution Wind Export Cable corridor (RWEC), will consist of several different types of permanent offshore infrastructure, including wind turbine generators (WTGs; *e.g.,* Siemens Gamesa 11 megawatt (MW)) and associated foundations, offshore substations (OSS), offshore substation array cables, offshore export cables, and substation interconnector cables. Overall, Revolution Wind will conduct the following specified activities: install 79 WTGs and 2 OSS on monopile foundations via impact pile driving; install and subsequently remove cofferdams to assist in the installation of the export cable route by vibratory pile driving, or installation of a casing pipe by pneumatic hammering and goal posts by vibratory pile driving; several types of fishery and ecological monitoring surveys; placement of scour protection; trenching, laying, and burial activities associated with the installation of the export cable route from OSSs to shore-based converter stations and inter-array cables between turbines; HRG vessel-based site characterization surveys using active acoustic sources with frequencies of less than 180 kilohertz (kHz); the detonation of up to 13 UXOs/MECs of different charge weights, as necessary; transit within the Project Area and between ports and the Lease Area to transport crew, supplies, and materials to support pile installation via vessels, and WTG operation. All offshore cables will connect to onshore export cables, substations, and grid connections, which will be located at Quonset Point in North Kingstown, Rhode Island. Marine mammals exposed to elevated noise levels during impact and vibratory pile driving, detonations of UXOs/MECs, and/or site characterization surveys may be taken by Level A harassment and/or Level B harassment, depending on the specified activity. A detailed description of the Project is provided in the published notice of the proposed rule (87 FR 79072, December 23, 2022).

Dates and Duration

Revolution Wind anticipates its specified activities will occur throughout all 5 years of the regulations, beginning on November 20, 2023 and continuing through November 19, 2028. Revolution Wind anticipates the following construction schedule over the 5 year period (Table 1). Revolution Wind has noted that these are the best and conservative estimates for activity durations but that the schedule may shift due to weather, mechanical, or other related delays. Additional information on dates and activity-specific durations can be found in the proposed rule and are not repeated here.

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Table 1 -- Revolution Wind's Construction and Operations Schedule[1, 2]

Project Phase	Project Phase Component	Expected Duration and Timing
RWF Construction	WTG foundation installation	~ 5 months Q2 - Q3 2024
	OSS foundation installation	~ 2 – 3 days Q2 2024
	Array cable installation	~ 8 months Q1 - Q4 2024
	HRG surveys	Any time of year
	UXO/MEC detonation	~ up to 7 days
RWEC Construction	Cable landfall installation (temporary cofferdam, or casing pipe and goal post installation and removal)	~ up to 4 months Q4 2023 - Q1 2024
	Offshore export cable installation	~ 5 months Q4 2023 – Q4 2024
	HRG surveys	Any time of year
	UXO/MEC detonation	~ up to 6 days
Operations	HRG surveys	Any time of year Q4 2024 – Q3 2028

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.

1 - Project components in italics are not expected to result in take.

2 - We acknowledge that the schedule may need to shift, given unforeseeable circumstances (e.g., inclement weather, mechanical difficulties) but the dates and durations presented here represent the most realistic schedule.

Specific Geographic Region

A detailed description of the Specific Geographic Region is provided in the proposed rule as published in the **Federal Register** (87 FR 79072, December 23, 2022). Since the proposed rule was published, no changes have been made to the Specified Geographic Region. Generally, Revolution Wind's specified activities (*i.e.,* impact pile driving of WTGs and OSS monopile foundations; vibratory pile driving (installation and removal) of temporary cofferdams, or pneumatic hammering of casing pipes and vibratory pile driving of goal posts; placement of scour protection; trenching, laying, and burial activities associated with the installation of the RWEC and inter-array cables; HRG site characterization surveys; UXO/MEC detonation; and WTG operation) are concentrated in the Project Area. Vessel transit from ports in Maryland and Virginia could also occur; therefore, vessel use could occur in the Mid-Atlantic Bight.

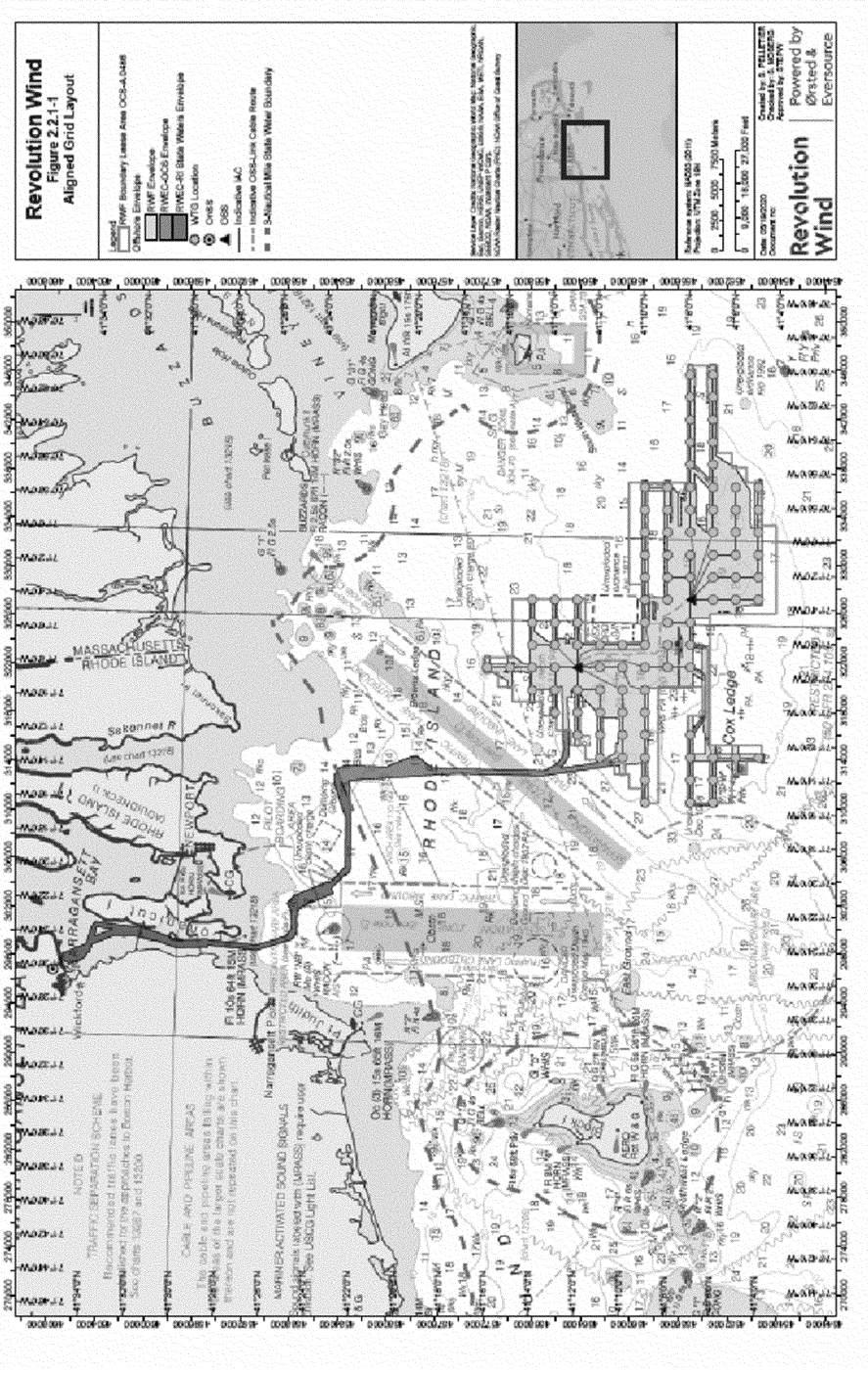

Figure 1 -- Project Area

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Comments and Responses

A notice of proposed rulemaking was published in the **Federal Register** on December 23, 2022 (87 FR 79072) and a 15-day extension to the public comment period was published on January 19, 2023 (88 FR 3375). The proposed rulemaking described, in detail, Revolution Wind's specified activities, the specific geographic region of the specified activities, the marine mammal species that may be affected by those activities, and the anticipated effects on marine mammals. In the proposed rule, we requested that interested persons submit relevant information, suggestions, and comments on Revolution Wind's request for the promulgation of regulations and issuance of an associated LOA described therein, our estimated take analyses, the preliminary determinations, and the proposed regulations. In total, the proposed rule was available for a 45-day public comment period.

NMFS received 404 comment submissions, including from the Marine Mammal Commission (Commission), several private organizations, and 396 from private citizens. Most of these comments were out-of-scope or not applicable to this specific action and location (*e.g.,* specific opposition to offshore wind development offshore of New Jersey; general opposition to or support of offshore wind projects;

concerns for other species outside NMFS' jurisdiction (*i.e.,* birds)), and are not described herein or discussed further. Four comment letters were from environmental non-governmental organizations, including one from the Responsible Offshore Development Alliance (RODA), one from Oceana, Inc. (Oceana), and two from the Natural Resources Defense Council (NRDC), of which one was a comment letter with an attachment and the other was a request to extend the comment period an additional 15 days (hence, the extension published in the **Federal Register** on January 19, 2023 (88 FR 3375)). We also received one comment letter from a public organization, the Conservation Law Foundation (CLF). These six letters (excluding the NRDC request for a 15-day comment period extension on the proposed regulations) contained substantive information that NMFS considered in its estimated take analysis, final determinations, and final regulations. In addition, we received comment letters from Salty Enterprises, the Washington Dungeness Crab Association, and a group of Rhode Island fishermen. The comments are described below, along with NMFS' responses.

All substantive comments and letters are available on NMFS' website: *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.* Please review the corresponding public comment link for full details regarding the comments and letters.

Comment 1: The Commission recommended that, until JASCO Applied Sciences' (hereafter, ''JASCO'') model has been validated with in-situ measurements from the impact installation of monopiles and pin piles in the northwest Atlantic, NMFS should require Revolution Wind and thus JASCO to re-estimate the various Level A harassment and Level B harassment zones for the final rule using source levels that are at a minimum 3 dB greater than those currently used.

Response: The Commission has expressed concerns about the lack of validation of JASCO's models in previous Commission letters for Orsted's other wind projects. JASCO has compared their source model predictions to an empirical model prediction by the Institute of Technical and Applied Physics (ITAP). The empirical model is based on a large data set of pile driving sounds measured at 750 meters (m) from the source collected during installation of large-diameter piles (up to 8 m) during wind farm installation in the North Sea (Bellmann, 2020). As no noise measurements exist for tapered 8/11-m monopile at this time (yet to be installed offshore), the ITAP prediction facilitates a way of validating the source levels of the numerical finite difference (FD) model. The ITAP data are averaged across different scenarios—pile sizes are grouped, which includes different hammers, water depths, depths of penetration, and environmental conditions—and the 95th percentile level is reported, whereas the aim of JASCO's modeling is to estimate the median value. While the ITAP forecast and the FD source predictions were comparable (see Appendix I of the Revolution Wind Underwater Acoustic and Exposure Modeling report (Küsel *et al.,* 2022)), there is variance in the underlying ITAP data and there are parametric choices for the FD model in the different environments, so an exact match is not expected. As part of the comparison, it was found that different (but reasonable) parametric input choices in the FD modeling can result in output differences on the order of the variance in the ITAP data so it was concluded that the FD modeling approach performed as well as can be discernible given the available data. While adding 3 dB to the JASCO predictions at 750 m may bring JASCO's source predictions into line with the finite-element (FE) predictions for the portmanteau combining computation, comparison, and pile (COMPILE) scenario but it is not clear that this would be more accurate. This approach assumes that the FE models are correct but Lippert *et al.* (2016) also state ''a drawback of (the FE) approach is that it simulates the energy loss due to friction in an indirect and rather nonphysical way.'' The Commission also suggested that NMFS could have used damped cylindrical spreading model (DCSM; Lippert *et al.,* 2018) and the source levels provided by the time-domain finite difference pile-driving source model (TDFD PDSM); however, for reasons described herein, NMFS has determined JASCO's model results are reliable and achievable.

Recent measurements taken during the Coastal Virginia Offshore Wind (CVOW) Pilot Project reported the range to the marine mammal Level B threshold (160 dB re 1 microPascal (1μPa)) from the 7.8-m pile installed with a double big bubble curtain to be 3,891 m (12,765.75 feet (ft)) when using a hammer operating at a maximum of 550 kilojoules (kJ) (WaterProof, 2020). JASCO's model prediction for 7/12-m tapered piles using a 4,000 kJ hammer is 3,833 m (12,575 ft). The Commission states that, based on the CVOW reported sound levels, it is unrealistic that an impact hammer with seven times more energy intensity would result in a smaller harassment zone. NMFS disagrees. The 3,891-m distance to the Level B harassment threshold measured during the CVOW Pilot Project cited by the Commission was obtained based on the maximum measured sound pressure level (RMS SPL), which is not an ideal statistic to base estimates of Level B harassment isopleths, as it is not representative of average operating conditions and represents one hammer strike. Further, small differences in the propagation environment could account for the ranges being more comparable than expected. Importantly, as described below, NMFS is also now in receipt of measurements from the South Fork project which indicate JASCO's predicted distance to the Level B harassment threshold is realistic and attainable. Based on the expected variance between the Revolution Wind and CVOW projects and measurement data from South Fork (see below), it cannot be concluded that the CVOW measured results (using the maximum RMS SPL reported) indicate that JASCO's 4,684 m modeled distance to Level B harassment threshold should be increased.

Importantly, since the proposed rule phase, NMFS has received interim sound field verification reports from the South Fork Wind project, which used JASCO's modeling. In all but one case, and out of six tapered piles (8/10-m or 7/9.5-m) installed, the measured distances to NMFS' Level B harassment threshold were lower than JASCO's model predicted. The distance to NMFS Level B harassment threshold for the South Fork project was modeled as 4,684 m while *in-situ* measurements identified distances, excluding the one aforementioned pile, ranging from 1.84 kilometers (km) to 3.25 km. JASCO's modeling predicts the distances to the Level B harassment threshold during installation of Revolution Wind monopiles will be approximately 3.8 km in summer, which is slightly greater than the loudest pile installed during the South Fork Wind results. We note that South Fork Wind determined that the one pile generating noise levels above those predicted (the first pile) did so due to a malfunctioning noise attenuation system which was quickly rectified and deployed appropriately on all future piles. Further, in this final rule, we are requiring Revolution Wind's measured sound levels do not exceed those modeled, assuming 10 dB, for at least three consecutively measured monopiles. Based on all these

reasons, NMFS is not requiring Revolution Wind to remodel the harassment zone sizes by adding 3 dB to the source levels and is, instead, carrying forward the modeling results as presented in the proposed rule.

Of note, NMFS has also received interim sound field reports from Vineyard Wind. However, comparisons between the modeled and measured results are not as directly applicable as the South Fork Wind results due to assumptions in the model and operations Therefore, the Vineyard Wind data are less useful in judging predicted alignment between modeled and measured zones for the Revolution Wind project.

Based on this discussion and given our consideration of the best available scientific information, including available interim sound field verification (SFV) reports from other offshore wind construction projects in the United States, we disagree with the suggestions made by the Commission. NMFS has incorporated the best available scientific information into this final rule, using recent measurements as well as estimates obtained through JASCO's modeling.

Comment 2: The Commission suggested that JASCO should consider revising its exposure modeling to include single-day simulations for stationary, discrete sound sources and numerous Monte Carlo simulations (*e.g.,* at least 30) for modeling reports for future rules.

Response: JASCO typically uses 7-day simulations to get a representative sample of the installation process (*e.g.,* impact piling every day or every other day). From those 7-day simulations, several 24-hour windows within the 7-day simulations are used to find the average exposure expected in a 24-hour period that includes impact pile driving. The average 24-hour estimates are then scaled by the number of days of impact pile driving. The use of the 7-day simulation allows for a robust probability calculation. The Commission recommends that, instead, JASCO run 30 single-day simulations to generate an average daily exposure. While NMFS makes recommendations, as appropriate, regarding the inputs, assumptions, and methods used by applicants to model and estimate marine mammal take, there is no one single correct overall methodology. The Commission does not provide any information to support an assertion that the method used by JASCO is not appropriate or sufficient, and NMFS supports the use of this methodology.

Furthermore, it is unclear what the Commission means by ''stationary, discrete sound sources.'' If the sources referred to are monopiles, then JASCO's modeling approach does use a Monte Carlo approach for sampling the expected sound fields. With the typical modeling density of 0.5 animats/km^2, there are usually tens of thousands of animats meaning there are tens of thousands of Monte Carlo samples. If the suggestion is to run the simulations (with tens of thousands of animats) 30 times, that is equivalent to increasing the modeling density by 30. Previous work, such as the work done by Houser (2006), has indicated that such high modeling densities are not necessary. Please refer to NMFS' related response to Comment 1.

Comment 3: The Commission recommended that NMFS authorize Level A harassment (permanent threshold shift (PTS)) takes for fin whales, humpback whales, minke whales, common dolphins, bottlenose dolphins, and Atlantic white-sided dolphins during UXO/MEC detonations and increase to group size, if needed, in the final rule.

Response: NMFS concurs with the Commission's general recommendation and notes that the Commission did not provide specific Level A harassment (PTS) take numbers NMFS should authorize in the final rule. As described in the proposed rule, take by Level A harassment is considered less likely given the required shutdown zones and the instantaneous duration of the detonation, however, NMFS acknowledges the large mitigation and monitoring zone size (particularly for heavier charge weight UXOs/MECs) required for this activity, the cryptic nature of some marine mammal species (*e.g.,* minke whales, dolphin *spp.*), and that the authorized take numbers do not fully account for the effectiveness of the required mitigation measures other than the 10 dB noise attenuation incorporated in acoustic and exposure modeling. Therefore, NMFS is conservatively authorizing the number of model-estimated takes by Level A harassment (PTS) (increased to group size when the modeled exposures were less than a single group size) incidental to UXO/MEC detonations that were included in the exposure estimate table (Table 23) in the proposed rule: 2 fin whales (modeled exposures = 1.2), 2 humpback whales (modeled exposure = 0.9), 8 minke whales (modeled exposures = 7.7), 35 common dolphins (modeled exposure = 0.4), 8 bottlenose dolphins (Western North Atlantic offshore stock) (modeled exposure = 0.1), and 28 Atlantic white-sided dolphins (modeled exposure = 0.1). Consistent with this rationale, NMFS is also authorizing Level A harassment (PTS) of two sei whales (modeled exposure = 0.5) based on the result of exposure modeling rounded to group size.

Comment 4: The Commission recommended that NMFS revise its take estimates for impact installation of monopiles based on the possibility that only a single monopile is installed per day over 79 days rather than three per day over 26 days.

Response: The Commission asserted that JASCO should have conducted single-day simulations adjusted by the respective density and multiplied by the number of days of each activity (29 days of the highest mean density month). Further, as addressed in Comment 2, the Commission suggested that single-day simulations run 30 or 50 times per activity, species, and season are more consistent with other entities' methods for conducting exposure modeling and would reduce the variance and standard error in the predictions as compared to single seven-day simulations. Regarding density seeding, the Commission did not provide a justification for the claim that JASCO's assumptions used to seed its exposure modeling were inappropriate. Additionally, the Commission did not provide references for the other ''entities'' that have conducted exposure modeling using single-day simulations, so we are unable to make direct comparisons. We can, however, further explain and address the use of seven-day simulations. JASCO ran JASCO's Animal Simulation Model Including Noise Exposure (JASMINE) simulations for seven days, assuming piling every day. Separate simulations were run for each scenario (*e.g.,* pile diameter/number of piles per day/season combination). The average number of exposures for a 24-hour window for the scenario in question was then multiplied by the number of days planned for that scenario. For example, if the scenario includes installation of three 7/15-m WTG monopiles per day in the summer, JASCO ran the simulation for 7 days, resetting exposures each day. If the daily counts were 20, 19, 21, 20, 19, 22, and 20 the average number of exposures per day would be 20.14. If Revolution Wind plans to install that particular configuration for 5 days, the exposure estimate would be $20.14 \times 5 = 100.71$.

JASCO conducted 7-day simulations because there is some variation in the exposure estimates due to the statistical nature of the exposure model and the approach captures installation conditions in multiple possible pile locations across the wind farm area. Modeling every pile location in the area

is not practicable due to computational limitations. For sequential piling simulations, where more than one pile is installed per day, the sound fields may overlap but are temporally separated. Whether or not a particular animat is exposed to sound from installation of one or the other, both, or all piles is dependent on the spacing of the locations and the swimming behaviors of the animats. JASCO modeled all other scenarios (*e.g.,* one pile per day, 7/12-m monopile, summer) completely separately and multiplied the resulting average number of exposures per day for a given scenario by the number of days Revolution Wind plans to conduct the scenario.

The Commission cited an assumption in the take estimate methodology for installation of monopiles that could push the take estimate in the direction of less than the maximum expected takes. However, there are multiple other assumptions in the take estimate methodology that consider conditions that would result in the maximum possible takes or even an overestimate of possible takes. When all of these assumptions are considered together, NMFS expects the take estimation model and methodology to produce the maximum take that could occur incidental to the specified activity.

While Revolution Wind acknowledged that it may not install three piles every day, it indicated it is capable of installing up to three piles per day with the goal is to complete installation as quickly as possible. Hence, to assume only one monopile per day everyday (as recommended by the Commission) would not be consistent with what Revolution Wind, a company with offshore wind farm installation experience, indicated is possible or is planned.

The exposure estimates contained within the proposed rule are a product of modeling that assumes three piles are driven per day. This assumption is most influential when estimating the number of Level B harassment exposures but provides minimal influence over the number of Level A harassment exposures modeled. There are several conservative assumptions that offset the potential to underestimate take should Revolution Wind not be able to install three piles per day every day, including, but not limited to, all piles are installed during 29 days of the highest density month for each species from May–December. This is conservative because pile driving every day within a given month is not possible due to historical weather patterns and potential technical issues that may be encountered and the highest density of every species does not occur in the same month. It is more likely that pile driving will occur over several months in which marine mammal species' densities are lower. For example, for North Atlantic right whales, December is the highest density month (from May–December); this maximum density value was thus conservatively incorporated in take estimation even though NMFS added a requirement in the final rule that Revolution Wind must not plan to impact pile drive monopiles during December, unless NMFS gives approval due to unforeseen circumstances. Further, for some species, group size or PSO data adjustments were made that increased the amount of take authorized compared to the modeled exposure estimates. In addition, the modeled exposure estimates on which the amount of take authorized is based for some species (versus group size or PSO data adjustments) do not consider natural avoidance of marine mammals to noise levels that could elicit PTS, or the use of mitigation such as shutdown or clearance zones, which are designed to effect the least practicable adverse impact on marine mammals, including North Atlantic right whales (*e.g.,* pile driving may not commence and must shut down if a North Atlantic right whale is observed at any distance).

NMFS has retained the exposure estimate methodology from the proposed rule despite the potential for less pile driving per day (equating to more days of pile driving) for the reasons provided above. In some cases, as described in this final rule, we have increased the amount of take authorized from that proposed for some species (*e.g.,* increased Level A harassment for marine mammals with modeled Level A harassment exposures) (see Comments 3, 5, and 6). Furthermore, as described above, there are numerous other conservative assumptions in the model such that, when considered together, support NMFS assessment that the number of take authorized represents the number of take expected to occur incidental to the impact installation of monopiles.

For these reasons, NMFS disagrees with the Commission's assessment that the number of take is underestimated for monopile installation and has not adjusted take based on the possibility that only a single monopile is installed per day.

Comment 5: The Commission recommended that NMFS should authorize the model-estimated Level A harassment takes of fin whales, minke whales, sei whales, harbor porpoises, gray seals, and harbor seals during impact installation of monopiles.

Response: NMFS agrees with the Commission that some Level A take of the species referenced may occur; however, NMFS disagrees that the full number of modeled Level A exposures should equate to the number of take authorized for all species. The exposure modeling resulted in the following estimated number of Level A harassment (PTS) exposures incidental to impact installation of monopiles: 7 humpback whales, 7 fin whales, 3 sei whales, 61 minke whales, 321 harbor porpoises, 5 gray seals, and 32 harbor seals. Revolution Wind requested and NMFS proposed to authorize in the proposed rule 7 Level A harassment (PTS) takes of humpback whales because the size of the large whale shutdown zone (summer 2.3 km; winter 4.4 km) is smaller than the distance to the PTS Level A harassment isopleth (summer 2.66 km; winter 6.29 km) for this species. NMFS did not propose Level A harassment of other marine mammals because Revolution Wind did not request it and in consideration of mitigation measures, such as a prescribed shutdown zone that is larger than the 95 percent exposure range ($ER_{95\%}$) Level A harassment (PTS) zone for all species except, as noted, humpback whales. While NMFS carried this analysis forward in the proposed rule, in making the final decision to authorize Level A harassment of the additional species indicated above, NMFS considered the impracticality of implementing shutdown measures under certain pile installation circumstances (*i.e.,* pile instability or pile refusal) for safety concerns, and the cryptic nature of minke whales, harbor porpoises, gray seals, and harbor seals (particularly in higher sea states or reduced visibility conditions). Although the combination of visual and acoustic monitoring is designed to reliably detect marine mammals such that effective mitigation can be implemented, NMFS acknowledges PTS may not be entirely avoidable.

Density-based exposure modeling results indicate there is potential for 7 fin whale, 3 sei whale, 61 minke whale, 321 harbor porpoise, 32 harbor seal, and 5 gray seal PTS exposures. These numbers represent the potential for PTS absent consideration of any mitigation or natural aversion that would prevent them from approaching at the closer distances associated with PTS and are based on the assumption that all piles would be driven in the highest density month (May through December) for any given species. Hence, based on modeling assumptions alone, these values can be considered a conservative.

As described above, in the proposed rule, based on Revolution Wind's request, we considered the potential for shutdown measures to alleviate potential for PTS except for humpback whales. In consideration of the Commission's comment, we re-evaluated the potential for marine mammals of the aforementioned species to remain undetected and remain close enough and for long enough duration to accumulate energy levels necessary to elicit PTS. NMFS has determined that where PTS density-based exposure estimates are very low (*i.e.,* three sei whales, five gray seals), exposures could occur. However, where exposure estimates are higher, it would be overly conservative to assume that all exposures would occur given the required mitigation and monitoring measures, natural avoidance responses, and that piles will be installed during lower density months. Therefore, NMFS is authorizing Level A harassment to sei and gray seals equal to the exposure estimates (three sei whale, five gray seal). However, for other species, in order to appropriately consider the likelihood of aversion in the closer vicinity of the source and the likely effectiveness of the mitigation measures, we estimate that 20 percent of the calculated exposure estimates could occur (rounded to the nearest whole number), which is equal to 2 fin whale exposures, 13 minke whale exposures, 65 harbor porpoise exposures, and 7 harbor seal exposures. This adjustment is consistent with the adjustment used in the Gulf of Mexico incidental take regulations (86 FR 5354, January 19, 2021), which was informed by the associated relative risk assessment framework developed by an expert working group to support the analyses and findings in those regulations. The risk assessment framework referenced Ellison *et al.* (2016), in which modeled scenarios using animal movement models were used to evaluate predicted PTS in which no aversion was assumed relative to scenarios where reasonable assumptions were made about aversion, in line with historical response probability assumptions and that existing scientific literature suggest are appropriate. Scenarios where no aversion probability was used overestimated the potential for high levels of exposure required for PTS by about five times. Accordingly, total modeled injurious exposures calculated without accounting for behavioral aversion were multiplied by 0.2 as part of the Expert Working Group (EWG) risk analysis for the Gulf of Mexico, and we have determined that this adjustment is similarly appropriate for this analysis.

Comment 6: The Commission recommended that NMFS include in the final rule a small number of Level A harassment takes of harbor porpoises incidental to cable landfall construction, specifically installation and removal of casing pipes.

Response: NMFS concurs with the Commission's general recommendation and notes the Commission did not recommend a number of takes by Level A harassment. NMFS has added a small number of Level A harassment takes of harbor porpoises during pneumatic hammering installation and removal of casing pipes should this landfall construction activity occur (rather than installation of a cofferdam). Since publication of the proposed rule, Revolution Wind determined that it will be impracticable to monitor a 4-km shutdown zone. Based on NOAA shipboard observations of harbor porpoises used in habitat-based density modeling conducted by Roberts *et al.* (2016, 2023), the detection probability for harbor porpoises drops off substantially in the 750–1,000 m range when sea states are a Beaufort Sea State of 2 or less. Therefore, Revolution concluded that 750 m is the maximum practicable extent within which they could effectively monitor for harbor porpoise during casing pipe installation and removal. NMFS has adjusted the shutdown zone in this final rule to 750 m. Given this new information, similar to our approach to responding to Comments 3 and 5, we reconsidered the available information on this species' habitat distribution, the distance to the Level A harassment threshold, and the potential for harbor porpoise, a small, fast moving species that can be difficult to see, to be exposed to sound energy levels necessary to induce PTS. As described in the proposed rule, modeling results estimate that a harbor porpoise would have to remain at approximately 4 km for 3 hours of hammering per day to experience PTS (or some lesser duration if the animal approaches closer). Harbor porpoises are one of the few marine mammals known to occur regularly in Narragansett Bay (*e.g.,* Kenney and Vigness-Raposa, 2010) and are most frequently observed in winter and spring during which casing pipe installation and removal would occur (Q4 2023–Q1 2024). The potential temporal and spatial overlap of harbor porpoise occurrence with the PTS Level A harassment acoustic footprint resulting from pneumatic hammering, the size of the PTS Level A harassment zone (3,950 m), and the cryptic nature of harbor porpoises (particularly at a distance) support authorization of Level A harassment. Revolution Wind expects that it will require 8 days of pneumatic hammering to install the casing pipes. Because Revolution Wind has not specified exactly which 8 days in Q4 2023–Q1 2024 casing pipe installation would occur, it is possible that they would complete this activity in December or January, when harbor porpoise densities near the landfall construction site are an order of magnitude higher than in the other months in which the species consistently utilizes habitat in/near Narragansett Bay (March–May), and the potential for acoustic impacts from pneumatic hammering is highest. Given that there are no modeled results for takes by Level A harassment, NMFS conservatively assumes that one group (group size = 2.7 rounded to 3; Kraus *et al.,* 2016) may be taken by Level A harassment per day of pneumatic hammering (n=8). Therefore, NMFS is authorizing 24 takes by Level A harassment zone of harbor porpoises incidental to casing pipe installation.

Comment 7: The Commission is concerned the number of take of common dolphin proposed to be authorized (3,913 common dolphins across all activities) is an underestimate considering the size of the Level B harassment zones, the potential number of days of activities, and the known presence of delphinids in the area, and recommended that NMFS ensure that the number of Level B harassment takes of common dolphins is sufficient for impact driving of monopiles or other activities (landfall construction, HRG surveys, and UXO/MEC detonations) and increase the total number, as necessary, for the final rule. The Commission notes that other wind-energy operators have had to revise their HRG survey incidental harassment authorization mid-authorization and in some cases, twice when the authorized number of takes had been met (*e.g.,* 86 FR 13695, March 10, 2021), thus, there is the potential for this to occur for Revolution Wind given the frequency of common dolphin occurrence in the Project Area. The Commission notes 4,644 common dolphins were observed in the lease areas during combined HRG surveys (*i.e.,* site assessment surveys) for Revolution Wind and two other wind projects from September 2019 to September 2020 (Smultea Environmental Sciences, LLC, 2020).

Response: NMFS acknowledges the importance of accurate take estimates. NMFS notes that the IHA referenced by the Commission that required multiple revisions to increase the authorized take numbers for delphinids, including

common dolphins, was associated with HRG surveys occurring off the coast of Virginia and therefore, is not representative of occurrence patterns in the Project Area. Regarding the cited monitoring results from Smultea Environmental Sciences, LLC (Smultea) (2020) from Orsted Wind Power, LLC's HRG surveys (84 FR 52464, October 2, 2019), NMFS also notes that this survey covered 103,186 km while Revolution Wind only plans to survey 29 percent of that distance (30,345 km). However, the common dolphin sighting data in the Smultea (2020) monitoring report can inform estimates of take within the Project Area, given that the area surveyed included the Revolution Wind and surrounding leases.

Importantly, the common dolphin take numbers Revolution Wind requested and NMFS proposed for authorization were based on the best scientific information available and a conservative methodology, including that the number of takes was the largest estimate among multiple take estimation methods (*i.e.,* modeled density-based exposures, PSO data-derived estimates, and published group size value) and the data used to estimate take incidental to cofferdam installation were collected outside Narragansett Bay, where common dolphin occur more frequently.

NMFS disagrees that authorization of additional take of common dolphins incidental for landfall construction activities and WTG foundation installation is warranted. While common dolphins are known to occur near the landfall construction location in Narragansett Bay, the frequency of occurrence is expected to be significantly less than that in open water; thus, the number of takes is conservative as it is based on oceanic PSO data. In addition, common dolphins are rarely sighted in Narragansett Bay in the winter months (Kenney and Vigness-Raposa, 2010) when cable landfall construction will take place. The proposed common dolphin density-based Level B harassment take estimate for impact foundation installation incorporated the maximum monthly average density, which occurs in December. However, the final rule specifies that Revolution Wind must not plan to install foundations in December and may only do so with NMFS-explicit approval. Thus the take estimate for landfall construction activities is conservative.

NMFS agrees with the Commission's recommendation to increase the number of Level B harassment take of common dolphins incidental to UXO/MEC detonation given the prevalence of the species in southern New England; however, the Commission did not provide any suggested number of takes NMFS should authorize and, as described previously, based their recommendation partially on PSO sighting data that include observations of common dolphins over a much larger spatial scale than the Project Area. While there is no new information to consider, similar to our approach to responding to Comments 3, 5 and 6, we reconsidered the available information on this species' monthly densities, which NMFS considers the best available science for this purpose, and the currently unpredictable timing of UXO/MEC detonations. Given the timing of UXO/MEC detonations is unknown, it's equally possible that detonations could occur when common dolphin densities are highest or lowest in the Project Area, although take estimation did conservatively incorporate the maximum average monthly common dolphin density from May–December in the Lease Area (November) and export cable route (September). In addition, Revolution Wind assumed six and seven detonations would occur in the export cable corridor and Lease Area, respectively. However, it is possible that more than the estimated number of UXO/MECs could be located and detonated in either area. The maximum average monthly density used to estimate take in the export cable corridor (0.0389 individuals/km^2) is approximately half of the Lease Area maximum average monthly density. (0.0762 individuals/km^2). Thus, should more than seven detonations (if required) occur in the Lease Area, the estimated Level B harassment take incidental to UXO/MEC detonation could be underestimated. Based on these factors, NMFS assumed that one group (group size = 34.9, rounded to 35) could be taken by Level B harassment incidental to approximately half (n=7) of all UXO/MEC detonations, and is, therefore, authorizing a total of 632 common dolphin Level B harassment takes due to UXO/MEC detonations; a change from the proposed rule of 211 as the corrected number of Level B harassment takes of common dolphin which Revolution Wind requested was 387 and the addition of 245 takes by Level B harassment as a result of a comment from the Commission.

Please note that Revolution Wind is required to implement the As Low as Reasonably Practicable (ALARP) process, which indicates that detonation would occur as a last resort after all other methods (*e.g.,* lift-and-shift) are exhausted.

NMFS agrees with the Commission's recommendation to increase take of common dolphins incidental to HRG surveys and is authorizing an additional number of common dolphin takes based on data in the PSO monitoring report cited in their comment, which NMFS considers to be the best available science for this purpose. The total number of common dolphins sighted by PSOs is highly variable, depending on the survey timing (which may align more or less with peaks in expected common dolphin occurrence), the number of kilometers surveyed, and survey conditions, among other factors. As described above, Revolution Wind anticipates that they may conduct HRG surveys at any time of year throughout construction and non-construction years. Given common dolphins are one of the most frequently sighted species during HRG surveys (as reported by PSOs in the monitoring reports cited here) and the number of dolphins sighted is highly variable and dependent on multiple influencing factors (*e.g.,* time of year), NMFS is conservatively authorizing 4,457 common dolphin Level B harassment takes incidental to HRG surveys during the year of construction, which is equivalent to the number of common dolphins taken by Level B harassment during the HRG surveys the Commission refers to in their comment (Smultea Environmental Sciences, LLC, 2020). This is an 89 percent increase from the 2,354 common dolphin Level B harassment takes proposed for authorization (87 FR 79072, December 23, 2022). Accordingly, NMFS is authorizing 1,094 takes per year (89 percent increase from 579 per year, as presented in the proposed rule) of common dolphins, by Level B harassment, incidental to HRG surveys for each of the 4 years following construction (4,376 total in the years following construction).

Comment 8: The Commission recommended that NMFS determine if the 2017 Department of the Navy's (2017) group size estimates are more appropriate or reflective of the expected group size estimates for the Project than those used in the proposed rule (see Borcuk *et al.,* 2017). If so, the Commission suggested the take numbers be amended in the final rule for all of Revolution Wind's activities.

Response: We appreciate the Commission's suggestion to review the 2017 Department of the Navy's (2017) group size estimates to see if they are more applicable for the Project (see Borcuk *et al.,* 2017). Based on our review, we disagree that the Navy's group size estimates are the most

applicable in this case. First, the Navy only provides group size estimates for odontocetes, which means we would still need to find applicable estimates for non-odontocete species found in the Atlantic Ocean. Second, the group sizes provided in Kraus *et al.* (2016) (used for 10 species in our analysis) are derived from data gathered specifically in the Massachusetts and Rhode Island/Massachusetts Wind Energy Areas (MA and RI/MA WEAs), where Revolution Wind's Project will occur. The group sizes in the Navy (2017) report are based on data collected more broadly across the entire East Coast of the United States and Canada, including the Gulf of Mexico, Sargasso Sea, Labrador Sea, and Labrador Basin. Furthermore, Atlantic Marine Assessment Program for Protected Species (AMAPPS) data (Palka *et al.,* 2017; which was used as a group size reference for six species in our analyses) uses more recent information, as demonstrated in the 2010–2021 annual reports found on NMFS' web page, (*https://www.fisheries.noaa.gov/new-england-mid-atlantic/population-assessments/atlantic-marine-assessment-program-protected*). The Navy (2017) group sizes are based on data from 1990 through 2013 (see Table 3–1 in the report). Lastly, based on monitoring reports received from PSOs in the field (and found on NMFS' website: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-other-energy-activities-renewable#expired-authorizations*), the group sizes observed align more with estimates found in Kraus *et al.* (2016) and AMAPPS (Palka *et al.,* 2017). For these reasons, the group sizes proposed by Revolution Wind, any adjustments using Kraus *et al.* (2016) or AMAPPS data, and any group sizes used in the proposed and final rules are based on the best available scientific information.

Comment 9: The Commission disagrees with NMFS that the potential for non-auditory injury and mortality during UXO/MEC detonations are considered *de minimis.* They stated that although non-auditory injury and mortality could be unlikely, these outcomes are not *de minimis* because these assumptions were based off Bellmann *et al.* (2020) and Bellmann (2021) and their reports of bubble curtain effectiveness, which are based on information obtained from mitigating UXO/MECs in European waters using a big bubble curtain. The Commission went further to state that these results from Bellmann are only potentially possible if the single or double bubble curtain was optimized for the environmental conditions and that these results are specific to European charges, which may not be representative of charges in the United States as charges in Europe have been degrading in the water for approximately 75 years, which compromises the integrity of the trinitrotoluene (TNT)-equivalent material. Additionally, the charge weights described in Bellmann (2021) are much smaller than those described for Revolution Wind (*i.e.,* 100 grams (g), 5 kilograms (kg), 10 kg compared to 454 kg). The Commission also adds that the shockwave from the UXO/MEC detonations may displace or disrupt the bubble curtains due to the speed the shockwave travels (*i.e.,* supersonic). Because of these reasons, the Commission recommended that NMFS re-estimate the distances to threshold and the mitigation and monitoring zones for mortality, Level A harassment, and Level B harassment based on 0 dB of sound attenuation.

The Commission also recommended that NMFS estimate and authorize Level B harassment behavior takes of marine mammals, in addition to takes from temporary threshold shift (TTS), for UXO/MEC detonations in the final rule. Finally, the Commission recommended that, because of the reasons already explained regarding attenuating UXO/MEC detonations, NMFS should require that Revolution Wind utilize a double big bubble curtain (DBBC) during all detonations and that NMFS not allow Revolution Wind to detonate UXOs/MECs when currents are moving faster than 2 knots (kn; 2.3 miles per hour (mph)).

Response: NMFS appreciates the Commission's recognition that European waters offer a different environment than the Atlantic Ocean and that the conditions and size of explosives potentially encountered in the Revolution Wind Project Area. Bellmann (2021) summarized findings from Bellmann *et al.* (2021) that showed use of a single big bubble curtain during UXO/MEC detonation reduced noise levels by 11 dB for broadband sound exposure levels and up to 18 dB for peak sound pressure (L_{pk}). While NMFS agrees with the Commission's comment that big bubble curtains (BBCs) attenuate high-frequency (HF) sound (<1 kHz) more efficiently than low-frequency (LF) sound (Bellmann *et al.,* 2020) that corresponds to most of the UXO/MEC energy, the broadband attenuation is expected to be similar, if the bubble curtain radius is large enough to avoid nearfield effects of the explosive detonations. While it is true that theoretical explosive spectra are flat at low frequencies and decay at high-frequencies, there remains significant energy at frequencies at which bubble curtains have been shown to be effective (Bellmann *et al.,* 2020). A recent study of UXO/MEC detonations in the North Sea (Robinson *et al.,* 2022) showed that measured spectra at 5.1 km had the majority of its energy between 32 and 250 Hz, in this range, the insertion loss data from Bellman (2021) has a minimum attenuation of approximately 16.8 dB in the 50-hertz (Hz) band and is greater than 20 dB for all other bands. Further, Verfuss *et al.* (2019) summarize the effectiveness of bubble curtains on UXO/MEC detonations beyond those sizes considered in Bellman *et al.* (2021) which, while variable, provide support for the 10-dB broadband assumption when bubble curtains are deployed correctly (*i.e.,* with a sufficiently large diameter to suppress the flow of displaced water). Therefore, the choice of 10 dB as a broadband attenuation for UXO/MEC detonations in our analysis is based on the best scientific information available and thus is appropriate.

In addressing the Commission's additional comments regarding mitigating pile driving and UXO/MEC detonations and the efficacy, the physical principles of inserting an impedance change between the source and farther receivers is the same whether the source is an explosive or a pile. It is important, however, that the bubble curtain be placed outside of the region where the explosive causes nonlinear changes in the medium. While we do agree that ''deployment'' and ''efficacy'' are not synonymous terms, there will be a deployed bubble curtain on each of the piles driven for the project so an understanding of bubble curtain deployment strategies, maintenance, and use will be understood by the operations team. As above, the mechanism of sound attenuation, while frequency dependent, does not change for the source as long as the bubble curtain is deployed at distance where the acoustics is linear. For UXOs/MECs, the distances to thresholds for different sized charges likely to be encountered were calculated by JASCO assuming the sources were full strength and not degraded due to time. While the Commission has also accurately stated that the bubble curtain could be displaced due to the supersonic shock wave produced by the detonation event, we acknowledge that this would require the bubble curtain to be placed in the area outside of the non-linear zone.

NMFS is requiring Revolution Wind to meet the noise levels modeled assuming 10-dB attenuation, which

must be verified by SFV and, as recommended by the Commission, is requiring Revolution Wind deploy a double big bubble curtain (DBBC) during all UXO/MEC detonations. Further, we are requiring that the bubble curtain be placed at a distance such that the nozzle hose remains undamaged. Given the best available science suggests 10-dB attenuation is achievable, the additional information provided above by JASCO, the requirement to meet the noise levels modeled assuming 10 dB, and the requirement to use a double big bubble curtain, as well as the extensive monitoring requirements associated with the clearance requirements (including aerial surveys if the clearance zone is greater than 5 km), NMFS has not adjusted any distances to thresholds or take estimates assuming no noise attenuation. At this time, NMFS is not requiring UXO/MEC detonation be limited to times when current speed is 2 kn (2.3 mph) or less but, as described above, is requiring Revolution Wind to meet the noise levels modeled. Should SFV identify that noise levels are not being met, NMFS will consider the current conditions during detonation and determine if such a measure is necessary to meet the noise levels modeled assuming 10-dB attenuation. Nonetheless, regarding the Commission's comment about use of the term ''*de minimis*'' to describe the likelihood of non-auditory injury or mortality, we concur that ''unlikely'' is a better descriptor and have changed it in this final rule where appropriate.

NMFS agrees with the Commission that there is potential for behavioral disturbance from a single detonation per day and this impact is accounted for with the Level B harassment takes authorized from UXO/MEC detonations. The current take estimation framework allows for the consideration of animals exhibiting behavioral disturbance during single explosions as they are counted as ''taken by Level B harassment'' if they are exposed above the TTS threshold, which is 5-dB higher than the explosive behavioral harassment threshold. The behavioral threshold for underwater detonations (*i.e.,* 5 dB less than the TTS thresholds for each functional hearing group) that the Commission identifies in its comment is only applicable to multiple detonations per day. We acknowledge in our analysis that individuals exposed above the TTS threshold may also be harassed by behavioral disruption and those potential impacts are considered in the negligible impact determination. NMFS is not aware of evidence to support the assertion that animals will have behavioral responses that would qualify as take to temporally and spatially isolated explosions at received levels below the TTS threshold. However, if any such responses were to occur, they would be expected to be few and to result from exposure to the somewhat higher received levels bounded by the TTS thresholds and would, thereby, be accounted for in the take estimates. The derivation of the explosive injury criteria is provided in the 2017 technical report titled ''Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III).''

In the final rule, we have clarified that (1) Revolution Wind will be limited to detonating one UXO/MEC per day, and (2) that the TTS thresholds provided in Table 5 are used to estimate the potential for Level B (behavioral) harassment. In both the proposed and this final rule, NMFS applied the TTS thresholds to determine the received level at which Level B harassment (which includes both behavioral responses and TTS) may occur. Hence, no adjustments to take estimates are necessary.

Comment 10: Citing the dire situation of North Atlantic right whales, the commenter stated that NMFS should clearly describe in the regulations or LOA for wind projects that the activities cannot result in any Level A harassment, serious injury, or mortality of North Atlantic right whales.

Response: The proposed rule clearly states that no take of North Atlantic right whales by Level A harassment, mortality, or serious injury was requested or proposed for authorization (see the Estimated Take and Negligible Impact Analysis and Determination sections in the proposed rule) and those statements are also included in this final rule. In this final rule, for example, Tables 27 and 28 show that only Level B harassment is authorized for North Atlantic right whales, and the North Atlantic right whale sub-section in the Negligible Impact Analysis and Determination section also states that no take of North Atlantic right whale by Level A harassment, mortality, or serious injury is anticipated or authorized and any take that is authorized is limited to Level B harassment only.

Mitigation

Comment 11: Commenters recommended that NMFS require Revolution Wind to implement the best commercially available combined noise attenuation system (NAS) technology to achieve the greatest level of noise reduction and attenuation possible for pile driving. One commenter recommended that NMFS require, at a minimum, a 10-dB reduction in sound exposure level (SEL), but other commenters recommended that NMFS require a minimum of 15-dB or greater reductions, citing successes described in Bellman *et al.* (2020 and 2022) and recommended ''state-of-the art'' methods using a combination of two NAS systems simultaneously. A commenter further stated that NMFS should require field measurements to be taken throughout the construction process, including on the first pile installed, to ensure compliance with noise reduction requirements. A commenter also suggested that NMFS require Revolution Wind to use HRG acoustic sources at the lowest practicable source levels needed to meet the objectives of the site characterization surveys.

Response: NMFS agrees that underwater noise levels should be reduced to the greatest degree practicable to reduce impacts on marine mammals as required by the MMPA. As described in both the proposed and final rule, NMFS has included requirements for sound attenuation methods that successfully (evidenced by required sound field verification measurements) reduce real-world noise levels produced by impact pile driving of foundation installation to, at a minimum, the levels provided by JASCO modeled assuming 10 dB reduction, as analyzed in the proposed rule. Preliminary sound measurements from South Fork Wind, another Orsted project, indicate that with multiple NAS systems, measured sound levels during impact driving foundation piles using a 4,000 kJ hammer are below those modeled assuming a 10-dB reduction and suggest, in fact, that two systems may sometimes be necessary to reach the targeted 10-dB reductions. While NMFS is requiring that Revolution Wind reduce sound levels to match the model outputs analyzed (assuming a reduction of 10 dB), we are not requiring greater reduction as it is currently unclear (based on measurements to date) whether greater reductions are consistently practicable for these activities, even if multiple NAS systems are used.

In response to the recommendation by the commenters for NMFS to confirm that a 10-dB reduction is achieved, NMFS clarifies that, because no unattenuated piles would be driven, there is no way to confirm a 10-dB reduction; rather, in-situ SFV measurements will be required to confirm that sound levels are at or

below those modeled assuming a 10-dB reduction.

Regarding the recommendation that Revolution Wind should utilize its HRG acoustic sources at the lowest practicable source level to meet the survey objective, NMFS agrees with this suggestion and has incorporated this requirement into the final rule.

Comment 12: To minimize the risk of vessel strikes for all whales, especially in recognition of the imperiled state of North Atlantic right whales, commenters recommended that NMFS require a mandatory 10-kn (11.5 mph) speed restriction for all project vessels (including PSO survey vessels) at all times, except for reasons of safety, and in all places except in limited circumstances where the best available scientific information demonstrates that whales do not occur in the area. Another commenter made the same recommendation but suggested no exceptions. Alternatively, commenters suggest that project proponents could work with NMFS to develop an ''Adaptive Plan'' that modifies vessel speed restrictions if the monitoring methods informing the Adaptive Plan are proven as effective when for vessels traveling 10 kn (11.5 mph) or less and must follow a scientific study design. One commenter suggests that if the Adaptive Plan is scientifically proven to be equally or more effective than a 10-kn speed restriction, that the Adaptive Plan could be used as an alternative to the 10-kn speed restriction. Commenters also recommend that NMFS (1) require all offshore personnel to be trained to identify North Atlantic right whales and other large whales, (2) that all vessels maintain a 500 m separation distance from North Atlantic right whale, 100 m for other large whale species while also maintaining a vigilant watch for North Atlantic right whale and other large whale species, (3) that NMFS require vessels to slow down or maneuver their vessels appropriately to avoid a potential interaction with a North Atlantic right whale and other large whale species, and (4) that NMFS require vessels to maintain a separation distance from North Atlantic right whales at all times.

Response: NMFS acknowledges that vessel strikes pose a risk to all large whales, including North Atlantic right whales. Based on the density information provided by Roberts *et al.* (2023), many large whale species are less frequently found within the Revolution Wind Project Area during the months when foundation installation, which requires the use of multiple vessels, would occur (*i.e.,* May through November and possibly December, if approved by NMFS). Furthermore, while we acknowledge that North Atlantic right whales can be found year round in the Project Area, NMFS, as described in the proposed rule and included in this final rule, is requiring Revolution Wind to reduce speeds to 10 kn (11.5 mph) or less in circumstances when North Atlantic right whales are known to be present or more likely to be in the area, which include, but are not limited to, all Slow Zones (Dynamic Management Area or acoustic Slow Zone), when traveling between ports in New Jersey, New York, Maryland, or Virginia from November 1–April 30, and if a North Atlantic right whale is detected visually or acoustically at any distance or reported within 10 km. Vessels are also required to slow and maintain separation distances if other species of large whales are observed. Additionally, aside from any requirements of this rule, Revolution Wind is required to comply with all spatial and temporal speed restrictions outlined in existing regulations. Together, these speed requirements align with the commenters' recommendations.

The required mitigation measures, all of which were included in the proposed rule and are now required in the final rule, can be found in Section 217.274(b) of the regulatory text. For the final rule, NMFS has also included a requirement that all vessels be equipped with automatic identification system (AIS) to facilitate compliance checks with the speed limit requirements. At least 180 days prior to the start of vessel operations commencing, Revolution Wind must submit both a Vessel Strike Avoidance Plan, including plans for conducting PAM in the transit corridors should Revolution Wind determine they wish to travel over 10 kn (11.5 mph) in the transit corridors, to NMFS for review and approval.

While NMFS acknowledges that vessel strikes can result in injury or mortality, we have analyzed the potential for vessel strike resulting from Revolution Wind's activity and have determined that based on the required mitigation measures specific to vessel strike avoidance included in the final rule, the potential for vessel strike is so low as to be discountable and thus, no vessel strikes are expected or authorized to occur. These measures also ensure the least practicable adverse impact on species or stocks and their habitat. Therefore, we are not requiring project-related vessels to travel 10 kn (11.5 mph) or less at all times.

Comment 13: Commenters recommended that NMFS should prohibit pile driving during periods of highest risk for North Atlantic right whales, which they defined as times of the highest relative density of animals during foraging and migration, and times where cow-calf pairs, pregnant females, surface active groups (that are foraging or socializing), or aggregations of three or more whales, are not expected to be present. Citing multiple information sources, commenters further specifically recommended the seasonal restriction for pile driving be expanded to November 1 through April 30 to reflect the period of highest detections of vocal activity, sightings, and abundance estimates of North Atlantic right whales. A commenter recommends prohibiting pile driving during seasons when protected species are known to be present or migrating in the Project Area, in addition to any dynamic restrictions due to the presence of North Atlantic right whale or other endangered species.

Response: NMFS has restricted foundation installation pile driving from January through April which represent the times of year when North Atlantic right whales are most likely to be in the Project Area. We recognize that the density of whales begins to elevate in December; however, it is not until January when density greatly increases. Revolution Wind has indicated that to complete the project, pile driving in December will be avoided as much as possible but may be required. In this final rule, NMFS has included an additional measure wherein impact pile driving must be avoided to the maximum extent practicable in December; however, with prior approval by NMFS, it may occur if necessary to complete the project. In any time of year when foundation installation is occurring, a visual or acoustic detection of a North Atlantic right whale at any distance triggers a pile driving delay or shutdown. We also reiterate that Revolution Wind is required to implement a larger minimum visibility zone in December (4.4 km (2.7 mi)) as compared to other project months (2.3 km), reflecting the results of JASCO's underwater sound propagation modeling. With the application of these enhanced mitigation and monitoring measures in December, impacts to the North Atlantic right whale will be further reduced, if any are encountered when transiting through the Project Area.

Regarding further restrictions on pile driving in the month of November, as noted in the comments and supporting information and acknowledged by NMFS in both the proposed and final rules, North Atlantic right whale distribution is shifting due to climate

change and other factors, and they are now present year round in the vicinity of the project (*e.g.,* Quintana-Rizzo *et al.,* 2021), with observations of feeding behavior and some detections of mothers with calves. However, as shown in Roberts *et al.* (2023), which is considered the best available science regarding marine mammal densities in the Atlantic Ocean, it is not until January that densities begin to significantly increase. Further, North Atlantic right whales are not likely to be engaged in extensive feeding behaviors in the Project Area, in November, relative to the extent of foraging in habitat to the east (*e.g.,* in and around Nantucket Shoals). For these reasons and given the inclusion of December in the pile driving temporal restrictions, except with NMFS prior approval, NMFS finds that further expansion of the pile driving restrictions (beyond December–April) is unwarranted.

Inasmuch as commenters may be suggesting prohibiting pile driving when any protected species are present, it would not be practicable to implement as there is no time of year when some species of marine mammals are not present. The measures prescribed in this final rule ensure the least practicable adverse impact on species or stocks and their habitat.

Comment 14: Commenters recommended that NMFS increase the size of the clearance and shutdown zones for HRG surveys, require a delay in the start and resumption of HRG surveys and pile driving if a large whale is visually or acoustically detected in the clearance and shutdown zones, require soft start for pile driving and ramp up for HRG surveys, and require PAM during HRG surveys. In addition, a commenter acknowledges the purpose of an exemption from shutdown for safety reasons for pile driving but recommends that, if this exemption occurs, Revolution Wind must immediately notify NMFS and provide justification for using the exemption. Additionally, a commenter stated that a summary of the frequency of these exceptions must be made publicly available.

Response: NMFS disagrees with the commenters' recommendation to increase HRG survey clearance and shutdown zone sizes, and the commenters' do not provide additional scientific information for NMFS to consider to support their recommendation. As described in the proposed rule and this final rule, the required 500-m shutdown zone for North Atlantic right whales exceeds the modeled distance to the largest 160-dB Level B harassment isopleth (141 m during sparker use) by a large margin, minimizing the likelihood that they will be harassed in any manner during this activity. For other Endangered Species Act (ESA)-listed species (*e.g.,* fin and sei whales), the NMFS Greater Atlantic Regional Fisheries Office (GARFO) 2021 Offshore Wind Site Assessment Survey Programmatic ESA consultation (see *https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-take-reporting-programmatics-greater-atlantic*) determined that a 100-m shutdown zone is sufficient to minimize exposure to noise that could be disturbing. Accordingly, NMFS has adopted this shutdown zone size for all baleen whale species, other than the North Atlantic right whale.

NMFS notes that the recommended requirement that any detection of a North Atlantic right whale (visually, and acoustically for pile driving) in the associated clearance zone during the clearance period would trigger a delay to the onset of HRG surveys and pile driving was included in the proposed rule and is included in this final rule. Similarly, NMFS notes that the recommended requirement that any detection of a North Atlantic right whale (visually, or acoustically in the associated ''exclusion'' zone) while pile driving is occurring would trigger a shutdown of pile driving (with the noted safety exception) was included in the proposed rule and is included in this final rule. In this final rule, NMFS has also added the requirement that shutdown of pile driving must occur if a North Atlantic right whale is visually detected at any distance or acoustically detected at any distance within the PAM monitoring zone.

Regarding the resumption of pile driving and HRG surveys following a shutdown, NMFS notes that the following requirements were included in the proposed rule and in this final rule: (1) PSOs must monitor clearance zones prior to impact pile driving or use of survey equipment starting, (2) impact pile driving and survey activities must begin only when the Lead PSO confirms that no North Atlantic right whales or other marine mammal species have been detected in the applicable clearance zones, and the PAM operator confirms no detection of North Atlantic right whales (for pile driving), and (3) soft-start to pile driving or ramp-up to HRG surveys are required.

The commenters do not provide additional scientific information for NMFS to consider to support their recommendation to require PAM during HRG surveys. NMFS disagrees that this measure is warranted because it is not expected to be effective for use in detecting the species of concern given the noise from the vessel, the flow noise, and the cable noise are in the same frequency band and will mask the vast majority of baleen whale calls. Vessels produce low-frequency noise, primarily through propeller cavitation, with main energy in the 5–300 Hz frequency range. Source levels range from about 140 to 195 dB re 1 µPa at 1 m (NRC, 2003; Hildebrand, 2009), depending on factors such as ship type, load, and speed, and ship hull and propeller design. Studies of vessel noise show that it appears to increase background noise levels in the 71–224 Hz range by 10–13 dB (Hatch *et al.,* 2012; McKenna *et al.,* 2012; Rolland *et al.,* 2012). PAM systems employ hydrophones towed in streamer cables approximately 500 m behind a vessel. Noise from water flow around the cables and from strumming of the cables themselves is also low frequency and typically masks signals in the same range. Experienced PAM operators (Thode *et al.,* 2017) emphasized that a PAM operation could easily report no acoustic encounters, depending on species present, simply because background noise levels rendered any acoustic detection impossible. The same report stated that a typical eight-element array towed 500 m behind a vessel could be expected to detect delphinids, sperm whales, and beaked whales at the required range but not baleen whales due to expected background noise levels (including seismic noise, vessel noise, and flow noise).

Further, there are several additional reasons why we do not agree that use of PAM is warranted for HRG surveys. While NMFS agrees that PAM can be an important tool for augmenting detection capabilities in certain circumstances (*e.g.,* foundation installation), its utility in further reducing impacts during HRG survey activities is limited. For this activity, the area expected to be ensonified above the Level B harassment threshold is relatively small (a maximum of 141 m); this reflects the fact that the source level is comparatively low and the intensity of any resulting impacts would be lower level and, further, it means that inasmuch as PAM will only detect a portion of any animals exposed within a zone, the overall probability of PAM detecting an animal in the harassment zone is low (particularly because of flow noise masking vocalizations). Together, these factors support the limited value of PAM for use in reducing take for activities/sources with smaller zones. Also, PAM is only capable of detecting animals that are actively vocalizing,

while many marine mammal species vocalize infrequently or during certain activities, which means that only a subset of the animals within the range of the PAM would be detected (and potentially have reduced impacts). Additionally, localization and range detection can be challenging under certain scenarios. For example, odontocetes are fast moving and often travel in large or dispersed groups which makes localization difficult.

Given that the effects to marine mammals from the types of HRG surveys authorized in this final rulemaking are expected to be limited to low level behavioral harassment even in the absence of mitigation, the limited additional benefit anticipated by adding this detection method (especially for North Atlantic right whales and other low frequency cetaceans, species for which PAM has limited efficacy during this specific activity), and the cost and impracticability of implementing a full-time PAM program, we have determined the current requirements for visual monitoring are sufficient to effect the least practicable adverse impact on the affected species or stocks and their habitat during HRG surveys.

Regarding the recommendation that Revolution Wind should be required to notify NMFS in the event that mitigation actions are not undertaken based on specific exceptions (*e.g.,* unable to shutdown pile driving for safety reasons), NMFS notes that both the proposed and final rules require weekly, monthly, and annual reports where Revolution Wind must provide reasons why mitigation actions could not occur (including for this exception). We acknowledge the importance of transparency in the reporting process and plan to make all final annual and 5-year marine mammal monitoring reports and final SFV report on our website. However, NMFS will not be making the weekly or monthly reports available to the public given the amount of total reports that would be obtained over a 5-year period.

NMFS has determined that the prescribed mitigation requirements are sufficient to effect the least practicable adverse impact on all affected species or stocks.

Comment 15: Commenters recommended that NMFS require pile-driving clearance and shutdown zones for large whales (other than North Atlantic right whale) that are large enough to avoid all take by Level A harassment and minimize Level B harassment to the most practicable extent.

Response: The commenters do not provide additional scientific information for NMFS to consider to support their recommendation to expand clearance and shutdown zones to effect the least practicable adverse impact on marine mammals, particularly large whales, excluding the North Atlantic right whale. The required shutdown and clearance zones (equally sized) for large whales (other than North Atlantic right whale) are based on the largest exposure range calculated for any mysticete, other than humpback whales, that represents the distance to the Level A harassment (isopleth for the low frequency hearing group, rounded up to the nearest hundred for PSO clarity. Required monitoring and mitigation for these zones will minimize Level A harassment and Level B harassment to the extent practicable and avoid most Level A harassment of large whales (note that for all but minke whales (n = 21), other species of large whales have 9 or fewer takes by Level A harassment across all 5 years of the rule). Further enlargement of these zones could interrupt and delay the project such that a substantially higher number of days would be needed to complete the construction activities, which would incur additional costs but, importantly, also potentially increase the number of days that marine mammals are exposed to the disturbance. Accordingly, NMFS has determined that enlargement of these zones is not warranted, and that the existing required clearance and shutdown zones support a suite of measures that will effect the least practicable adverse impact on other large whales.

Comment 16: Commenters recommended that NMFS require clearance and shutdown zones for North Atlantic right whales specifically, including (1) a minimum of 5,000 m (3.1 mi) for the visual clearance, acoustic clearance, and shutdown zones in all directions from the driven pile location; and (2) an acoustic shutdown zone that would extend at least 2,000 m (1.2 mi) in all directions from the driven pile location.

Response: The commenters do not provide additional scientific information for NMFS to consider to support their recommendation to expand clearance and shutdown zones for impact pile driving to effect the least practicable adverse impact on North Atlantic right whales. The proposed rule and this final rule require impact pile driving to be delayed or shutdown if a North Atlantic right whale is visually or acoustically detected at any distance. Given NMFS neither anticipates nor authorizes any take by Level A harassment of North Atlantic right whales, NMFS concludes that these measures will effect the least practicable adverse impact on the species. Delaying the project due to overly enlarged zone sizes would result in longer construction time frames, prolonging the time periods over which marine mammals may be exposed to construction-related stressors. Accordingly, NMFS has determined that enlargement of these zones is not warranted and that the existing required clearance and shutdown zones support a suite of measures that will effect the least practicable adverse impact on North Atlantic right whales and other affected species.

Comment 17: For all large whale species, commenters recommended that NMFS require real-time PAM during pile driving to monitor the acoustic clearance and acoustic shutdown zones, and must assume a detection range of at least 10 km. They stated that this monitoring must be undertaken from a vessel other than the pile driving vessel or from a stationary unit to avoid masking of the hydrophone from the pile driving vessel or other development-related noise.

Response: As described in the proposed rule, NMFS is requiring the use of PAM to monitor 10 km zones around the piles and that the systems be capable of detecting marine mammals during pile driving within this zone. However, NMFS acknowledges that this could be made clearer and has modified Table 29 to clearly specify this 10-km PAM monitoring zone. Revolution Wind is required to submit a PAM Plan to NMFS for approval at least 180 days prior to the planned impact pile driving start date. NMFS will not approve a Plan where hydrophones used for PAM would be deployed from the pile driving vessel as this would result in hydrophones inside the bubble curtains, which would clearly be ineffective for monitoring; therefore, there is no need to explicitly state in this rule that this would not be allowed. Further, Revolution Wind may launch PAM drones from shore; hence, NMFS is not requiring that Revolution Wind deploy any monitoring systems from a vessel.

Comment 18: Commenters recommended that NMFS should restrict pile driving at night and during periods of low visibility to protect all large whale species. This would include no pile driving being allowed to begin after 1.5 hours before civil sunset or during times where the visual clearance zone and shutdown zone (called the ''exclusion zone'' by the commenter) cannot be visually monitored, as determined by the Lead PSO.

If nighttime pile driving is to be allowed, the commenters recommended that NMFS require that pile driving be initiated no later than 1.5 hours prior to civil sunset at the latest in order to maximize monitoring capabilities during hours of optimal visibility/daylight. The commenters also recommended that impact pile driving started at least 1.5 hours prior to civil sunset during good visibility conditions can then continue after dark, as necessary providing the best available infrared technologies are used to support visual monitoring of the clearance and exclusion zones during periods of darkness.

Commenters caveat this by stating that NMFS should only allow pile driving to continue after dark if the activity began during daylight hours and must continue for human safety or due to installation feasibility (*i.e.,* instability or pile refusal) but only if required nighttime monitoring protocols are followed.

Commenters suggested that if pile driving must continue after dark due to safety reasons, Revolution Wind should be required to notify NMFS with these reasons and an explanation for exemption. Additionally, a commenter states that a summary of the frequency of these exceptions must be made publicly available to ensure that these are indeed exceptions, rather than the norm, for the project.

Response: NMFS acknowledges the limitations inherent in visual detection of marine mammals at night and that these could potentially result in some limited number of marine mammals being exposed to higher levels of sound for a longer duration before a shutdown was implemented. However, there are offsetting benefits to completing the pile driving in a shorter total amount of time, in that some number of marine mammals (those that might intersect the much larger Level B harassment zone) would be exposed to fewer overall days of pile driving noise, and potentially a smaller magnitude or severity of behavioral disturbance as a result given repeated exposures would be minimized. Further, Revolution Wind submitted a final draft Alternative Monitoring Plan (AMP) on August 4, 2023. NMFS will review the AMP to determine sufficiency in maximizing nighttime detection to support the required mitigation measures. Should NMFS approve the AMP, nighttime pile driving may occur given Revolution Wind adherence to the AMP.

NMFS disagrees with the recommendation to require Revolution Wind to notify NMFS each time that pile(s) must be finished after dark due to safety and/or stability concerns and note that the rule already requires weekly reports during foundation installation, which must contain information that would inform on how long impact pile driving occurred and if it was necessary for this activity to occur during hours of darkness (*i.e.,* information that would document the daily start and stop of all pile-driving activities). These weekly reports would be combined into monthly and annual reports. We do not plan to make the weekly or monthly reports publicly available, due to the number or reports that Revolution Wind must submit to NMFS; however, as described in Comment 39, we do plan to make the final reports available, which must summarize all of the information contained in the weekly and monthly reports. Accordingly, NMFS has determined requiring additional reporting beyond that described in the proposed rule is not warranted and that the existing reporting requirements support a suite of measures that will effect the least practicable adverse impact on marine mammals and their habitat.

Comment 19: Commenters recommended that NMFS implement diel restrictions for HRG surveys within 1.5 hours of civil sunset and in low visibility conditions when the visual clearance zone and shutdown zone (referred to as the ''exclusion zone'' by the commenter) cannot be visually monitored by the Lead PSO.

Response: NMFS acknowledges the limitations inherent in visual detection of marine mammals at night. As proposed, this final rule requires that visual PSOs use alternative technology (*i.e.,* infrared or thermal cameras) during periods of low visibility to monitor the clearance and shutdown zones. We note that no Level A harassment is expected to result from exposure to HRG equipment, even in the absence of mitigation, given the characteristics of the sources planned for use (supported by the very small estimated Level A harassment zones; *i.e.,* <36.5 m (119.8 ft) for all sources). Regarding Level B harassment, any potential impacts are limited to short-term behavioral responses. Given these factors combined with other mitigation measures, NMFS has determined that more restrictive mitigation requirements are not warranted.

Restricting surveys in the manner suggested by the commenters may reduce marine mammal exposures by some degree at night if, in fact, detectability is less at night and animals do approach within the small harassment zone but would not result in any significant reduction in either intensity or duration of noise exposure over the course of the surveys. In fact, the restrictions recommended by the commenters could result in the surveys spending increased total time (number of days) on the water introducing noise into the marine environment, which may result in greater overall impacts to marine mammals; thus, the commenters have not demonstrated that such a requirement would result in a net benefit. Furthermore, restricting the ability of the applicant to begin operations only during daylight hours, which could result in the applicant failing to collect the data they have determined is necessary within the specific timeframe and, subsequently, may necessitate the need to conduct additional surveys in the future across additional days. This would result in significantly increased costs incurred by the applicant. Thus, the restriction suggested by the commenters would not be practicable for the applicant to implement. In consideration of the likely effects of the activity on marine mammals absent mitigation, potential unintended consequences of the measures as proposed by the commenters, and practicability of the recommended measures for the applicant, NMFS has determined that restricting operations as recommended is not warranted or practicable in this case.

Comment 20: Commenters recommended that NMFS prohibit HRG surveys during times of highest risk for North Atlantic right whales (foraging and migration and times when mother-calf pairs, pregnant females, surface active groups, or aggregations of three or more whales (indicative of feeding or social behavior), using the best available science to define high-risk timeframes. Commenters stated that the Project is sited in critically important year round North Atlantic right whale foraging and socializing habitat; thus, NMFS should require corresponding year-round protections and critical mitigation measures. Commenters recommended that NMFS develop a real-time mitigation and monitoring protocol to dynamically manage the timing of HRG surveys to ensure those activities are undertaken during times of lowest risk for all relevant large whale species.

Response: NMFS neither anticipates nor authorizes take of North Atlantic right whales by Level A harassment (PTS) from this activity. While NMFS is authorizing a total 22 Level B harassment takes of North Atlantic right whales incidental to HRG surveys over the 5-year effective period of this rulemaking, the required mitigation will

affect the least practicable adverse impact on the species from this activity. Specifically, the largest modeled Level B harassment zone size for the sparker (141 m) is already much smaller than the required separation, clearance, and shutdown distances for North Atlantic right whale (500 m) and any unidentified large whale must be treated as if it were a North Atlantic right whale, triggering associated mitigation. Any Level B harassment that is not avoided is not expected to impact important feeding or other behaviors that may occur throughout the year in the Project Area in a manner that poses energetic or reproductive risks for any individuals. NMFS also notes that North Atlantic right whale presence, while not completely absent, decreases significantly during summer months as compared to winter when the majority of foundation installation would occur. Given the minimal anticipated impacts of the HRG survey, NMFS disagrees that additional mitigation measures, including dynamic management of HRG surveys timing, are warranted.

Comment 21: Commenters suggested that all acoustic and visual monitoring must begin at least 60 minutes prior to the start of or re-start of pile driving and must be conducted throughout the entire duration of the pile driving event. They also suggest that visual monitoring must continue for 30 minutes after pile driving has ceased.

Response: The recommended requirements were included in the proposed rule and are carried forward in this final rule. Also, as proposed, this final rule includes a requirement that Revolution Wind review PAM data collected for at least 24 hours immediately prior to pile driving, for situational awareness. NMFS notes that if PAM continues throughout any pauses in pile driving, Revolution Wind is not required to begin the clearance process again (*i.e.,* monitor for 60 minutes, ensuring the clearance zone is free of marine mammals for 30 minutes immediately prior to recommencing pile driving). However, pile driving would not be allowed to recommence until the clearance zones are confirmed to be visually and acoustically clear of marine mammals.

Comment 22: Commenter recommends that UXOs/MECs must first be evaluated to see if they can be moved without detonation. If detonation must occur, the commenter states that the mitigation measures for pile driving should be the same with regards to noise abatement technology, clearance zones, and the use of PSOs. If the impact area is larger than predicted after detonation, the commenter suggests that expanded mitigation measures should be implemented.

Response: As proposed, this final rule requires Revolution Wind to use the ALARP approach such that detonation would be the last resort to removing a UXO/MEC. That is, Revolution Wind is required to use detonation as a means of removing UXO/MECs only if all other options of removal have been exhausted. The following proposed mitigation measures are also required by this final rule: Revolution Wind will be required to implement visual monitoring using PSOs and PAM prior to detonation; these PSOs and PAM operators will be required to clear the appropriate zones prior to Revolution Wind detonating any UXO/MEC; SFV must be conducted on every UXO/MEC; and a double big bubble curtain must be used that is positioned far enough away from the blast such that the hose nozzles are not damaged.

Furthermore, NMFS retains the ability to modify existing mitigation measures through adaptive mitigation in the event new information becomes available and if doing so creates a reasonable likelihood of more effectively accomplishing the goal(s) of the measure.

Comment 23: Commenter asserts that the LOA must include requirements to hold all vessels associated with site characterization surveys accountable to the ITA requirements, including vessels owned by the developer, contractors, employees, and others regardless of ownership, operator, and contract. They state that exceptions and exemptions will create enforcement uncertainty and incentives to evade regulations through reclassification and redesignation. They recommend that NMFS simplify this by requiring all vessels to abide by the same requirements, regardless of size, ownership, function, contract or other specifics.

Response: NMFS agrees and notes, as described in the proposed rule and this final rule, that the regulations apply to Revolution Wind and those persons it authorizes or funds to conduct the specified activities on its behalf; a copy of the LOA must be in the possession of Revolution Wind, its designees, all vessel operators, PSOs/PAM operators; and Revolution Wind must ensure that the vessel operator and other relevant vessel personnel, including the PSO team, are briefed on all responsibilities, communication procedures, marine mammal monitoring protocols, operational procedures, and rule requirements prior to the start of survey activity, and when relevant new personnel join the survey operations.

Comment 24: A commenter raised concerns about offshore wind activities leading to increases in vessel traffic and vessel noise, which may increase the risk of North Atlantic right whales being struck by a vessel and may disrupt normal North Atlantic right whale behavior. Another commenter recommends that NMFS restrict vessels of all sizes associated with the projects to travel at 10 kn (11.5 mph) or less at all times to avoid vessel strikes to North Atlantic right whales. Other commenters recommend that NMFS require management measures of all boats that reduces the risk of lethal vessel strikes to a level approaching zero. They suggest implementing a mandatory 10 kn (11.5 mph) speed restriction for all project-associated vessels at all times, except in limited circumstances where the best available scientific information demonstrates that whales do not use an area. In addition, a commenter claims that vessel speed restrictions are not 'fully mandated' or enforced for offshore wind vessels.

Response: While NMFS acknowledges that vessel strikes can result in injury or mortality, we have analyzed the potential for vessel strike resulting from Revolution Wind's activities and have determined that based on the nature of the activity and the required mitigation measures specific to vessel strike avoidance included in the rulemaking, the potential for vessel strike is so low as to be discountable. All of the mitigation measures that were included in the proposed rulemaking are now required in the final regulations (see § 217.274(b)). Based on our analysis, we have determined that the vessel strike avoidance measures in the rulemaking are sufficient to ensure the least practicable adverse impact on species or stocks and their habitat.

Furthermore, we contend that the commenter who raised concerns about offshore wind activities leading to increases in vessel traffic and vessel noise is conflating two different points: there is a difference between vessel strike risks and impacts to marine mammals due to noise from construction. NMFS acknowledges the aggregate impacts of Revolution Wind's vessel operations on the acoustic habitat of marine mammals and has considered it in the analysis (see responses to Comments 14 and 42). Another commenter's reference to vessel speed restrictions being ''not fully mandated'' is unclear. NMFS refers again to the required vessel strike avoidance measures described above. The commenter does not provide a rationale for its suggestion that vessel speed restrictions are not enforced for offshore

wind vessels. We note that all vessels associated with Revolution Wind's activities must be equipped with a properly installed, operational Automatic Identification System (AIS) device and Revolution Wind must report all Maritime Mobile Service Identify (MMSI) numbers to NMFS Office of Protected Resources, thus facilitating monitoring of vessel speeds. In addition, NMFS maintains an Enforcement Hotline for members of the public to report violations of vessel speed restrictions. Further, the LOA states that the authorization may be modified, suspended, or revoked if the holder fails to abide by the conditions prescribed therein.

Comment 25: A commenter states that the LOA must include conditions for the survey and construction activities that will first avoid adverse effects on North Atlantic right whales in and around the area and then minimize and mitigate the effects that cannot be avoided. This should include a full assessment of which activities, technologies and strategies are truly necessary to achieve site characterization and construction to inform development of the offshore wind projects and which are not critical, asserting that NMFS should prescribe the most appropriate techniques that would produce the lowest impact while achieving the same goals while prohibiting those other tools/techniques that would cause more frequent, intense, or long-lasting effects.

Response: The MMPA requires that we include measures that will effect the least practicable adverse impact on the affected species and stocks and, in practice, NMFS agrees that the rule should include conditions for the construction activities that will first avoid adverse effects on North Atlantic right whales in and around the Project Area, where practicable and then minimize the effects that cannot be avoided. NMFS has determined that this final rule meets this requirement to effect the least practicable adverse impact. The commenter does not make any specific recommendations of measures to add to the rulemaking. NMFS is required to authorize the requested incidental take if it finds such incidental take of small numbers of marine mammals by the requestor while engaging in the specified activities within the specified geographic region will have a negligible impact on such species or stock and where appropriate, will not have an unmitigable adverse impact on the availability of such species or stock for subsistence uses. As described in this notice of final rulemaking, NMFS finds that small numbers of marine mammals may be taken relative to the population size of the affected species or stocks and that the incidental take of marine mammal from all of Revolution Wind's specified activities combined will have a negligible impact on all affected marine mammal species or stocks. It is not within NMFS' authority to determine the requestor's specified activities.

Comment 26: A commenter recommended that the use of quieter foundations be given full consideration when selecting a ''preferred alternative'' and that direct drive turbines be used in lieu of gear boxes.

Response: The commenter's reference to a ''preferred alternative'' suggests this comment is specific to the Environmental Impact Statement (EIS) BOEM developed for the project. NMFS agrees with the commenter that full consideration of various turbine foundations should be evaluated in an EIS but also recognizes that there are technological challenges and that the ultimate foundation type chosen must be practicable. Regardless, this rule evaluates the specified activities as described in Revolution Wind's MMPA application, which includes installation of monopiles. With respect to direct-drive, NMFS agrees that the best available science indicates that these are known to be less noisy than gearboxes and we understand gearboxes are older technology. Revolution Wind has confirmed with NMFS that direct drive turbines will be used for the Revolution Wind project.

Monitoring, Reporting, and Adaptive Management

Comment 27: Commenters recommended that NMFS increase the frequency of information review for adaptive management to at least once a quarter and also have a mechanism in place to undertake review and adaptive management on an ad hoc basis if a serious issue is identified (*e.g.,* if unauthorized levels of Level A take of marine mammals are reported, or if serious injury or mortality of an animal occurs).

Response: Regarding the recommendation that NMFS have a mechanism in place to undertake review and adaptive management on an ad hoc basis if a serious issue is identified, there are no timing restrictions in the adaptive management provisions and, therefore, NMFS may undertake review and adaptive management actions at any time under the regulations, as written. Regarding the recommendation to increase the frequency of information review, Revolution Wind is required to submit weekly, monthly, and annual reports that NMFS will review in a timely manner and may act on pursuant to the adaptive management provisions at any time and, therefore, a separate specific quarterly review is unnecessary.

Comment 28: Commenters recommended that NMFS require robust monitoring protocols during pre-clearance and when HRG surveys are underway, including (1) passive acoustic monitoring from a nearby vessel (other than the survey vessel) or a stationary unit to avoid masking, (2) visual monitoring of the clearance zone for North Atlantic right whales and other large whales by two on-duty PSOs each scanning 180 degrees and with another two PSOs stationed on the vessel (for a total of four PSOs on the survey vessel), and (3) visual and acoustic monitoring beginning 30 minutes prior to commencement or re-initiation of survey activities through the duration of the survey.

Response: Regarding the recommendation to require acoustic monitoring (in any form) to support clearance and shutdown requirements for HRG surveys, please see NMFS response to Comment 14, which describes why PAM is not warranted for HRG surveys. With respect to the number of PSOs, NMFS is not requiring four on-duty PSOs given the very small harassment zone sizes associated with HRG surveys. In the proposed rule and in this final rule, PSOs are required to commence monitoring for marine mammals 30 minutes before HRG surveys begin; hence, this recommendation has already been satisfied.

Comment 29: Commenters recommended that NMFS require infrared technology to support visual monitoring for all vessels responsible for crew transport and during any pile driving activities that occur in periods of darkness or nighttime to supplement the visual monitoring efforts for marine mammals. They additionally included a suggestion that additional observers and monitoring approaches (*i.e.,* infrared, drones, hydrophones) must be used, as determined to be necessary, to ensure that monitoring efforts for the clearance and shutdown zones are effective during daytime, nighttime, and during periods of poor visibility.

Response: NMFS notes the commenter's recommendations were included in the proposed rule and are carried forward here. Specifically, NMFS described in the proposed rule, and is requiring in the final rule, that infrared technologies and PAM hydrophone deployments be available and used before, during, and after pile driving. Moreover, since publication of the proposed rule, Revolution Wind has

submitted an Alternative Monitoring Plan that includes details about advanced technologies for monitoring marine mammals at night for both trained crew observers and PSOs. As for the recommendation to specifically require drones, NMFS would evaluate any proposal including drones on a case-by-case basis but is not requiring use of this technology. The commenter did not provide data indicating drones would be more effective than other monitoring technology already required.

Comment 30: Commenters recommended that additional monitoring of the visual clearance and shutdown zones must be undertaken by PSOs located on the pile driving vessel and on an additional vessel that would circle the pile driving site. They specified that a minimum of four PSOs must be on each vessel and must have two PSOs monitoring per shift operating on a two on, two off rotation, with another commenter suggesting that human observation be supplemented with infrared (IR) technology and drones.

Response: NMFS notes the proposed rule aligned with the recommendation, requiring a total of four PSOs on each monitoring vessel, two on-duty and two off-duty, working in rotation. On-duty PSOs on the pile driving vessel and the secondary PSO vessel, circling at a distance from the pile, would each monitor 180 degrees. To ensure marine mammal detection is maximized, and in response to public comments, NMFS is now requiring monitoring for marine mammals before, during, and after foundation installation and is requiring in this final rule three on-duty PSOs on both platforms such that each PSO is responsible for 120 degree coverage. In addition, as proposed, this final rule requires that visual observers must be equipped with alternative monitoring technology (*e.g.,* night vision devices, infrared cameras) to monitor clearance and shutdown zones during periods of low visibility (*e.g.,* darkness, rain, fog, *etc.*).

Comment 31: Commenters recommended that NMFS should require sound field verification during installation of WTG and OSS foundations on the first monopile installed and then on a random sample of monopiles throughout the installation process. They also noted that they do not support the installation of unmitigated piles. They added that all sound source validation reports for field measurements must be made publicly available after being evaluated by both NMFS and BOEM prior to the installation of any additional monopiles. Finally, the Commission recommended that NMFS require wind farm applicants to include monitoring of operational sound in their SFV plans in all future proposed rules.

Response: NMFS notes that, as proposed, this final rule requires that no unmitigated piles can be installed and that SFV is required for the first three piles and additional piles where conditions suggest noise levels may be higher or propagate farther than those piles previously measured. Furthermore, under this final rule, Revolution Wind must ensure that measured sound levels do not exceed those modeled assuming 10 dB of attenuation, which will be validated through SFV. Revolution Wind has the Lease Area data to identify if a pile would be more difficult to drive than the initial piles measured, and the requirement that they would have to conduct SFV on such piles where information suggests a pile may be more difficult to drive. Given these requirements, NMFS does not believe random sampling is necessary.

NMFS acknowledges the importance of transparency in the reporting process (see Comment 39) and plans to make all final SFV reports on our website. Regarding the Commission's suggestion that NMFS require SFV during operations, NMFS notes this requirement was included in the proposed rule and in this final rule

Comment 32: The Commission suggested that the monitoring measures included in the proposed rule may not be sufficient in reducing the potential for Level A harassment of North Atlantic right whales, specifically indicating that visually monitoring a 2.3 to 4.4 km would prove difficult and cited literature (Oedekoven and Thomas (2022)) estimating effectiveness of marine mammal observers (MMOs) to be 54 percent for detecting rorquals at 914 m or more, 31 percent for small cetaceans in pods of more than six, and 14 percent for small cetaceans in pods of six or fewer. The Commission did not provide any recommendations to increase visual detection capabilities.

Response: The time of year when Revolution Wind would be conducting the majority of pile driving is when North Atlantic right whale density in the Project Area is relatively low, given that pile driving is seasonally restricted from December 1–April 30, unless Revolution Wind receives NMFS' prior approval to conduct activities in December. Although modeling predicts 17.5 Level A harassment North Atlantic right whale exposures (Table 12 in final rule), this estimate does not consider any mitigation measures, other than 10 dB of sound attenuation, or natural avoidance of the animal to loud sounds. Revolution Wind must delay or shutdown impact pile driving if a North Atlantic right whale is visually detected at any distance or acoustically detected at any distance within the PAM monitoring zone, a measure that is more conservative than the finite clearance and shutdown zones determined for other large whale species. The Commission cites information from a paper related to the use of trained lookouts and a team of two on-duty MMOs on moving Navy military vessels actively engaged in sonar training (Oedekoven and Thomas, 2022) to support its claim that visual monitoring would prove difficult. We note that these ''trained lookouts'' are Navy personnel who are specifically trained as lookouts in contrast to NMFS-approved PSOs who are required to have specific education backgrounds, trainings, and experience before undertaking PSO duties (see requirements found in the regulatory text at Section 217.275(a)). NMFS disagrees that the statistics generated from that report are equivalent to the effectiveness of monitoring for the Revolution Wind project. At least three PSOs would be placed on the stationary pile driving platform and three PSOs would also be placed on each of two dedicated PSO vessels traveling at slow speeds (less than 10 kn (11.5 mph)) for a total of nine PSOs. Concurrently, real-time PAM is required to supplement visual monitoring during impact pile driving and UXO/MEC detonation. Further, Revolution Wind must monitor several times daily supplemental marine mammal detection information systems (*e.g.,* the Right Whale Sighting Advisory System) to increase situational awareness. We note that the MMO team in Oedekoven and Thomas (2022) was not always using PAM in that study and had significantly more *Balaenoptera spp.* sightings than the lookout team (see Table 2 in Oedekoven and Thomas (2022)). Given the monitoring measures that are required for the Project in combination with the mitigation measures (*i.e.,* clearance and shutdown zones), NMFS disagrees that the monitoring measures will be insufficient to avoid Level A harassment (PTS) of North Atlantic right whales.

Comment 33: The Commission recommended that NMFS require Revolution Wind to have PAM operators also review acoustic data for at least 24 hours prior to UXO/MEC detonations, when available.

Response: We appreciate the Commission's recommendation and have incorporated it into the final rule.

Comment 34: A commenter stated that Revolution Wind should be required to use PSOs at all times when underway.

Response: NMFS is not requiring PSOs to be onboard every transiting vessel. However, as described in the proposed rule and carried forward in this final rule, Revolution Wind must have trained observers onboard all vessels. The dedicated observer may be a PSO or a crew member with no other concurrent duties. NMFS is also requiring Revolution Wind to provide a Vessel Strike Avoidance Plan to NMFS 180 days prior to the onset of vessel use. Revolution Wind submitted that plan on July 13, 2023, and a revised version on August 25, 2023. Once approved, all plans will be made available on NMFS' website.

Comment 35: A commenter recommended that the LOA should require all vessels supporting site characterization to be equipped with and to use Class A Automatic Identification System (AIS) devices at all times while on the water. The commenter suggested this requirement should apply to all vessels, regardless of size, associated with the survey.

Response: NMFS agrees and has included an AIS requirement in more recently issued IHAs and wind construction proposed rules. This final rule includes a requirement that all vessels associated with the project be equipped with AIS.

Comment 36: The Commission recommended that NMFS require Revolution Wind to submit a PAM plan and to allow for public comments to occur prior to the issuance of the final rule. The Commission specifies that this plan should include the number, type(s) (*e.g.,* moored, towed, drifting, autonomous), deployment location(s), bandwidth/sampling rate, sensitivity of the hydrophones, estimated detection range(s) for ambient conditions and during pile driving, and the detection software to be used. They also recommend that Revolution Wind and other wind developers consider whether vector sensors should be used in addition to deployed hydrophones to enhance detection capabilities, with a particular focus on ''those vocalizations that may be drowned out by the hammer strikes and resulting reverberation.''

Response: NMFS notes that the Commission's recommendation for Revolution Wind to submit a PAM Plan to NMFS for approval is consistent with the proposed rule and this final rule. As proposed, under this final rule a PAM plan must be submitted to NMFS at least 180 days prior to the start of the activity. Further, NMFS identified the requirements that Revolution Wind must meet in its PAM plan in the proposed rule, which was made available for public comment, and those requirements are included in this final rule. Given NMFS' extensive expertise with passive acoustic monitoring and the fact that we are coordinating with BOEM's Center for Marine Acoustics (CMA), NMFS has determined that approval of the plan does not warrant public input. However, NMFS will share the plan with the Commission for review prior to approval of the plan. NMFS has included the Commission's recommendations, among other things, of what would be required in the PAM plan.

Comment 37: The Commission recommended that in the final rule NMFS: (1) specify which model-estimated zones (*i.e.,* acoustic ranges, exposure ranges, mitigation zones, monitoring zones) and which metrics (*i.e.,* flat R_{max}, flat $R_{95\%}$) should be compared to the *in-situ* Level A and B harassment zones, (2) specify which type of *in-situ* Level A harassment zone (*i.e.,* acoustic or exposure ranges) should be calculated, and, (3) require that *in-situ* measurements be conducted for monopiles that are not represented by the previous three locations (*i.e.,* substrate composition, water depth) or by the hammer energies and numbers of strikes needed or number of piles installed in a given day.

Response: We agree with the Commission about the importance of specifying quantities to be compared following SFV and have required in the final rule that calculations of the $R_{95\%}$ SEL and $R_{95\%}$ SPL_{rms} acoustic ranges for Level A harassment and Level B harassment, respectively, based on in situ measurements must be compared to the same modeled metrics.

Regarding the Commission's third suggestion, NMFS notes that, under the proposed rule, if a monopile installation site or construction scenario was determined to be not representative of the rest of the monopile installation sites, Revolution Wind would be required to provide information on how additional sites and construction scenarios would be selected for SFV measurements, as would be described in their Foundation Installation Pile Driving SFV Plan. This plan would also be required to describe the methodology for collecting, analyzing, and preparing SFV measurement data for submission to NMFS. We agree with the Commission that this information is important and include the same requirement in the final rule. However, we do not agree with the suggestion to require additional SFV based on variations in the hammer energies, number of strikes used for installation, or number of piles installed per day. NMFS applied the largest distances modeled, which represents the maximum number of piles installed per day, maximum strikes predicted, and maximum hammer energies. Because of this, Revolution Wind is required to stay within the bounds of the analysis. We also note that any variation assuming less hammer strikes, less piles installed per day, or lower hammer energies would likely result in less anticipated take per day, as the take authorized in the final rule is based on the highest bounds of the analysis. For all these reasons, we are not requiring additional SFV based on variations specific to the hammer energy, number of piles installed, or the total number of strikes.

Comment 38: The Commission recommended that NMFS require Revolution Wind to include in the pile driving SFV report additional metrics not identified in the proposed rule, including SPL_{rms} source levels, cumulative SEL, ranges to Level A harassment and Level B harassment thresholds, and types and locations of sound attenuation systems. In addition, the Commission recommended that NMFS require Revolution Wind to deploy a minimum of three hydrophones for SFV during impact pile driving

Response: NMFS partially concurs with the Commission's recommendations. This final rule requires the interim report to include peak, sound pressure level (SPL), and cumulative sound exposure level (SEL_{cum}) metrics for all hydrophones, estimated distances to NMFS Level A harassment and Level B harassment threshold isopleths, types and locations of sound attenuation systems. This information is also required in the final report. NMFS is not requiring source levels be estimated in interim reports given the quick turnaround time (48 hours) and amount of data needing to be analyzed in that time. The purpose of the interim reports are to determine that modeled distances to isopleths corresponding to Level A harassment and Level B harassment thresholds are not being exceeded and to determine if any mitigative action needs to be taken. Hence knowing source levels is not required at this stage. However, NMFS is requiring source levels (peak, cumulative SEL, and SPL_{rms}) be included in the final SFV report. Regarding the hydrophones for SFV during pile driving, NMFS is requiring that Revolution Wind place two hydrophones at four locations at an azimuth of least propagation loss and

two at 750 m and 90 degrees from this azimuth (total = 10 hydrophones).

Comment 39: Commenters stated that the LOA must include a requirement for all phases of the Revolution Wind site characterization to subscribe to the highest level of transparency, including frequent reporting to Federal agencies, requirements to report all visual and acoustic detections of North Atlantic right whales and any dead, injured, or entangled marine mammals to NMFS or the U.S. Coast Guard as soon as possible and no later than the end of the PSO shift. A commenter stated that to foster stakeholder relationships and allow public engagement and oversight of the permitting, the ITA should require all reports and data to be accessible on a publicly available website. Another commenter also suggested that all quarterly reports of PSO sightings must be made publicly available to continue to inform marine mammal science and protection.

Response: NMFS notes the commenters' recommendations to report all visual and acoustic detections of North Atlantic right whales and any dead, injured, or entangled marine mammals to NMFS are consistent with the proposed rule and this final rule (see Situational Reporting). We refer the reader to section 217.275(g)(13)(i)–(vi) of the regulations for more information on situational reporting.

Daily visual and acoustic detections of North Atlantic right whales and other large whale species along the Eastern Seaboard, as well as Slow Zone locations, are publicly available on WhaleMap (*https://whalemap.org/whalemap.html*). Further, recent acoustic detections of North Atlantic right whales and other large whale species are available to the public on NOAA's Passive Acoustic Cetacean Map website (*https://www.fisheries.noaa.gov/resource/data/passive-acoustic-cetacean-map*). Given the open access to the resources described above, NMFS does not concur that public access to quarterly PSO reports is warranted, and we have not included this measure in the authorization. However, NMFS will post all final reports to our website. We reference the commenters to Section 217.275(g) for more information on reporting requirements in the regulations.

Effects Assessment

Comment 40: Commenters stated that NMFS must utilize the best available science in their analysis. A commenter stated that NMFS must use the more recent and best available science in evaluating impacts to North Atlantic right whales, including updated population estimates, recent habitat usage patterns for the Project Area, and a revised discussion of the acute and cumulative stress on whales in the region. Another commenter further added that NMFS should use the most comprehensive models for estimating marine mammal take and developing robust mitigation measures.

Response: The MMPA and its implementing regulations require that incidental take regulations be established based on the best available information, which does not always mean the most recent information. NMFS generally considers the information in the most recent U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments Report (SAR; Hayes *et al.,* 2023) to be the best available information for a particular marine mammal stock because of the MMPA's rigorous SAR procedural requirements, which includes peer review by a statutorily established Scientific Review Group.

Regarding the comment related to the North Atlantic right whale population abundance that was cited in the proposed rule, since publication of the proposed rule, NMFS has finalized the 2022 Stock Assessment Report indicating the North Atlantic right whale population abundance is estimated as 338 individuals (Nbest; 95 percent confidence interval: 325–350; 88 FR 54592, August 11, 2023). NMFS has used this most recent best available scientific information in the analysis of this final rule. This new estimate, which is based off the analysis from Pace *et al.* (2017) and subsequent refinements found in Pace (2021), is included by reference in the final 2022 SARs (*https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports*) and provides the most recent and best available estimate, including improvements to NMFS' right whale abundance model. Specifically, Pace (2021) looked at a different way of characterizing annual estimates of age-specific survival. The results from the Pace (2021) paper that informed the final 2022 SARs strengthened the case for a change in mean survival rates after 2010 through 2011, but did not significantly change other current estimates (population size, number of new animals, adult female survival) derived from the model. Furthermore, NMFS notes that the SARs are peer reviewed by other scientific review groups prior to being finalized and published and that the North Atlantic Right Whale Report Card (Pettis *et al.,* 2022) does not undertake this process. Based on this, NMFS has considered all relevant information regarding North Atlantic right whale, including the information cited by the commenters. However, NMFS has relied on the final 2022 SAR in this final rule as it reflects the best available scientific information.

We note that this change in abundance estimate does not change the estimated take of North Atlantic right whales or authorized take numbers, nor affect our ability to make the required findings under the MMPA for Revolution Wind's construction activities.

While NMFS cannot require applicants to utilize specific models for the purposes of estimating take incidental to offshore wind construction activities, we evaluate the models used to support take estimates to ensure that they are methodologically sound and incorporate the best available science. NMFS does require use of the Roberts *et al.* (2016, 2023) density data and SARs abundance estimates for all species, both of which represent the best available science regarding marine mammal occurrence.

Comment 41: Several commenters raised concerns regarding the cumulative impacts of the multiple offshore wind projects being developed throughout the range of North Atlantic right whales and other marine mammal species and specifically recommend that we carefully consider the take from all of these projects in combination when conducting the negligible impact analysis for Revolution Wind. One commenter recommended NMFS establish an ''IHA threshold'' for offshore wind activities regionally and across project phases. Another commenter suggests NMFS' issuance of ITAs for offshore wind construction projects should be based on a Programmatic Environmental Impact Statement that assesses cumulative impacts analyses of individual projects as well as the cumulative impacts from the consequent multiple project developments rather than separate EISs for each project. Another commenter suggested that NMFS should analyze the cumulative impacts of the multiple concurrent phases of offshore wind energy development on right whales and other marine mammal species in southern New England waters prior to proceeding with permitting the Revolution Wind Project.

Response: Neither the MMPA nor NMFS' implementing regulations call for consideration of the take resulting from other specified activities in the negligible impact analysis. The preamble to NMFS' implementing regulations (54 FR 40338, September 29,

1989) states, in response to comments, that the impacts from other past and ongoing anthropogenic activities are to be incorporated into the negligible impact analysis via their impacts on the baseline. Consistent with that direction, NMFS has factored into its negligible impact analysis the impacts of other past and ongoing anthropogenic activities via their impacts on the baseline (*e.g.,* as reflected in the density/distribution and status of the species, population size and growth rate, and other relevant stressors). The 1989 final rule for the MMPA implementing regulations also addressed public comments regarding cumulative effects from future, unrelated activities. There, NMFS stated that such effects are not considered in making findings under section 101(a)(5) concerning negligible impact. In this case, this incidental take regulation (ITR), as well as other ITRs currently in effect or proposed within the specified geographic region, are appropriately considered an unrelated activity relative to the others. The ITRs are unrelated in the sense that they are discrete actions under section 101(a)(5)(A) issued to discrete applicants. Section 101(a)(5)(A) of the MMPA requires NMFS to make a determination that the take incidental to a ''specified activity'' will have a negligible impact on the affected species or stocks of marine mammals.

NMFS' implementing regulations require applicants to include in their request a detailed description of the specified activity or class of activities that can be expected to result in incidental taking of marine mammals. 50 CFR 216.104(a)(1). Thus, the ''specified activity'' for which incidental take coverage is being sought under section 101(a)(5)(A) is generally defined and described by the applicant. Here, Revolution Wind was the applicant for the ITR, and we are responding to the specified activity as described in that application and making the necessary findings on that basis.

Through the response to public comments in the 1989 implementing regulations (54 FR 40338, September 29, 1989), NMFS also indicated (1) that we would consider cumulative effects that are reasonably foreseeable when preparing a National Environmental Policy Act (NEPA) analysis and (2) that reasonably foreseeable cumulative effects would also be considered under Section 7 of the ESA for listed species, as appropriate. Accordingly, NMFS has adopted an EIS written by BOEM and reviewed by NMFS as part of its inter-agency coordination. This EIS addresses cumulative impacts related to Revolution Wind and substantially similar activities in similar locations. Cumulative impacts regarding the promulgation of the regulations and issuance of a LOA for construction activities, such as those planned by Revolution Wind, have been adequately addressed under NEPA in the adopted EIS that supports NMFS' determination that this action has been appropriately analyzed under NEPA. Separately, the cumulative effects of Revolution Wind on ESA-listed species, including North Atlantic right whales, was analyzed under Section 7 of the ESA when NMFS engaged in formal inter-agency consultation with GARFO. The Biological Opinion for Revolution Wind determined that NMFS' promulgation of the rulemaking and issuance of a LOA for construction activities associated with leasing, individually and cumulatively, are likely to adversely affect, but not jeopardize, listed marine mammals.

Comment 42: Commenters stated that (1) NMFS' reliance on the 160 dB (re 1 μPa^2s) threshold for behavioral harassment is not supported by the best available scientific information and grossly underestimates takes by Level B harassment and (2) an assertion the monitoring protocols prescribed for the clearance zones are under-protective.

Response: For the reasons described below, NMFS disagrees that the 160-dB threshold for behavioral harassment is not supported by the best available science. The potential for behavioral response to an anthropogenic source can be highly variable and context-specific (Ellison *et al.,* 2012). While NMFS acknowledges the potential for Level B harassment at exposures to received levels below 160 dB rms, it should also be acknowledged that not every animal exposed to received levels above 160 dB rms will respond in ways constituting behavioral harassment. There are a variety of studies indicating that contextual variables play a very important role in response to anthropogenic noise, and the severity of effects are not necessarily linear when compared to a received level (RL). Several studies (*e.g.,* Nowacek *et al.,* 2004 and Kastelein *et al.,* 2012 and 2015) showed there were behavioral responses to sources below the 160 dB threshold but also acknowledged the importance of context in these responses. For example, Nowacek *et al.* (2004) reported the behavior of five out of six North Atlantic right whales was disrupted at RLs of only 133–148 dB re 1 µPa (returning to normal behavior within minutes) when exposed to an alert signal. However, the authors also reported that none of the whales responded to noise from transiting vessels or playbacks of ship noise even though the RLs were at least as loud and contained similar frequencies to those of the alert signal. The authors state that a possible explanation for whales responding to the alert signal and not responding to vessel noise is due to the whales having been habituated to vessel noise while the alert signal was a novel sound. In addition, the authors noted differences between the characteristics of the vessel noise and alert signal, which may also have played a part in the differences in responses to the two noise types. Therefore, it was concluded that the signal itself, as opposed to the RL, was responsible for the response. DeRuiter *et al.* (2012) also indicate that variability of responses to acoustic stimuli depends not only on the species receiving the sound and the sound source, but also on the social, behavioral, or environmental contexts of exposure. Finally, Gong *et al.* (2014) highlighted that behavioral responses depend on many contextual factors, including range to source, RL above background noise, novelty of the signal, and differences in behavioral state. Similarly, Kastelein *et al.* (2015) examined behavioral responses of a harbor porpoise to sonar signals in a quiet pool, but stated behavioral responses of harbor porpoises at sea would vary with context such as social situation, sound propagation, and background noise levels.

NMFS uses 160 dB (rms) as the received sound pressure level for estimating the onset of Level B behavioral harassment takes and is currently considered the best available science while acknowledging that the 160 dB_{rms} step-function approach is a simplistic approach. However, there appears to be a misconception regarding the concept of the 160 dB threshold. While it is correct that in practice it works as a step-function (*i.e.,* animals exposed to received levels above the threshold are considered to be ''taken'' and those exposed to levels below the threshold are not), it is in fact intended as a sort of mid-point of likely behavioral responses, which are extremely complex depending on many factors including species, noise source, individual experience, and behavioral context. What this means is that, conceptually, the function recognizes that some animals exposed to levels below the threshold will in fact react in ways that appropriately considered take while others that are exposed to levels above the threshold will not. Use of the 160-dB threshold allows for a simplistic quantitative estimate of take while we can qualitatively address the variation

in responses across different received levels in our discussion and analysis.

Overall, we reiterate the lack of scientific consensus regarding what criteria might be more appropriate. Defining sound levels that disrupt behavioral patterns is difficult because responses depend on the context in which the animal receives the sound, including an animal's behavioral mode when it hears sounds (*e.g.,* feeding, resting, or migrating), prior experience, and biological factors (*e.g.,* age and sex). Other contextual factors, such as signal characteristics, distance from the source, and signal to noise ratio, may also help determine response to a given received level of sound. Therefore, levels at which responses occur are not necessarily consistent and can be difficult to predict (Southall *et al.,* 2007; Ellison *et al.,* 2012; Southall *et al.,* 2021). For example, Gomez *et al.* (2016) reported that RL was not an appropriate indicator of behavioral response.

There is currently no concurrence on these complex issues, and NMFS followed its practice at the time of submission and review of this application in assessing the likelihood of disruption of behavioral patterns by using the 160 dB threshold. This threshold has remained in use in part because of the practical need to use a relatively simple threshold based on the best available information that is both predictable and measurable for most activities. We note that the seminal reviews presented by Southall *et al.* (2007), Gomez *et al.* (2016), and Southall *et al.* (2021) did not suggest any specific new criteria due to lack of convergence in the data. NMFS is currently evaluating available information towards development of updated guidance for assessing the effects of anthropogenic sound on marine mammal behavior. However, undertaking a process to derive defensible exposure-response relationships, as suggested by Tyack and Thomas (2019), is complex. The recent systematic review by Gomez *et al.* (2016) was unable to derive criteria expressing these types of exposure-response relationships based on currently available data.

NMFS acknowledges that there may be methods of assessing likely behavioral responses to acoustic stimuli that better capture the variation and context-dependency of those responses than the simple 160 dB step-function used here; there is no agreement on what that method should be or how more complicated methods may be implemented by applicants. NMFS is committed to continuing its work in developing updated guidance with regard to acoustic thresholds but pending additional consideration and process is reliant upon an established threshold that is reasonably reflective of available science.

Regarding the assertion that monitoring protocols prescribed for the clearance and shutdown zones (called ''exclusion zones'' in the comment letter) are under-protective, please refer to Comments 13, 14, 22, 30.

Comment 43: Commenters recommended that NMFS fully account for the consequences of any other proposed North Atlantic right whale seasonal restriction on other protected species and evaluate alternative risk reduction strategies that would protect multiple species.

Response: In order to promulgate a rulemaking under Section 101(a)(5)(A) of the MMPA, NMFS must find that the total taking from the specified activities will have a negligible impact on species and stocks among other requirements, and subsequently prescribe means of effecting the least practicable adverse impact on affected species or stock and its habitat. In the proposed rule and in this final rule, NMFS has determined the specified activities will have a negligible impact on species and stock and the mitigation measures will affect the least practicable adverse impact on all of the affected species or stocks and their habitat. NMFS acknowledges that the seasonal restriction for impact pile driving is to effect the least practicable adverse impact on North Atlantic right whales; however, NMFS notes that this seasonal restriction provides additional protections to large whale species that occur off of Massachusetts during winter months. For example, fin whales are the second-most commonly occurring baleen whale species, based on density (Roberts *et al.,* 2023), in the Project Area from December through February and the fin whale feeding Biological Important Area (BIA) (March through October) overlaps the seasonal restriction period (March and April). Harbor porpoises, as another example, are also more likely to be more present when foundation installation and UXO/MEC detonation would not be occurring. As described in this final rule, there is no habitat of significance in the specified geographic region other than the seasonal migratory BIA for North Atlantic right whales and a small feeding BIA for fin whales.

Comment 44: A commenter claimed that the analyses supporting the proposed rule did not comprehensively consider potential indirect negative impacts to fishermen and coastal communities that could result from cumulative offshore wind activities, particularly as those activities impact North Atlantic right whales (*i.e.,* vessel strike). In addition, a commenter requested an explanation of how the offshore wind industry will be held accountable for their impacts and asserts that the offshore wind industry must be accountable for incidental takes from construction and operations separately from the take authorizations for managed commercial fish stocks.

Commenters expressed concern about the potential impacts of offshore wind development on marine species, particularly the North Atlantic right whale, and the potential that any disturbance, added distress, and mortality of North Atlantic right whales will be attributed to the commercial, charter, and recreational fishers who frequently access these same areas in which offshore wind development is occurring. They requested a moratorium on new incidental harassment authorizations until more is known about the potential impacts of offshore wind development on marine species.

Response: NMFS has determined that no serious injury or mortality is anticipated to result from Revolution Wind's specified activities, and as discussed in the Negligible Impact Analysis and Determination section in this final rule, NMFS has determined that Revolution Wind's specified activities will have a negligible impact on marine mammal species or stocks. Furthermore, NMFS has determined that the mitigation measures will effect the least practicable adverse impact on marine mammals and their habitat. Neither the MMPA nor our implementing regulations require NMFS to analyze impacts to other industries (*e.g.,* fisheries) or coastal communities from issuance of an ITA pursuant to section 101(a)(5)(A). We note that the Revolution Wind Final EIS assesses the impacts of both BOEM and NMFS' actions (permitting Revolution Wind's activities and authorizing the associated take of marine mammals, respectively) on the human environment, including to fishermen and coastal communities, and NMFS considered the analysis, as appropriate, in the final decisions under the MMPA.

Regarding accountability, Revolution Wind would be required to submit frequent monitoring reports, which would include accounts of any takes by Level A harassment or Level B harassment. NMFS must withdraw or suspend any LOA, if issued under these regulations, after notice and opportunity for public comment, if it finds the methods of taking or the mitigation, monitoring, or reporting measures are not being substantially complied with

(16 U.S.C. 1371(a)(5)(B); 50 CFR 216.206(e)). Additionally, failure to comply with the requirements of the LOA may result in civil monetary penalties, and knowing violations may result in criminal penalties (16 U.S.C. 1375). NMFS notes the anticipated impacts from Revolution Wind's activities (*e.g.,* behavioral harassment, acoustic disturbance, temporary hearing loss) are different from those anticipated from fishing activities (*e.g.,* entanglement).

Other

Comment 45: Commenters encouraged NMFS to issue LOAs on an annual basis, rather than a single 5-year LOA, to allow for the continuous incorporation of the best available scientific and commercial information and to modify mitigation and monitoring measures as necessary and in a timely manner. Both commenters also state that due to the precarious nature of the North Atlantic right whale, this annual approach is necessary to implement flexible protections.

Response: While NMFS acknowledges the commenters' rationale, we do not think it is necessary to issue annual LOAs as: (1) the final rule includes requirements for annual reports (in addition to weekly and monthly requirements) to support annual evaluation of the activities and monitoring results, and (2) the final rule includes an Adaptive Management provision (see § 217.277(c)) that allows NMFS to make modifications to the mitigation, monitoring, and reporting measures found in the LOA if new information supports the modifications and doing so creates a reasonable likelihood of more effectively accomplishing the goals of the measures.

Comment 46: The Commission recommended that NMFS specify in section 217.275(d)(9)(ii) of the final rule that the final SFV report must include source levels at 10 m during wind turbine operations, received levels at 50 m, 100 m, and 250 m from the wind turbine, operational parameters (*i.e.,* direct drive/gearbox information, turbine rotation rate), sea state conditions, and any nearby anthropogenic activities. In addition, the Commission recommends that NMFS rectify in the final rule the following proposed rule omissions and errors: (1) Proposed section 217.272(a) should also specify impact pile driving and removal of casing pipes and vibratory pile installation or removal of goal posts, (2) Proposed section 217.272(b) omitted impact removal of casing pipes, (3) Proposed section 217.274(d)(3)(vii) contradicts proposed section 217.274(f)(5)(1), which specifies that SFV must be conducted for each UXO/MEC detonation, (4) Proposed section 217.274(f)(2) specified that seasonal restrictions for UXO/MEC detonations would be in place from 1 December through 31 April; however, April has only 30 days, (5) Bellmann (2021) was cited incorrectly as Bellmann and Betke (2021) in the preamble to the final rule. (6) The terms 'small odontocetes', 'delphinids and harbor porpoises', and 'dolphins and porpoises' were used interchangeably throughout the various mitigation measures in proposed section 217.274, and the terms 'seals' and 'pinnipeds' were used interchangeably or omitted altogether from the various mitigation measures in proposed section 217.274.

Response: We appreciate the specific suggestions provided by the Commission here. We have rectified all of the concerns described in the Commission's list, except for those found in (6) above. Please note that the Section references for each of the items noted by the Commission have changed from those in the proposed rule due to reorganization. We have not made adjustments with respect to the suggestions regarding the intermixed use of ''seals'' versus ''pinnipeds,'' and ''small odontocetes'' (which we now refer to as ''odontocetes''), ''delphinids and harbor porpoises'', and ''dolphins and porpoises,'' as those terms are clearly describing the species at hand. Furthermore, this variation in language does not affect the clarity or understanding of the final rule or its provisions.

Comment 47: A commenter claimed that NMFS, and BOEM should have conducted more public outreach for the Revolution Wind project and sought public comments from parties outside of the states in which the project's land-based operations will occur, given that marine mammals have migratory patterns that range the entire East Coast.

Response: NMFS disagrees that public outreach regarding the Revolution Wind project was limited to individuals in particular states. Both NMFS and BOEM provided all members of the general public from any location opportunities to comment on and provide information pertaining to Revolution Wind's potential impacts on marine mammals and the environment. BOEM published a Notice of Intent to prepare an EIS on April 30, 2021 (86 FR 22972) in the **Federal Register**, followed by a 30-day public comment period and three virtual scoping meetings (May 13, 18, and 20, 2021) to facilitate public engagement in development of an assessment of potential impacts from Revolution Wind's planned activities. Additionally, BOEM's draft EIS (Revolution Wind Draft Environmental Impact Statement (DEIS) for Commercial Wind Lease OCS–A 0486) was made available for public comment on September 2, 2022 (87 FR 54248), which included a 45-day comment period. Finally, BOEM held three in-person public hearings on October 4, 2022, in Aquinnah, MA, October 5, 2022, in East Greenwich, CT, and October 6, 2022, in New Bedford, MA, and two virtual public hearings (again, open to all members of the public from any location) on September 29 and October 11, 2022. On March 21, 2022, NMFS published a Notice of Receipt (NOR) of Revolution Wind's adequate and complete MMPA ITA application in the **Federal Register** (87 FR 15942), which included a 30-day public comment period and access to the full application, which was posted on NMFS' publicly available website (*https://www.fisheries.noaa.gov/action/incidental-take-authorization-revolution-wind-llc-construction-revolution-wind-energy*). NMFS considered all of this information when developing the proposed rule, which was published in the **Federal Register** on December 23, 2022 (87 FR 79072). A 45-day public comment period followed publication of the proposed rule, during which NMFS received 404 comment submissions. NMFS carefully considered each of the received comments when developing this final rule. Comments submitted on the NOI, DEIS, NOR, and proposed rule were submitted by individuals from a variety of states, rather than the select few in Revolution Wind's Project Area. Thus, all members of the public had notice and opportunity to comment on multiple occasions and had access to relevant documents via NMFS' and BOEM's websites.

Comment 48: A commenter claimed that recent whale strandings are the result of offshore wind pre-construction activities. Another commenter suggested that NMFS should consider whether or not authorizing Level A harassment or Level B harassment should be permissible given the recent elevated public concern about potential impacts on marine mammals from offshore wind activities.

Response: NMFS emphasizes that there is no evidence that noise resulting from offshore wind development-related marine site characterization surveys, cause marine mammal strandings, and there is no evidence linking recent large whale mortalities and currently ongoing surveys. The commenters offer no such

evidence or other scientific information to substantiate their claim. The best scientific information available indicates that only Level B harassment, or disruption of behavioral patterns (*e.g.,* avoidance), may occur as a result of Revolution Wind's HRG surveys. NMFS will continue to gather data to help us determine the cause of these strandings. NMFS notes the Commission's statement: ''There continues to be no evidence to link these large whale strandings to offshore wind energy development, including no evidence to link them to sound emitted during wind development-related site characterization surveys, known as HRG surveys. Although HRG surveys have been occurring off New England and the mid-Atlantic coast, HRG devices have never been implicated or causatively-associated with baleen whale strandings'' (Marine Mammal Commission Newsletter, Spring 2023). There is an ongoing UME for humpback whales along the Atlantic coast from Maine to Florida, which includes animals stranded since 2016, and we provide further information on the humpback UME in the humpback whale subsection in the Description of Marine Mammals in the Specific Geographic Region section of this final rule.

Changes From the Proposed to Final Rule

Since the publication of the proposed rule in the **Federal Register** (87 FR 79072, December 23, 2022), NMFS has made changes, where appropriate, that are reflected in the preamble text of this final rule and the final regulatory text. These changes are briefly identified below, with more information included in the indicated sections of the preamble to this final rule.

Changes to Information Provided in the Preamble

The information found in the preamble of the proposed rule was based on the best available information at the time of publication. Since publication of the proposed rule, new information has become available, which has been incorporated into this final rule as discussed below.

The following changes are reflected in the Description of Marine Mammals in the Specific Geographic Region section of the preamble to this final rule:

Given the release of NMFS' final 2022 SARs (Hayes *et al.,* 2023), we have updated the population estimate for the North Atlantic right whale (*Eubalaena glacialis*) from 368 to 338 and the total mortality/serious injury (M/SI) amount from 8.1 to 31.2. This increase is due to the inclusion of undetected annual M/SI in the total annual serious injury/mortality.

Given the availability of new information, we have made updates to the UME summaries for North Atlantic right whales, humpback whales, minke whales, and phocid seals (pinnipeds).

The following changes are reflected in the Estimated Take section the preamble to this final rule:

Seal take estimates were previously calculated by scaling the take estimates derived from a single ''seal'' guild density using proportions calculated from the range-wide abundance values in the NMFS stock assessment reports. To more accurately estimate take for each species for all activities in the final rule, Revolution Wind scaled the single seal guild exposure estimate using proportions calculated from the relative occurrence of each species reported in PSO monitoring reports for HRG surveys conducted in the Project Area from 2018–2021 (AIS-Inc., 2019; Bennett, 2021; Stevens *et al.,* 2021; Stevens and Mills, 2021) and more recent data collected in 2023 during construction of the South Fork Wind Farm (South Fork Wind 2023, unpublished data).

Based on a recommendation by the Commission, we have increased the number of takes by Level A harassment of harbor porpoises incidental to cable landfall construction, specifically pneumatic hammering, from 0 to 24, should Revolution Wind choose to install casing pipes.

Based on a recommendation by the Commission, we have increased the number of common dolphin takes by Level B harassment for UXO/MEC detonations (from 211 to 632); HRG surveys during construction (from 2,354 to 4,457); and HRG surveys during operations (from 2,312 to 4,376).

Based on our consideration of the Commission's recommendation, we are authorizing the number of model-estimated Level A harassment (PTS) take (increased to group size where applicable) incidental to UXO/MEC detonations: fin whales (n=2), sei whales (n=2), humpback whales (n=2), minke whales (n=8), common dolphins (n=35), bottlenose dolphins (Western North Atlantic offshore stock) (n=8), and Atlantic white-sided dolphins (n=28). The proposed rule did not authorize Level A harassment (PTS) of these species incidental to UXO/MEC detonations.

Based on consideration of comments from the Commission, we are now also authorizing the amount of model-estimated Level A harassment (PTS) take of sei whales (n=3) and 5 gray seals (n=5), as well 20 percent of the model-estimated Level A harassment (PTS) for the other species, including fin whales (2), minke whales (13), harbor porpoises (65), and harbor seals (7) during impact installation of monopiles. The proposed rule did not authorize Level A harassment (PTS) of these species incidental to impact pile driving monopiles.

In Tables 27 and 28, we have corrected mathematical errors reflected in Tables 32 and 33 of the proposed rule resulting from transcription errors and incorrect summation of take numbers for a given species across all activities (*i.e.,* foundation installation, landfall construction, UXO/MEC detonations, and HRG surveys). The corrections do not change NMFS' findings.

In the proposed rule, NMFS proposed to authorize take by Level B harassment of sperm whales (n=2) incidental to cofferdam installation. In this final rule, NMFS is not authorizing Level B harassment of sperm whales incidental to this specified activity because the sperm whale exposure estimate is 0.1 and the species exhibits a preference for deep oceanic habitat rather than the shallow waters in Narragansett Bay, thus, the probability of take is de minimis.

Changes in the Regulatory Text

We have made the following changes to the regulatory text, which are reflected, as appropriate, throughout this final rule and described, as appropriate, in the preamble.

For clarity and consistency, we revised two paragraphs in § 217.270 Specified activity and specified geographical region of the regulatory text to fully describe the specified activity and specified geographical region.

The following changes are reflected in § 217.272 Permissible Methods of Taking.

NMFS added vibratory pile driving of goal posts to the list of permissible methods of taking by Level B harassment as ''goal posts'' was inadvertently excluded;

Based on the Commission's recommendation to authorize take by Level A harassment from pneumatic hammering and NMFS' concurrence, NMFS added pneumatic hammering of casing pipes to the list of permissible methods of taking by Level A harassment.

The following changes are reflected in § 217.274 Mitigation Requirements and the associated Mitigation section of the preamble to this final rule.

Based on a recommendation by a commenter, NMFS added a requirement that all project vessels must utilize AIS.

Given that North Atlantic right whale density in the Project Area increases by an order of magnitude from November to December, NMFS expanded the seasonal restriction for impact pile driving to include December, during which impact pile driving must be avoided, although, with prior approval by NMFS, it may occur if necessary to complete the project.

NMFS added a requirement for a 10-m (32.8-ft) shutdown zone for all other in-water activities that are not expected to cause take of marine mammals (*e.g.,* trenching, dredging) which may be monitored by any individual on watch (approved PSO not specifically required).

NMFS has included mitigation and monitoring zones specific to the different UXO/MEC charge weights, rather than a single zone size assuming only the largest charge weight, as Orsted has since provided evidence to NMFS that they can reliably identify UXO/MEC charge weights in the field.

We now specify that the mitigation measure restricts all Project vessels, rather than only crew transfer vessels, from traveling over 10 kn (11.5 mph) in the transit corridor unless Revolution Wind conducts real-time acoustic monitoring to detect large whales (including North Atlantic right whales) in and near the transit corridor, and that this measure applies only when other speed restrictions are not in place.

We now specify that an acoustic detection of any large whale (rather than only North Atlantic right whales) via the PAM system within the transit corridor will trigger a 10 kn (11.5 mph) or less speed restriction for all Project vessels until the whale can be confirmed visually beyond 500m of the vessel or 24 hours following the detection and any re-detection has passed.

The following changes are reflected in the § 217.275 Monitoring and Reporting requirements and the associated Monitoring and Reporting section of the preamble to this final rule:

NMFS updated the process for obtaining NMFS approval for PSO and PAM Operators to be similar to requirements typically included for seismic (*e.g.,* airgun) surveys and have clarified education, training, and experience necessary to obtain NMFS' approval.

NMFS added a requirement to have at least three PSOs on pile driving vessels rather than two PSOs, as was originally described in the proposed rule.

NMFS increased the PAM shutdown zone from 3.9 km (summer) and 4.4 km (winter) by now requiring Revolution Wind to delay or shutdown if a North Atlantic right whale is acoustically detected at any distance within the PAM monitoring zone.

Based on a recommendation by the Marine Mammal Commission, NMFS added a requirement that increases the time that PAM data must be reviewed prior to all UXO/MEC detonations from 1 to 24 hours (except in emergency cases where the 24-hour delay before the detonation occurred would create risk to human safety).

NMFS added a requirement that a double big bubble curtain must be placed at a distance that would avoid damage to the nozzle holes during all UXO/MEC detonations.

Based on a recommendation by the Marine Mammal Commission, NMFS added a requirement that a pressure transducer must be used during all UXO/MEC detonations.

NMFS added a requirement stating that Revolution Wind must use two NAS to ensure that measured sound levels do not exceed the levels modeled for a 10-dB sound level reduction for foundation installation (*e.g.,* double BBC (DBBC), hydro-sound damper, an AdBm Helmholz resonator). A single bubble curtain must not be used;

NMFS added requirements that SFV must be conducted on every pile until measured noise levels are at or below the modeled noise levels, assuming 10 dB, for at least three consecutive monopiles, and that SFV is required for each UXO/MEC detonation.

NMFS added a requirement that Revolution Wind must deploy at least eight hydrophones at four locations (one bottom and one mid-water column at each location) along an azimuth that is likely to see lowest propagation loss, and two hydrophones (one bottom and one mid-water) at 750 m, 90 degrees from the primary azimuth during installation of all piles where SFV monitoring is required, and equivalent requirements during all UXO/MEC detonations.

NMFS is now requiring Revolution Wind deploy two dedicated PSOs vessels to monitor the clearance and shutdown zones prior to and during impact pile driving installation of monopile foundations. In addition to the three PSOs on the pile driving platform, three PSOs must be deployed on each of the dedicated PSO vessels to monitor for marine mammals.

NMFS is now requiring that Revolution Wind must deploy at least three PSOs on each observation platform for all detonations with clearance zones less than 5 km (3.1 mi). If the clearance zone is larger than 5 km, at least one dedicated PSO vessel (with at least three on-duty PSOs) and an aerial platform (with at least two on-duty PSOs) must be used.

NMFS added a requirement that Revolution Wind submit a UXO/MEC PAM plan for NMFS' approval 180 days prior to the start of any UXO/MEC detonation.

NMFS now specifies that, for SFV during monopile installations, calculations of the $R_{95\neq}$ SEL and $R_{95\neq}$ SPL_{rms} acoustic ranges for Level A harassment and Level B harassment, respectively, based on in situ measurements must be compared to the same modeled metrics.

Based on consideration of the Commission recommendation, NMFS has added additional specified reporting requirements for SFV conducted during operations, and clarified the general SFV reporting metrics to align with the Commission's comments;

NMFS updated the North Atlantic right whale detection (visual and acoustic) reporting guidance.

NMFS removed the requirements for reviewing data on an annual and biennial basis for adaptive management and instead will make adaptive management decisions as new information warrants it.

Description of Marine Mammals in the Specific Geographic Region

As noted in the Changes From the Proposed to Final Rule section, since publication of the proposed rule (87 FR 79092, December 23, 2022), updates have been made to the abundance estimate for North Atlantic right whales and the UME summaries of multiple species. These changes are described in detail in the sections below; otherwise, the Description of Marine Mammals in the Specific Geographic Region section has not changed since the publication of the proposed rule in the **Federal Register** (87 FR 79072, December 23, 2022).

Sections 3 and 4 of Revolution Wind's application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history of the potentially affected species (Revolution Wind, 2022). NMFS fully considered all of this information, and we refer the reader to these descriptions in the application, incorporated here by reference, instead of reprinting the information. Additional information regarding population trends and threats may be found in NMFS' SARs (*https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*) and more general information about these species (*e.g.,* physical and behavioral descriptions) may be found on NMFS'

website (*https://www.fisheries.noaa.gov/find-species*).

Table 2 lists all species or stocks for which take is authorized under this final rule and summarizes information related to the species or stock, including regulatory status under the MMPA and 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 (as described in NMFS' SARs; (16 U.S.C. 1362(20))). While no mortality is anticipated or authorized here, PBR and annual serious injury and mortality from anthropogenic sources are included here as gross indicators of the status of the species and other threats.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or 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 2 are the most recent available data at the time of publication which can be found in NMFS' 2022 final SARs (Hayes *et al.,* 2023), available online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports.*

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Table 2 -- Marine Mammal Species that May Occur in the Project Area and be Taken, by Harassment

Common Name	Scientific Name[5]	Stock	ESA/MMPA status; Strategic (Y/N)[1]	Stock abundance (CV, N_{min}, most recent abundance survey)[2]	PBR	Annual M/SI[3]
Order Artiodactyla – Cetacea – Superfamily Mysticeti (baleen whales)						
Family Balaenidae						
North Atlantic right whale	*Eubalaena glacialis*	Western Atlantic	E, D, Y	338 (0; 332; 2020)[6]	0.7	31.2[6]
Family Balaenopteridae (rorquals)						
Blue whale	*Balaenoptera musculus*	Western North Atlantic	E, D, Y	UNK (UNK; 402; 1980-2008)	0.8	0
Fin whale	*Balaenoptera physalus*	Western North Atlantic	E, D, Y	6,802 (0.24; 5,573; 2016)	11	1.8
Humpback whale	*Megaptera novaeangliae*	Gulf of Maine	-, -, Y	1,396 (0; 1,380; 2016)	22	12.15
Sei whale	*Balaenoptera borealis*	Nova Scotia	E, D, Y	6,292 (1.02; 3,098; 2016)	6.2	0.8
Minke whale	*Balaenoptera acutorostrata*	Canadian Eastern Coastal	-, -, N	21,968 (0.31; 17,002; 2016)	170	10.6
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Physeteridae						
Sperm whale	*Physeter macrocephalus*	North Atlantic	E, D, Y	4,349 (0.28; 3,451; 2016)	3.9	0
Family Delphinidae						
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Western North Atlantic	-, -, N	93,233 (0.71; 54,433; 2016)	544	27
Atlantic spotted dolphin	*Stenella frontalis*	Western North Atlantic	-, -, N	39,921 (0.27; 32,032; 2016)	320	0

Bottlenose dolphin	*Tursiops truncatus*	Western North Atlantic Offshore	-, -, N	62,851 (0.23; 51,914; 2016)	519	28
Long-finned pilot whales	*Globicephala melas*	Western North Atlantic	-, -, N	39,215 (0.30; 30,627; 2016)	306	29
Risso's dolphin	*Grampus griseus*	Western North Atlantic	-, -, N	35,215 (0.19; 30,051; 2016)	301	34
Common dolphin	*Delphinus delphis*	Western North Atlantic	-, -, N	172,897 (0.21; 145,216; 2016)	1,452	390
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 – Superfamily Pinnipedia						
Family Phocidae (earless seals)						
Gray seal[4]	*Halichoerus grypus*	Western North Atlantic	-, -, N	27,300 (0.22; 22,785; 2016)	1,458	4,453
Harbor seal	*Phoca vitulina*	Western North Atlantic	-, -, N	61,336 (0.08; 57,637; 2018)	1,729	339

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

2 - NMFS' marine mammal stock assessment reports can be found online at: *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.

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

4 - 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.

5 - 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://marinemammalscience.org/science-and-publications/list-marine-mammal-species-subspecies/*; Committee on Taxonomy (2023)).

6 - In the proposed rule (87 FR 79072, December 23, 2022), a population estimate of 368 was used which represented the best available science at the time of publication. However, since the publication of the proposed rule, a new estimate (n=338) was released in NMFS' draft and final 2022 SARs and has been

incorporated into this final rule. In addition, the total annual average observed North Atlantic right whale mortality was updated in the final SARs from 8.1 to 31.2. Total annual average observed North Atlantic right whale mortality during the period 2016 through 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 through 2019 estimated annual means, accounting for undetected mortality and serious injury. (Hayes *et al*., 2023).

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All species that could potentially occur in the Project Area are included in Table 5 in Revolution Wind ITA application and discussed therein. While the majority of these species have been documented or sighted in southern New England (including off the coast of Rhode Island) in the past, for the species and stocks not listed in Table 2, NMFS considers it unlikely that their occurrence would overlap the activity in a manner that would result in harassment, due to their spatial distribution (*i.e.,* more northern or southern ranges) and/or the geomorphological characteristics of the underwater environment (*i.e.,* water depth in the development area). There are two pilot whale species, long-finned (*Globicephala melas*) and short-finned (*Globicephala macrorhynchus*), with distributions that overlap in the latitudinal range of the Project Area (Hayes *et al.,* 2023; Roberts *et al.,* 2016; Roberts *et al.,* 2023). Because it is difficult to differentiate between the two species at sea, sightings, and thus the densities calculated from them, are generally reported together as *Globicephala spp.* (Roberts *et al.,* 2016; Hayes *et al.,* 2023). However, based on the best available information, short-finned pilot whales occur in habitat that is both further offshore on the shelf break and further south than the project area (Hayes *et al.,* 2020). Therefore, NMFS assumes that any take of pilot whales would be of long-finned pilot whales. Similarly, in the Western North Atlantic, there are two morphologically and genetically distinct common bottlenose morphotypes, the Western North Atlantic Northern Migratory Coastal stock and the Western North Atlantic Offshore stock. The western North Atlantic offshore stock is primarily distributed along the outer shelf and slope from Georges Bank to Florida during spring and summer and has been observed in the Gulf of Maine during late summer and fall (Hayes *et al.* 2020), whereas the northern migratory coastal stock is distributed along the coast between southern Long Island, New York, and Florida (Hayes *et al.* 2018). Given their distribution, only the offshore stock is likely to occur in the Project Area and is the only stock included in this application.

A detailed description of the species likely to be affected by the Project, including brief introductions to the species and relevant stocks as well as available information regarding population trends and threats, and information regarding local occurrence, were provided in the proposed rule (87 FR 79072, December 23, 2022). Since that time, a new SAR (Hayes *et al.,* 2023) has become available for the North Atlantic right whale. Estimated abundance for the species declined from 368 to 338 and annual M/SI increased from 8.1 to 31.2. This large increase in annual serious injury/mortality is a result of NMFS including undetected annual M/SI in the total annual serious injury/mortality. The North Atlantic right whale population remains in decline, as described in the *North Atlantic Right Whale* species section below. We are not aware of any additional changes in the status of the species and stocks listed in Table 2; therefore, detailed descriptions are not provided here. Please refer to the proposed rule for these descriptions (87 FR 79072, December 23, 2022). Please also refer to NMFS' website (*https://www.fisheries.noaa.gov/find-species*) for generalized species accounts.

Since the publication of the proposed rule, the following updates have occurred to the below species in regards to general information or their active UMEs.

North Atlantic Right Whale

In August 2023, NMFS released its final 2022 SARs, which updated the population estimate (N_{best}) of North Atlantic right whales from 368 to 338 individuals and the annual M/SI value from 8.1 to 31.2 due to the addition of estimated undetected mortality and serious injury, as described above, which had not been previously included in the SAR. The population estimate is slightly lower than the North Atlantic Right Whale Consortium's 2022 Report Card, which identifies the population estimate as 340 individuals (Pettis *et al.,* 2023). Elevated North Atlantic right whale mortalities have occurred since June 7, 2017, along the U.S. and Canadian coast, with the leading category for the cause of death for this UME determined to be ''human interaction,'' specifically from entanglements or vessel strikes. Since publication of the proposed rule, the number of animals considered part of the UME has increased. As of September 11, 2023, there have been 36 confirmed mortalities (dead, stranded, or floaters), 0 pending mortalities, and 34 seriously injured free-swimming whales for a total of 70 whales. As of October 14, 2022, the UME also considers animals (n=45) with sublethal injury or illness (called ''morbidity'') bringing the total number of whales in the UME to 115. 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

Since January 2016, elevated humpback whale mortalities have occurred along the Atlantic coast from Maine to Florida. This event was declared a UME in April 2017. Partial or full necropsy examinations have been conducted on approximately half of the 208 known cases (as of September 2023). Of the whales examined (approximately 90), about 40 percent had evidence of human interaction either from vessel strike or entanglement (refer to *https://www.fisheries.noaa.gov/national/marine-life-distress/2016-2023-humpback-whale-unusual-mortality-event-along-atlantic-coast*). While a portion of the whales have shown evidence of pre-mortem vessel strike, this finding is not consistent across all whales examined and more research is needed. NOAA is consulting with researchers that are conducting studies on the humpback whale populations, and these efforts may provide information on changes in whale distribution and habitat use that could provide additional insight into how these vessel interactions occurred. More information is available at: *https://www.fisheries.noaa.gov/national/marine-life-distress/2016-2023-humpback-whale-unusual-mortality-event-along-atlantic-coast.*

Since December 1, 2022, the number of humpback strandings along the mid-Atlantic coast, from North Carolina to New York, has been elevated. In some cases, the cause of death is not yet

known; in others, vessel strike has been deemed the cause of death. As the humpback whale population has grown, they are seen more often in the Mid-Atlantic. These whales may be following their prey (small fish) which were reportedly close to shore in the 2022–2033 winter. Changing distributions of prey impact larger marine species that depend on them, and result in changing distribution of whales and other marine life. These prey also attract fish that are targeted by recreational and commercial fishermen, which increases the number of boats and amount of fishing gear in these areas. This nearshore movement increases the potential for anthropogenic interactions, particularly as the increased presence of whales in areas traveled by boats of all sizes increases the risk of vessel strikes.

Minke Whale

Since January 2017, a UME has been declared based on elevated minke whale mortalities detected along the Atlantic coast from Maine through South Carolina. As of September, 2023, a total of 158 minke whales have stranded during this UME. Full or partial necropsy examinations were conducted on more than 60 percent of the whales. Preliminary findings have shown evidence of human interactions or infectious disease in several of the whales, but these findings are not consistent across all of the whales examined, so more research is needed. This UME has been declared non-active and is pending closure. More information is available at: *https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2023-minke-whale-unusual-mortality-event-along-atlantic-coast.*

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 was declared a UME in July 2022. Preliminary testing of samples has found some harbor and gray seals positive for highly pathogenic avian influenza. While the UME is not occurring in the Project Area, the populations affected by the UME are the same as those potentially affected by the Project. Information on this UME is available online at: *https://www.fisheries.noaa.gov/2022-2023-pinniped-unusual-mortality-event-along-maine-coast.*

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

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.,* Richardson *et al.,* 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.,* low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 dB threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. Marine mammal hearing groups and their associated hearing ranges are provided in Table 3.

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

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

The effects of underwater noise from the Project's specified activities have the potential to result in the harassment of marine mammals in the specified geographic region. The proposed rule (87 FR 79072, December 23, 2022) included a discussion of the effects of anthropogenic noise on marine mammals and the potential effects of underwater noise from the Revolution Wind's project activities on marine mammals and their habitat. While some new literature has been published since publication of the proposed rule (*e.g.,* Meyer-Gutbrod *et al.,* 2023), there is no new information that NMFS is aware of that changes the analysis in the proposed rule. The information and analysis included in the proposed rule is incorporated by reference into this final rule and is not repeated here; please refer to the notice of the proposed rule (87 FR79072, December 23, 2022).

Estimated Take

As noted in the Changes From the Proposed to Final Rule section, NMFS has revised take estimates for several species based on our concurrence with comments received on the proposed rule and due to transcription and mathematical errors summing take estimates across activities for several species. These changes are described in detail in the sections below and, otherwise, the methodology for and number of estimated take has not changed since the proposed rule.

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

Authorized takes would be primarily by Level B harassment, as use of the acoustic sources (*i.e.,* impact and vibratory pile driving, site characterization surveys, and UXO/MEC detonations) have the potential to result in disruption of marine mammal behavioral patterns due to exposure to elevated noise levels. Impacts such as masking and TTS can contribute to behavioral disturbances. There is also some potential for auditory injury (Level A harassment) to occur in select marine mammal species incidental to the specified activities (*i.e.,* impact pile driving, vibratory pile driving, and UXO/MEC detonations). As described below, the larger distances to the PTS thresholds, when considering marine mammal weighting functions, demonstrate this potential. For mid-frequency hearing sensitivities, when thresholds and weighting and the associated PTS zone sizes are considered, the potential for PTS from the noise produced by the project is negligible. The required mitigation and monitoring measures are expected to minimize the severity of the taking to the extent practicable.

As described previously, no serious injury or mortality is anticipated or authorized for this project. Below we describe how the take numbers are estimated.

Generally speaking, we estimate take by considering: (1) acoustic thresholds above which NMFS believes the best available science indicates marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment; (2) the area or volume of water that will be ensonified above these levels in a day; (3) the density or occurrence of marine mammals within these ensonified areas;

and, (4) and the number of days of activities. We note that while these basic factors can contribute to a basic calculation to provide an initial prediction of takes, additional information that can qualitatively inform take estimates is also sometimes available (*e.g.,* previous monitoring results or average group size). Below, we describe the factors considered here in more detail and present the authorized take estimates.

Marine Mammal 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 (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment). Thresholds have also been developed to identify the levels above which animals may incur different types of tissue damage (non-acoustic Level A harassment or mortality) from exposure to pressure waves from explosive detonation. Thresholds have also been developed identifying the received level of in-air sound above which exposed pinnipeds would likely be behaviorally harassed. 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), the environment (*e.g.,* other noises in the area) and the receiving animals (hearing, motivation, experience, demography, 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 root-mean-squared pressure received levels (RMS SPL) of 120 dB (referenced to re 1 μPa) for continuous (*e.g.,* vibratory pile driving, drilling) and above RMS SPL 160 dB re 1 μPa for non-explosive impulsive (*e.g.,* seismic airguns) or intermittent (*e.g.,* scientific sonar) sources (Table 4). 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 behavior patterns that would not otherwise occur.

Revolution Wind's construction activities include the use of continuous (*i.e.,* vibratory pile driving) and intermittent (*i.e.,* impact pile driving, pneumatic hammering, HRG acoustic sources) sources, therefore, the 120 and 160 dB re 1 μPa (rms) thresholds are applicable. NMFS notes there are separate explosive thresholds to account for Level B harassment from a single detonation per day and those are included in Table 5 below.

Level A harassment—NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) (Technical Guidance, 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). Revolution Wind's project includes the use of both impulsive and non-impulsive sources.

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

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Table 4 -- Onset of Permanent Threshold Shift (PTS) (NMFS, 2018)

Hearing Group	PTS Onset Thresholds* (Received Level)	
	Impulsive	Non-impulsive
Low-Frequency (LF) Cetaceans	Cell 1 $L_{p,0\text{-}pk,flat}$: 219 dB $L_{E,p,\ LF,24h}$: 183 dB	Cell 2 $L_{E,p,\ LF,24h}$: 199 dB
Mid-Frequency (MF) Cetaceans	Cell 3 $L_{p,0\text{-}pk,flat}$: 230 dB $L_{E,p,\ MF,24h}$: 185 dB	Cell 4 $L_{E,p,\ MF,24h}$: 198 dB
High-Frequency (HF) Cetaceans	Cell 5 $L_{p,0\text{-}pk,flat}$: 202 dB $L_{E,p,HF,24h}$: 155 dB	Cell 6 $L_{E,p,\ HF,24h}$: 173 dB
Phocid Pinnipeds (PW) (Underwater)	Cell 7 $L_{p,0\text{-}pk.flat}$: 218 dB $L_{E,p,PW,24h}$: 185 dB	Cell 8 $L_{E,p,PW,24h}$: 201 dB

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

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

Explosive sources—Based on the best available science, NMFS uses the acoustic and pressure thresholds indicated in Tables 5 and 6 to predict the onset of behavioral harassment, TTS, PTS, tissue damage, and mortality incidental to explosive detonations. Given Revolution Wind would be limited to detonating one UXO/MEC per day, the TTS threshold is used to estimate the potential for Level B (behavioral) harassment (*i.e.,* individuals exposed above the TTS threshold may also be harassed by behavioral disruption but we do not anticipate any impacts from exposure to UXO/MEC detonation below the TTS threshold would constitute behavioral harassment).

Table 5 -- PTS Onset, TTS Onset, for Underwater Explosives (NMFS, 2018)

Hearing Group	PTS Impulsive Thresholds (Level A harassment)	TTS Impulsive Thresholds (Level B harassment)	Behavioral Threshold (multiple detonations; Level B harassment)[1]
Low-Frequency (LF) Cetaceans	*Cell 1* $L_{pk,flat}$: 219 dB $L_{E,LF,24h}$: 183 dB	*Cell 2* $L_{pk,flat}$: 213 dB $L_{E,LF,24h}$: 168 dB	*Cell 3* $L_{E,LF,24h}$: 163 dB
Mid-Frequency (MF) Cetaceans	*Cell 4* $L_{pk,flat}$: 230 dB $L_{E,MF,24h}$: 185 dB	*Cell 5* $L_{pk,flat}$: 224 dB $L_{E,MF,24h}$: 170 dB	*Cell 6* $L_{E,MF,24h}$: 165 dB
High-Frequency (HF) Cetaceans	*Cell 7* $L_{pk,flat}$: 202 dB $L_{E,HF,24h}$: 155 dB	*Cell 8* $L_{pk,flat}$: 196 dB $L_{E,HF,24h}$: 140 dB	*Cell 9* $L_{E,HF,24h}$: 135 dB
Phocid Pinnipeds (PW) (Underwater)	*Cell 10* $L_{pk,flat}$: 218 dB $L_{E,PW,24h}$: 185 dB	*Cell 11* $L_{pk,flat}$: 212 dB $L_{E,PW,24h}$: 170 dB	*Cell 12* $L_{E,PW,24h}$: 165 dB

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

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

1 – Given Revolution Wind would be limited to detonating one UXO/MEC per day, the TTS threshold is used to estimate the potential for Level B (behavioral) harassment (i.e., individuals exposed above the TTS threshold may also be harassed by behavioral disruption but we do not anticipate any impacts from exposure to UXO/MEC detonation below the TTS threshold would constitute behavioral harassment.

Additional thresholds for non-auditory injury to lung and gastrointestinal (GI) tracts from the blast shock wave and/or onset of high peak pressures are also relevant (at relatively close ranges) (Table 6). These criteria have been developed by the U.S. Navy (DoN (U.S. Department of the Navy) 2017) and are based on the mass of the animal and the depth at which it is present in the water column. Equations predicting the onset of the associated potential effects are included below (Table 6).

Table 6 -- Lung and G.I. Tract Injury Thresholds (DoN, 2017)

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

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

Note: Peak sound pressure (L_{pk}) has a reference value of 1 µPa. In this Table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI, 2013). However, ANSI defines peak sound pressure as incorporating frequency weighting, which is not the intent for this Technical Guidance. Hence, the subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the overall marine mammal generalized hearing range.

Modified Goertner Equations for severe and slight lung injury (pascal-second)

Equation 1: $103M^{1/3}(1 + D/10.1)^{1/6}$ Pa-s

Equation 2: $47.5M^{1/3}(1 + D/10.1)^{1/6}$ Pa-s

M animal (adult and/or calf/pup) mass (kg) (Table C.9 in DoN, 2017)

D animal depth (meters)

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Below, we discuss the acoustic modeling, marine mammal density information, and take estimation for each of Revolution Wind's construction activities. NMFS has carefully considered all information and analysis presented by Revolution Wind as well as all other applicable information and, based on the best available science, concurs that Revolution Wind's estimates of the types and amounts of take for each species and stock are complete and accurate.

Marine Mammal Density and Occurrence

In this section we provide the information about the presence, density, or group dynamics of marine mammals that will inform the take calculations. As noted above, depending on the species and as described in the take estimation section for each activity, take estimates may be based on the Roberts *et al.* (2023) density estimates, marine mammal monitoring results from HRG surveys, or average group sizes.

Habitat-based density models produced by the Duke University Marine Geospatial Ecology Laboratory and the Marine-life Data and Analysis Team, based on the best available marine mammal data from 1992–2022 obtained in a collaboration between Duke University, the Northeast Regional Planning Body, the University of North Carolina Wilmington, the Virginia Aquarium and Marine Science Center, and NOAA (Roberts *et al.,* 2016a, 2016b, 2017, 2018, 2020, 2021a, 2021b, 2023), represent the best available information regarding marine mammal densities in the Project Area. More recently, these data have been updated with new

modeling results and include density estimates for pinnipeds (Roberts *et al.,* 2016b, 2017, 2018, 2023). Density data are subdivided into five separate raster data layers for each species, including: Abundance (density), 95 percent Confidence Interval of Abundance, 5 percent Confidence Interval of Abundance, Standard Error of Abundance, and Coefficient of Variation of Abundance.

Revolution Wind's initial densities and take estimates were included in the ITA application that was considered Adequate & Complete on February 28, 2022, in line with NMFS' standard ITA guidance (*https://www.fisheries.noaa.gov/national/marine-mammal-protection/apply-incidental-take-authorization*). However, on June 20, 2022, the Duke Marine Geospatial Ecology Laboratory released a new, and more comprehensive, set of marine mammal density models for the area along the East Coast of the United States (Roberts *et al.,* 2023). The differences between the new density data and the older data necessitated the use of updated marine mammal densities and, subsequently, revised marine mammal take estimates. This information was provided to NMFS as a memo (referred to as the Revised Density and Take Estimate Memo) on August 19, 2022 after continued discussion between Revolution Wind and NMFS and NMFS has considered it in this analysis. The Revised Density and Take Estimate Memo was made public on NMFS' website (*https://www.fisheries.noaa.gov/action/incidental-take-authorization-revolution-wind-llc-construction-revolution-wind-energy*) on August 26, 2022.

Immediately below, we describe observational data from monitoring reports and average group size information, both of which are appropriate to inform take estimates for certain activities or species in lieu of density estimates. As noted above, the density and occurrence information type resulting in the highest take estimate was used, and the explanation and results for each activity are described in the specific activity sub-sections in the Modeling and Take Estimation section.

For some species, observational data from PSOs aboard HRG and geotechnical (GT) survey vessels 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. PSO data from HRG and GT surveys conducted in and near the Project Area from October 2018 through February 2021 (AIS-Inc., 2019; Bennett, 2021; Stevens *et al.,* 2021; Stevens and Mills, 2021) were analyzed to determine the average number of individuals of each species observed per vessel day. For each species, the total number of individuals observed (including the ''proportion of unidentified individuals'') was divided by the number of vessel days during which observations were conducted in 2018–2021 HRG surveys (407 vessel days) to calculate the number of individuals observed per vessel day, as shown in the final columns of Tables 7a and 7b in the Updated Density and Take Estimation Memo.

For other less-common species, the predicted densities from Roberts *et al.* (2023) are very low and the resulting density-based exposure estimate is less than a single animal or a typical group size for the species. In such cases, the mean group size was considered as an alternative to the density-based or PSO data-based take estimates to account for potential impacts on a group during an activity. Mean group sizes for each species were calculated from recent aerial and/or vessel-based surveys as shown in Table 7.

The estimated monthly density of seals provided in Roberts *et al.* (2023) includes all seal species present in the region as a single guild. To split the resulting ''seal'' density-based take estimate by species (harbor and gray seals), the estimate was multiplied by the proportion of the combined abundance attributable to each species. In the proposed rule, seal take estimates were previously calculated by scaling the exposure estimates derived from a single ''seal'' guild density using proportions calculated from the range-wide abundance values in the NMFS stock assessment reports (87 FR 79072, December 23, 2022). To more accurately estimate take for each species for all activities in the final rule, Revolution Wind instead scaled the single seal guild take estimates using proportions calculated from the relative occurrence of each species reported in PSO monitoring reports for HRG surveys conducted in the Project Area from 2018–2021 (AIS-Inc., 2019; Bennett, 2021; Stevens *et al.,* 2021; Stevens and Mills, 2021) and more recent data collected during construction of the South Fork Wind Farm in 2023 (South Fork Wind 2023, unpublished data). In the combined dataset, there were 62 seal sightings recorded to the species level. Of those, 17 individuals were harbor seals (0.27 or 27 percent) and 45 were gray seals (0.73 or 73 percent). Revolution Wind used these proportions to recalculate the species-specific seal take shown in Tables 12, 16, 20, 25, and 26.

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Table 7 -- Average Marine Mammal Species Group Sizes Used in Take Estimate Calculations

Species	Individuals	Sightings	Mean Group Size	Source
North Atlantic Right Whale*	145	60	2.4	Kraus *et al*. (2016)
Blue Whale*	3	3	1.0	Palka *et al*. (2017)
Fin Whale*	155	86	1.8	Kraus *et al*. (2016)
Humpback Whale	160	82	2.0	Kraus *et al*. (2016)
Minke Whale	103	83	1.2	Kraus *et al*. (2016)
Sei Whale*	41	25	1.6	Kraus *et al.* (2016)
Sperm Whale*	208	138	1.5	Palka *et al.* (2017)
Atlantic Spotted Dolphin	1334	46	29.0	Palka *et al.* (2017)
Atlantic White-Sided Dolphin	223	8	27.9	Kraus *et al.* (2016)
Bottlenose Dolphin	259	33	7.8	Kraus *et al.* (2016)
Common Dolphin	2896	83	34.9	Kraus *et al*. (2016)
Pilot Whales	117	14	8.4	Kraus *et al.* (2016)
Risso's Dolphin	1215	224	5.4	Palka *et al*. (2017)
Harbor Porpoise	121	45	2.7	Kraus *et al.* (2016)
Seals (Harbor and Gray)	201	144	1.4	Palka *et al*. (2017)

* Denotes species listed under the Endangered Species Act.

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The estimated exposure and take tables for each activity present the density-based exposure estimates, PSO-date derived take estimate, and mean group size for each species. The number of takes by Level B harassment Revolution Wind requested and NMFS authorizes is based on the largest of these three values. As mentioned previously, the amount of take by Level A harassment authorized is based strictly on density-based exposure modeling results, rounded up to the nearest whole number or group size, as appropriate. As described in the Comments and Responses section and based on specific recommendations by the Commission during the 45-day public comment period, NMFS is authorizing additional take for a subset of species for particular activities. Details are included in the following activity-specific sections.

Modeling and Take Estimation

Revolution Wind estimated potential density-based exposures in two separate ways, depending on the activity. For WTG and OSS monopile foundation installation, sophisticated sound and animal movement modeling was conducted to more accurately account for the movement and behavior of marine mammals and their exposure to the underwater sound fields produced during impact pile driving, as described below. For landfall construction activities, HRG surveys, and in-situ UXO/MEC disposal (*i.e.,* detonation), takes were estimated by multiplying the expected densities of marine mammals in the activity area(s) by the area of water likely to be ensonified above harassment threshold levels in a single day (24-hour period). The result was then multiplied by the number of days on which the activity is expected to occur, resulting in a density-based exposure estimate for each activity. In addition to the sophisticated modeling conducted for WTG and OSS monopile foundation installation, this method was used to produce a take estimate for each species for comparison with the exposure-based estimate, PSO-data estimate, and group size. Again, in some cases, these results directly inform the take estimates while, in other cases, adjustments are made based on monitoring results or average group size.

Below, we describe, in detail, the approach used to estimate take, in consideration of the acoustic thresholds and appropriate marine mammal density and occurrence information described above for each of the four different activities (WTG/OSS foundation installation, UXO/MEC detonation, landfall construction activities, and HRG surveys). The activity-specific exposure estimates (as relevant to the analysis) and activity-specific take estimates are also presented, alongside the combined totals annually, across the entire 5-year project, and as the maximum take of marine mammals that could occur within any 1 year.

WTG and OSS Monopile Foundation Installation

Here, for WTG and OSS monopile foundation installation, we provide summary descriptions of the modeling methodology used to predict sound levels generated from the Project with respect to harassment thresholds and potential exposures using animal movement, the density and/or occurrence information used to support the take estimates for this activity, and the resulting acoustic and exposure ranges, exposures, and authorized takes. Additional modeling details are available in the proposed rule **Federal Register** document (87 FR 79092, December 23, 2022).

In this section, we present Revolution Wind's acoustic and exposure estimates for installation of up to 79 WTG foundations and 2 OSS foundations, as requested by Revolution Wind.

The full installation parameters for each size monopile are described below. The two impact pile driving installation acoustic modeling scenarios are:

(1) 7/12-m diameter WTG monopile foundation: A total of 10,740 hammer strikes per pile modeled over 220 minutes (3.7 hours); and,

(2) 7/15-m diameter OSS foundation: A total of 11,564 hammer strikes per pile modeled over 380 minutes (6.3 hours).

Representative hammering schedules (Table 8), including increasing hammer energy with increasing penetration depth, were modeled because maximum sound levels usually occur during the last stage of impact pile driving, where the greatest resistance is typically encountered (Betke 2008). The hammering schedule includes a soft start, or a period of hammering at a reduced hammer energy (relative to full operating capacity).

Table 8 -- Hammer Energy Schedules for Monopile Installation Used in Source Modeling [1]

Monopile foundations (7/12-m diameter)			OSS Foundations (7/15- m diameter)		
Hammer: IHC S-4000			Hammer: IHC S-4000		
Energy Level (kilojoule, kJ)	Strike Count	Pile Penetration Depth (m)	Energy Level (kilojoule, kJ)	Strike Count	Pile Penetration Depth
1,000	1,705	0-6	1,000	954	0-5
2,000	3,590	6-24	2,000	2,944	5-17
3,000	2,384	24-36	3,000	4,899	17-36
4,000	3,061	36-50	4,000	2,766	36-50
Total:	10,740	50	Total:	11,563	50

1 - Modeled strike rate (min^{-1}) for both schedules = 50

Revolution Wind will install monopiles vertically to a maximum penetration depth of 50 m; therefore, the model includes this assumption. While pile penetration depth among the foundation positions might vary slightly, this value was chosen as a reasonable penetration depth for the purposes of acoustic modeling based on Revolution Wind's engineering designs. All modeling was performed assuming that only one pile is driven at a time (*i.e.,* Revolution Wind will not conduct concurrent monopile installations), up to three WTG foundations will be installed per day, and no more than one OSS foundation will be installed per day.

Sound fields produced during impact pile driving were modeled by first characterizing the sound signal produced during pile driving using the industry standard GRLWEAP (wave equation analysis of pile driving) model and JASCO Applied Sciences' (JASCO) Pile Driving Source Model (PDSM). We provide a summary of the modelling effort below but the full JASCO modeling report can be found in Section 6 and Appendix A of Revolution Wind's ITA application (*https://www.fisheries.noaa.gov/action/incidental-take-authorization-ocean-wind-lcc-construction-revolution-wind-wind-energy-facility*).

Underwater sound propagation (*i.e.,* transmission loss) as a function of range from each source was modeled using JASCO's Marine Operations Noise Model (MONM) for multiple propagation radials centered at the source to yield three-dimensional (3D) transmission loss fields in the surrounding area. The MONM computes received per-pulse SEL for directional sources at specified depths.

MONM uses two separate models to estimate transmission loss. At frequencies less than 2 kHz, MONM computes acoustic propagation via a wide-angle parabolic equation (PE) solution to the acoustic wave equation based on a version of the U.S. Naval Research Laboratory's Range-dependent Acoustic Model (RAM) modified to account for an elastic seabed. MONM–RAM incorporates bathymetry, underwater sound speed as a function of depth, and a geo-acoustic profile based on seafloor composition, and accounts for source horizontal directivity. The PE method has been extensively benchmarked and is widely employed in the underwater acoustics community, and MONM–RAM's predictions have been validated against experimental data in several underwater acoustic measurement programs conducted by JASCO. At frequencies greater than 2 kHz, MONM accounts for increased sound attenuation due to volume absorption at higher frequencies with the widely used BELLHOP Gaussian beam ray-trace propagation model. Both propagation models account for full exposure from a direct acoustic wave, as well as exposure from acoustic wave reflections and refractions (*i.e.,* multi-path arrivals at the receiver).

Two WTG and three OSS locations within the Lease Area were selected for acoustic modeling to provide representative propagation conditions and sound fields (see Figure 2 in Küsel *et al.,* 2021). The two WTG locations were selected to represent the relatively shallow (36.8 m) northwest section of the Lease Area to the somewhat deeper (41.3 m) southeast section. The three potential OSS locations (of which only two will be used to install the two OSS foundations) selected occupy similar water depths (33.7, 34.2, and 34.4 m). The acoustic propagation fields applied to exposure modeling (described below) were conservatively based on the WTG (1 of 2) and OSS (1 of 3) locations resulting in the largest fields.

The model also incorporated two different sound velocity profiles related to *in-situ* measurements of temperature, salinity, and pressure within the water column to account for variations in the acoustic propagation conditions between summer (May–November) and winter (December only).

Next, Revolution Wind modeled the sound field produced during impact pile driving by incorporating the results of the source level modeling into an acoustic propagation model. The sound propagation model incorporated site-specific environmental data that considers bathymetry, sound speed in the water column, and seabed geo-acoustics in the construction area.

Revolution Wind estimated both acoustic ranges and exposure ranges. Acoustic ranges represent the distance to a harassment threshold based on sound propagation through the environment (*i.e.,* independent of any receiver) while exposure range represents the distance at which an animal can accumulate enough energy to exceed a Level A harassment threshold in consideration of how it moves through the environment (*i.e.,* using movement modeling). In both cases, the sound level estimates are calculated from 3D sound fields and then, at each horizontal sampling range, the maximum received level that occurs within the water column is used as the received level at that range. These maximum-over-depth (R_{max}) values are then compared to predetermined threshold levels to determine acoustic and exposure ranges to Level A harassment and Level B harassment zone isopleths. However, the ranges to a threshold typically differ among radii from a source, and might not be continuous along a radii because sound levels may drop below threshold at some ranges and then exceed threshold at farther ranges. To minimize the influence of these inconsistencies, 5 percent of the farthest such footprints were excluded from the model data. The resulting range, $R_{95\%}$, was chosen to identify the area over which marine mammals may be exposed above a given threshold, because, regardless of the shape of the maximum-over-depth footprint, the predicted range encompasses at least 95 percent of the horizontal area that would be exposed to sound at or above the specified threshold. The difference between R_{max} and $R_{95\%}$ depends on the source directivity and the heterogeneity of the acoustic environment. $R_{95\%}$ excludes ends of protruding areas or small isolated acoustic foci not representative of the nominal ensonified zone. For purposes of calculating Level A harassment take, Revolution Wind applied exposure $R_{95\%}$ ranges, not acoustic $R_{95\%}$ ranges, to estimate take and determine mitigation distances for the reasons described below.

In order to best evaluate the SEL_{cum} harassment thresholds for PTS, it is necessary to consider animal movement, as the results are based on how sound moves through the environment between the source and the receiver. Applying animal movement and behavior within the modeled noise fields provides the exposure range, which allows for a more realistic indication of the distances at which PTS acoustic thresholds are reached that considers the accumulation of sound over different durations (note that in all cases the distance to the peak threshold is less than the SEL-based threshold).

As described in Section 2.6 of Appendix A of Revolution Wind's ITA application, for modeled animals that have received enough acoustic energy to exceed a given Level A harassment threshold, the exposure range for each animal is defined as the closest point of approach (CPA) to the source made by that animal while it moved throughout the modeled sound field, accumulating received acoustic energy. The resulting exposure range for each species is the 95th percentile of the CPA distances for all animals that exceeded threshold levels for that species (termed the 95 percent exposure range ($ER_{95\%}$)). The $ER_{95\%}$ ranges are species-specific rather than categorized only by any functional hearing group, which allows for the incorporation of more species-specific biological parameters (*e.g.,* dive durations, swim speeds, *etc.*) for assessing the impact ranges into the model. Furthermore, because these $ER_{95\%}$ ranges are species-specific, they can be used to develop mitigation monitoring or shutdown zones.

Sound exposure modeling, like JASCO's JASMINE, involves the use of a 3D computer simulation in which simulated animals (animats) move through the modeled marine environment over time in ways that are defined by the known or assumed movement patterns for each species derived from visual observation, animal borne tag, or other similar studies. The predicted 3D sound fields (*i.e.,* the output of the acoustic modeling process described earlier) are sampled by animats using movement rules derived from animal observations. The output of the simulation is the exposure history for each animat within the simulation. The precise location of animats (and their pathways) are not known prior to a project, therefore, a repeated random sampling technique (Monte Carlo) is used to estimate exposure probability with many animats and randomized starting positions. The probability of an animat starting out in or transitioning into a given behavioral state can be defined in terms of the animat's current behavioral state, depth, and the time of day. In addition, each travel parameter and behavioral state has a termination function that governs how long the parameter value or overall behavioral state persists in the simulation.

The sound field produced by the activity, in this case impact pile driving, is then added to the modeling environment at the location and for the duration of time anticipated for one or more pile installations. At each time step in the simulation, each animat records the received sound levels at its location resulting in a sound exposure history for each animat. These exposure histories are then analyzed to determine whether and how many animats (*i.e.,* simulated animals) were exposed above harassment threshold levels. Finally, the density of animats used in the modeling environment, which is usually much higher than the actual density of marine mammals in the activity area so that the results are more statistically robust, is compared to the actual density of marine mammals anticipated to be in or near the Lease Area.

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. Scaling the probability density function by the real-world densities for an animal results in the mean number of animats expected to be exposed over the duration of the project. Due to the probabilistic nature of the process, fractions of animats may be predicted to exceed threshold. If, for example, 0.1 animats are predicted to exceed threshold in the model, that is interpreted as a 10-percent chance that one animat will exceed a relevant threshold during the project, or equivalently, if the simulation were re-run 10 times, 1 of the 10 simulations would result in an animat exceeding the threshold. Similarly, a mean number prediction of 33.11 animats can be interpreted as re-running the simulation where the number of animats exceeding the threshold may differ in each simulation but the mean number of animats over all of the simulations is 33.11. A portion of an individual marine mammal cannot be taken during a project, so it is common practice to round mean number animat exposure values to integers using standard rounding methods. However, for low-probability events it is more precise to

provide the actual values. For this reason, mean number values are not rounded. A more detailed description of this method is available in Appendix A of Revolution Wind's application.

For the Project, JASMINE animal movement model was used to predict both the $ER_{95\%}$ ranges and the probability of marine mammal exposure to impact pile driving sound generated by monopile installation. Sound fields generated by the acoustic propagation modeling described above were input into the JASMINE model, and animats were programmed based on the best available information to ''behave'' in ways that reflect the behaviors of the 16 marine mammal species expected to occur in or near the Lease Area. The various parameters for forecasting realistic marine mammal behaviors (*e.g.,* diving, foraging, surface times, *etc.*) are determined based on the available literature (*e.g.,* tagging studies), or by extrapolating from a species expected to behave similarly (*e.g.,* fin and sei whales). More information regarding modeling parameters can be found Appendix A of the ITA application.

The mean numbers of animats that may be exposed to noise exceeding acoustic thresholds were calculated based on installation of 1, 2, or 3 WTG foundations and, separately, 1 or 2 OSS foundations in 24 hours. Animats were modeled to move throughout the 3D sound fields produced by each construction schedule for the entire construction period. For PTS exposures, both SPL_{peak} and SPL_{cum} were calculated for each species based on the corresponding acoustic criteria. Once an animat is taken within a 24-hour period, the model does not allow it to be taken a second time in that same period but rather resets the 24-hour period on a sliding scale across 7 days of exposure. For Level A harassment, an individual animat's exposure levels are summed over that 24-hour period to determine its total received energy, and then compared to the appropriate PTS threshold. Takes by behavioral disturbance are predicted when an animat is modeled to come within the area ensonified by sound levels exceeding the corresponding Level B harassment thresholds. Please note that animal aversion was not incorporated into the JASMINE model runs that were the basis for the take estimate for any species. See Appendix A of the ITA application for more details on the JASMINE modeling methodology.

Revolution Wind will employ a noise abatement system during all impact pile driving of monopiles. Noise abatement systems, such as bubble curtains, are sometimes used to decrease the sound levels radiated from a source. In modeling the sound fields produced by Revolution Wind's planned activities, hypothetical broadband attenuation levels of 0 dB, 6 dB, 10 dB, 12 dB, 15 dB, and 20 dB for were modeled to gauge effects on the ranges to threshold isopleths given these levels of attenuation. Although six attenuation levels were evaluated, Revolution Wind anticipates that the noise abatement system ultimately chosen will be capable of reliably reducing source levels by 10 dB; therefore, modeling results assuming 10-dB attenuation are carried forward in this analysis. Additional information related to Revolution Wind's use of noise abatement systems is provided in the Mitigation and Monitoring and Reporting sections.

As described more generally above, updated Roberts *et al.* (2023) habitat-based marine mammal density models provided the densities used to inform and scale the marine mammal exposure estimates produced by the JASMINE model. For monopile installation, specifically, mean monthly densities for all species were calculated by first selecting density data from 5 x 5 km (3.1 x 3.1 mile) grid cells (Roberts *et al.,* 2016; Roberts *et al.* (2023) both within the Lease Area and out to 10 km (6.2 mi) from the perimeter of the Lease Area. This is a reduction from the 50 km (31 mi) perimeter used in the ITR application. The relatively large area selected for density estimation encompasses and extends approximately to the largest estimated exposure acoustic range ($ER_{95\%}$) to the isopleth corresponding to Level B harassment, assuming no noise attenuation) (see Tables 19 and 20 of the ITA application) for all hearing groups using the unweighted threshold of 160 dB re 1 µPa (rms). Please see Figure 6 in Revolution Wind's Updated Density and Take Estimation Memo for an example of a density map showing Roberts and Halpin (2022) density grid cells overlaid on a map of the Lease Area.

Although there is some uncertainty in the monopile foundation installation schedule, Revolution Wind anticipates that it could occur over approximately 1 month provided good weather conditions and no unexpected delays. The exposure calculations were thus conducted using marine mammal densities from the month with the highest average density estimate for each species, based on the assumption that all 79 WTG and 2 OSS foundations will be installed in the highest density month (78 WTG monopile (3 per day for 26 days), 1 WTG monopile (1 per day for 1 day) and 2 OSS monopile foundations (1 per day for 2 days)). Due to differences in the seasonal migration and occurrence patterns, the month selected differs for each species. The estimated monthly density of seals provided in Roberts *et al.* (2023) includes all seal species present in the region as a single guild. To split the resulting ''seal'' density-based exposure estimate by species (harbor and gray seals), the estimate was multiplied by the proportion of the combined abundance attributable to each species. Specifically, the SAR N_{best} abundance estimates (Hayes *et al.,* 2023) for the two species (gray seal = 27,300, harbor seal = 61,336; total = 88,636) were summed and divided the total by the estimate for each species to get the proportion of the total for each species (gray seal = 0.308; harbor seal = 0.692). The total estimated exposure value based on the pooled seal density provided by Roberts *et al.* (2023) was then multiplied by these proportions to get the species-specific exposure estimates. Monthly densities were unavailable for pilot whales, so the annual mean density was used instead. The blue whale density was considered too low to be carried into exposure estimation so the amount of blue whale take Revolution Wind requested (see Estimated Take) is instead based on group size. Table 9 shows the maximum average monthly densities by species that were incorporated in exposure modeling to obtain conservative exposure estimates.

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Table 9 -- Maximum Monthly Marine Mammal Densities (Animals Per Km^2) Within and Around the Lease Area Out To 10 Km (6.2 Mi)

Marine Mammal Species	Highest Density
North Atlantic right whale [1]	0.0026 (December)
Blue whale [1,2]	–
Fin whale [1]	0.0029 (July)
Humpback whale	0.0021 (May)
Minke whale	0.0174 (May)
Sei whale [1]	0.0013 (May)
Sperm whale[1]	0.0004 (August)
Atlantic spotted dolphin	0.0005 (October)
Atlantic white-sided dolphin	0.0174 (May)
Bottlenose dolphin	0.0091 (August)
Common dolphin	0.0743 (December)
Pilot whales[3]	0.0007 (annual)
Risso's dolphin	0.0017 (December)
Harbor porpoise	0.0515 (December)
Seals (Harbor and Gray)	0.2225 (May)

1 – Listed as Endangered under the Endangered Species Act.

2 – Exposure modeling for the blue whale was not conducted because impacts to those species approach zero due to their low predicted densities in the Project; therefore, were excluded from all quantitative analyses and tables based on modeling results.

3 – Roberts *et al.* (2023) does not distinguish between short- and long-finned pilot whales, thus the pooled density provided represents both species. However, short-finned pilot whales are not expected to occur in the Project Area, therefore, NMFS assumes that any take of pilot whales would be of long-finned pilot whales.

For the exposure analysis, it was assumed that a maximum of three WTG monopile foundations may be driven in 24 hours, presuming installations are permitted to continue in darkness and would occur in the highest density month for any species. It is unlikely that this installation rate will be consistently possible throughout the WTG foundation construction phase, but this scenario was considered to have the greatest potential impact on marine mammals and was, therefore, carried forward into take estimation. Exposure ranges ($ER_{95\neq}$) to the Level A SEL_{cum} thresholds and Level B SPL_{rms} threshold resulting from animal exposure modeling for installation of one (for comparative purposes) or three (assumed for exposure modeling) WTG foundations and one OSS foundation per day (assumed for exposure modeling), assuming 10-dB of attenuation, for the summer (when Revolution Wind intends to install the majority of monopile foundations) and winter are shown in Tables 10 and 11. Exposure ranges were also modeled assuming installation of two WTG foundations per day (not shown here); see Appendix A of Revolution Wind's ITA application for those results. Although only allowed with NMFS approval in the case of unforeseen circumstances, any activities conducted in the winter (December) will utilize monitoring and mitigation measures based on the exposure ranges ($ER_{95\neq}$) calculated using winter sound speed profile, which are longer than $ER_{95\neq}$ modeled using a summer sound speed profile. Revolution Wind does not plan to install two OSS foundations in a single day due to the distance between the OSS locations coupled with the longer installation time for the larger diameter monopile (7/15-m versus 7/12-m diameter WTG monopile); therefore, modeling results are provided for installation of a single OSS foundation per day. Meaningful differences (greater than 500 m) between species within the same hearing group occurred for low-frequency cetaceans, so exposure ranges are shown separately for those species (Tables 10 and 11). For mid-frequency cetaceans and pinnipeds, the largest value among the species in the hearing group was selected to be included in Tables 10 and 11.

Table 10 -- Exposure Ranges[1] ($ER_{95\%}$), in Kilometers, to Level A (SEL_{cum}) Thresholds for Installation of One and Three 7/12-m WTG Monopiles (10,740 Strikes) and One 7/15-m OSS Monopile (11,564 Strikes) During Summer and Winter Assuming 10-dB Attenuation

Hearing Group	SEL_{cum} Threshold (dB re 1 $\mu Pa^2 \cdot s$)	WTG Monopile (1 pile/day)		WTG Monopile (3 piles/day)		OSS Monopile (1 pile/day)	
		Summer	Winter	Summer	Winter	Summer	Winter
Low-frequency	183						
North Atlantic Right Whale*	-	1.85	3.42	1.93	3.97	1.25	2.66
Fin Whale*	-	2.15	3.53	2.23	4.38	1.57	2.68
Humpback Whale	-	2.46	4.88	2.66	6.29	1.79	3.56
Minke Whale	-	1.32	3.03	1.51	3.45	0.94	1.81
Sei Whale*	-	1.42	2.82	1.81	3.67	1.22	2.05
Mid-frequency	185	0	0.01	0.02	0.02	0	0
High-frequency	155	1.28	2.29	1.34	2.33	0.83	1.25
Phocid pinnipeds	185	0.6	0.73	0.44	0.81	0.37	0.37

* Denotes species listed under the Endangered Species Act.
1 - Exposure ranges are a result of animal movement modeling.

Table 11 -- Exposure Ranges[1] ($ER_{95\%}$), in Kilometers, to the Level B (SPL_{rms}) Isopleth for Installation of One and Three 7/12-m WTG Monopiles or One 7/15-m OSS Monopile During Summer and Winter Assuming 10-dB Attenuation

Hearing Group	WTG Monopile (1 pile/day)		WTG Monopile (3 piles/day)		OSS Monopile (1 pile/day)	
	Summer	Winter	Summer	Winter	Summer	Winter
North Atlantic Right Whale*	3.70	4.06	3.67	3.95	3.51	3.75
Fin Whale*	3.72	4.05	3.76	4.09	3.62	3.88
Humpback Whale	3.75	4.15	3.72	4.11	3.61	3.87
Minke Whale	3.71	4.07	3.63	4.07	3.56	3.84
Sei Whale*	3.66	4.11	3.67	4.02	3.58	3.92
Mid-frequency	3.69	4.07	3.67	4.03	3.63	3.81
High-frequency	3.71	4.00	3.62	4.03	3.50	3.91
Phocid pinnipeds	3.79	4.21	3.80	4.23	3.75	4.02

* Listed as Endangered under the Endangered Species Act.

1 - Exposure ranges are a result of animal movement modeling.

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As mentioned previously, acoustic ranges ($R_{95\%}$) were also modeled. These thresholds were used to define the Level B harassment threshold (160 dB rms) for all species (see Mitigation) for WTG and OSS foundation installation in summer and winter (in parentheses):

- WTG monopile: 3,833 m (4,271 m)
- OSS monopile: 4,100 m (4,698 m)

Finally, the results of marine mammal exposure modeling, assuming 10-dB attenuation, for installation of 79 WTG and 2 OSS monopile foundations are shown in columns 2 and 3 of Table 12; these values assume that all 81 foundations (79 WTGs and 2 OSSs) will be installed in a single year and form the basis for the amount of take requested by Revolution Wind and authorized by NMFS. Columns 4 and 5 show what the take estimates would be if the PSO data or average group size, respectively, were used to inform the take by Level B harassment in lieu of the density and exposure modeling. The last two columns represent the take, by Level A harassment (PTS) and Level B harassment, respectively, NMFS is authorizing, The Level A exposure estimates shown in Table 12 are based only on the Level A SEL_{cum} threshold and associated exposure ranges (Table 10), as the very short distances to isopleths based on the Level A SPL_{pk} thresholds (Table 14 in the ITA application) resulted in no meaningful likelihood of take from exposure to those sound levels. The Level B

exposure estimates shown in Table 12 are based on the exposure ranges resulting from sound exposure modeling using the unweighted 160 dB SPL_{rms} threshold (Table 11). For each species, the number of takes, by Level B harassment, in the last column of Table 12 is based on the highest of the three estimates shown in columns 3 (Exposure Modeling Take Estimates—Level B), 4 (PSO Date Take Estimate), and 5 (Mean Group Size).

Revolution Wind requested, and NMFS proposed to authorize, Level A harassment (PTS) take for humpback whales (n=7) incidental to foundation installation because, for this species only, the shutdown zone is smaller (summer = 2,300 m; winter = 4,400 m) than the PTS Level A harassment $ER_{95\%}$ distance (summer = 2,660 m; winter = 6,290 m), thus humpback whales could be exposed to noise levels capable of inducing PTS before pile driving is shutdown. However, based on consideration of a comment from the Commission, NMFS is also authorizing a portion of the model-estimated Level A harassment (PTS) take of additional species. Revolution Wind must monitor extensive zones prior to and during pile driving during both daytime and nighttime pile driving, if it occurs. Although the combination of PSOs using promising new alternative visual monitoring equipment and PAM operators conducting extensive acoustic monitoring is expected to facilitate detection of marine mammals in the clearance and shutdown zones during daytime and nighttime (if it occurs) pile installation, it's possible that a marine mammal may enter the shutdown zone undetected. This situation is more likely for species that are challenging to detect (particularly in higher sea states), including minke whales, harbor porpoises, gray seals, and harbor seals. As indicated in the proposed rule, modeling resulted in the following number of Level A harassment (PTS) takes incidental to foundation installation for the indicated species: 7 fin whales, 3 sei whales, 61 minke whales, 321 harbor porpoises, 5 gray seals, and 32 harbor seals. Although some of these species are more difficult to detect, particularly at the farthest extent of the shutdown zones (*e.g.,* minke whale: summer = 2,300 m, winter = 4,400 m; harbor porpoise: summer = 1,400 m, winter = 2,400 m), NMFS considers it unlikely that 7 fin whales, 61 minke whales, 321 harbor porpoises, and 32 harbor seals would enter the Level A harassment (PTS) zone undetected and remain there for an extended duration, given the extensive monitoring and mitigation (*e.g.,* large clearance zones) NMFS is requiring Revolution Wind to implement. Thus, for these species, NMFS is authorizing 20 percent of the model-estimated Level A harassment (PTS) take proposed for authorization (rounded up to the nearest whole number) incidental to foundation installation, which is equal to 2 fin whales, 13 minke whales, 65 harbor porpoises, and 7 harbor seals. Additionally, NMFS is authorizing take, by Level A harassment, of 7 humpback whales (included in the proposed rule), 3 sei whales, and 5 gray seals, all of which are based solely on the density-based exposure estimate resulting from animal movement modeling presented in the proposed rule. We did not apply a 20 percent reduction to density-based exposure estimates for sei whales and harbor seals given the estimates are low in number and similar to a group size.

Although model estimated, Level A harassment of 18 North Atlantic right whales is not anticipated or authorized, given the extensive mitigation and monitoring measures prescribed to avoid this level of harassment for North Atlantic right whales.

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Table 12 -- Estimated Take, By Level A Harassment and Level B Harassment, for 79 (7/12-m) WTG and Two (7/15-m) OSS Monopile Foundation Installations Assuming 10-dB Attenuation

Species	Exposure Modeling Take Estimates[1]		PSO Data Take Estimate	Mean Group Size	Authorized Annual Level A Take	Authorized Annual Level B Take
	Level A (SPL_{cum})	Level B (SPL_{rms})				
North Atlantic Right Whale*	17.5	21.6	1.4	2.4	0	22
Blue Whale*	N/A	N/A	-	1.0	0	1
Fin Whale*	6.4	14.9	15.8	1.8	2[2]	16
Humpback Whale	6.5	11.5	47.1	2.0	7	48
Minke Whale	60.9	191.2	5.8	1.2	13[2]	192
Sei Whale*	2.5	7.8	0.4	1.6	3[3]	8
Sperm Whale*	0.0	2.8	-	1.5	0	3
Atlantic Spotted Dolphin	0.0	0.0	-	29.0	0	29
Atlantic White-Sided Dolphin	0.1	199.5	4.6	27.9	0	200
Bottlenose Dolphin	0.0	68.8	51.4	7.8	0	69
Common Dolphin	0.0	1,327.6	1,308.9	34.9	0	1,328
Long-finned pilot whales[4]	0.0	5.5	-	8.4	0	9
Risso's Dolphin	0.0	15.5	3.6	5.4	0	16
Harbor Porpoise	320.9	661.0	1.3	2.7	65[2]	661
Gray Seal	4.9	731.1	3.5	1.4	5[3]	732
Harbor Seal	32	328.0	4.6	1.4	7[2]	329

* Denotes species listed under the Endangered Species Act.

1 - Exposure estimates assume all piles will be installed in a single year.

2 - NMFS considers it unlikely that 7 fin whales, 61 minke whales, 321 harbor porpoises, and 32 harbor seals would enter their respective Level A harassment (PTS) zone undetected and remain there for an extended period of time, given the extensive monitoring and mitigation (e.g., large clearance zones) NMFS is requiring Revolution Wind to implement. Thus, NMFS is authorizing 20 percent of the model-estimated Level A harassment (PTS) (rounded to the nearest whole number).

3 - NMFS is authorizing take, by Level A harassment, of 3 sei whales and 5 gray seals, both of which are based solely on the density-based exposure estimates (rounded up to the nearest whole number) resulting from animal movement modeling. We did not apply a 20 percent reduction to density-based exposure estimates for these species given the exposure estimates are low in number and/or similar to a group size.

4 - Roberts *et al.* (2023) does not distinguish between short- and long-finned pilot whales, thus the pooled density provided represents both species. However, short-finned pilot whales are not expected to occur in the Project Area; therefore, NMFS assumes that any take of pilot whales would be of long-finned pilot whales.

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UXO/MEC Detonations

To assess the impacts from UXO/MEC detonations, JASCO conducted acoustic modeling based on previous underwater acoustic assessment work that was performed jointly between NMFS and the United States Navy. JASCO evaluated the effects thresholds for TTS, PTS, non-auditory injury, and mortality based on the appropriate metrics to use as indicators of disturbance and injury: (1) peak pressure level; (2) SEL; and (3) acoustic impulse. Charge weights of 2.3 kg (5.1 pounds (lbs)), 9.1 kg (20.1 lbs), 45.5 kg (100.3 lbs), 227 kg (500 lbs), and 454 kg (1,000.9 lbs), which is the largest charge the Navy considers for the purposes of its analyses (see the Description of the Specified Activities section in the proposed rule), were modeled to determine the ranges to mortality, gastrointestinal injury, lung injury, PTS, and TTS thresholds. These charge weights were modeled at four different locations and associated water depths in the Project Area (12 m (Site S1), 20 m (Site S2), 30 m (Site S3), and 45 m (Site S4)). The sites were deemed to be representative of both the RWEC (S1 and S2) and the Lease Area (S3 and S4).

Here, we present distances to PTS and TTS thresholds for all UXO/MEC charge weights. In the proposed rule, we only described the distances to thresholds for the largest E12 charge weight. However, as already described, Revolution Wind will be able to identify and mitigate at the relevant distances for each specific charge weight, so we have incorporated the maximum values for each size herein. Because of implementation of mitigation and monitoring measures, the potential for mortality and non-auditory injury is low and Revolution Wind did not request and we are not authorizing take by mortality or non-auditory injury. All modeling results, including mortality and non-auditory injury, can be found in Appendix B of the application.

UXOs/MECs were modeled at the locations listed below. The locations for these modeling sites are shown in Figure 1 of Appendix B in Revolution Wind's application:

- Shallow water RWEC: Site S1; In the channel within Narragansett Bay (12 m depth);
- Shallow water RWEC: Site S2; Intermediate waters outside of Narragansett Bay (20 m depth);
- Shallow water Lease Area: Site S3; Shallower waters in the southern portion of the Hazard Zone 2 area (30 m depth);
- Deeper water Lease Area: Site S4; Deeper waters in northern portion of the Hazard Zone 2 area (45 m depth).

For the RWEC, JASCO selected the largest distances to the PTS and TTS isopleths between S1 and S2 to carry forward for take estimation (Tables 45 and 47 in ITA application). This same approach was used to determine the largest distances to these isopleths for the Lease Area (S3 and S4; Tables 46 and 48 in ITA application). The distances were not always consistently larger for one site versus the other, so the results in Tables 45 and 47 in the ITA application represent a mixture of S1 and S2 for the RWEC and Tables 46 and 48 represent a mixture of results for S3 and S4 for the Lease Area. For all species, the distance to the SEL threshold isopleth exceeded that for the SPL peak isopleth (Table 29 in Appendix B of the ITA application). Model results for all sites and all charge weights can be found in Appendix B of Revolution Wind's application. Further, Revolution Wind presented results for both mitigated and unmitigated scenarios in the ITA application and the August 2022 Updated Densities and Takes Estimation Memo; however, Revolution Wind has committed to use a noise abatement system capable of 10-dB attenuation (minimally a double bubble curtain) during all detonations. As a result, the Updated Densities and Take Estimation Memo mitigated UXO/MEC scenario is the one carried forward into exposure and take estimation here. Tables 13 and 14 provide the largest ranges $R_{95\%}$ among all sites (S1–S4) to the SEL-based PTS-Onset and SEL-based TTS-Onset, assuming 10-dB attenuation. Additional information can be found in JASCO's UXO/MEC report and the Revised Density and Take Estimate Memo on NMFS' website (*https://www.fisheries.noaa.gov/action/incidental-take-authorization-revolution-wind-llc-construction-revolution-wind-energy*).

NMFS notes that the more detailed results for the mortality and non-auditory injury analysis for marine mammals for onset gastrointestinal injury, onset lung injury, and onset of mortality can be found in Appendix B of the ITA application, which can be found on NMFS' website. NMFS concurs with Revolution Wind's analysis and neither expects nor authorizes any non-auditory injury, serious injury, or mortality of marine mammals from UXO/MEC detonation. The modeled distances to the mortality threshold for all UXO/MECs sizes for all animal masses are small enough that they can be effectively monitored (*i.e.,* 5–353 m; see Tables 35–38 in Appendix B of Revolution Wind's application) and these types of impacts avoided, given the robust mitigation and monitoring measures required. The modeled distances to non-auditory injury thresholds range from 5–648 m (see Tables 30–34 in Appendix B of the application). Revolution Wind will be required to conduct extensive monitoring using both PSOs and PAM operators and clear an area of marine mammals prior to detonating any UXO/MEC. Given that Revolution Wind will be employing multiple platforms to visually monitor marine mammals as well as conducting passive acoustic monitoring, it is reasonable to assume that marine mammals will be reliably detected within approximately 660 m of the UXO/MEC being detonated and mortality or non-auditory injury is not likely to occur.

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Table 13 -- SEL-based $R_{95\%}$ PTS-Onset Ranges, in Meters, from all Site Modeled During UXO/MEC Detonation by Charge Weight, Assuming 10-dB Sound Attenuation

Marine Mammal Hearing Group	2.3 kg (5.1 lbs)		9.1 kg (20.1 lbs)		45.5 kg (100.3 lbs)		227 kg (500 lbs)		454 kg (1,000.9 lbs)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
LFC	632	552	1,230	982	2,010	1,730	3,370	2,970	4,270	3,780
MFC	<50	<50	79	75	175	156	419	337	535	461
HFC	2,100	1,820	3,020	2,590	4,400	3,900	6,130	5,400	6,960	6,200
PP	192	182	413	357	822	690	1,410	1,220	1,830	1,600

Note: LFC = low-frequency cetaceans; MFC = mid-frequency cetaceans; HFC = high-frequency cetaceans; PP = phocid pinnipeds

Table 14 -- SEL-based $R_{95\%}$ TTS-Onset Ranges, in Meters, from all Site Modeled During UXO/MEC Detonation by Charge Weight, Assuming 10-dB Sound Attenuation

Marine Mammal Hearing Group	2.3 kg (5.1 lbs)		9.1 kg (20.1 lbs)		45.5 kg (100.3 lbs)		227 kg (500 lbs)		454 kg (1,000.9 lbs)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
LFC	3,140	2,820	5,230	4,680	8,160	7,490	11,700	10,500	13,500	11,900
MFC	535	453	910	773	1,520	1,240	2,400	2,120	2,930	2,550
HFC	6,920	6,160	8,970	8,000	11,300	10,300	14,600	12,900	15,600	14,100
PP	1,730	1,470	2,710	2,350	4,340	3,820	6,640	5,980	7,820	7,020

Note: LFC = low-frequency cetaceans; MFC = mid-frequency cetaceans; HFC = high-frequency cetaceans; PP = phocid pinnipeds

Table 15 -- Maximum of Average Monthly Marine Mammal Densities (Individuals/km^2) Within 15 Km of the RWEC and Lease Area (May-November), and Associated Month

Species	RWEC		Lease Area	
	Maximum Density	Maximum Density Month	Maximum Density	Maximum Density Month
North Atlantic right whale*	0.0009	May	0.0019	May
Blue whale*	0.0000	Annual	0.0000	Annual
Fin whale*	0.0015	July	0.0029	July
Humpback whale	0.0014	May	0.0020	May
Minke whale	0.0110	May	0.0167	May
Sei whale*	0.0007	May	0.0012	May
Sperm whale*	0.0002	August	0.0004	August
Atlantic spotted dolphin	0.0002	October	0.0007	October
Atlantic white-sided dolphin	0.0086	May	0.0175	May
Bottlenose dolphin	0.0047	July	0.0093	August
Common dolphin	0.0389	November	0.0762	September
Pilot whales[1]	0.0001	Annual	0.0007	Annual
Risso's dolphin	0.0003	November	0.0006	November
Harbor porpoise	0.0218	May	0.0392	May
Grey Seal	0.0769	May	0.0692	May
Harbor Seal	0.1728	May	0.1554	May

* Denotes species listed under the Endangered Species Act.

1 - Roberts *et al.* (2023) does not distinguish between short- and long-finned pilot whales, thus the pooled density provided represents both species. However, short-finned pilot whales are not expected to occur in the Project Area, thus NMFS assumes that any take of pilot whales would be of long-finned pilot whales.

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To estimate the maximum ensonified zones that could result from UXO/MEC detonations, the $R_{95\%}$ to PTS and TTS threshold isopleths within the RWEC (S1 and S2; Tables 47 and 47 in ITA application), respectively, were used as radii to calculate the area of a circle (pi $\times r^2$ where r is the range to the threshold level) for each marine mammal hearing group. The results represent the largest area potentially ensonified above threshold levels from a single detonation within the RWEC. The same method was used to calculate the maximum ensonified area from a single detonation in the Lease Area (S3 and S4), based on the distances in Tables 46 and 48 in the ITA application. Again, modeling results are presented here for mitigated (*i.e.,* using a noise abatement system) detonations of UXO/MECs. The results for unmitigated detonations can be found Tables 44–48 in the ITA application.

As mentioned previously, Revolution Wind used the Duke Habitat-based Density Models to determine species-specific densities for inclusion in estimation of take incidental to UXO/MEC detonation. To avoid detonations of UXO/MECs during periods when North Atlantic right whale densities are highest in and near the Project Area, NMFS is imposing a seasonal restriction on detonations from December 1–April 30. For each species, Revolution Wind selected the highest average monthly marine mammal density among the months of May through November (Roberts *et al.* (2023)) to conservatively estimate exposures from UXO/MEC

detonation for a given species (*i.e.,* assumed all 13 UXO/MECs would be detonated in the month with the highest average density). This approach is similar to what was used for determining the most appropriate species densities for monopile foundation installation take estimation. Given that UXOs/MECs detonations have the potential to occur anywhere within the Lease Area and RWEC, a 15-km (9.32 mi) perimeter was applied around the Lease Area when selecting density data to include in take estimation (reduced from the 50 km (31 mi) perimeter in the ITA application) and a 10 km (6.2 mi) perimeter was applied to the RWEC (see Figures 12 and 13 of the Updated Density and Take Estimation Memo). In some cases where monthly densities were unavailable, annual densities were used instead for certain species (*i.e.,* blue whales, pilot whale *spp.*).

Table 15 provides those densities and the associated months in which the species-specific densities are highest for the RWEC and Lease Area, respectively.

In addition to assuming all detonations would be of the largest charge weight, Revolution Wind assumed six detonations would occur in the RWEC and seven would occur in the Lease Area. To estimate take incidental to UXO/MEC detonations in the RWEC, the maximum ensonified areas based on the largest $R_{95\%}$ to Level A harassment (PTS) and Level B harassment (TTS) thresholds (assuming 10-dB attenuation) from a single detonation in the RWEC, shown in Tables 45 and 47 in Revolution Wind's ITA application, were multiplied by six (the estimated number of UXOs/MECs that may be encountered in the RWEC) and then multiplied by the marine mammal densities shown in Table 15, resulting in the take estimates in Table 16. For the Lease Area, the same method was applied, using the maximum ensonified areas in Tables 46 and 48 in the ITA application multiplied by seven (the estimated number of UXOs/MECs that may be encountered in the Lease Area) and then multiplied by the marine mammal densities shown in Table 15, resulting in the values shown in the columns for the Lease Area (with the heading ''LA'') of Table 16. Again, Revolution Wind based the amount of requested take on the number of exposures estimated assuming 10-dB attenuation using a noise abatement system because they believe consistent, successful implementation of this mitigation measure will be possible.

Revolution Wind's mitigation and monitoring measures are intended to avoid Level A take of most species and the extent and severity of Level B harassment (see Mitigation and Monitoring and Reporting sections below). However, given the relatively large distances to the high-frequency cetacean Level A harassment (PTS, SEL_{cum}) isopleth applicable to harbor porpoises, and the difficulty detecting this species at sea, Revolution Wind requested and NMFS authorizes take by Level A harassment of 49 harbor porpoises. Similarly, seals are difficult to detect at longer ranges and, although the distance to the phocid hearing group SEL PTS threshold is not as large as that for high-frequency cetaceans, it may not be possible to detect all seals within the threshold distances even with the required monitoring measures. Therefore, in addition to the requested Level B harassment in Table 16, Revolution Wind requested Level A harassment of three gray seals and five harbor seals. For the proposed rule, NMFS adjusted the amount of take proposed for authorization to 7 gray seals and 16 harbor seals to correct for Revolution Wind's arithmetic error in the application when summing the density-based Level A exposures for the Lease Area and RWEC for each species. As described in the Comments and Responses section in the final rule, NMFS is also authorizing the amount of model-estimated Level A harassment (PTS) take (increased to group size where applicable) incidental to UXO/MEC detonations: 2 fin whales, 2 humpback whales, 8 minke whales, 35 common dolphins, 8 bottlenose dolphins (Western North Atlantic offshore stock), and 28 Atlantic white-sided dolphins. In making the decision to authorize the take indicated above, NMFS considered the Commission's recommendation, the challenge of monitoring the large mitigation and monitoring zone size (particularly for heavier charge weight UXOs/MECs) required for this activity, difficulty visually detecting smaller, cryptic marine mammals (*e.g.,* minke whales, dolphin *spp.*) at the furthest extent of the clearance zones, and that the authorized take numbers do not fully account for the effectiveness of the required mitigation measures other than the 10-dB noise attenuation incorporated in acoustic and exposure modeling.

As described for WTG and OSS installation, the Commission suggested that, given the frequency of common dolphin occurrence in the Project Area, NMFS should authorize an increased (relative to the amount included in the proposed rule) number of common dolphin takes, by Level B harassment, for all activities. Before we addressed the Commission's suggestion, we corrected the following transcription errors included in the proposed rule: the proposed take, by Level B harassment, should have been 14, not 9, bottlenose dolphins and 387, not 211, common dolphins. NMFS concurs with the Commission's suggestion and has included 245 Level B harassment takes of common dolphins incidental to UXO/MEC detonations (in addition to the corrected number (n=387) of estimated Level B harassment takes). Because Revolution Wind did not specify the time of year for this activity, it's equally possible that detonations could occur when common dolphin densities are highest or lowest in the Project Area. To account for this in determining the appropriate number of additional common dolphin takes to authorize, NMFS assumed that one group (group size = 34.9, rounded to 35) could be taken by Level B harassment incidental to every other detonation (n=7), equaling 245 common dolphin takes. Table 16 incorporates a total number of 632 Level B harassment takes (387 plus 245) of common dolphins incidental to UXO/MEC detonations.

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Table 16 -- Estimated and Authorized Level A Harassment and Level B Harassment Takes Resulting from the Detonation of Up to 13 UXOs, Assuming 10-dB of Sound Attenuation, Over 5 Years

Species	Modeled Level A Harassment			Modeled Level B Harassment			PSO Data Take Estimate	Mean Group Size	Authorized Annual Level A Take	Authorized Annual Level B Take
	LA[1]	RWEC[2]	Total (LA +RWEC)	LA	RWEC	Total (LA and RWEC)				
North Atlantic Right Whale*	0.6	0.2	0.8	6.0	5.2	11.2	0.5	2.4	0	12
Blue Whale*	0.0	0.0	0.0	0.0	0.0	0.1	-	1.0	0	1
Fin Whale*	0.8	0.4	1.2	8.9	7.8	16.7	3.2	1.8	2[3]	17
Humpback Whale	0.6	0.4	0.9	6.1	5.3	11.4	9.6	2.0	2[3]	12
Minke Whale	4.8	3.0	7.7	51.1	44.6	95.7	2.0	1.2	8[3]	96
Sei Whale*	0.4	0.2	0.5	3.8	3.3	7.1	0.1	1.6	2[3]	8
Sperm Whale*	0.0	0.0	0.0	0.1	0.0	0.1	-	1.5	0	2
Atlantic Spotted Dolphin	0.0	0.0	0.0	0.1	0.1	0.2	-	29.0	0	29
Atlantic White-Sided Dolphin	0.1	0.0	0.1	2.4	2.1	4.5	0.7	27.9	28[3]	28
Bottlenose Dolphin	0.0	0.6	0.1	1.3	1.1	2.4	13.7	7.8	8[3]	14
Common Dolphin	0.3	0.2	0.4	10.3	9.3	19.6	386.9	34.9	35[3]	632[4]
Long-finned Pilot Whales[5]	0.0	0.0	0.0	0.1	0.1	0.2	-	8.4	0	9
Risso's Dolphin	0.0	0.0	0.0	0.1	0.1	0.2	1.0	5.4	0	6
Harbor Porpoise	33.1	15.8	48.9	161.9	147.0	308.9	0.3	2.7	49	309
Gray Seal	7.9	8.7	16.6	176.7	150.2	326.8	0.9	0.4	17	327
Harbor Seal	3.0	3.3	6.3	66.7	56.7	123.5	1.1	1.0	7	124

* Denotes species listed under the Endangered Species Act

1 - LA = Lease Area

2 - RWEC = Revolution Wind Export Cable route

3 - NMFS is authorizing Level A harassment of the modeled number of Level A harassment (PTS) takes, rounded up to the nearest whole number and/or group size, as appropriate, in addition to the Level A harassment (PTS) take of harbor porpoises, gray seals, and harbor seals proposed for authorization (87 FR 79072, December 23, 2022).

4 - NMFS is authorizing 632 Level B harassment takes of common dolphins incidental to UXO/MEC detonations, which includes the corrected number of Level B harassment takes Revolution Wind requested (n=387) and an additional 245 takes as a result of a comment from the Commission questioning if the amount of proposed take was sufficient.

5 – Roberts *et al.* (2023) does not distinguish between short- and long-finned pilot whales, thus the pooled density provided represents both species. However, short-finned pilot whales are not expected to occur in the Project Area, thus NMFS assumes that any take of pilot whales would be of long-finned pilot whales.

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While there would be no more than 13 detonations of UXOs/MECs, each of which would be of very short duration (approximately 1 second), UXO/MEC detonations have a higher potential to cause mortality and injury than other Project activities and therefore have specific mitigation measures designed to prevent mortality and/or injury of marine mammals, including: (1) time of year/seasonal restrictions; (2) time of day restrictions; (3) use of PSOs to visually observe for North Atlantic right whales; (4) use of PAM to acoustically detect North Atlantic right whales; (5) implementation of clearance zones; (6) use of noise mitigation technology; and, (7) post-detonation monitoring visual and acoustic monitoring by PSOs and PAM operators.

The mitigation measures Revolution Wind must implement during any UXO/MEC detonations are expected to reduce the likelihood of Level A harassment (PTS) and, to a degree, Level B harassment to the extent practicable. However, as described above, there remains potential for Level A harassment (PTS) for multiple species.

Temporary Cofferdam or Casing Pipe/Goal Post Installation and Removal

Acoustic modeling, using JASCO's MONM–BELLHOP model (used for modeling impact pile driving), was performed for Ørsted's Sunrise Wind Farm project to determine distances to the Level A harassment and Level B harassment isopleths resulting from

installation and removal of steel sheet piles to construct cofferdams and goal posts, and installation and removal of casing pipes using pneumatic hammering (Küsel *et al.,* 2022b). Revolution Wind will install the same type of sheet piles and casing pipes in a similar location using the exact same methods as Sunrise Wind used to inform a published analysis, therefore, the modeling results described for Sunrise Wind (Küsel *et al.,* 2022b) and presented here are considered applicable to Revolution Wind's project. For take assessment purposes, the sheet pile cofferdam scenario results in a larger amount (compared to pneumatic hammering for casing pipe installation and vibratory pile driving for goal posts) of take by Level B harassment and was, therefore, the scenario carried further in the Estimated Take section. This is because acoustic propagation modeling predicts that the distance to the Level B harassment threshold isopleth produced by vibratory pile driving is approximately 10 km, while the distance to the same isopleth produced by pneumatic hammering is approximately 0.92 km. The sheet pile cofferdam scenario will require up to 56 days of vibratory hammer use for installation and removal, while the casing pipe scenario (including goal posts) will require 8 days of pneumatic hammering (2 days to install and 2 days to remove each casing pipe) and up to 12 days of vibratory pile driving. Removal of the casing pipes also involves the use of a pneumatic pipe ramming tool, but the pipe would be pulled out of the seabed while hammering was occurring instead of pushed into it. The larger number of total days of pile driving for the sheet pile cofferdam scenario coupled with the fact that vibratory pile driving on all of those days will produce the larger Level B harassment zone means the anticipated take, by Level B harassment, from the sheet pile cofferdam scenario will necessarily be higher and is, therefore, carried forward as the more conservative Level B harassment assumption. The acoustic ranges to the Level A harassment (SEL_{cum}) thresholds from pneumatic hammering of the casing pipe are estimated to be the following for each hearing group: low frequency = 3.87 km, mid frequency = 0.23 km, high frequency = 3.95 km, and phocid pinnipeds = 1.29 km. Level A harassment (SPL_{pk}) thresholds are not expected to be generated by pneumatic hammering. The estimated distances to Level A harassment SEL_{cum} thresholds are larger than the distance to the Level B harassment threshold (920 m). This is due to the high strike rate of the pneumatic hammer resulting in a high number of accumulated strikes per day. Most cetacean species are not expected to occur frequently close to this nearshore site, and individuals of any species (including seals) are not expected to remain within the estimated SEL_{cum} threshold distances for the entire 3-hour duration of hammering in a day. However, based on the Commission's recommendation (see Comments and Responses section) and given the (1) relatively frequent occurrence of harbor porpoises in Narragansett Bay, particularly at the time of year when Revolution Wind will conduct landfall construction (Kenney and Vigness-Raposa 2010), (2) the large distance to the Level A harassment SEL_{cum} threshold isopleth for harbor porpoises (3.95 km), and (3) the difficulty visually detecting harbor porpoises (particularly with increasing distance from the source), it's possible that this species may be exposed to noise levels that rise to the level of Level A harassment (PTS). In addition, since publication of the proposed rule, Revolution Wind determined that it will be impracticable to monitor a 4-km shutdown zone, as described in the proposed rule (87 FR 79072, December 23, 2022). Based on NOAA shipboard observations of harbor porpoises used in habitat-based density modeling conducted by Roberts *et al.* (2016, 2023), the detection probability for harbor porpoises drops off substantially in the 750–1000 m range when sea states are a Beaufort Sea State of 2 or less. Therefore, Revolution concluded that 750 m is the maximum practicable extent within which they could effectively monitor for harbor porpoise during casing pipe installation and removal. NMFS has adjusted the shutdown zone in this final rule to 750 m. Based on these factors and a recommendation from the Commission (see Comments and Responses section), NMFS is authorizing take of harbor porpoises, by Level A harassment (PTS), incidental to pneumatic hammering of casing pipe installation should this activity occur. Given (1) that work will occur within Narragansett Bay, a habitat that few marine mammal species typically use, (2) the short duration of pneumatic hammering, and (3) the implementation of mitigation and monitoring measures, Level A harassment of all other marine mammal species incidental to pneumatic hammering of casing pipe installation is not expected or authorized. In addition, given the nature of vibratory pile driving and the small distances to Level A harassment thresholds (5–190 m), sheet pile cofferdam installation is also not expected to result in Level A harassment. Revolution Wind did not request and NMFS is not authorizing any Level A harassment incidental to installation of sheet pile cofferdams via vibratory pile driving.

In summary, the Level B harassment zone produced by vibratory pile driving of sheet piles (9.74 km) is significantly larger than that produced by pneumatic hammering of a casing pipe (0.92 km). Additionally, as mentioned previously, the sheet pile cofferdam scenario will require up to a total of 56 days of vibratory pile driving for installation and removal, while the casing pipe scenario will require up to 24 days of vibratory pile driving plus 8 days of pneumatic hammering. The larger spatial impact for Level B harassment combined with the longer duration of sheet pile cofferdam installation will produce a larger amount of Level B harassment; therefore, this landfall construction activity was carried forward as the most conservative scenario to estimate the amount of Level B harassment.

JASCO used its MONM–BELLHOP to predict acoustic propagation for frequencies between 5 Hz and 25 kHz produced by vibratory pile driven installation of the steel sheet piles that will be used to construct temporary cofferdams (Küsel *et al.,* 2022b). Acoustic propagation modeling was based on a winter sound speed profile, which was deemed both conservative and appropriate for the Project because of the timing of landfall construction (Q4 2023–Q1 2024). Additional modeling assumptions are included in Table 17.

Decidecade band SEL levels were obtained from vibratory pile driving measurements available in the literature (Illingworth and Rodkin, 2017). The Illingworth and Rodkin (2017) measurements are for vibratory driving of four 12-in wide connected sheet piles (48 inch/122 centimeter total width) using an APE Model 300 vibratory hammer (1842.0 kilonewton (kN) centrifugal force). Illingworth and Rodkin (2017) included SEL at 10 m from the pile in the frequency band 5–25,000 Hz. The average (from 10 piling measurements) maximum broadband SEL was 182.7 dB re 1 $\mu Pa^2 \cdot s$. For modeling of vibratory driving of sheet piles at the landfall construction horizontal directional drilling (HDD) location, SEL band levels were corrected for spherical spreading (+20 dB, corresponding to 10 m range) (Küsel *et al.,* 2021).

Additional details on the acoustic modeling conducted for the Sunrise

Wind project can be found in the Sunrise Wind Farm Project Underwater Noise and Exposure Modeling report available on NMFS' website: *https://www.fisheries.noaa.gov/action/incidental-take-authorization-sunrise-wind-llc-construction-and-operation-sunrise-wind.*

Table 17 -- Sheet Pile Installation Key Piling Assumptions Used in the Source Modeling

Parameter	Model Input
Vibratory Hammer	APE 300
Pile Type	Sheet Pile
Pile Length	30 m
Pile Width	0.6 m
Pile Wall Thickness	2.54 cm
Seabed Penetration	10 m
Time to Install 1 Pile	2 hours
Number of Piles per Day	4

Similar to the modeling approach for impact pile driving, distances to harassment thresholds are reported as $R_{95\%}$ values (Table 18). Distances to the Level A harassment threshold (SEL_{cum}) are relatively small, ranging from 5 m for low-frequency cetaceans to 190 m for high-frequency cetaceans. The distance to the Level B harassment threshold is 9,740 m for all species.

Table 18 -- Acoustic Ranges ($R_{95\%}$), in Meters, to Level A Harassment (PTS) and Level B Harassment Thresholds from Vibratory Pile Driving, Assuming a Winter Sound Speed Profile

Marine Mammal Hearing Group	Level A Harassment SEL_{cum} Thresholds (dB re 1 $\mu Pa^2 \cdot s$)	Level B Harassment SPL_{rms} Threshold (120 dB re 1 µPa)
Low-frequency	5	9,740
Mid-frequency	-	9,740
High-frequency	190	9,740
Phocid pinniped	10	9,740

Accounting for the effects that nearby land would have on sound propagation using geospatial information systems (GIS) (Environmental Systems Research Institute, Inc. (ESRI), 2017) results in a reduction in the estimated area of 54.1 km^2 (20.9 mi^2) potentially being ensonified above the 120 dB threshold. As a cautionary approach, this 54.1 km^2 (20.9 mi^2) includes some areas beyond 9.74 km (6.05 mi) from the landfall location and reflects the maximum area potentially ensonified above threshold levels from construction activities at that site, including if a larger vibratory pile driving hammer were to be used.

Regarding how density and occurrence information was applied in estimating take for cofferdam installation, the export cable landfall construction work will take place near Quonset Point in North Kingstown, Rhode Island, which is within Narragansett Bay. However, the habitat-based marine mammal densities from Roberts *et al.* (2023) do not include waters within Narragansett Bay. As an alternative, densities calculated from the area just outside of Narragansett Bay were used in exposure estimation. This is a conservative approach since there have been few reported sightings of marine mammals, other than seals, within Narragansett Bay (Raposa, 2009).

To select marine mammal density grid cells from the Roberts *et al.* (2023) data representative of the area just outside of Narragansett Bay, a zone representing the ensonified area plus a 5-km buffer from the mouth of Narragansett Bay was created in GIS (ESRI, 2017). This buffer was then intersected with the density grid cells for each individual species to select those near the mouth of

Narragansett Bay (Figure 8 in Revolution Wind's Updated Density and Take Estimation Memo). Since the timing of landfall construction could vary somewhat from the planned schedule, the maximum average monthly density from January through December for each species was selected (Table 19) and used to estimate exposures from landfall construction.

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Table 19 -- Maximum Monthly Marine Mammal Densities In and Near the Mouth of Narragansett Bay and the Month in Which Each Maximum Density Occurs

Species	Maximum Monthly Density (Ind/km^2)	Maximum Density Month
North Atlantic Right Whale*	0.0002	March
Blue Whale*	0.0000	Annual
Fin Whale*	0.0000	-
Humpback Whale	0.0004	December
Minke Whale	0.0005	May
Sei Whale*	0.0002	April
Sperm Whale*	0.0000	-
Atlantic Spotted Dolphin	0.0000	-
Atlantic White-Sided Dolphin	0.0004	November
Bottlenose Dolphin	0.0002	September
Common Dolphin	0.0065	November
Pilot Whales[1]	0.0000	-
Risso's Dolphin	0.0000	-
Harbor Porpoise	0.0125	December
Gray seal	0.128	October
Harbor seal	0.204	October

* Denotes species listed under the Endangered Species Act.

1 – Roberts *et al.* (2023) does not distinguish between short- and long-finned pilot whales, thus the pooled density provided represents both species. However, short-finned pilot whales are not expected to occur in the Project Area, thus NMFS assumes that any take of pilot whales would be of long-finned pilot whales.

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Cable Landfall Construction Take Estimation

Given the short duration of the activity and shallow, coastal location, animat exposure modeling was not conducted for cofferdam or casing pipe and goal post installation and removal to determine potential exposures from vibratory pile driving. Rather, the modeled acoustic ranges to Level A harassment (PTS) and Level B harassment isopleths were used to calculate the area around the cofferdam predicted to be ensonified daily to levels that exceed the thresholds, or the Ensonified Area. The Ensonified Area was calculated as the following:

$$Ensonified\ Area = pi*r^2,$$

where r is the linear acoustic range from the source to the Level A harassment and Level B harassment isopleths. Because the distance to the Level B harassment threshold for cofferdam installation and removal (9,740 m) is larger than the distance for pneumatic hammering of casing pipes (920 m), the amount of Level B harassment take authorized assuming cofferdam will be installed encompasses any take that may occur incidental to installing goal posts or casing pipes.

To calculate density-based exposures estimates incidental to installation of two cofferdams, the average marine mammal densities from Table 19 were multiplied by the daily ensonified area (54.1 km^2) for installation of sheet piles. Given that use of the vibratory hammer during cofferdam installation and

removal may occur on up to 56 days, the daily estimated take was multiplied by 56 to produce the results shown in Table 20. However, as noted above, to be conservative, Revolution Wind has requested take by Level B harassment based on the highest exposures predicted among the density-based, PSO-based, or average group size-based estimates; the authorized take is indicated in column 5 of Table 20. Mysticete whales are unlikely to occur in the immediate vicinity of the activity or within Narragansett Bay (Raposa, 2009); therefore, Revolution Wind did not request and NMFS is not authorizing take of these species. In their ITR application, Revolution Wind requested two sperm whale Level B harassment takes incidental to landfall construction, which we included in the proposed rule. In this final rule, NMFS is not authorizing Level B harassment of sperm whales incidental to the specified activity because the sperm whale exposure estimate is 0.1 and the species exhibits a preference for deep oceanic habitat rather than the shallow waters in Narragansett Bay, thus, the probability of take is de minimis. Finally, we addressed the following transcription errors included in the proposed rule: the proposed take, by Level B harassment, should have been 60, not 36, bottlenose dolphins and 1,667, not 905, common dolphins.

As mentioned in the Comments and Responses section, the Commission recommended that NMFS authorize Level A harassment (PTS) of harbor porpoises incidental to pneumatic hammering of casing pipes, should Revolution choose to conduct that activity. Harbor porpoises are one of the few marine mammals known to occur regularly in Narragansett Bay (*e.g.,* Kenney and Vigness-Raposa, 2010), particularly in the winter during which casing pipe installation would occur (Q4 2023—Q1 2024). The likely temporal and spatial overlap of harbor purpose occurrence with the Level A harassment (PTS) acoustic footprint resulting from pneumatic hammering, the size of the Level A harassment zone (PTS) (3,950 m), and the species' cryptic nature support authorization of Level A harassment. Revolution Wind expects that it will require 8 days of pneumatic hammering to install and remove the casing pipes. Because Revolution Wind has not specified exactly which 8 days in Q4 2023–Q1 2024 casing pipe installation would occur, it is possible that they would complete this activity in December or January, when harbor porpoise densities near the landfall construction site are an order of magnitude higher than in the other months in which the species consistently utilizes habitat in/near Narragansett Bay (March-May), and the potential for acoustic impacts from pneumatic hammering is highest. Thus, NMFS conservatively assumed that one group (group size = 2.7; Kraus *et al.,* 2016) rounded to the nearest whole number may be taken by Level A harassment per day of pneumatic hammering (n=8). Therefore, NMFS is authorizing 24 takes, by Level A harassment, of harbor porpoises incidental to casing pipe installation (Table 21).

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Table 20 -- Estimated Level B Harassment Incidental to Cofferdam, Goal Posts, or Casing Pipe Construction

Species	Exposure Estimate	PSO Data Take Estimate	Mean Group Size	Highest Level B Take
Atlantic Spotted Dolphin	0.1	-	29.0	29
Atlantic White-Sided Dolphin	1.2	5.2	27.9	28
Bottlenose Dolphin	0.5	59.2	7.8	60
Common Dolphin	19.6	1,666.6	34.9	1,667
Long-finned Pilot Whales[1]	0.0	-	8.4	9
Risso's Dolphin	0.1	4.1	5.4	6
Harbor Porpoise	37.8	1.5	2.7[1]	38
Gray Seal	833.1	2.5	1.4	834
Harbor Seal	314.7	3.2	1.4	315

* Denotes species listed under the Endangered Species Act.

1 – Roberts *et al.* (2023) does not distinguish between short- and long-finned pilot whales, thus the pooled density provided represents both species. However, short-finned pilot whales are not expected to occur in the Project Area, thus NMFS assumes that any take of pilot whales would be of long-finned pilot whales.

Table 21 -- Estimated Level A harassment (PTS) Incidental to Casing Pipe Installation

Species	Level A harassment (PTS) take
Harbor porpoises	24[1]

1 - NMFS has authorized Level A harassment (PTS) of 24 harbor porpoises. NMFS calculated this number of takes by multiplying group size (2.7, rounded to 3) times the number of days on which pneumatic hammering will occur (n=8).

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HRG Surveys

NMFS considers the data provided by Crocker and Fratantonio (2016) to represent the best available information on source levels associated with HRG equipment and, therefore, recommends that source levels provided by Crocker and Fratantonio (2016) be incorporated in the method described in NMFS (2018) to estimate ranges to the Level A harassment and Level B harassment isopleths. In cases when the source level for a specific type of HRG equipment is not provided in Crocker and Fratantonio (2016), NMFS recommends that either the source levels provided by the manufacturer be used, or, in instances where source levels provided by the manufacturer are unavailable or unreliable, a proxy from Crocker and Fratantonio (2016) be used instead. Revolution Wind utilized the following criteria for selecting the appropriate inputs into the NMFS User Spreadsheet Tool (NMFS, 2018):

(1) For equipment that was measured in Crocker and Fratantonio (2016), the reported source level (SL) for the most likely operational parameters was selected.

(2) For equipment not measured in Crocker and Fratantonio (2016), the best available manufacturer specifications were selected. Use of manufacturer specifications represent the absolute maximum output of any source and do not adequately represent the operational source. Therefore, they should be considered an overestimate of the sound propagation range for that equipment.

(3) For equipment that was not measured in Crocker and Fratantonio (2016) and did not have sufficient manufacturer information, the closest proxy source measured in Crocker and Fratantonio (2016) was used.

The Dura-spark measurements and specifications provided in Crocker and Fratantonio (2016) were used for all sparker systems that will be used during HRG surveys. These included variants of the Dura-spark sparker system and various configurations of the GeoMarine Geo-Source sparker system. The data provided in Crocker and Fratantonio (2016) represent the most applicable data for similar sparker systems with comparable operating methods and settings when manufacturer or other reliable measurements are not available. Crocker and Fratantonio (2016) provide S-Boom measurements using two different power sources (CSP–D700 and CSP–N). The CSP–D700 power source was used in the 700 joules (J) measurements but not in the 1,000 J measurements. The CSP–N source was measured for both 700 J and 1,000 J operations but resulted in a lower source level; therefore, the single maximum source level value was used for both operational levels of the S-Boom.

Table 22 identifies all the representative survey equipment that operates below 180 kHz (*i.e.,* at frequencies that are audible and have the potential to disturb marine mammals) that may be used in support of planned survey activities and are likely to be detected by marine mammals given the source level, frequency, and beamwidth of the equipment.

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Table 22 -- Summary of representative HRG Survey equipment

Equipment Type	Representative Model	Operating Frequency (kHz)	Source Level SPL_{rms} (dB)	Source Level 0-pk (dB)	Pulse Duration (ms)	Repetition Rate (Hz)	Beamwidth (degrees)	Information Source
Sub-bottom Profiler	EdgeTech 216	2 – 16	195	-	20	6	24	MAN
	EdgeTech 424	4 – 24	176	-	3.4	2	71	CF
	Edgetech 512	0.7 – 12	179	-	9	8	80	CF
	GeoPulse 5430A	2 – 17	196	-	50	10	55	MAN
	Teledyn Benthos CHIRP III - TTV 170	2 – 17	197	-	60	15	100	MAN
Sparker	Applied Acoustics Dura-Spark UHD (400 tips, 500 J)[1]	0.3 – 1.2	203	211	1.1	4	Omni	CF
Boomer	Applied Acoustics triple plate S-Boom (700–1,000 J)[2]	0.1 – 5	205	211	0.6	4	80	CF

- = not applicable; ET = EdgeTech; J = joule; kHz = kilohertz; dB = decibels; SL = source level; UHD = ultra-high definition; AA = Applied Acoustics; rms = root-mean square; µPa = microPascals; re = referenced to; SPL = sound pressure level; PK = zero-to-peak pressure level; Omni = omnidirectional source.

1 - The Dura-spark measurements and specifications provided in Crocker and Fratantonio (2016) were used for all sparker systems that will be used in the surveys. These include variants of the Dura-spark sparker system and various configurations of the GeoMarine Geo-Source sparker system. The data provided in Crocker and Fratantonio (2016) represent the most applicable data for similar sparker systems with comparable operating methods and settings when manufacturer or other reliable measurements are not available.

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

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When the NMFS Technical Guidance (2016) was published, in recognition of the fact that ensonified area/volume could be more technically challenging to predict because of the duration component in the new thresholds, we developed a User Spreadsheet that includes tools to help predict a simple isopleth that can be used in conjunction with marine mammal density or occurrence to help predict takes. We note that because of some of the assumptions included in the methods used for these tools, we anticipate that isopleths produced are typically going to be overestimates of some degree, which may result in some degree of overestimation of Level A harassment. However, these tools offer the best way to predict appropriate isopleths when more sophisticated 3D modeling methods are not available, and NMFS continues to develop ways to quantitatively refine these tools, and will qualitatively address the output where appropriate. For mobile sources (such as the active acoustic sources proposed for use during Revolution Wind's HRG surveys), the User Spreadsheet predicts the closest distance at which a stationary animal would not incur PTS if the sound source traveled by the animal in a straight line at a constant speed. JASCO modeled distances to Level A harassment isopleths for all types of HRG equipment and all marine mammal functional hearing groups using the NMFS User Spreadsheet and NMFS Technical Guidance (2018).

For HRG surveys, in order to better consider the narrower and directional beams of the sources, NMFS has developed an additional tool for determining the sound pressure level (SPL_{rms}) at the 160-dB isopleth for the purposes of estimating the extent of Level B harassment isopleths associated with HRG survey equipment (NMFS, 2020). This methodology incorporates frequency-dependent absorption and some directionality to refine estimated ensonified zones. Revolution Wind used NMFS' methodology with additional modifications to incorporate a seawater absorption formula and account for

energy emitted outside of the primary beam of the source. For sources that operate with different beam widths, the maximum beam width was used (see Table 22). The lowest frequency of the source was used when calculating the absorption coefficient.

Results of modeling using the methodology described above indicated that, of the HRG equipment planned for use by Revolution Wind that has the potential to result in Level B harassment of marine mammals, sound produced by the Applied Acoustics sparkers and Applied Acoustics triple-plate S-boom will propagate furthest to the Level B harassment isopleth (141 m; Table 23). For the purposes of take estimation, it was conservatively assumed that sparkers and/or boomers will be the dominant acoustic source for all vessel days (although, again, this may not always be the case). Thus, the distances to the isopleth corresponding to the threshold for Level B harassment for the boomer and sparkers (141 m) was used as the basis of take calculations for all marine mammals.

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Table 23 -- Distances to the Level B Harassment Thresholds for Each HRG Sound Source or Comparable Sound Source Category for Each Marine Mammal Hearing Group

Equipment Type	Representative Model	Distance to Level B harassment threshold (m)
		All (SPL_{rms})
Sub-bottom Profiler	EdgeTech 216	9
	EdgeTech 424	4
	Edgetech 512	6
	GeoPulse 5430A	21
	Teledyn Benthos CHIRP III - TTV 170	48
Sparker	Applied Acoustics Dura-Spark UHD (700 tips, 1,000 J)	34
	Applied Acoustics Dura-Spark UHD (400 tips, 500 J)	141
	Applied Acoustics Dura-Spark UHD (400 tips, 500 J)	141
Boomer	Applied Acoustics triple plate S-Boom (700–1,000 J)	141

To estimate densities for the HRG surveys occurring both within the Lease Area and within the RWEC based on Roberts *et al.* (2023), a 5-km (3.11 mi) perimeter was applied around each area (see Figures 10 and 11 of the Updated Density and Take Estimation Memo). Given this work could occur year-round, the annual average density for each species was calculated using average monthly densities from January through December (Table 24).

Table 24 -- Annual Average Marine Mammal Densities (Indiv/km^2) Along the RWEC and Lease Area

Species	RWEC	Lease Area
North Atlantic Right Whale*	0.0011	0.0027
Blue Whale*	0.0000	0.0000
Fin Whale*	0.0008	0.0016
Humpback Whale	0.0008	0.0010
Minke Whale	0.0022	0.0044
Sei Whale*	0.0003	0.0004
Sperm Whale*	0.0001	0.0001
Atlantic Spotted Dolphin	0.0000	0.0001
Atlantic White-Sided Dolphin	0.0038	0.0090
Bottlenose Dolphin	0.0021	0.0049
Common Dolphin	0.0202	0.0409
Pilot Whales[1]	0.0001	0.0005
Risso's Dolphin	0.0001	0.0003
Harbor Porpoise	0.0191	0.0316
Seals (Harbor and Gray)	0.1477	0.1182

* Denotes species listed under the Endangered Species Act.

1 – Roberts *et al.* (2023) does not distinguish between short- and long-finned pilot whales, thus the pooled density provided represents both species. However, short-finned pilot whales are not expected to occur in the Project Area, thus NMFS assumes that any take of pilot whales would be of long-finned pilot whales.

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The maximum range (*i.e.,* 141 m) to the Level B harassment threshold and the estimated trackline distance traveled per day by a given survey vessel (*i.e.,* 70 km) were used to calculate the daily ensonified area, or zone of influence (ZOI), around the survey vessel.

The ZOI is a representation of the maximum extent of the ensonified area around a HRG sound source over a 24-hr period. The ZOI for each piece of equipment operating at or below 180 kHz was calculated per the following formula:

$ZOI = (Distance/day \times 2r) + pi*r^2$

Where r is the linear distance from the source to the harassment isopleth.

The largest daily ZOI (19.8 km^2), associated with the use of boomers and sparkers, was applied to all planned vessel days.

Potential Level B harassment density-based exposures were estimated by multiplying the average annual density of each species within the survey area by the daily ZOI. That product was then multiplied by the number of planned vessel days in each sector during the approximately 1-year construction timeframe (82.1 in RWEC, 165.7 in Lease Area), and the product was rounded to the nearest whole number. These results are shown in columns 2 (Lease Area) and 3 (RWEC) of Table 25. Similar to the approach described above, to be conservative, Revolution Wind has requested take by Level B harassment based on the highest exposures predicted by the density-based, PSO based, or average group size-based estimates, and the authorized take is indicated in column 7 of Table 25 below.

As described in the Comments and Responses section, the Commission suggested that, given the frequency of common dolphin occurrence in the Project Area, NMFS should authorize an increased (relative to the amount included in the proposed rule) number of common dolphin takes, by Level B harassment for HRG surveys. Common dolphins are regularly sighted by PSOs during HRG surveys but, as described previously, only a portion of those sighted are actually within the Level B harassment zone, as evidenced by PSO monitoring reports for the Project Area (*e.g.,* Smultea Environmental Sciences, LLC, 2020; Valencia *et al.,* 2021; Smultea Environmental Sciences, LLC, 2022). The total number of common dolphins sighted by PSOs is highly variable, depending on the survey timing (which may align more or less with peaks in expected common dolphin occurrence), the number of kilometers surveys, and survey conditions, among other factors. As described above, Revolution Wind anticipates that they may conduct HRG

surveys throughout the effective period of the authorization. Given common dolphins are one of the most frequently sighted species during HRG surveys (as reported by PSOs in the monitoring reports cited here) and the number of dolphins sighted is highly variable and dependent on multiple influencing factors (*e.g.*, time of year), NMFS concurs with the Commission and is conservatively authorizing 4,457 common dolphin Level B harassment takes incidental to HRG surveys during the year of construction, which is equivalent to the number of common dolphins taken by Level B harassment during the HRG surveys the Commission refers to in their comment. This is an 89 percent increase from the 2,354 common dolphin Level B harassment takes proposed for authorization.

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Table 25 -- Estimated Take, by Level B Harassment, Incidental to HRG Surveys during the Construction Period (Year 1)

Species	Modeled Exposures Lease Area	Modeled Exposures RWEC	Total Density-based Take Estimate	PSO Data Take Estimate	Mean Group Size	Authorized Level B Take
North Atlantic Right Whale*	7.4	1.8	9.2	-	2.4	10
Blue Whale*	0.0	0.0	0.0	-	1.0	1
Fin Whale*	4.4	1.4	5.8	6.6	1.8	7
Humpback Whale	2.8	1.2	4.0	16.5	2.0	17
Minke Whale	11.8	3.7	15.5	5.9	1.2	16
Sei Whale*	1.1	0.4	1.6	-	1.6	2
Sperm Whale*	0.4	0.1	0.5	-	1.5	2
Atlantic Spotted Dolphin	0.3	0.1	0.3	-	29.0	29
Atlantic White-Sided Dolphin	24.5	6.5	31.0	-	27.9	31
Bottlenose Dolphin	13.2	3.8	17.0	100.1	7.8	101
Common Dolphin	110.5	33.5	144.0	2,353.4	34.9	4,457[1]
Long-Finned Pilot Whales[2]	1.4	0.1	1.5	-	8.4	9
Risso's Dolphin	0.8	0.2	1.0	2.3	5.4	6
Harbor Porpoise	85.4	30.9	116.3	-	2.7	117
Gray Seal	232.0	177.9	410.0	7.1	1.4	410
Harbor Seal	87.7	67.2	154.9	11.2	1.4	155

* Denotes species listed under the Endangered Species Act.

1 - In response to consideration of a comment from the Commission, NMFS is authorizing 4,457 Level B harassment takes of common dolphins incidental to HRG surveys during construction (Years 1), which is an 80 percent increase from the number in the proposed rule (2,354). The percentage increase is based on PSO observations in/near the Lease Area (Smultea Environmental Services, 2020).

2 - Roberts *et al.* (2023) does not distinguish between short- and long-finned pilot whales, thus the pooled density provided represents both species. However, short-finned pilot whales are not expected to occur in the Project Area, thus NMFS assumes that any take of pilot whales would be of long-finned pilot whales.

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Authorized takes will be by Level B harassment, 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 (even absent mitigation), nor authorized. Consideration of the anticipated effectiveness of the mitigation measures (*i.e.,* pre-start clearance and shutdown measures), discussed in detail below in the Mitigation section, further strengthens the conclusion that Level A harassment is not a reasonably expected outcome of the survey activity. Revolution Wind did not request authorization of take by Level A harassment, and no take by Level A harassment is authorized by NMFS. As described previously, no serious injury or mortality is anticipated or authorized for this activity.

As mentioned previously, HRG surveys will also routinely be carried out during the period of time following construction of the RWF and RWEC which, for the purposes of exposure modeling, Revolution Wind assumed to be 4 years. Revolution Wind estimates that HRG surveys will cover 2,117 km within the Lease Area and 1,642 km along the RWEC annually. Assuming 70 km are surveyed per day, this amounts to 30.2 days of survey activity in the Lease Area and 23.5 days of survey activity along the RWEC each year, or 214.8 days total for the 4-year timeframe following the construction period (assuming all construction activities occur in a single year). Density-based take was estimated using the same approach outlined above by multiplying the daily ZOI by the annual average densities and separately by the number of vessel days planned for the RWEC and Lease Area; the results are shown in columns 2 and 3, respectively, in Table 26. Using the same approach described above, Revolution Wind estimated a conservative amount of annual take, by Level B harassment, based on the highest exposures predicted by the density-based, PSO-based, or average group size-based estimates. The highest predicted exposure value was multiplied by four to yield the amount of take Revolution Wind requested and NMFS is authorizing, shown in column 8 of Table 26 below. Consistent with the method used above to determine the increased number of common dolphin Level B harassment takes incidental to HRG surveys during construction, NMFS is authorizing 1,094 takes per year (89 percent increase from 579 per year, as presented in the proposed rule) of common dolphins, by Level B harassment, for each of the 4 years following construction (4,376 total over 4 years).

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Table 26 -- Estimated Take, by Level B Harassment, from HRG Surveys During Non-construction Years (Years 2-5) and Total 4-year Take

Species	Lease Area	RWEC	Annual Total Density-based Exposures	Annual PSO Data Take Estimate	Mean Group Size	Highest Annual Level B Take (Years 2-5)	4-Year Level B Take
North Atlantic Right Whale*	1.6	0.5	2.1	-	2.4	3	12
Blue Whale*	0.0	0.0	0.0	-	1.0	1	4
Fin Whale*	1.0	0.4	1.3	1.6	1.8	2	8
Humpback Whale	0.6	0.4	1.0	4.0	2.0	5	20
Minke Whale	2.6	1.0	3.6	1.5	1.2	4	16
Sei Whale*	0.3	0.1	0.4	-	1.6	2	8
Sperm Whale*	0.1	0.0	0.1	-	1.5	2	8
Atlantic Spotted Dolphin	0.1	0.0	0.1	-	29.0	29	116
Atlantic White-Sided Dolphin	5.4	1.8	7.2	-	27.9	28	112
Bottlenose Dolphin	2.9	1.0	3.9	24.6	7.8	25	100
Common Dolphin	24.5	9.4	33.8	578.0	34.9	1,094	4,376[1]
Long-Finned Pilot Whales[2]	0.3	0.0	0.3	-	8.4	9	36
Risso's Dolphin	0.2	0.1	0.2	0.6	5.4	6	24
Harbor Porpoise	18.9	8.9	27.8	-	2.7	28	112
Gray Seal	64.1	29.8	113.9	1.7	1.4	114	456
Harbor Seal	24.2	18.8	43.0	2.7	1.4	44	176

* Denotes species listed under the Endangered Species Act.

1 - In response to consideration of a comment from the Commission, NMFS is authorizing 1,094 Level B harassment takes of common dolphins per year (Years 2-5) incidental to HRG surveys, which an 80 percent increase from the number in the proposed rule (579), amounting to 4,376 total Level B harassment takes of common dolphins in non-construction year. The percentage increase is based on PSO observations in/near the Lease Area (Smultea Environmental Services, 2020).

2 - Roberts *et al.* (2023) does not distinguish between short- and long-finned pilot whales, thus the pooled density provided represents both species. However, short-finned pilot whales are not expected to occur in the Project Area, thus NMFS assumes that any take of pilot whales would be of long-finned pilot whales.

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Total Authorized Take Across All Activities

NMFS is authorizing take by Level A and Level B harassment incidental to Project activities combined (*i.e.,* impact pile driving to install WTG and OSS monopile foundations (assuming 10-dB attenuation), vibratory pile driving to install and remove temporary cofferdams and goal posts, pneumatic hammering to install and remove temporary casing pipes UXO/MEC detonations (assuming 10-dB attenuation), and HRG surveys) as shown in Table 27. The number of takes that would occur in each year, based on Revolution Wind's current schedule, is provided in Table 27. The Year 1 take estimates include 165.7 days of HRG surveys, impact installation of WTG and OSS foundations, cofferdam installation/removal, and mitigated UXO/MEC detonations. Year 2 includes 30.2 days of HRG surveys, and potential impact installation of WTG and OSS monopile foundations, depending on whether or not delays in the schedule for Year 1 occur. Years 3, 4, and 5 each include 30.2 days of HRG surveys. Although temporary cofferdam installation/removal could occur in Year 2, all of the authorized takes were allocated to Year 1 as this represents the most accurate construction scenario. All impact pile driving activities for the WTGs and OSSs could also occur outside of Year 1; however, all of the

takes were allocated to Year 1 as this represents the most likely scenario.

The mitigation and monitoring measures provided in the Mitigation and Monitoring and Reporting sections are activity-specific and are designed to minimize acoustic exposures to marine mammal species.

The number of takes that NMFS authorized is considered conservative for several reasons, including, but not limited to, the following: authorized take numbers are based on the highest number resulting from among three take estimate methodologies (density-based exposure, PSO data-derived, and group size); authorized take numbers assume all foundation piles (n=81) will be installed and all UXO/MECs detonations would occur in the month with the highest monthly average density for each marine mammal species; authorized Level B harassment take numbers for landfall construction assume 56 days of vibratory pile driving for cofferdam installation, although the casing pipe and goal post alternative would only require 24 days of vibratory pile driving and a short period of pneumatic hammering which has shorter distances to the Level B harassment isopleth than cofferdam installation, if installed; authorized take numbers assume sparkers and/or boomers, which result in the largest acoustic footprint, would be the dominant source for all HRG surveys days, although this may not be the case; authorized take numbers for Level A harassment (PTS) do not fully account for the likelihood that marine mammals will avoid a stimulus when possible before the individual accumulates enough acoustic energy to potentially cause auditory injury, nor do the take numbers fully account for the effectiveness of the required mitigation and monitoring measures (exception for foundation installation and UXO/MEC detonations, which incorporate 10-dB of sound attenuation).

NMFS also presents the percentage of each marine mammal stock estimated to be taken based on the total amount of allowable annual take for each species, which is presented in Table 28. Table 27 provides the total authorized take from the entire 5-year effective period of the rulemaking and issued LOA. NMFS recognizes that schedules may shift due to a number of planning and logistical constraints such that take may be redistributed throughout the 5 years. However, the 5-year total amount of take for each species, shown in Table 27, and the maximum amount of take in any 1 year (Table 28) would not be exceeded. Additionally, NMFS has required extensive mitigation and monitoring measures, provided in the Mitigation and Monitoring and Reporting sections, which are activity-specific and are designed to minimize, to the extent practicable, impacts to marine mammal species.

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Table 27 -- Annual and Total 5-Year Estimated Level A Harassment and Level B Harassment Takes for All Activities Conducted During the Revolution Wind Offshore Wind Energy Facility Project (2023-2028)

Species	NMFS Stock Abundance	Year 1 (Maximum)		Year 2		Year 3		Year 4		Year 5		5-Year Total	
		Level A	Level B	Level A	Level B	Level A	Level B	Level A	Level B	Level A	Level B	Level A	Level B
North Atlantic Right Whale*	338[1]	0	44	0	3	0	3	0	3	0	3	0	56
Blue Whale*	412[2]	0	3	0	1	0	1	0	1	0	1	0	7
Fin Whale*	6,802	4	40	0	2	0	2	0	2	0	2	4	48
Humpback Whale	1,396	9	77	0	5	0	5	0	5	0	5	9	97
Minke Whale	21,968	21	304	0	4	0	4	0	4	0	4	21	320
Sei Whale*	6,292	5	18	0	2	0	2	0	2	0	2	5	26
Sperm Whale*	4,349	0	7	0	2	0	2	0	2	0	2	0	15
Atlantic Spotted Dolphin	39,921	0	116	0	29	0	29	0	29	0	29	0	232
Atlantic White-sided Dolphin	93,233	28	287	0	28	0	28	0	28	0	28	28	399
Bottlenose Dolphin	62,851	8	244	0	25	0	25	0	25	0	25	8	344
Common Dolphin	172,974	35	8,084	0	1,094	0	1,094	0	1,094	0	1,094	35	12,460
Long-finned Pilot Whales[3]	39,215[4]	0	36	0	9	0	9	0	9	0	9	0	72
Risso's Dolphin	35,215	0	34	0	6	0	6	0	6	0	6	0	58
Harbor Porpoise	95,543	138	1,125	0	28	0	28	0	28	0	28	138	1,237

Gray Seal	27,300	22	2,303	0	114	0	114	0	114	0	114	22	2,759
Harbor Seal	61,336	14	923	0	44	0	44	0	44	0	44	14	1,099

* Listed as Endangered under the Endangered Species Act (ESA).

1 - In the proposed rule (87 FR 79072, December 23, 2022), a population estimate of 368 was used which represented the best available science at the time of publication. However, since the publication of the proposed rule, a new estimate (n=338) was released in NMFS' final 2022 SARs and has been incorporated into this final rule. In addition, the total annual average observed North Atlantic right whale mortality was updated in the final SAR from 8.1 to 31.2. Total annual average observed North Atlantic right whale mortality during the period 2016 through 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 through 2019 estimated annual means, accounting for undetected mortality and serious injury. (Hayes *et al.,* 2023).

2 - The minimum blue whale population is estimated at 412, although the exact value is not known. NMFS is utilizing this value for our small numbers determination, as shown in parenthesis.

3 - Roberts *et al.* (2023) does not distinguish between short- and long-finned pilot whales, thus the pooled density provided represents both species. However, short-finned pilot whales are not expected to occur in the Project Area, thus NMFS assumes that any take of pilot whales would be of long-finned pilot whales.

4 - Long-finned pilot whale abundance estimate (Hayes *et al.,* 2023).

In making the negligible impact determination and the necessary small numbers finding, NMFS assesses the greatest number of authorized take of marine mammals that could occur within any 1 year, which in the case of this rule is based on the predicted Year 1 for all species. In this calculation, the maximum estimated number of Level A harassment (PTS) 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 amount of estimated take that could occur in any year. We

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Table 28 -- Maximum Number of Authorized Takes (Level A Harassment and Level B Harassment) that Could Occur in Any 1 Year of the Project and the Total Percent Stock that Would be Taken Based on the Maximum Annual Authorized Take

Species	NMFS Stock Abundance	Max Level A Harassment	Max Level B harassment	Max Annual Take (Max Level A Harassment + Max Level B Harassment)	Total Percent Stock Taken Based on Maximum Annual Take[1]
North Atlantic Right[2] Whale*	338	0	44	44	13.0
Blue Whale*	402 [3]	0	3	3	0.73
Fin Whale*	6,802	4	40	44	0.65
Humpback Whale	1,396	9	77	86	6.16
Minke Whale	21,968	21	304	325	1.48
Sei Whale*	6,292	5	18	23	0.37
Sperm Whale*	4,349	0	7	7	0.16
Atlantic Spotted Dolphin	39,921	0	116	116	0.29
Atlantic White-Sided Dolphin	93,233	28	287	315	0.34
Bottlenose Dolphin	62,851	8	244	252	0.40
Common Dolphin	172,974	35	8,084	8,119	4.70
Long-finned Pilot Whales[4]	39,215[5]	0	36	36	0.09
Risso's Dolphin	35,215	0	34	34	0.10
Harbor Porpoise	95,543	138	1,125	1,263	1.32
Gray Seal	27,300	22	2,303	2,325	8.52
Harbor Seal	61,336	14	923	937	1.53

* Listed as Endangered under the Endangered Species Act (ESA).

1 - Calculations of percentage of stock taken are based on the maximum requested Level A harassment take in any one year plus the total requested Level B harassment take in any one year and then compared against the best available abundance estimate as shown in Table 2. For this action, the best available abundance estimates are derived from the NMFS Stock Assessment Reports (Hayes *et al.,* 2023).

2 - In the proposed rule (87 FR 79072, December 23, 2022), a population estimate of 368 was used which represented the best available science at the time of publication. However, since the publication of the proposed rule, a new estimate (n=338) was released in NMFS' draft and final 2022 SARs and has been incorporated into this final rule. In addition, the total annual average observed North Atlantic right whale mortality was updated in the final SARs from 8.1 to 31.2. Total annual average observed North Atlantic right whale mortality during the period 2016 through 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 through 2019 estimated annual means, accounting for undetected mortality and serious injury. (Hayes *et al.,* 2023).

3 - The minimum blue whale population is estimated at 412, although the exact value is not known. NMFS is utilizing this value for our small numbers determination, as shown in parenthesis.

4 - Roberts *et al.* (2023) does not distinguish between short- and long-finned pilot whales, thus the pooled density provided represents both species. However, short-finned pilot whales are not expected to occur in the Project Area, thus NMFS assumes that any take of pilot whales would be of long-finned pilot whales.

5 - Long-finned pilot whale abundance estimate (Hayes *et al.,* 2023).

recognize that certain activities could shift within the 5-year effective period of the rule; however, the rule allows for that flexibility and the takes are not expected to exceed those shown in Table 28 in any year.

Mitigation

As noted in the Changes from the Proposed to Final Rule section, NMFS has added several new mitigation requirements and clarified a few others, and these changes are described in detail in the sections below. Other than the changes described, the required measures remain the same as those described in the proposed rule. However, NMFS has also re-organized and simplified the section to avoid full duplication of the specific requirements that are fully described in the regulatory text.

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 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 specified activities, and then in the following subsections we describe the measures that apply specifically to foundation installation, landfall construction, HRG surveys, and UXO/MEC detonation. Details on specific requirements can be found in Part 217—Regulations Governing The Taking and Importing of Marine Mammals at the end of this rulemaking.

Training and Coordination

NMFS requires all Revolution Wind employees and contractors conducting activities on the water, including, but not limited to, all vessel captains and crew are trained in marine mammal detection and identification, communication protocols, and all required measures to minimize impacts on marine mammals and support Revolution 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, Revolution Wind is required to instruct all project personnel regarding the authority of the marine mammal monitoring team(s). For example, training must include that the HRG acoustic equipment operator is required to immediately comply with any call for a delay or shut down by the Lead PSO, and that 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. Revolution Wind will provide documentation of training to NMFS.

North Atlantic Right Whale Awareness Monitoring

Revolution Wind must 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 Revolution 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 final 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 are described generally here and in detail in the regulation text at the end of this final rule (see 50 CFR 217.274(b)). Revolution Wind will be required to comply with these measures unless an emergency 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 (11.5 mph) to fulfill those responsibilities, while in the specified geographical region.

While underway, Revolution Wind is 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 during all vessel operations and slow down, stop their vessel, or alter course (as appropriate) to avoid striking any marine mammal. The dedicated visual observer on each vessel, equipped with and trained to use 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 (*i.e.,* bow-riding dolphins)). If any of these species are sighted within their respective minimum separation zone, the underway vessel must shift its engine to neutral 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. All project vessels, regardless of size, must immediately reduce speed to 10 kn (11.5 mph) 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 will trigger an additional 24-hour period. If a North Atlantic right whale is reported via any of the monitoring systems within 10 km (6.2 miles (mi)) of a transiting vessel(s), that vessel must operate at 10 kn (11.5 mph) or less for 24 hours following the reported detection. Additionally, in the event that any project-related vessel, regardless of size, observes any unidentified large whale within 500 m of an underway vessel, the vessel is required to immediately reduce speeds to 10 kn (11.5 mph) or less until the minimum separation distance is established.

All Project-related vessels are 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 no other speed restrictions are in place, all Project-related vessels (including crew transfer vessels) are restricted from traveling over 10 kn (11.5 mph), unless traveling in a frequently traveled transit corridor (*e.g.,* crew transfer corridor) from port to the Lease Area while Revolution Wind conducts real-time PAM to detect large whales, in addition to visual monitoring. All Revolution Wind's vessels, regardless of size, must immediately reduce speed to 10 kn (11.5 mph) 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 (*e.g.,* in transit corridor). Each subsequent observation or acoustic detection in the Project area must trigger an additional 24-hour period. If a North Atlantic right whale is reported via any of the monitoring systems within 10 kilometers (km; 6.2 miles (mi)) of a transiting vessel(s), that vessel must operate at 10 kn (11.5 mph) or less for 24 hours following the reported detection. If a large whale (other than a North Atlantic right whale) is detected via the transit corridor PAM system, all vessels must travel at 10 kn (11.5 mph) until the whale can be confirmed visually beyond 500 m of the vessel or 24 hours has passed.

To maintain awareness of North Atlantic right whale presence, vessel operators, crew members, and the marine mammal monitoring team would 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 Revolution Wind must report all Maritime Mobile Service Identify (MMSI) numbers to NMFS Office of Protected Resources prior to initiating in-water activities. Revolution Wind is required to submit a NMFS-approved North Atlantic Right Whale Vessel Strike Avoidance Plan at least 90 days prior to commencement of vessel use.

Revolution Wind's compliance with these measures will 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.,* 2015; 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 Project Area 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 Project Area throughout the year, although the numbers of North Atlantic right whales are not expected to be as large as those in foraging grounds to the east (south of Martha's Vineyard and Nantucket) and north (*e.g.,* Cape Cod Bay, Gulf of St. Lawrence) or calving grounds in the southeast U.S. from Cape Fear, North Carolina, to below Cape Canaveral, Florida.

NMFS is requiring seasonal work restrictions to minimize the North Atlantic right whales risk of exposure to noise incidental to some project activities. These seasonal work restrictions are expected to greatly reduce the number of takes of North Atlantic right whales, and also afford protection to other marine mammals that are known to use the Project Area with greater frequency during winter months, including minke whales.

As described previously, no foundation impact pile driving activities will occur January 1 through April 30. A new measure included in this final rule requires Revolution Wind to avoid impact pile driving to the maximum extent practicable in December; however, pile driving may occur in December if it is unavoidable upon approval from NMFS. Revolution Wind plans to complete landfall construction from Q4 2023 through Q1 2024; however, NMFS is not seasonally restricting this activity given its location (nearshore, inside Narragansett Bay) and relatively short duration of work (particularly for installation and removal of casing pipes), and the minimal expected impacts to marine mammals. Detonations will be considered on a case-by-case basis, thus Revolution Wind did not specify a particular time of year during which they will detonate UXOs/MECs. However, Revolution Wind will be restricted from detonating UXO/MECs December 1 through April 30 to reduce impacts to North Atlantic right whales during peak occurrence periods. Seasonal restrictions do not apply to HRG surveys; however, Revolution Wind will only survey a predetermined number of survey days each year (Year 1 = 218.7; Years 2–5 = 53.7/year or 214.8 total).

NMFS is also requiring temporal restrictions for some activities. Within any 24-hour period, Revolution Wind is limited to installing up to three monopile foundations. Revolution Wind had requested to initiate pile driving during nighttime when detection of marine mammals is visually challenging. Since the publication of the proposed rule, Revolution Wind has continued discussions with NMFS and BOEM regarding field trials they have been performing to demonstrate the efficacy of their nighttime monitoring methods and systems. These field trials have provided information and evidence that their systems are capable of detecting marine mammals, particularly large whales, at distances necessary to ensure that the required mitigation measures are effective. On April 20, 2023, Revolution Wind submitted an AMP for Nighttime Pile Driving outlining nighttime monitoring protocols and equipment. We reviewed their AMP and, after further discussions and revisions based on our comments back to Revolution Wind, Revolution Wind submitted a final draft AMP on August 4, 2023. NMFS will review the AMP to determine sufficiency. Should NMFS approve the AMP, nighttime pile driving may occur given Revolution Wind adherence to the AMP and additional mitigation and monitoring measures prescribed by NMFS.

Any and all vibratory pile driving associated with cofferdams and goal post installation and removal must only occur during daylight hours. UXO/MEC detonation will be limited to daylight hours only to ensure PSOs can most effectively carry out visual clearance to the farthest extent of the clearance zone prior to detonation, should they need to detonate a UXO/MEC of the largest charge weight. Lastly, given the very small Level B harassment zone associated with HRG survey activities and no anticipated or authorized Level A harassment, NMFS is not requiring 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 rulemaking.

Noise Abatement Systems

Revolution Wind is required to employ NAS, also known as noise attenuation systems, during all foundation installation (*i.e.,* impact pile driving) and UXO/MEC detonation activities to reduce the sound pressure levels that are transmitted through the water in an effort to reduce ranges to acoustic thresholds and minimize, to the extent practicable, any acoustic impacts resulting from these activities. Revolution Wind is 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 (*e.g.,* hydro-sound damper, or an AdBm Helmholz resonator), as well as the adjustment of operational protocols to minimize noise levels. For UXO/MEC detonation, a double big bubble curtain must be used and the hoses must be placed at distances to avoid damage to the bubble curtain during detonation. A single bubble curtain, alone or in combination with another NAS device, may not be used for either pile driving or UXO/MEC detonation as received SFV data reveals this approach is unlikely to attenuate sounds to the degree distances to harassment thresholds are less than or equal to those modeled assuming 10-dB of attenuation. Should the research and development phase of newer systems demonstrate effectiveness, as part of adaptive management, Revolution Wind may submit data on the effectiveness of these systems and request approval from NMFS to use them during foundation installation and UXO/MEC detonation activities.

Two categories of NAS exist: primary and secondary. A primary NAS would be used to reduce the level of noise produced by foundation installation activities at the source, typically through adjustments on to the equipment (*e.g.,* hammer strike parameters). Primary NAS are still evolving and will be considered for use during mitigation efforts when the NAS has been demonstrated as effective in commercial projects. However, as primary NAS are not fully effective at eliminating noise, a secondary NAS would be employed. The secondary NAS is a device or group of devices that would reduce noise as it was transmitted through the water away from the pile, typically through a physical barrier that would reflect or absorb sound waves and therefore, reduce the distance the higher energy sound propagates through the water column. Together, these systems must reduce noise levels to 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 Sound Field Verification (SFV; see *Sound Field Verification* section below and § 217.274(c)(14)).

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

The literature presents a wide array of observed attenuation results for bubble curtains. The variability in attenuation levels is the result of variation in design as well as differences in site conditions and difficulty in properly installing and operating in-water attenuation devices. Dähne *et al.* (2017) found that single bubble curtains that reduce sound levels by 7 to 10 dB reduced the overall sound level by approximately 12 dB when combined as a double bubble curtain for 6-m steel monopiles in the North Sea. During installation of monopiles (consisting of approximately 8-m in diameter) for more than 150 WTGs in comparable water depths (>25 m) and conditions in Europe indicate that attenuation of 10 dB is readily achieved (Bellmann, 2019; Bellmann *et al.,* 2020) using single BBCs for noise attenuation. If a double big bubble curtain is used (noting a single bubble curtain is not allowed), Revolution Wind is required to maintain numerous operational performance standards. These standards are defined in the regulatory text at the end of this rulemaking, and include, but are not limited to, construction contractors must train personnel in the proper balancing of airflow to the bubble ring and Revolution Wind must 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 and UXO/MEC detonation. In addition, a full maintenance check (*e.g.,* manually clearing holes) must occur prior to each pile being installed or any UXO/MEC detonated. If Revolution Wind uses a noise mitigation device in addition to a double big bubble curtain, similar quality control measures are required.

Revolution Wind is required to submit an SFV plan to NMFS for approval at least 180 days prior to installing foundations or detonating UXO/MECs. They are also 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. These frequent and immediate reports 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 systems are not required during landfall construction activities and HRG surveys. Although NAS is not practicable to implement during landfall construction due to the physical nature of linear sheet piles and angled pipe piles, there is a low risk for impacts to marine mammals due to the short work duration and lower noise levels produced during the activities. Regarding HRG surveys, NAS cannot practicably be employed around a moving survey ship, but Revolution Wind is 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 requires the establishment of both clearance and, where technically feasible, 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 rulemaking). At least one PAM operator must review data from at least 24 hours prior to foundation installation or any UXO/MEC detonations and must actively monitor hydrophones for 60 minutes prior to commencement of these activities. Any sighting or acoustic detection within the PAM monitoring zone of a North Atlantic right whale will trigger a delay to commencing pile driving and shutdown.

Prior to the start of certain specified activities (*i.e.,* foundation installation, landfall construction, UXO/MEC detonations, HRG surveys), Revolution Wind must ensure designated areas (*i.e.,* clearance zones, Tables 29–33) are clear of marine mammals prior to commencing activities to minimize the potential for and degree of harassment. For foundation installation and UXO/MEC detonation, PSOs must visually and acoustically 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 foundation installation, the minimum visibility zone must extend 2,300 m from the pile May 1 through November 30 and 4,400 m during December (Table 29). These values correspond to the seasonally-specific modeled maximum $ER_{95\%}$ distances to the Level A harassment isopleths among all low-frequency cetaceans (excluding humpback whales), rounded up to the nearest hundred, assuming three monopiles are driven in a day and 10-dB attenuation.

For vibratory pile driving for cofferdam or goal post installation,

pneumatic hammering for casing pipe installation, and HRG surveys, monitoring must be conducted for 30 minutes prior to initiating activities and the clearance zones (Tables 30, 31, and 33) must be free of marine mammals during that time.

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, Revolution Wind is 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 activity cessation. For impact pile driving, the shutdown requirement may be waived if it is not practicable due to imminent risk of injury or loss of life to an individual or risk of damage to a vessel that creates risk of injury or loss of life for individuals or the lead engineer determines there is pile refusal or pile instability. In situations when shutdown is called for during impact pile driving but Revolution 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. Revolution Wind must document and report to NMFS all cases where the emergency exemption is taken. Because UXO/MEC detonations are instantaneous, no shutdown is possible; therefore, there are clearance zones but no shutdown zones for UXO/MEC detonations (Table 32).

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, at which time the lowest hammer energy 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 neither 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 29 through 33. For foundation installation and UXO/MEC detonation, Revolution Wind is allowed to request modification to these zone sizes pending results of sound field verification (see regulatory text at the end of this rulemaking). Any changes to zone size would be part of adaptive management and would require NMFS' approval.

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Table 29 -- Clearance, Shutdown, Minimum Visibility, and Level B Harassment Zones (in Meters) During Impact Pile Driving in Summer And Winter[1]

Monitoring details	North Atlantic right whales		Other large whales		Delphinids		Harbor porpoises		Seals	
Foundation Type	WTG	OSS	WTG	OSS	WTG	OSS	WTG	OSS	WTG	OSS
Clearance Zone	any distance		2,300 (4,400)	1,600 (2,700)	NAS[2]	NAS	1,400 (2,400)	900 (1,300)	500 (900)	400 (400)
PAM Clearance Zone	any distance within PAM Monitoring Zone		n/a							
Shutdown Zone	any distance		2,300 (4,400)	1,600 (2,700)	NAS	NAS	1,400 (2,400)	900 (1,300)	500 (900)	400 (400)
PAM Shutdown Zone	any distance within PAM Monitoring Zone		n/a							
PAM Monitoring Zone	10,000 m									
Minimum Visibility Zone	WTG: 2,300 (4,400) OSS: 1,600 (2,700)									
Level B Harassment Zone	WTG: 3,833 (4,271) OSS: 4,100 (4,698)									

1 - Winter (i.e., December) distances are presented in parentheses.
2 - NAS (noise abatement system) means that the zone is small enough that it will be encompassed by the bubble curtain.

Table 30 -- Distances to Harassment Thresholds and Mitigation Zones During Vibratory Pile Driving

Marine Mammal Species	Level A harassment (SEL_{cum}) (m)	Level B harassment (m)	Clearance Zone (m)	Shutdown Zone (m)
Low-frequency cetaceans	5	9,740	100	100
Mid-frequency cetaceans (Sperm whale)	-	9,740	100	100
Mid-frequency cetaceans (non-Sperm whale)	-	9,740	50	50
High-frequency cetaceans	190	9,740	200[1]	200[1]
Phocid Pinnipeds (in water)	10	9,740	50	50

1 - Distance has been increased from 100 m, as initially proposed by Revolution Wind, to ensure the clearance and shutdown zones are larger than the Level A harassment zone (190 m).

Table 31 -- Distances to Harassment Thresholds and Mitigation Zones During Pneumatic Hammering

Marine Mammal Hearing Group	Level A harassment (SEL_{cum}) (m)	Level B harassment (m)	Clearance Zone (m)	Shutdown Zone (m)
Low-frequency	3,870	920	3,900	3,900
Mid-frequency	230	920	250	250
High-frequency	3,950	920	4,000	4,000
Phocid pinnipeds	1,290	920	1,300	1,300

In the proposed rule, we presented zone sizes based solely on the largest charge weight due to uncertainty on how accurately these charge weights could be identified in the water. Since the proposed rule, Revolution Wind has demonstrated that they can reliably identify charge weights in the field charge, which will allow for implementation of weight-specific mitigative zones. Because of this, Revolution Wind is required to implement the ALARP process, as described in the UXO/MEC Charge Weight Memo. This process requires Revolution Wind to undertake ''lift-and-shift'' (*i.e.,* physical removal) and then lead up to *in situ* disposal, as necessary, which could include low-order (deflagration) to high-order (detonation) methods of removal. Another approach involves the cutting of the UXO/MEC to extract any explosive components. Implementing the ALARP approach would minimize potential impacts to marine mammals, as UXOs/MECs would only be detonated as a last resort. Revolution Wind will follow a Risk Management Framework designed to align with the ALARP principle, which includes historical research/hazard profiling, communication with all relevant State and Federal Agencies, and the standards within their removal plan (see the UXO/MEC Charge Weight Memo); there is a high level of certainty that charge weights and appropriate removal approaches can be implemented in the field. Furthermore, we are confident that this approach will ensure the least practicable adverse impact on marine mammals by mitigating the potential for TTS for each charge weight. The UXO/MEC Charge Weight Memo is found on NMFS' website at *https://www.fisheries.noaa.gov/action/incidental-take-authorization-revolution-wind-llc-construction-revolution-wind-energy.*

In following this charge weight-specific approach, Revolution Wind is required to clear the relevant zones that apply to detonation of a specific charge weight, as specified in Table 32. These zones are based on (but not equal to) the greatest TTS threshold distances for each charge weight at any modeled site. We note that harbor porpoises and seals are difficult to detect at great distances but, due to the UXO/MEC detonation time of year restrictions, their abundance is likely to be relatively low. These zone sizes may be adjusted based on SFV and confirmation of the UXO/MEC or donor charge sizes after approval by NMFS.

No minimum visibility zone is required for UXO/MEC detonation as the entire visual clearance zone must be clear given the potential for lung and gastrointestinal injury.

Table 32 -- Clearance, Level A Harassment, and Level B Harassment Zones During UXO/MEC Detonations, by Charge Weight and Assuming 10 dB of Sound Attenuation

UXO/MEC Charge Weights		Low-frequency cetaceans	Mid-frequency cetaceans	High-frequency cetaceans	Phocid Pinnipeds
E4 (2.3 kg)	Level A harassment (m)	552	50	1,820	182
	Level B harassment (m)	2,82	453	6,160	1,470
	Clearance Zone (m)[a, b]	2,500	500	2,500	1,000
E6 (9.1 kg)	Level A harassment (m)	982	75	2,590	357
	Level B harassment (m)	4,680	773	8,000	2,350
	Clearance Zone (m)[a, b]	4,000	600	4,000	1,500
E8 (45.5 kg)	Level A harassment (m)	1,730	156	3,900	690
	Level B harassment (m)	7,490	1,240	10,300	3,820
	Clearance Zone (m)[a, b]	6,000	1,000	6,000	3,000
E10 (227 kg)	Level A harassment (m)	2,970	337	5,400	1,220
	Level B harassment (m)	10,500	2,120	12,900	5,980
	Clearance Zone (m)[a, b]	9,000	1,500	9,000	4,000
E12 (454 kg)	Level A harassment (m)	3,780	461	6,200	1,600
	Level B harassment (m)	11,900	2,550	14,100	7,020
	Clearance Zone (m)[a, b]	10,000	2,000	10,000	5,000

a - The clearance zones presented here for the Level B harassment thresholds were derived based on an approximate proportion of the size of the Level B harassment isopleth.

b - Some of the zones have been rounded for PSO clarity.

Revolution Wind must establish clearance and shutdown zones around HRG survey equipment based upon the radial distance (Table 33) from the acoustic source rather than the vessel itself and monitor Level B harassment zones specific to equipment type (*i.e.,* boomers, sparkers, and CHIRP sub-bottom profilers). Prior to initiating HRG

survey activities, Revolution Wind must implement a 30-minute pre-start clearance period, during which the entire clearance zone must be visible. If an HRG source is active and a marine mammal is observed within or entering a relevant shutdown zone (as described above), an immediate shutdown of the HRG survey equipment is required.

Table 33 -- Level B Harassment Threshold Ranges and Mitigation Zones During HRG Surveys

Marine Mammal Species	Level B Harassment Zone (m)		Clearance Zone (m)	Shutdown Zone (m)
	Boomer/Sparker	CHIRPs		
Low-frequency cetacean (North Atlantic right whale)	141	48	500	500
Other low-frequency cetaceans (non-North Atlantic right whale species)			100	100
Mid-frequency cetaceans	141	48	100	100[a]
High-frequency cetaceans	141	48	100	100
Phocid Pinnipeds (in water)	141	48	100	100

* Denotes species is listed under the Endangered Species Act.

a - An exception is noted for bow-riding delphinids of the following genera: *Delphinus, Stenella, Lagenorhynchus, and Tursiops.*

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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. Revolution Wind must utilize a soft-start protocol for impact pile driving of monopiles 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. The final methodology will be developed by Revolution Wind considering final design details including site-specific soil properties and other considerations. HRG survey operators are 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. Given the instantaneous nature of UXO/MEC detonations, no ramp-up/soft-start protocol is possible.

Soft-start and ramp-up will be required at the beginning of impact pile driving and use of HRG equipment 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 Revolution Wind's fishery monitoring surveys

impacting marine mammals is minimal, NMFS requires Revolution 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 are required to receive protected species identification training prior to activities occurring and attend the aforementioned onboarding training. The specific requirements that NMFS has set for the fishery monitoring surveys can be found in the regulatory text at the end of this rulemaking.

Based on our evaluation of the mitigation measures, as well as other measures considered by NMFS, NMFS has determined that these measures will 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.

Monitoring and Reporting

As noted in the Changes From the Proposed to Final Rule section, we have added, modified, or clarified a number of monitoring and reporting measures since the proposed rule. These changes are described in detail in the sections below and, otherwise, the marine mammal monitoring and reporting requirements have not changed since the proposed rule.

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, vibratory pile driving, UXO/MEC detonations, and HRG surveys. PAM must be conducted during impact pile driving and UXO/MEC detonation. Revolution must verify that distances to harassment isopleths are not larger than those modeled assuming 10-dB attenuation by performing SFV during impact pile driving and UXO/MEC detonations. 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, during active HRG acoustic sources, and during UXO/MEC detonations. 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

Revolution Wind is required to employ NMFS-approved PSOs and PAM operators. PSOs are trained professionals who are tasked with visually monitoring for marine mammals during pile driving, UXO/MEC detonation, HRG surveys, and pneumatic hammering. The primary purpose of a PSO is to carry out the monitoring, collect data, and, when appropriate, call for the implementation of mitigation measures. In addition to visual observations, NMFS requires that Revolution Wind conduct PAM using trained, experienced PAM operators during impact pile driving, UXO/MEC detonations, 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 and, together, these two monitoring methods are well understood to provide best results when combined together (*e.g.,* Barlow and Taylor, 2005; Clark *et al.,* 2010; Gerrodette *et al.,* 2011; Van Parijs *et al.,* 2021). Acoustic monitoring (in addition to visual monitoring) increases the likelihood of detecting marine mammals within the shutdown and clearance zones of project activities, which when applied in combination of required shutdowns helps to further reduce the risk of marine mammals being exposed to sound levels that could otherwise result in acoustic injury or more intense behavioral harassment.

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; 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, these set-ups would need to be considered on a case-by-case basis.

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 training requirements referenced below and further specified in the regulatory text at the end of this rulemaking.

NMFS will provide PSO and PAM operator approvals in the context of the need to ensure 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. A conditional approval may be given to one who is trained but has not yet attained the requisite experience. An 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 rulemaking.

Conditionally-approved PSOs and PAM operators would be paired with an unconditional-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. Revolution 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 Revolution Wind at least 30 days prior to the start of the project. Should Revolution Wind require additional PSOs or PAM operators throughout the project, Revolution 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 and UXO/MEC detonation. The types of equipment required (*e.g.,* big eyes on the pile driving vessel) are also designed to increase marine mammal detection capabilities. Specifics on these types of requirements can be found in the regulations at the end of this rulemaking. In summary, 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 each UXO/MEC detonation event; at least two PSOs must be on duty during cable landfall construction (vibratory pile installation and removal of sheet piles or pneumatic hammering of casing pipes); at least one PSO must be on-duty during HRG surveys conducted during daylight hours; and at least two PSOs must be on-duty during HRG surveys conducted during nighttime.

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 rulemaking.

Revolution Wind is required to submit a Pile Driving and UXO/MEC Marine Mammal Monitoring Plan and a PAM Plan to NMFS 180 days in advance of foundation installation activities. The Plan must include details regarding PSO monitoring and PAM protocols and equipment proposed for us. More specifically, the PAM Plan must include a description of all proposed PAM equipment, address how the proposed PAM 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 foundation installation activities or UXO/MEC detonation commencing. Specific details on NMFS' PSO or PAM operator qualifications and requirements can be found in § 217.275(a) at the end of this rulemaking. Additional information can be found in Revolution Wind's Protected Species Mitigation and Monitoring Plan (PSMMP) (Appendix B) found in their ITA application on NMFS' website at *https://www.fisheries.noaa.gov/action/incidental-take-authorization-revolution-wind-llc-construction-revolution-wind-energy.*

Sound Field Verification

Revolution Wind must conduct SFV measurements during all UXO/MEC detonations and for 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 piles demonstrate distances to thresholds are at or below those modeled assuming 10 dB of attenuation. Subsequent SFV measurements are also required should larger piles be installed or additional piles be driven that are anticipated to produce longer distances to harassment isopleths than those previously measured (*e.g.,* higher hammer energy, greater number of strikes). The measurements and reporting associated with SFV can be found in the regulatory text at the end of this rulemaking. The requirements are extensive to ensure monitoring is conducted appropriately and the reporting frequency is such that Revolution Wind is required to make adjustments quickly (*e.g.,* ensure bubble curtain hose maintenance, check bubble curtain air pressure supply, add additional sound attenuation, *etc.*) 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 ISO 18406 ''Underwater acoustics—Measurement of radiated underwater sound from percussive pile driving'' (2017).

Reporting

Prior to any construction activities occurring, Revolution Wind would provide a report to NMFS Office of Protected Resources that demonstrates that all required training for Revolution 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 Revolution 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. Revolution Wind is 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 final rule.

Weekly Report—During foundation installation activities, Revolution 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–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—Revolution Wind is 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—Revolution Wind is 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—Revolution Wind must submit its draft 5-year report(s) to NMFS Office of Protected Resources on all visual and acoustic monitoring conducted under the LOA within 90 calendar days of the completion of activities occurring under the LOA. A final 5-year report must be prepared and submitted within 60 calendar days following receipt of any NMFS comments on the draft report. Information contained within this report is described at the beginning of this section.

Situational Reporting—Specific situations encountered during the development of the Project requires 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, Revolution Wind must immediately cease all activities until NMFS Office of Protected Resources is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate to ensure compliance with the terms of the LOA. NMFS Office of Protected Resources may impose additional measures to minimize the likelihood of further prohibited take and ensure MMPA compliance. Revolution Wind may 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, Revolution Wind must immediately report the strike incident. If the strike occurs in the Greater Atlantic region (Maine to Virginia), Revolution Wind must call the NMFS Greater Atlantic Stranding Hotline. Separately, Revolution Wind must also immediately report the incident to NMFS Office of Protected Resources and GARFO. Revolution Wind must immediately cease all on-water activities until NMFS Office of Protected Resources is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate to ensure compliance with the terms of the LOA. NMFS Office of Protected Resources may impose additional measures to minimize the likelihood of further prohibited take and ensure MMPA compliance. Revolution Wind may not resume their activities until notified by NMFS.

In the event of any lost gear associated with the fishery surveys, Revolution 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 rulemaking in the regulatory text.

Sound Field Verification—Revolution Wind is required to submit interim SFV reports after each foundation installation and UXO/MEC detonation monitored as soon as possible but within 48 hours. A final SFV report for all monopile foundation installation and UXO/MEC detonations would be required within 90 days following completion of acoustic monitoring.

Adaptive Management

The regulations governing the take of marine mammals incidental to Revolution Wind's construction activities contain an adaptive management component. Our understanding of the effects of offshore

wind construction activities (*e.g.,* acoustic and explosive 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 Revolution 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, Revolution 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 in this preamble, we discuss the estimated maximum number of takes by Level A harassment and Level B harassment that could occur incidental to Revolution 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 final rule, we evaluate the likely impacts of the enumerated harassment takes that are 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 authorized for any species or stock.

The Description of the Specified Activities section of this preamble describes Revolution Wind's specified activities that may result in take of marine mammals and an estimated schedule for conducting those activities. Revolution Wind has provided a realistic construction schedule although we recognize schedules may shift for a variety of reasons (*e.g.,* weather or supply delays). However, the total amount of take would not exceed the 5-year totals and maximum annual total in any given year indicated in Tables 27 and 28, respectively.

We base our analysis and negligible impact determination on the maximum number of takes that could occur and are 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 2 given that some of the anticipated effects of the project'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 (*e.g.,* North Atlantic right whales given their population status). Organizing our analysis by grouping species or stocks that share common traits or that would respond similarly to effects of the project activities and then providing species- or stock-specific information allows us to avoid duplication while ensuring that we have analyzed the effects of the specified activities on each affected species or stock. It is important to note that in the group or species sections, we base our negligible impact analysis on the maximum annual take that is predicted under the 5-year rule; however, the majority of the impacts are associated with WTG foundation and OSS foundation installation, which will occur largely within the first year of the effective period of these regulations (2023–2024). The estimated take in the other years is expected to be notably less, which is reflected in the total take that would be allowable under the rule (see Tables 27 and 28).

As described previously, no serious injury or mortality is anticipated or authorized in this rule. Any Level A harassment authorized would be in the form of auditory injury (*i.e.,* PTS) and not non-auditory injury (*e.g.,* lung injury or gastrointestinal injury from UXO/MEC detonation). The number of takes by harassment Revolution Wind requested and NMFS is authorizing is based on exposure models that consider the outputs of acoustic source and

propagation models and other data such as frequency of occurrence or group sizes. Several conservative parameters and assumptions are ingrained into these models, such as assuming forcing functions that consider direct contact with piles (*i.e.,* no cushion allowances) and application of the average summer 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 for impact pile driving and UXO/MEC detonations) or avoidance response. The number of takes requested and authorized also reflects careful consideration of other data (*e.g.,* group size data) and for Level A harassment of some large whales, the consideration of mitigation measures. For all species, the number of take 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 to Marine Mammals and their Habitat section of the proposed rule, the intensity and duration of any impact resulting from exposure to Revolution Wind's activities is dependent upon a number of contextual factors including, but not limited to, sound source frequencies, whether the sound source is moving towards the animal, hearing ranges of marine mammals, behavioral state at time of exposure, status of individual exposed (*e.g.,* reproductive status, age class, health) and an individual's experience with similar sound sources. Southall *et al.* (2021), Ellison *et al.* (2012) and Moore and Barlow (2013), among others, emphasize the importance of context (*e.g.,* behavioral state of the animals, distance from the sound source) in evaluating behavioral responses of marine mammals to acoustic sources. Harassment of marine mammals may result in behavioral modifications (*e.g.,* avoidance, temporary cessation of foraging or communicating, changes in respiration or group dynamics, masking) or may result in auditory impacts such as hearing loss. In addition, some of the lower level physiological stress responses (*e.g.,* change in respiration, change in heart rate) discussed previously would likely co-occur with the behavioral modifications, although these physiological responses are more difficult to detect and fewer data exist relating these responses to specific received levels of sound. Takes by Level B harassment, then, may have a stress-related physiological component as well; however, we would not expect Revolution Wind's activities to produce conditions of long-term and continuous exposure to noise leading to long-term physiological stress responses in marine mammals that could affect reproduction or survival.

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

Many species perform vital functions, such as feeding, resting, traveling, and socializing on a diel cycle (24-hour cycle). Behavioral reactions to noise exposure, when taking place in a biologically important context, such as disruption of critical life functions, displacement, or avoidance of important habitat, are more likely to be significant if they last more than one day or recur on subsequent days (Southall *et al.,* 2007) due to diel and lunar patterns in diving and foraging behaviors observed in many cetaceans (Baird *et al.,* 2008; Barlow *et al.,* 2020; Henderson *et al.,* 2016; Schorr *et al.,* 2014). It is important to note the water depth in the Project Area is shallow (ranging from 2 to 40 m in the RWEC and 24 to 50 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 Revolution 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 brief exposures of seconds for UXO/MEC detonations, seconds to minutes for HRG surveys, or, in some cases, longer durations of exposure within a day (*e.g.,* pile driving). Some individuals of a species may experience recurring instances of take over multiple days throughout the year, while some members of a species or stock may experience one exposure as they move through an area, which means that the number of individuals taken is smaller than the total estimated takes. In short, for species that are more likely to be migrating through the area and/or for which only a comparatively smaller number of takes are predicted (*e.g.,* some of the mysticetes), it is more likely that each take represents a different individual, whereas for non-migrating species with larger amounts of predicted take, we expect that the total anticipated takes represent exposures of a smaller number of individuals of which some would be taken across multiple days.

For Revolution Wind, impact pile driving of foundation piles is most likely to result in a higher magnitude and severity of behavioral disturbance than other activities (*i.e.,* vibratory pile driving, pneumatic hammering, UXO/MEC detonations, and HRG surveys). Impact pile driving has higher source levels and longer durations (on an annual basis) than vibratory pile driving and HRG surveys. HRG survey equipment also produces much higher frequencies than pile driving, resulting in minimal sound propagation. While UXO/MEC detonations may have higher source levels, impact pile driving is planned for longer durations (*i.e.,* a maximum of 13 UXO/MEC detonations are planned, which would result in only instantaneous exposures). While impact pile driving for foundation installation is anticipated to be most impactful for

these reasons, impacts are minimized, to the extent practicable, 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. 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 and UXO/MEC detonations will increase the overall capability to detect marine mammals compared to one method alone. Measures such as the requirement to apply sound attenuation devices and implement clearance zones also apply to UXO/MEC detonation(s), which also have the potential to elicit more severe behavioral reactions in the unlikely event that an animal is relatively close to the explosion in the instant that it occurs; hence, severity of behavioral responses are expected to be lower than would be the case without mitigation.

Occasional, milder behavioral reactions are unlikely to cause long-term consequences for individual animals or populations, and even if some smaller subset of the takes are in the form of a longer (several hours or a day) and more severe response, if they are not expected to be repeated over numerous or sequential days, impacts to individual fitness are not anticipated. Also, the effect of disturbance is strongly influenced by whether it overlaps with biologically important habitats when individuals are present—avoiding biologically important habitats will provide opportunities to compensate for reduced or lost foraging (Keen *et al.,* 2021). Nearly all studies and experts agree that infrequent exposures of a single day or less are unlikely to impact an individual's overall energy budget (Farmer *et al.,* 2018; Harris *et al.,* 2017; King *et al.,* 2015; National Academy of Science, 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 Revolution Wind's activities and, as described earlier, the 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 of the proposed rule, in general, TTS can last from a few minutes to days, be of varying degree and occur across different frequency bandwidths, all of which determine the severity of the impacts on the affected individual, which can range from minor to more severe. Impact and vibratory pile driving, pneumatic hammering, and UXO/MEC detonations are broadband noise sources but generate sounds in the lower frequency ranges (with most of the energy below 1–2 kHz but with a small amount energy ranging up to 20 kHz); therefore, in general and all else being equal, we anticipate the potential for TTS is higher in low-frequency cetaceans (*i.e.,* mysticetes) than other marine mammal hearing groups and would be more likely to occur in frequency bands in which they communicate. However, we would not expect the TTS to span the entire communication or hearing range of any species given the frequencies produced by these activities do not span entire hearing ranges for any particular species. Additionally, though the frequency range of TTS that marine mammals might sustain would overlap with some of the frequency ranges of their vocalizations, the frequency range of TTS from Revolution Wind's pile driving and UXO/MEC detonation activities would not typically span the entire frequency range of one vocalization type, much less span all types of vocalizations or other critical auditory cues for any given species. The mitigation measures required by NMFS further reduce the potential for TTS in mysticetes.

Generally, both the degree of TTS and the duration of TTS would be greater if the marine mammal is exposed to a higher level of energy (which would occur when the peak dB level is higher or the duration is longer). The threshold for the onset of TTS was discussed previously (see to Estimated Take section of this preamble). 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 required mitigation and the nominal speed of the receiving animal relative to the stationary sources such as impact pile driving. The recovery time of TTS is also of importance when considering the potential impacts from TTS. In TTS laboratory studies (as discussed in the Potential Effects of the Specified Activities on Marine Mammals and their Habitat section of the proposed rule), some using exposures of almost an hour in duration or up to 217 SEL, almost all individuals recovered within 1 day (or less, often in minutes) and we note that while the pile driving activities last for hours a day, it is unlikely that most marine mammals would stay in the close vicinity of the source long enough to incur more severe TTS. UXO/MEC detonations also have the potential to result in TTS. However, given the duration of exposure is extremely short (milliseconds), the degree of TTS (*i.e.,* the amount of dB shift) is expected to be small and TTS duration is expected to be short (minutes to hours). Overall, given the small number of times that any individual might incur TTS, the low degree of TTS and the short anticipated duration, and the unlikely scenario that any TTS overlapped the entirety of a critical hearing range, it is unlikely that TTS of the nature expected to result from the project's activities would result in behavioral changes or other impacts that would impact any individual's (of any hearing sensitivity) reproduction or survival.

Permanent Threshold Shift (PTS)

NMFS is authorizing a small amount of take by PTS to some marine mammal individuals. The numbers of authorized annual takes by Level A harassment are relatively low for all marine mammal stocks and species (Table 27). The only activities incidental to which we anticipate PTS may occur is from exposure to impact pile driving and UXO/MEC detonation, 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 or instantaneous UXO/MEC

detonation (*i.e.,* the low-frequency region below 2 kHz) (Cody and Johnstone, 1981; McFadden, 1986; Finneran, 2015), not severe hearing impairment. If hearing impairment occurs from either impact pile driving or UXO/MEC detonation, it is most likely that the affected animal would lose a few decibels in its hearing sensitivity, which in most cases is not likely to meaningfully affect its ability to forage and communicate with conspecifics. Revolution Wind estimates 13 UXO/MECs may be detonated and the exposure analysis conservatively assumes that all of the UXOs/MECs found would consist of the largest charge weight of UXO/MEC (E12; 454 kg). However, it is highly unlikely that all charges would be the maximum size; thus, the amount of Level A harassment that may occur incidental to the detonation of the UXO/MECs is likely less than what is estimated here. In addition, during impact pile driving, given sufficient notice through use of soft-start prior to implementation of full hammer energy during impact pile driving, marine mammals are expected to move away from a sound source that is 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. In summary, the nature of Revolution 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.

Impacts on Habitat and Prey

Impact pile driving of monopile foundations and UXO/MEC detonation may result in fish and invertebrate mortality or injury very close to the source, and all of Revolution 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 and UXO/MEC detonation would further limit the degree of impact (again noting UXO/MEC detonation would be limited to 13 events over 5 years). Behavioral changes in prey in response to construction activities could temporarily impact marine mammals' foraging opportunities in a limited portion of the foraging range; however, due to the relatively small area of the habitat that may be affected at any given time (*e.g.,* around a pile being driven), the impacts to marine mammal habitat are not expected to cause significant or long-term negative consequences.

Cable presence 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.

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 (Chen *et al.,* 2021; Johnson *et al.,* 2021; Christiansen *et al.,* 2022; Dorrell *et al.,* 2022).

As discussed in the Potential Effects of the Specified Activities on Marine Mammals and their Habitat section of the proposed rule, the project would consist of no more than 81 foundations (79 WTGs and 2 OSSs) in the Lease Area, which will gradually become operational following construction completion, likely in Year 2 of the rule (2024–2025). While there are likely to be oceanographic impacts from the presence of the Revolution Wind project, meaningful oceanographic impacts relative to stratification and mixing that would significantly affect marine mammal habitat and prey over large areas in key foraging habitats during the effective period of the regulations are not anticipated (which considers 2–3 years of turbine operation). For these reasons, if oceanographic features are affected by the project during the effective period of these regulations, the impact on marine mammal habitat and their prey is likely to be comparatively minor; therefore, we are not authorizing take due to habitat and prey impacts.

The Revolution Wind Biological Opinion provided an evaluation of the presence and operation of the Project on, among other species, marine mammals and their prey. While the consultation considered the life of the project (25+ years), we considered the potential for the habitat and prey impacts to occur within the 5-year effective time frame of this rule. Overall, the Biological Opinion concluded that impacts from loss of sandy bottom habitat (from the presence of turbines and placement of scour protection) as well as any beneficial reef effects are expected to be so small that they cannot be meaningfully measured, evaluated, or detected and are, therefore, insignificant. The Biological Opinion also concluded that the presence and operation of the wind farm may change the distribution of plankton with the wind farm, these changes are not expected to affect the oceanographic forces transporting zooplankton into the area. Therefore, the Biological Opinion concluded that the overall reduction in

biomass of plankton is not an anticipated outcome of operating the Project. Thus, because changes in the biomass of zooplankton are not anticipated, any higher trophic level impacts are also not anticipated. That is, no effects to pelagic fish or benthic invertebrates that depend on plankton as forage food are expected to occur. Zooplankton, fish and invertebrates are all considered marine mammal prey and, as fully described in the Biological Opinion, measurable, detectable or significant changes to marine mammal prey abundance and distribution from wind farm operation is not anticipated.

Mitigation To Reduce Impacts on All Species

This rulemaking includes a variety of mitigation measures designed to minimize impacts on all marine mammals to the extent practicable with a focus on North Atlantic right whales (the latter is described in more detail below). For impact pile driving of foundation piles and UXO/MEC detonations, nine overarching mitigation measures are required, 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 that would trigger 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 for impact pile driving of foundations; (7) use of noise attenuation technology; (8) maintaining situational awareness of marine mammal presence through the requirement that any marine mammal sighting(s) by Revolution Wind 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 cofferdam, casing pipe, and goal post installation and removal, we are requiring five overarching mitigation measures: (1) time of day work restrictions; (2) use of multiple PSOs to visually observe for marine mammals (with any detection with specifically designated zones that would trigger a delay or shutdown); (3) implementation of clearance zones; (4) implementation of shutdown zones); and (5) maintaining situational awareness of marine mammal presence through the requirement that any marine mammal sighting(s) by Revolution Wind personnel must be reported to PSOs. Lastly, for HRG surveys, we are requiring six measures: (1) measures specifically for Vessel Strike Avoidance; (2) required use of one PSO during daytime operations and two PSOs utilizing specialized night-vision technologies during nighttime operations for 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 Revolution Wind personnel must be reported to PSOs.

NMFS prescribes mitigation measures based on the following rationale. For activities with large harassment isopleths, Revolution Wind is committed to reducing the noise levels generated to the lowest levels practicable and is 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 (Revolution Wind will use the minimum amount of hammer energy to install piles). Similarly, ramp-up during HRG surveys will allow animals to move away and avoid the acoustic sources before they reach their maximum energy level (Revolution Wind will use the lowest energy level practicable to conduct survey activities). For all activities (with some exception for UXO/MEC detonations, which would not have a shutdown zone), clearance zone and shutdown zone implementation, which are required when marine mammals are within given distances associated with certain impact thresholds for all activities, will reduce the magnitude and severity of marine mammal take. Additionally, the use of multiple PSOs (WTG and OSS foundation installation, temporary cofferdam, casing pipe, or goal post installation and removal, UXO/MEC detonations, HRG surveys), PAM, operators (for impact foundation installation and UXO/MEC detonations), and maintaining awareness of marine mammal sightings reported in the region (WTG and OSS foundation installation, temporary cofferdam casing pipe, or goal post installation and removal, UXO/MEC detonations, HRG surveys) will aid in detecting marine mammals that would trigger the implementation of the mitigation measures. The reporting requirements, including SFV reporting for foundation installation, foundation operation, and UXO/MEC detonations will assist NMFS in identifying if impacts beyond those analyzed in this final rule are occurring, potentially leading to the need to enact adaptive management measures in addition to or in place of the mitigation measures.

Mysticetes

Six mysticete species (comprising six stocks) of cetaceans (North Atlantic right whale, blue 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 be migrating through and/or 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 primary feeding habitats (*e.g.,* Cape Cod Bay, Great South Channel, and Gulf of St. Lawrence). While we have acknowledged above that mortality, hearing impairment, or displacement of mysticete prey species may result locally from impact pile driving and UXO/MEC detonations, given the very short duration of and broad availability of prey species in the area and the availability of alternative suitable foraging habitat for the mysticete species most likely to be affected, any impacts on mysticete foraging are 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, including to the east near Nantucket Shoals. 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 numbers of species-specific take by Level B harassment are predicted (compared to the abundance of each mysticete species or stock; see Table 28) 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 and is not be expected 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, 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 Revolution Wind has identified. Species-specific analysis regarding potential for repeated exposures and impacts is provided below.

Humpback whales, minke whales, fin whales and sei whales are the mysticete species for which PTS is anticipated and 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 under the MMPA. As described in the Potential Effects to Marine Mammals and Their Habitat section of the proposed rule, 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 authorized for this species.

For North Atlantic right whales, this rule authorizes up to 56 takes, by Level B harassment, over the 5-year period, with a maximum annual allowable take of 44 (equating to approximately 13 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers expected in the years following foundation installation (*e.g.,* years when only HRG surveys would be occurring).

Southern New England, including the Project Area, is part of a known migratory corridor for North Atlantic right whales and may be a stopover site for migrating North Atlantic right whales moving to or from southeastern calving grounds and northern foraging grounds. However, North Atlantic right whales range outside of the Project Area for their main feeding, breeding, and calving activities. Additional qualitative observations in southern New England include animals feeding and socializing (Quintana-Rizzo *et al.,* 2021). North Atlantic right whales are primarily concentrated in the northeastern and southeastern sections of the Massachusetts Wind Energy Area (MA WEA) (*i.e.,* east of the Project Area) during the summer (June–August) and winter (December–February) while distribution likely shifts to the west, closer to the Project Area, into the Rhode Island/Massachusetts Wind Energy Area (RI/MA WEA) in the spring (March–May) (Quintana-Rizzo *et al.,* 2021). Approximately 23 percent of the right whale population is present in southern New England from December through May, and the mean residence time has tripled to an average of 13 days during these months (Quintana-Rizzo *et al.,* 2021).

In general, North Atlantic right whales in the Project Area are expected to be engaging in migratory and/or feeding behavior. Migrating whales would typically be moving through the Project Area, rather than lingering for extended periods of time; however, foraging whales may remain in the Project Area, with an average residence time of 13 days between December and May (Quintana-Rizzo *et al.,* 2021). It is important to note that the activities that would occur from December through April that may impact North Atlantic right whales using the habitat for foraging or migration would be primarily HRG surveys, which are not expected to result in very high received levels given the rapid transmission loss resulting in the small (less than 150 m) Level B harassment zone. 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 section of the Proposed Rule, 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 authorized. Any disturbance to North Atlantic right whales due to Revolution Wind's activities is expected to result in temporary avoidance of the immediate area of construction. As no injury, serious injury, or mortality is expected or authorized and Level B harassment of North Atlantic right whales will be reduced to the level of least practicable adverse impact through use of mitigation measures, the authorized number of takes of North Atlantic right whales would not exacerbate or compound the effects of the ongoing UME.

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 is limited to up to 79 days assuming Revolution Wind is only able to install one foundation per day over a maximum of 1 year, (although it will likely be less as Revolution Wind anticipates being able to install more than one pile per day throughout the construction period), 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 activities are expected to be sufficiently low-level and localized to specific areas as to not meaningfully impact important behaviors such as migration and foraging for 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 many of these exposures are generally expected to occur to different individual right whales migrating through (*i.e.,* many individuals would not be impacted on more than one day in a year), with some subset potentially being exposed on no more than a few days within the year, they are unlikely to result in energetic consequences that could affect reproduction or survival of any individuals.

Overall, NMFS expects that any 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 migrate, forage, or socialize in the Project Area but are not expected to remain in this habitat for extensive durations relative to core foraging habitats to the east, south of Nantucket and Martha's Vineyard, Cape Cod Bay, or the Great South Channel (Quintana-Rizzo *et al.,* 2021). Any temporarily displaced animals would be able to return to or continue to travel through the Project Area and subsequently utilize this habitat 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, pneumatic hammering) 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. TTS is another potential form of Level B harassment that could result in brief periods of slightly reduced hearing sensitivity affecting behavioral patterns by making it more difficult to hear or interpret acoustic cues within the frequency range (and slightly above) of sound produced during impact pile driving; however, any TTS would likely be of low amount, limited duration, and limited to frequencies where most construction noise is centered (below 2 kHz). NMFS expects that right whale hearing sensitivity would return to pre-exposure levels shortly after migrating through the area or moving away from the sound source.

As described in the Potential Effects to Marine Mammals and Their Habitat section of the proposed rule, 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, we anticipate that course diversion would be of small magnitude. Hence, while some avoidance of the pile-driving activities may occur, we anticipate any avoidance behavior of migratory North Atlantic right whales would be similar to that of gray whales (Tyack *et al.,* 1983), on the order of hundreds of meters up to 1 to 2 km. This diversion from a migratory path otherwise uninterrupted by the project's activities is not expected to result in meaningful energetic costs that would impact annual rates of recruitment of survival. NMFS expects that North Atlantic right whales would be able to avoid areas during periods of active noise production while not being forced out of this portion of their habitat.

North Atlantic right whale presence in the Project Area is year-round. However, abundance during summer months is lower compared to the winter months with spring and fall serving as ''shoulder seasons'' wherein abundance waxes (fall) or wanes (spring). Given this year-round habitat usage, in recognition that where and when whales may actually occur during project activities is unknown as it depends on the annual migratory behaviors, NMFS is requiring 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, Revolution 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 Specific Geographic Region section in the preamble of this rule, Revolution Wind would be constructed within the North Atlantic right whale migratory corridor BIA, which represent areas and months within which a substantial portion of a species or population is known to migrate. The Lease Area is relatively small compared with the migratory BIA area (approximately 339 km^2 for OCS–A–0486 versus the size of the full North Atlantic right whale migratory BIA, 269,448 km^2). Because of this, the overall North Atlantic right whale migration is not expected to be impacted by the proposed activities. Although North Atlantic right whales forage to some degree in the Project Area, there are no known 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. Therefore, any impacts to prey that may occur are also unlikely to impact marine mammals.

The most significant measure to minimize impacts to individual North Atlantic right whales is the seasonal moratorium on all foundation installation activities from January 1 through April 30 and the limitation on these activities in December (*e.g.,* only work with approval from NMFS) when North Atlantic right whale abundance in the Project Area is expected to be highest. NMFS also expects this measure to greatly reduce the potential for mother-calf pairs to be exposed to impact pile driving noise above the Level B harassment threshold during their annual spring migration through the Project Area from calving grounds to

primary foraging grounds (*e.g.,* Cape Cod Bay). UXO/MEC detonations would also be restricted from December 1 through April 30, annually. NMFS expects that exposures to North Atlantic right whales would be reduced due to the additional 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 and UXO/MEC detonations may only begin in the absence of North Atlantic right whales (based on visual and passive acoustic monitoring). If pile driving or UXO/MEC detonations have commenced, NMFS anticipates North Atlantic right whales would avoid the area, utilizing nearby waters to carry on pre-exposure behaviors. However, foundation installation activities must be shut down if a North Atlantic right whale is sighted at any distance or acoustically detected at any distance within the PAM monitoring zone, unless a shutdown is not feasible due to risk of injury or loss of life. Shutdown may occur anywhere if North Atlantic right whales are seen within or beyond the Level B harassment zone, further minimizing the duration and intensity of exposure. NMFS anticipates that if North Atlantic right whales go undetected and they are exposed to foundation installation or UXO/MEC detonation noise, it is unlikely a North Atlantic right whale would approach the sound source locations to the degree that they would purposely expose themselves to very high noise levels. 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 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 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, NMFS requires the combination of PAM and visual observers. NMFS is requiring communication protocols with other project vessels and other heightened awareness efforts (*e.g.,* daily monitoring of North Atlantic right whale sighting databases) such that as a North Atlantic right whale approaches the source (and thereby could be exposed to higher noise energy levels), PSO detection efficacy would increase, the whale would be detected, and a delay to commencing foundation installation or shutdown (if feasible) would occur. In addition, the implementation of a soft-start for impact pile driving would provide an opportunity for whales to move away from the source if they are undetected, reducing received levels. The UXO/MEC detonations mitigation measures described above would further reduce the potential to be exposed to high received levels.

For HRG surveys, the maximum distance to the Level B harassment threshold is 141 m. The estimated take by Level B harassment associated with HRG surveys is to account for any potential exposures of North Atlantic right whales to active acoustic sources should there be a delay shutting it down (if called for). However, the authorized Level B harassment takes do not account for mitigation and monitoring, and because of the short maximum distance to the Level B harassment threshold, the requirement that vessels maintain a distance of 500 m from any North Atlantic right whales, the fact whales are unlikely to remain in close proximity to an HRG survey vessel for any length of time, and that the acoustic source would be 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 mitigation requirements, take by Level A harassment is not anticipated and therefore, not authorized. 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 number 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 whales is anticipated or authorized. 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 Project Area, many of the individuals predicted to be taken (including no more than 56 instances of take, by Level B harassment) over the course of the 5-year rule (with an annual maximum of no more than 44) would be impacted on only 1 or 2 days in a year, although it is possible that repeated exposures beyond this may occur should North Atlantic right whales briefly use the Project Area as a 'stopover' site and stay or swim in and out of the areas with pile driving for more than day. 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 required mitigation and other information presented, Revolution 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 determined that the take (by Level B harassment) anticipated and authorized would have a negligible impact on the North Atlantic right whale.

Blue Whale

The blue whale is listed as endangered under the ESA, and the Western North Atlantic stock is considered depleted and strategic under the MMPA. There are no known areas of specific biological importance in or around the Project Area, and there is no ongoing UME. The actual abundance of the stock is likely significantly greater than what is reflected in the SAR because the most recent population estimates are primarily based on surveys conducted in U.S. waters and the stock's range extends well beyond the U.S. exclusive economic zone (EEZ). No serious injury or mortality is anticipated or authorized for this species.

The rule authorizes up to seven takes, by Level B harassment, over the 5-year period. The maximum annual allowable take by Level B harassment is three, which equates to approximately 0.73 percent of the stock abundance if each take were considered to be of a different individual. Based on the migratory nature of blue whales and the fact that there are neither feeding nor reproductive areas documented in or near the Project Area, and in consideration of the very low number of predicted annual takes, it is unlikely that the predicted instances of takes would represent repeat takes of any individual—in other words, each take

likely represents one whale exposed on 1 day within a year.

With respect to the severity of those individual takes by 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 TTS would be concentrated at half or one octave above the frequency band of pile driving noise (most sound is below 2 kHz) which does not include the full predicted hearing range of blue whales. Any hearing ability temporarily impaired from TTS is anticipated to return to pre-exposure conditions within a relatively short time period after the exposures cease. Any avoidance of the Project Area due to the activities would be expected to be temporary.

Given the magnitude and severity of the impacts discussed above, and in consideration of the required mitigation and other information presented, Revolution 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 determined that the take by Level B harassment anticipated and authorized will have a negligible impact on the western North Atlantic stock of blue whales.

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 authorized for this species.

The rule authorizes up to 52 takes, by harassment only, over the 5 year period. The maximum annual allowable take by Level A harassment and Level B harassment, is 4 and 40, respectively (combined, this annual take (n=44) equates to approximately 0.65 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HRG surveys would be occurring). Given the project overlaps a small portion of a fin whale feeding BIA (2,933 km^2) in the months the project will occur (March–October) and that southern New England is generally considered a feeding area, it is likely that some subset of the individual whales exposed could be taken several times annually

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

Fin whales are present in the waters off of New England year-round and are one of the most frequently observed large whales and cetaceans in continental shelf waters, principally from Cape Hatteras, North Carolina in the Mid-Atlantic northward to Nova Scotia, Canada (Sergeant, 1977; Sutcliffe and Brodie, 1977; CETAP, 1982; Hain *et al.,* 1992; Geo-Marine, 2010; BOEM 2012; Edwards *et al.,* 2015; Hayes *et al.,* 2022). In the Project Area, fin whales densities are highest in the winter and summer months (Roberts *et al.,* 2023) though detections do occur in spring and fall (Watkins *et al.,* 1987; Clark and Gagnon, 2002; Geo-Marine, 2010; Morano *et al.,* 2012). However, fin whales feed more extensively in waters in the Great South Channel north to the Gulf Maine into the Gulf of St. Lawrence, areas north and east of the Project Area (Hayes *et al.,* 2023).

As described previously, the Project Area overlaps approximately 11 percent of a small fin whale feeding BIA (2,933 km^2) east of Montauk Point, New York (Figure 2.3 in LaBrecque *et al.,* 2015) that is active from March to October. Foundation installations and UXO/MEC detonations have seasonal work restrictions such that the temporal overlap between these project activities and the active BIA timeframe would exclude the months of March and April. A separate larger year-round feeding BIA (18,015 km^2) located to the east in the southern Gulf of Maine does not overlap with the Project Area and would thus not be impacted by project activities. We anticipate that if foraging is occurring in the Project Area and foraging whales are exposed to noise levels of sufficient strength, they would avoid the Project Area and move into the remaining 89 percent of the small feeding BIA to continue foraging without substantial energy expenditure or, depending on the time of year, travel to the larger year-round feeding BIA.

Given the documented habitat use within the area, some of the individuals taken would likely be exposed on multiple days. However, low level impacts are generally expected from any fin whale exposure. Given the magnitude and severity of the impacts discussed above (including no more than 52 takes of the course of the 5-year rule, and a maximum annual allowable take by Level A harassment and Level B harassment, of 4 and 40, respectively), and in consideration of the required mitigation and other information presented, Revolution 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 determined that the take by harassment anticipated and authorized will have a negligible impact on the western North Atlantic stock of fin whales.

Humpback Whale

The West Indies Distinct Population Segments (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 Specific Geographic Region section of this preamble to the rule, 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 authorized. Despite the UME, the relevant population of humpback whales (the West Indies breeding population, or DPS of which the Gulf of Maine stock is a part) remains stable at approximately 12,000 individuals.

The rule authorizes up to 106 takes, by harassment only, over the 5-year period. The maximum annual allowable take by Level A harassment and Level B harassment, is 9 and 77, respectively (combined, this maximum annual take (n=86) equates to approximately 6.16 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HRG surveys would be occurring). Given that feeding is considered the principal activity of humpback whales in southern New England waters, it is likely that some subset of the individual

whales exposed could be taken several times annually.

Among the activities analyzed, impact pile driving is likely to result in the highest amount of Level A harassment annual take (n=9) of humpback whales. The maximum amount of authorized annual take by Level B harassment is highest for impact pile driving (n=77; WTG plus OSS foundations).

In the western North Atlantic, humpback whales feed during spring, summer, and fall over a geographic range encompassing the eastern coast of the U.S. Feeding is generally considered to be focused in areas north of the Project Area, including in a feeding BIA in the Gulf of Maine/Stellwagen Bank/Great South Channel, but has been documented off the coast of southern New England and as far south as Virginia (Swingle *et al.,* 2006). Foraging animals 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 consist 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, such 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 half or one octave above the frequency band of pile driving noise (most sound is below 2 kHz) which does not include the full predicted hearing range of baleen whales. If TTS is incurred, hearing sensitivity would likely return to pre-exposure levels relatively shortly after exposure ends. Any masking or physiological responses would also be of low magnitude and severity for reasons described above.

Given the magnitude and severity of the impacts discussed above (including no more than 106 takes over the course of the 5-year rule, and a maximum annual allowable take by Level A harassment and Level B harassment, of 9 and 77 respectively), and in consideration of the required mitigation measures and other information presented, Revolution 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 determined that the take by harassment anticipated and authorized will 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 Specific Geographic Region section of this preamble, a UME has been designated for this species but is pending closure. No serious injury or mortality is anticipated or authorized for this species.

The rule authorizes up to 21 takes by Level A harassment and 320 takes by Level B harassment over the 5-year period. The maximum annual allowable take by Level A harassment and Level B harassment is 21 and 304, respectively (combined, this annual take (n=325) equates to approximately 1.48 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HRG surveys would be occurring). As described in the Description of Marine Mammals in the Specific Geographic Region 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.,* 2022). Spring through fall are times of relatively widespread and common acoustic occurrence on the continental shelf. From September through April, minke whales are frequently detected in deep-ocean waters throughout most of the western North Atlantic (Clark and Gagnon, 2002; Risch *et al.,* 2014; Hayes *et al.,* 2023). Because minke whales are migratory and their known feeding areas are north and east of the Project Area, including a feeding BIA in the southwestern Gulf of Maine and George's Bank, they would be more likely to be transiting 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 previously detailed in the Description of Marine Mammals in the Specific Geographic Region 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. 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 by harassment authorized through this action is not expected to exacerbate the UME.

We anticipate the impacts of this harassment to follow those described in the general *Mysticetes* section above. Any potential PTS would be minor (limited to a few dB) and any TTS would be of short duration and concentrated at half or one octave above the frequency band of pile driving noise (most sound is below 2 kHz) which does not include the full predicted hearing range of minke whales. Level B harassment would be temporary, with primary impacts being temporary displacement of the Project Area but not abandonment of any migratory or foraging behavior.

Given the magnitude and severity of the impacts discussed above (including no more than 341 takes of the course of the 5-year rule, and a maximum annual allowable take by Level A harassment and Level B harassment, of 21 and 304, respectively), and in consideration of the required mitigation and other information presented, Revolution 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 determined that the take by harassment anticipated and authorized will 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 authorized for this species.

The rule authorizes up to 31 takes by harassment only over the 5-year period. The maximum annual allowable take by Level A harassment and Level B harassment, is 5 and 18, respectively (combined, this annual take (n=23) equates to approximately 0.37 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 Specific Geographic Region section of this preamble, most of the sei whale distribution is concentrated in Canadian waters and seasonally in northerly U.S. waters, although they are uncommonly observed in the waters off of Rhode

Island. 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 Level B harassment, we anticipate impacts to be limited to low-level, temporary behavioral responses with avoidance and potential masking impacts in the vicinity of the WTG installation to be the most likely type of response. Any potential PTS and TTS would likely be concentrated at half or one octave above the frequency band of pile driving noise (most sound is below 2 kHz) which does not include the full predicted hearing range of sei whales. Moreover, any TTS would be of a small degree. Any avoidance of the Project Area due to the Project's activities would be expected to be temporary.

Given the magnitude and severity of the impacts discussed above (including no more than 31 takes of the course of the 5-year rule, and a maximum annual allowable take by Level A harassment and Level B harassment, of 5 and 18, respectively), and in consideration of the required mitigation and other information presented, Revolution 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 determined that the take by harassment anticipated and authorized will 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.

The authorized takes of odontocetes are incidental to all specified activities. No serious injury or mortality is anticipated or authorized. We anticipate that, given ranges of individuals (*i.e.,* that some individuals remain within a small area for some period of time) and non-migratory nature of some odontocetes in general (especially as compared to mysticetes), these takes are more likely to represent multiple exposures of a smaller number of individuals than is the case for mysticetes, though some takes may also represent one-time exposures to an individual. Foundation installation is likely to disturb odontocetes to the greatest extent compared to UXO/MEC detonations and HRG surveys. While we expect animals to avoid the area during foundation installation and UXO/MEC detonations, their habitat range is extensive compared to the area ensonified during these activities. In addition, as described above, UXO/MEC detonations are instantaneous; therefore, any disturbance would be very limited in time.

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

Any masking or TTS effects are anticipated to be of low-severity. First, the frequency range of pile driving, the most impactful planned activity 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 planned for the project. As described above, recent studies suggest odontocetes have a mechanism to self-mitigate (*i.e.,* reduce hearing sensitivity) the impacts of noise exposure, which could potentially reduce TTS impacts. Any masking or TTS is anticipated to be limited and would typically only interfere with communication within a portion of an odontocete's range and as discussed earlier, the effects would only be expected to be of a short duration and for TTS, a relatively small degree.

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

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

Sperm Whales

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

The rule authorizes up to 15 takes by Level B harassment over the 5-year period. The maximum annual allowable take by Level B harassment is 7, which equates to approximately 0.16 percent of the stock abundance, if each take were considered to be of a different

individual, with lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HRG surveys would be occurring). Given sperm whale's preference for deeper waters, especially for feeding, it is unlikely that individuals will remain in the Project Area for multiple days, and therefore, the estimated takes likely represent exposures of different individuals on 1 day each annually.

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

Given the magnitude and severity of the impacts discussed above (including no more than 15 takes by Level B harassment over the course of the 5-year rule, a maximum annual allowable take of 7, and in consideration of the required mitigation and other information presented, Revolution 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 determined that the take by Level B harassment anticipated and authorized will have a negligible impact on the North Atlantic stock of sperm whales.

Dolphins and Small Whales (Including Delphinids)

The six species and stocks included in this group (which are indicated in Table 2 in the *Delphinidae* family) are not listed under the ESA. 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 or mortality is anticipated or authorized for these species.

The six delphinid species with takes authorized for the Project are the Atlantic spotted dolphin, Atlantic white-sided dolphin, common bottlenose dolphin, common dolphin, long-finned pilot whale, and Risso's dolphin. The rule would allow for the authorization of up to between 58 and 12,460 takes (depending on species) by Level A harassment and/or Level B harassment over the 5-year period. The maximum annual allowable take for these species by Level A harassment and Level B harassment ranges from 0 to 35 and 34 to 8,086, respectively (this annual take equates to approximately 0.09 to 4.7 percent of the stock abundance, depending on each species, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HRG surveys would be occurring).

For all stocks listed above, 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.

The number of takes, likely movement patterns of the affected species, and the intensity of any Level A harassment or Level B harassment, combined with the availability of alternate nearby foraging habitat 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. The potential for PTS in dolphins and small whales is very low and, if PTS does occur, would occur to a limited number of individuals, be of small degree, and would be limited to the frequency ranges of the activities (which do not span across most of their hearing range). Some TTS can also occur but, again, it would be limited to the frequency ranges of the activities 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 required mitigation and other information presented, Revolution 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 determined that the take by harassment anticipated and authorized will have a negligible impact on all of the species and stocks addressed in this section.

Harbor Porpoises

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 authorized for this stock.

The rule authorizes up to 1,375 takes, by harassment only, over the 5-year period. The maximum annual allowable take by Level A harassment and Level B harassment, would be 138 and 1,237, respectively (combined, this annual take (n=1,263) equates to approximately 1.32 percent of the stock abundance, if each take were considered to be of a different individual), with lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HRG surveys would be occurring). 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.

Regarding the severity of takes by Level A harassment and 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, UXO/MEC detonations, and pneumatic hammering. In response to pile driving, harbor porpoises are likely to avoid the area during construction, as previously demonstrated in Tougaard *et al.* (2009) in Denmark, in Dahne *et al.* (2013) in Germany, and in Vallejo *et al.* (2017) in the United Kingdom, although a study by Graham *et al.* (2019) may indicate that the avoidance distance could decrease over time. However, foundation installation is scheduled to occur off the coast of Rhode Island and given alternative foraging areas, any avoidance of the area by individuals is not likely to impact the reproduction or survival of any individuals. Regarding UXO/MEC detonations and pneumatic hammering, any TTS or behavioral response would be brief and of low severity given only 1 UXO/MEC would be detonated on any given day and only up to 13 UXO/MECs could be detonated under these regulations and the brevity of pneumatic hammering required for installation and removal of both casing pipes (3 hours per day over 2 days per casing pipe for a total of 12 hours over 8 days).

With respect to PTS and TTS, the effects on an individual are likely relatively low, given the frequency bands of pile driving (most energy below 2 kHz) compared to harbor porpoise hearing (150 Hz to 160 kHz peaking around 40 kHz). Specifically,

TTS is unlikely to impact hearing ability in their more sensitive hearing ranges or the frequencies in which they communicate and echolocate. We expect any PTS that may occur to be within the very low end of their hearing range where harbor porpoises are not particularly sensitive and any PTS would be of small magnitude. As such, any PTS would not interfere with key foraging or reproductive strategies necessary for reproduction or survival.

As discussed in Hayes *et al.* (2022), harbor porpoises are seasonally distributed. During fall (October through November) 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 most 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 Rhode Island.

Given the magnitude and severity of the impacts discussed above, and in consideration of the required mitigation and other information presented, Revolution 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 determined that the take by harassment anticipated and authorized will have a negligible impact on the Gulf of Maine/Bay of Fundy stock of harbor porpoises.

Phocids (Harbor Seals and Gray Seals)

The harbor seal and gray seal are not listed under the ESA, and neither the western North Atlantic stock of gray seal nor the western North Atlantic stock of harbor seal are 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 Specific Geographic Region section of this preamble, a UME has been designated for harbor seals and gray seals and is described further below. No serious injury or mortality is anticipated or authorized for this species.

For the 2 seal species, the rule authorizes up to between 1,113 (harbor seals) and 2,781(gray seals) takes, by harassment only, over the 5-year period. The maximum annual allowable take for each species by Level A harassment and Level B harassment, would range from 14 to 923 (harbor seals), and 22 to 2,303, respectively (combined, this annual take (n=937 to 2,325) equates to approximately 1.53 to 8.5 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HRG surveys would be occurring). Though gray seals and harbor seals are considered migratory and no specific feeding areas have been designated in the area, the higher number of takes relative to the stock abundance suggests that while some of the takes likely represent exposures of different individuals on 1 day a year, it is likely that some subset of the individuals exposed could be taken several times annually.

Harbor and gray seals occur in southern New England waters most often from December through April. 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 would be expected to be at comparatively lower levels. Known haulouts for seals occur along the shores of Massachusetts and throughout Narragansett Bay, near the landfall construction location. However, neither Revolution Wind nor NMFS expect in-air sounds produced to cause take of hauled out pinnipeds at distances greater several hundred meters. NMFS does not expect any harassment to occur and has not authorized any take from in-air impacts on hauled out seals.

As described in the Potential Effects to Marine Mammals and Their Habitat section in the proposed rule, construction of wind farms in Europe resulted in pinnipeds temporarily avoiding construction areas but returning within short time frames after construction was complete (Carroll *et al.,* 2010; Hamre *et al.,* 2011; Hastie *et al.,* 2015; Russell *et al.,* 2016; Brasseur *et al.,* 2010). Effects on pinnipeds that are taken by Level B harassment in the Project Area would likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring). Most likely, individuals would simply move away from the sound source and be temporarily displaced from those areas (Lucke *et al.,* 2006; Edren *et al.,* 2010; Skeate *et al.,* 2012; Russell *et al.,* 2016). Given the low anticipated magnitude of impacts from any given exposure (*e.g.,* temporary avoidance), even repeated Level B harassment across a few days of some small subset of individuals, which could occur, is unlikely to result in impacts on the reproduction or survival of any individuals. Moreover, pinnipeds would benefit from the mitigation measures described in § 217.275.

As described above, noise from pile driving is mainly low frequency, and while any PTS and TTS that does occur would fall within the lower end of pinniped hearing ranges (50 Hz to 86 kHz), PTS and TTS would not occur at frequencies around 5 kHz where pinniped hearing is most susceptible to noise-induced hearing loss (Kastelein *et al.,* 2018). In summary, any PTS and TTS would be of small degree and not occur across the entire, or even most sensitive, hearing range. Hence, any impacts from PTS and TTS are likely to be of low severity and not interfere with behaviors critical to reproduction or survival.

Elevated numbers of harbor seal and gray seal mortalities were first observed in July 2018 and occurred across Maine, New Hampshire, and Massachusetts until 2020. Based on tests conducted so far, the main pathogen found in the seals belonging to that UME was phocine distemper virus, although additional testing to identify other factors that may be involved in this UME are underway. Currently, the only active UME is occurring in Maine with some harbor and gray seals testing positive for highly pathogenic avian influenza (HPAI) H5N1. Although elevated strandings continue, neither UME (alone or in combination) provide cause for concern regarding population-level impacts to any of these stocks. For harbor seals, the population abundance is over 61,000 and annual mortality/serious injury (M/SI) (n=339) is well below PBR (1,729) (Hayes *et al.,* 2020). The population abundance for gray seals in the United States is over 27,000, with an estimated overall abundance, including seals in Canada, of approximately 450,000. In addition, the abundance of gray seals is likely increasing in the U.S. Atlantic, as well as in Canada (Hayes *et al.,* 2020).

Given the magnitude and severity of the impacts discussed above, and in consideration of the required mitigation and other information presented, Revolution 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 determined that the take by harassment anticipated and authorized will have a negligible impact on harbor and gray seals.

Negligible Impact Determination

No mortality or serious injury is anticipated to occur or authorized. As described in the 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 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 required mitigation and monitoring measures, NMFS finds that the authorized incidental take of marine mammals from all of Revolution 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 is authorizing incidental take by Level A harassment and/or Level B harassment of 16 species of marine mammals (with 16 managed stocks). The maximum number of instances of takes by combined Level A harassment and Level B harassment possible within any 1 year relative to the best available population abundance is less than one-third for all species and stocks potentially impacted.

For nine stocks, less than 1 percent of the stock abundance is authorized for take by harassment; for four stocks, less than or equal to 5 percent of the stock abundance is authorized for take by harassment; for two stocks, less than 9 percent of the stock abundance has been authorized for take by harassment; and for one stock, less than 13 percent of the stock abundance has been authorized for take by harassment. Specific to the North Atlantic right whale, the maximum annual amount of take, which is by Level B harassment only, is 44, or 13 percent of the stock abundance, assuming that each instance of take represents a different individual. Please see Table 28 for information relating to this small numbers analysis.

Based on the analysis contained herein of the activities, including the required mitigation and monitoring measures, and the anticipated take of marine mammals, NMFS 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 NOAA GARFO.

The NMFS Office of Protected Resources has authorized the take of five marine mammal species, which are listed under the ESA: the North Atlantic right, sei, fin, blue, and sperm whale. The Permit and Conservation Division requested initiation of section 7 consultation on November 1, 2022 with GARFO for the promulgation of this rulemaking. NMFS issued a Biological Opinion on July 21, 2023 concluding that the promulgation of the rule and issuance of the LOA thereunder is not likely to jeopardize the continued existence of threatened and endangered species under NMFS' jurisdiction and is not likely to result in the destruction or adverse modification of designated or proposed critical habitat. The Biological Opinion is available at *https://repository.library.noaa.gov/view/noaa/51759.*

Revolution Wind is required to abide by the promulgated regulations, as well as the reasonable and prudent measure and terms and conditions of the Biological Opinion and Incidental Take Statement, as issued by NMFS.

National Environmental Policy Act (NEPA)

To comply with the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216–6A, NMFS must evaluate our proposed action (*i.e.,* promulgation of regulations) and alternatives with respect to potential impacts on the human environment. NMFS participated as a cooperating agency on the BOEM 2023 Final Environmental Impact Statement (FEIS), which was finalized on July 17, 2023, and is available at: *https://www.boem.gov/renewable-energy/state-activities/revolution-wind-final-eis.*

After carefully considering alternatives described and analyzed in the Revolution Wind FEIS and comments from the public on the Draft EIS, BOEM identified a preferred alternative (Alternative G) for consideration, which reduces the number of WTG foundations Revolution Wind can install from 79 to 65 but still includes installation of 2 OSSs (for a total of 67 foundations). NMFS is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action (construction of the Revolution Wind offshore wind energy facility, as proposed by Revolution Wind) and alternatives (variations of the Proposed Action that consider other specific concerns, *e.g.,* reducing impacts to the benthic habitat) involves activities that could affect marine resources, and due to NMFS' jurisdiction by law and special expertise. Issuance of an LOA under the MMPA triggers independent NEPA compliance obligations, which may be satisfied by adopting the FEIS prepared by BOEM. As a cooperating agency, NMFS provided extensive comments on the Draft Environmental Impact Statement. Based on BOEM's satisfactory revisions to the DEIS, NMFS made the decision to adopt the FEIS. On August 21, 2023, NMFS signed a joint Record of Decision (ROD), which satisfied NMFS' obligation under NEPA. The full text of the mitigation,

monitoring, and reporting requirements for Alternative G are available in Appendix A of the ROD, which is available on BOEM's website at: *https://www.boem.gov/renewable-energy/state-activities/revolution-wind.*

In accordance with 40 CFR 1506.3, NMFS independently reviewed and evaluated the 2023 Revolution Wind FEIS and determined that it is adequate and sufficient to meet our responsibilities under NEPA for the promulgation of this rule and issuance of the associated LOA. NMFS, therefore, has adopted the 2023 Revolution Wind FEIS through a joint ROD with BOEM. The joint ROD for adoption of the 2023 Revolution Wind FEIS and promulgation of this final rule and subsequent issuance of a LOA can be found at *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.*

Executive Order 12866

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

Regulatory Flexibility Act

Pursuant to the Regulatory Flexibility Act (RFA; 5 U.S.C. 601 *et seq.*), the Chief Counsel for Regulation of the Department of Commerce certified to the Chief Counsel for Advocacy of the Small Business Administration during the proposed rule stage that this action would not have a significant economic impact on a substantial number of small entities. The factual basis for the certification was published in the proposed rule and is not repeated here. No comments were received regarding this certification. As a result, a regulatory flexibility analysis was not required and none was prepared.

Paperwork Reduction Act

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

Coastal Zone Management Act (CZMA)

The Coastal Zone Management Act requires that any applicant for a required Federal license or permit to conduct an activity, within the coastal zone or within the geographic location descriptions (*i.e.,* areas outside the coastal zone in which an activity would have reasonably foreseeable coastal effects), affecting any land or water use or natural resource of the coastal zone be consistent with the enforceable policies of a state's federally-approved coastal management program. NMFS determined that Revolution Wind's application for an incidental take regulations is an unlisted activity 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. Pursuant to 15 CFR 930.54, NMFS published notice of receipt of Revolution Wind's application in the **Federal Register** on March 21, 2022 (87 FR 15942) and published notice of the proposed rule on December 23, 2022 (87 FR 79072). The state of Rhode Island did not request approval from the Director of NOAA's Office for Coastal Management to review Revolution 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.

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: September 29, 2023.

Samuel D. Rauch III,

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

For reasons set forth in the preamble, NMFS amends 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:

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

■ 2. Add subpart BB, consisting of §§ 217.270 through 217.279, to read as follows:

Subpart BB—Taking Marine Mammals Incidental to Construction of the Revolution Wind Project Offshore of Rhode Island

Subpart BB—Taking Marine Mammals Incidental to Construction of the Revolution Wind Project Offshore of Rhode Island

§ 217.270 Specified activity and specified geographical region.

(a) Regulations in this subpart apply to activities associated with the Revolution Wind project (hereafter referred to as the ''Project'') by Revolution Wind, LLC (hereafter referred to as ''Letter of Authorization (LOA) Holder'') and those persons it authorizes or funds to conduct activities on its behalf in the specified geographical region 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 0486 Commercial Lease of Submerged Lands for Renewable Energy Development, two export cable routes, and two sea-to-shore transition points located at Quonset Point in North Kingstown, Rhode Island.

(c) The specified activities are impact pile driving of wind turbine generator (WTGs) and offshore substation (OSSs) foundations; vibratory pile driving (install and subsequently remove) of cofferdams and goal posts; pneumatic hammering (install and subsequently remove) of casing pipes; high-resolution geophysical (HRG) site characterization surveys; detonation of unexploded ordnances or munitions and explosives of concern (UXOs/MECs); vessel transit within the specified geographical region to transport crew, supplies, and materials; WTG operation; fishery and ecological monitoring surveys; placement of scour protection; and trenching, laying, and burial activities associated with the installation of the export cable routes from OSSs to shore-

based converter stations and inter-array cables between turbines.

§ 217.271 Effective dates.

The regulations in this subpart are effective from November 20, 2023, through November 19, 2028.

§ 217.272 Permissible methods of taking.

Under the LOA, issued pursuant to §§ 217.276, and 217.277, and § 216.106 of this chapter, 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 0486 Commercial Lease of Submerged Lands for Renewable Energy Development, along export cable routes, and at the two sea-to-shore transition points located at Quonset Point in North Kingstown, Rhode Island in the following ways, provided LOA Holder is in complete compliance with all terms, conditions, and requirements of the regulations in this subpart and an LOA issue under §§ 217.276 and 217.277:

(a) By Level B harassment associated with the acoustic disturbance of marine mammals by impact pile driving (WTG and OSS foundation installation), vibratory pile driving (cofferdam and goal post installation and removal), pneumatic hammering (casing pipe installation and removal), UXO/MEC detonations, and HRG site characterization surveys;

(b) By Level A harassment associated with the acoustic disturbance of marine mammals by impact pile driving of WTG and OSS foundations, pneumatic hammering of casing pipes, and UXO/MEC detonations;

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

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

TABLE 1 TO PARAGRAPH (d)

Marine mammal species	Scientific name	Stock
North Atlantic right whale	*Eubalaena glacialis*	Western Atlantic.
Blue whale	*Balaenoptera musculus*	Western North 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.
Sperm whale	*Physeter macrocephalus*	North Atlantic.
Atlantic spotted dolphin	*Stenella frontalis*	Western North Atlantic.
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	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.
Risso's dolphin	*Grampus griseus*	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.

§ 217.273 Prohibitions.

Except for the takings described in § 217.272 and authorized by an LOA issued under §§ 217.276 or 217.277, it is unlawful for any person to do any of the following in connection with the activities described in this subpart:

(a) Violate or fail to comply with the terms, conditions, and requirements of this subpart or an LOA issued under §§ 217.276 and 217.277;

(b) Take any marine mammal stock not specified in § 217.272(d);

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

(d) Take any marine mammal stock specified in § 217.272(d) after National Marine Fisheries Service (NMFS) Office of Protected Resources determines such taking results in more than a negligible impact on the stock of marine mammals.

§ 217.274 Mitigation requirements.

When conducting the activities identified in § 217.270(c) within the specified geographical area described in § 217.270(b), LOA Holder must implement the mitigation measures contained in this section and any LOA issued under §§ 217.276 and 217.277. 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 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. For any UXO/MEC detonation, these systems must be monitored for 24 hours and immediately prior to blasting;

(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 or acoustic detection must trigger a delay to the commencement of impact pile driving, UXO/MEC detonation, and 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 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 odontocetes (excluding sperm whales) and pinnipeds, and 30 minutes for sperm and baleen whales (including North Atlantic right whales) with no further sightings;

(9) For in-water construction heavy machinery activities listed in § 217.270(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 Identify (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; and

(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.

(b) *Vessel strike avoidance measures.* LOA Holder must comply with the following vessel strike avoidance measures, unless an emergency 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 (11.5 miles per hour (mph)) to fulfill those responsibilities, while in the specified geographical region:

(1) Prior to the start of the Project's activities involving vessels, LOA Holder 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. The dedicated visual observers 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. 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's vessels, regardless of their vessel's size, must maintain a vigilant watch for all marine mammals during all vessel operations 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 on each vessel at all times to monitor for marine mammals primarily 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, use of visual monitoring and alternative monitoring equipment, and reporting requirements in this subpart. Visual observers may be third-party observers (*i.e.,* NMFS-approved PSOs as defined in § 217.275 (a)(1)) or trained crew members;

(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 notifications of North Atlantic right whale Slow Zones (DMAs and acoustically-triggered Slow Zones) 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 LOA Holder's Project-Wide 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 (11.5 mph) or less within any active North Atlantic right whale Seasonal Management Area (SMA) and Slow Zone (*i.e.,* Dynamic Management Areas (DMA) or acoustically-triggered Slow Zones);

(6) Between November 1 and April 30, all vessels, regardless of size, must operate port to port (specifically from ports in Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Virginia, and Maryland), and within the Lease Area and Revolution Wind Export Cable (RWEC) corridor at 10 k (11.5 mph) or less, except for vessels transiting in Narragansett Bay or Long Island Sound;

(7) All LOA Holder's vessel(s) (including crew transfer vessels) are restricted from traveling over 10 kn (11.5 mph), unless traveling in a frequently traveled transit corridor (*e.g.,* crew transfer corridor) between port to the Lease Area while LOA Holder monitors the transit corridor to detect large whales (including North Atlantic right whales) in real-time with PAM prior to and during transits. This measure only applies when no other vessel speed restrictions are in place;

(8) All LOA Holder's vessels, regardless of size, must immediately reduce speed to 10 kn (11.5 mph) 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 must trigger an additional 24-hour period of operating at 10 kn or less. If a North Atlantic right whale is reported via any of the monitoring systems (see (b)(4) of this section) within 10 kilometers (km; 6.2 miles (mi)) of a transiting vessel(s), that vessel must operate at 10 kn (11.5 mph) or less for 24 hours following the reported detection;

(8) LOA Holder's vessels, regardless of size, must immediately reduce speed to 10 kn (11.5 mph) 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;

(9) If a large whale (other than a North Atlantic right whale) is detected via the transit corridor PAM system, all vessels must travel at 10 kn (11.5 mph) until the whale can be confirmed visually beyond 500 m of the vessel or 24 hours has passed.

(10) LOA Holder's vessels must maintain a minimum separation distance of 500 m (1,640 ft) from North Atlantic right whales. If underway, all vessels must steer a course away from any sighted North Atlantic right whale at 10 kn (11.5 mph) 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;

(11) 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 (328 ft);

(12) LOA Holder's vessels must maintain a minimum separation distance of 50 m (164 ft) from all delphinid cetaceans and pinnipeds with an exception made for those that approach the vessel (*i.e.,* bow-riding dolphins). If a delphinid cetacean that is not bow riding or a pinniped is sighted within 50 m of a transiting vessel, LOA Holder's vessel operator must shift the engine to neutral, with an exception made for those that approach the vessel (*e.g.,* bow-riding dolphins). Engines must not be engaged until the animal(s) has moved outside of the vessel's path and beyond 50 m;

(13) When a marine mammal(s) is sighted while LOA Holder's vessel(s) is transiting, the vessel must not divert or alter course to approach any marine mammal and 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 excessive speed or abrupt changes in direction until the animal has left the area). If a separation distance is triggered, any vessel underway must avoid abrupt changes in course direction and take appropriate action as specified in paragraphs (b)(10), (b)(11), and (b)(12) of this section. 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);

(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 90 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 (11.5 mph) 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 and OSS foundation installation.* The following requirements apply to impact pile driving activities associated with the installation of WTG and OSS foundations:

(1) Impact pile driving must not occur January 1 through April 30. Impact pile driving must be avoided to the maximum extent practicable in December; however, it may occur if necessary to complete the project with prior approval by NMFS;

(2) Monopiles must be no larger than 15 m (49 ft) in diameter, representing the larger end of the monopile design. During all monopile installation, the minimum amount of hammer energy necessary to effectively and safely install and maintain the integrity of the piles must be used. Hammer energies must not exceed 4,000 kilojoules for monopile installation. No more than three monopiles may be installed per day;

(3) LOA Holder(s) must not initiate pile driving earlier than 1 hour after civil sunrise or later than 1.5 hours prior to civil sunset, unless 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 nighttime monitoring equipment and protocols;

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

(5) 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;

(6) LOA Holder must establish clearance 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 odontocetes (excluding sperm whales) and pinnipeds, and 30 minutes for sperm and baleen whales (including the North Atlantic right whale);

(7) For North Atlantic right whales, any visual observation at any distance or acoustic detection within the PAM monitoring zone must trigger a delay to the commencement of pile driving. Pile driving may begin only if no North Atlantic right whale visual detections at any distance or acoustic detections within the PAM monitoring zone have occurred during the 60-minute clearance zone monitoring period;

(8) LOA Holder must deploy at least two fully functional, uncompromised noise abatement systems that reduce noise levels to the modeled harassment isopleths, assuming 10-dB attenuation, during all impact pile driving:

(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, as described in (c)(8)(ii) through (v) of this paragraph, must occur prior to impact pile driving of monopiles. 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 paragraph (c)(9) of this section.

(9) 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 an adequate 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.

(10) LOA Holder must utilize PSO(s) and PAM operator(s), as described in § 217.275(c). At least 3 on-duty PSOs must be deployed on the pile driving platform. Additionally, two dedicated-PSO vessels must be used at least 60 minutes before, during, and 30 minutes after all pile driving, and each dedicated-PSO vessel must have at least three PSOs on duty during these time periods.

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

(12) Any visual observation at any distance or acoustic detection within the PAM Monitoring Zone of a North Atlantic right whale triggers shutdown requirements under paragraph (c)(11) 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;

(13) If pile driving has been shut down due to the presence of a marine mammal other than a North Atlantic right whale, pile driving must not restart until either the marine mammal(s) has voluntarily left the specific clearance zones and has been visually or acoustically confirmed beyond that clearance zone, or, when specific time periods have elapsed with no further sightings or acoustic detections have occurred. The specific time periods are 15 minutes for odontocetes (excluding sperm whales) and pinnipeds, and 30 minutes for sperm and baleen whales (including North Atlantic right whales) whales. 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;

(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. SFV measurements must continue until at least three consecutive piles 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). 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, and the signals avoid 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 (*e.g.,* hydrophones, recording devices, hydrophone calibrators, cables, batteries), 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 48-hour interim reports after each foundation is measured (see § 217.275(g) section for interim and final reporting requirements);

(vii) LOA Holder must not exceed modeled distances to NMFS marine mammal Level A harassment and Level B harassment thresholds, assuming 10-dB attenuation, for foundation installation. If any of the interim SFV measurement reports submitted for the first three monopiles indicate the modeled distances to NMFS marine mammal Level A harassment and Level B harassment thresholds assuming 10-dB attenuation are being exceeded, LOA Holder must implement additional sound attenuation measures such that measured distances to thresholds for future piles do not exceed modeled distances to thresholds assuming 10-dB attenuation. LOA Holder must also increase clearance and shutdown zone sizes to those identified by NMFS until SFV measurements on at least three additional foundations all demonstrate acoustic distances to harassment threshold isopleths meet or are less than those modeled assuming 10-dB of attenuation. LOA Holder must operate fully functional sound attenuation systems (*e.g.,* ensure hose maintenance, pressure testing) to meet noise levels modeled, assuming 10-dB attenuation;

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

(ix) LOA Holder must conduct SFV measurements 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 (c)(14)(i) through (v) of this section, 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 installation sites selected for SFV measurements are representative of the rest of the monopile 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; and

(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. The PAM 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) *Cofferdam and casing pipe/goal post installation and removal.* The following requirements apply to the installation and removal of cofferdams, casing pipes, and goal posts at the cable landfall construction sites:

(1) Installation and removal of cofferdams, casing pipes, and goal posts must not occur during nighttime hours;

(2) LOA Holder must establish and implement clearance zones for the installation and removal of cofferdams,

casing pipes, and goal posts using visual monitoring. These zones must be measured using the radial distance from the cofferdam, casing pipe, and goal post being installed and/or removed;

(3) LOA Holder must utilize PSO(s), as described in § 217.275(d). At least 2 on-duty PSOs must monitor for marine mammals at least 30 minutes before, during, and 30 minutes after vibratory pile driving associated with installation of cofferdam and goal posts and pneumatic hammering associated with casing pipe installation; and

(4) If a marine mammal is observed entering or within the respective shutdown zone after vibratory pile driving or pneumatic hammering has begun, the PSO must call for a shutdown of vibratory pile driving and pneumatic hammering. LOA Holder must stop vibratory pile driving and pneumatic hammering immediately unless shutdown is not practicable due to imminent risk of injury or loss of life to an individual or if there is a risk of damage to the vessel that would create a risk of injury or loss of life for individuals or if the lead engineer determines there is refusal or instability. In any of these situations, LOA Holder must document the reason(s) for not shutting down and report the information to NMFS Office of Protected Resources in the next available weekly report (as described in § 217.275(g)).

(e) *UXO/MEC detonations.* The following requirements apply to all UXO/MEC detonations:

(1) Upon encountering an UXO/MEC, LOA Holder may only resort to high-order removal (*i.e.,* detonation) if all other means of removal are impracticable;

(2) LOA Holder may detonate a maximum of 13 UXO/MECs of varying sizes but no larger than 1,000 pounds (lbs; 454 kilograms (kg)) charge weight (*i.e.,* E12), over the effective period of this rulemaking;

(3) LOA Holder must not detonate UXO/MECs from December 1 through April 30, annually;

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

(5) No more than one detonation may occur within a 24-hour period;

(6) LOA Holder must establish and implement clearance zones for UXO/MEC detonation using both visual and acoustic monitoring, as described in paragraphs (c)(6), (7), and (11) through (13) of this section. UXO/MEC clearance zones are specific to the known charge weight size of the UXO/MEC to be detonated; if charge weight is unknown or uncertain, then the largest zone size must be used;

(7) LOA Holder must utilize PSO(s) and PAM operator(s), as described in § 217.275(c). At least 3 PSOs on the activity platform and on each of 2 dedicated PSO vessels must be used for all detonations with clearance zones less than 5 km. If the clearance zone is larger than 5 km, at least one dedicated PSO vessel (with at least three on-duty PSOs) and an aerial platform (with at least two on-duty PSOs) must be used. Clearance zone size is measured using the radial distance from the UXO/MEC to be detonated;

(8) LOA Holder must utilize NMFS-approved PAM systems, as described in the PAM Plan see § 217.274(c)(16));

(9) LOA Holder must deploy at least a double big bubble curtain during all UXO/MEC detonations. The double bubble curtain must be deployed at a distance that avoids damage to the hose nozzles:

(i) 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 UXO/MEC detonation location throughout the full depth of the water column;

(ii) 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;

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

(iv) 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 UXO/MEC is detonated. Additionally, a full maintenance check (*e.g.,* manually clearing holes) must occur prior to each UXO/MEC detonation; and

(v) Corrections to the bubble ring(s) to meet the performance standards in this paragraph (e)(9) of this section must occur prior to UXO/MEC detonation.

(10) LOA Holder must conduct SFV during all UXO/MEC detonations as described in (c)(14) of this section and deploy a pressure transducer;

(11) Clearance zones must be fully visible for at least 60 minutes and all marine mammal(s) must be confirmed to be outside of the clearance zone for at least 30 minutes prior to detonation. PAM must also be conducted for at least 60 minutes and the zone must be acoustically cleared during this time. If a marine mammal is observed entering or within the clearance zone prior to denotation, the activity must be delayed. Detonation may only commence if all marine mammals have been confirmed to have voluntarily left the clearance zones and been visually confirmed to be beyond the clearance zone, or when 15 minutes have elapsed without any redetections of odontocetes (excluding sperm whales) and pinnipeds, or 30 minutes have elapsed without any redetections of sperm and baleen whales (including the North Atlantic right whale); or

(12) For UXO/MEC detonations, LOA Holder must follow all measures described in (c)(8)(ii) through (vi) and (c)(14)(i) through (x), of this section as applicable, as well as the measures below:

(i) LOA Holder must not exceed modeled distances to NMFS marine mammal Level A harassment and Level B harassment thresholds, assuming 10-dB attenuation, for UXO/MEC detonations. If any of the interim SFV measurement reports submitted for any UXO/MEC detonations indicate the modeled distances to NMFS marine mammal Level A harassment and Level B harassment thresholds assuming 10-dB attenuation for future detonations will be exceeded, then LOA Holder must implement additional sound attenuation measures on all subsequent UXO/MEC detonations, including but not limited to the deployment of additional noise abatement systems (NAS) to assist in achieving measurements in alignment with the modeled ranges. LOA Holder must also increase clearance zone sizes to those identified by NMFS until SFV measurements on UXO/MECs demonstrate distances to harassment thresholds will be met or will be less than those modeled assuming 10-dB of attenuation. LOA Holder must operate fully functional sound attenuation systems (*e.g.,* ensure hose maintenance, pressure testing) to meet noise levels modeled, assuming 10 dB attenuation, for UXO/MECs of the same charge weight or else no detonation activities may occur until NMFS and LOA Holder can evaluate the situation and ensure future UXO/MEC detonations do not exceed noise levels modeled, assuming 10-dB attenuation;

(ii) LOA Holder must submit a SFV Plan for UXO/MEC detonation to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of UXO/MEC detonation activities and abide by the Plan if approved. The SFV Plan must 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 UXO/MEC detonation cannot occur until NMFS approves the SFV Plan for this activity;

(iii) LOA Holder must submit a UXO/MEC Marine Mammal Monitoring Plan to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of UXO/MEC detonation, respectively, 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 UXO/MEC detonations. The Plan must include a description of all monitoring equipment and PAM and PSO protocols (including number and location of PSOs) for all UXO/MEC detonations. The Plan must include final UXO/MEC detonation project design (*e.g.,* number and type of UXO/MECs, removal method(s), charge weight(s), anticipated start date, *etc.*) and all information related to PAM and PSO monitoring protocols for UXO/MEC activities. The Plan must detail all plans and procedures for sound attenuation as well as for monitoring marine mammals during all UXO/MEC detonations. No UXO/MEC detonations can occur without NMFS' approval of the Plan; and

(iv) 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 UXO/MEC detonations 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. 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 UXO/MEC detonations 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.

(f) *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 § 217.275(e) conducted by PSOs, as described in § 217.275(b);

(2) LOA Holder must utilize PSO(s), as described in § 217.275(e);

(3) LOA Holder must abide by the relevant Project Design Criteria (PDCs 4, 5, and 7) of the programmatic consultation completed by NMFS' Greater Atlantic Regional Fisheries Office on June 29, 2021 (revised September 2021), pursuant to section 7 of the Endangered Species Act (ESA). To the extent that any relevant Best Management Practices (BMPs) described in these PDCs are more stringent than the requirements herein, those BMPs supersede these requirements;

(4) 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 source level to meet the survey objective, when in use, and must be turned off when they are not necessary for the survey;

(5) 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 fully visible (*e.g.,* not obscured by darkness, rain, fog) 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;

(6) 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 must 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 immediately prior to the initiation of ramp-up or activation (pre-start clearance). 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. During this 30-minute pre-start clearance period, the entire applicable clearance zones must be visible, except as indicated in paragraph (f)(10) of this section;

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

(8) 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;

(9) If a marine mammal is observed within a clearance zone during the clearance period, ramp-up of acoustic sources 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 odontocetes (excluding sperm whales) and pinnipeds, and 30 minutes for sperm and baleen whales, including North Atlantic right whales;

(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 are 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. In cases when the shutdown zones become obscured for brief periods due to inclement weather, survey operations are 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 (f)(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 odontocetes (excluding sperm whales) and pinnipeds, or 30 minutes for sperm and baleen whales, including North Atlantic right whales, 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 (f)(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.

(g) *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 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 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 must move again or skip the station;

(3) If a marine mammal is at risk of interacting with gear after it 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 by trained lookouts 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) Trawl tows must be limited to a maximum of a 20-minute trawl time at 3.0 kn (3.5 mph);

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

(9) During trawl surveys, vessel crew must open the codend of the trawl net close to the deck in order to avoid injury to animals that may be caught in the gear;

(10) Baited remote underwater video (BRUV) sampling must limit soak duration to 60 minutes or less, BRUVs must use a weighted line attached to surface and subsurface buoys that must hold a stereo-camera system in the water column and a system at the seafloor, and the vessel must remain on location with the gear while it is in use;

(11) Each chevron trap must have a vertical buoy line and must limit soak duration to 90 minutes or less;

(12) All fishery survey-related buoy lines must include the breaking strength of all lines being less than 1,700 pounds (771 kg). This may be accomplished by using whole buoy line that has a breaking strength of 1,700 lbs; or buoy line with weak inserts that result in line having an overall breaking strength of 1,700 lbs;

(13) 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;

(14) 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 buoy markings must comply with instructions received by the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division;

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

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

§ 217.275 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, and 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 of when in-water construction activities

were conducted, the dates and time when in-water construction activities were suspended to avoid potential incidental take of marine mammals from construction noise within a defined shutdown zone, and marine mammal behavior; and the ability to communicate orally, by radio, or in-person, with project personnel to provide real-time information on marine mammals observed in the area;

(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 217.275(b)(6) and 217.275(b)(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 an 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 cable landfall construction (*i.e.,* vibratory pile installation and removal, pneumatic hammering) and HRG surveys may be unconditionally or conditionally approved. PSOs and PAM operators for foundation installation and UXO/MEC 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, UXO/MEC detonation activities, 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, 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 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 from the 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, with NMFS-approval; however, they may only perform one role at any one 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 surveys, foundation installations, cable landfall activities, UXO/MEC detonations).

(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, vibratory pile driving, pneumatic hammering, UXO/MEC detonation activities, 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 and UXO/MEC detonation, 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 cable landfall activities (*i.e.,* cofferdams, casing pipes, and goal posts) and 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 the PAM monitoring 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 or UXO/MEC detonation) to ensure communication on marine mammal observations can easily, quickly, and consistently occur between all on-duty PSOs, PAM operator(s), and on-water Project personnel;

(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 (*e.g.,* 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 and UXO/MEC detonations, at least two PSOs on the pile driving and detonation-dedicated PSO vessel must be equipped with functional Big Eye binoculars (*e.g.,* 25 x 150; 2.7 view angle; individual ocular focus; height control); these must be pedestal mounted on the deck at the best vantage point that provides for optimal sea surface observation and PSO safety. 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 § 217.274(c)(16);

(7) During periods of low visibility (*e.g.,* darkness, rain, fog, poor weather conditions, *etc.*), PSOs must use alternative technology (*i.e.,* infrared or thermal cameras) to monitor the clearance and shutdown zones as approved by NMFS; and

(8) PSOs and PAM operators must not exceed 4 consecutive watch hours on duty at any time, must have a 2-hour (minimum) break between watches, and must not exceed a combined watch schedule of more than 12 hours in a 24-hour period. 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 and OSS foundation installation and UXO/MEC detonations.* The following measures apply to PSOs and PAM operators during WTG and OSS foundation installation and UXO/MEC detonations 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 and UXO/MEC detonation activities. If PSOs cannot visually monitor the minimum visibility zone prior to impact pile driving or the clearance zone prior to any UXO/MEC detonation at all times using the equipment described in paragraphs (b)(6) and (b)(7) of this section, pile-driving operations or UXO/MEC detonation 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 or UXO/MEC detonation and at least three on-duty PSOs must be stationed on each dedicated PSO vessel. If an aerial platform is required or used (see § 217.274(e)(7)), at least two on-duty PSOs must be actively searching for marine mammals. 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 or UXO/MEC detonation 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 or UXO/MEC detonation activities. The PAM operator must review all detections from the previous 24-hr period immediately prior to impact pile driving and UXO/MEC detonation activities.

(d) *PSO requirements during cofferdam, casing pipe, and goal post installation and removal.* The following measures apply to PSOs during cofferdam, casing pipe, and goal post installation and removal and must be implemented by LOA Holder:

(1) At least two PSOs must be on active duty during all activities related to the installation and removal of cofferdams, casing pipes, and goal posts; and

(2) PSOs must monitor the clearance zone for the presence of marine mammals for 30 minutes before, throughout the installation of the sheet piles (and casing pipe, if installed), and for 30 minutes after all vibratory pile driving and pneumatic hammering activities have ceased. Sheet pile or casing pipe installation must only commence when visual clearance zones are fully visible (*e.g.,* not obscured by darkness, rain, fog) and clear of marine mammals, as determined by the Lead PSO, for at least 30 minutes immediately prior to initiation of vibratory pile driving and pneumatic hammering.

(e) *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) Between 4 and 6 PSOs must be present on every 24-hour survey vessel and two to three PSOs must be present on every 12-hour survey vessel;

(2) At least one PSO must be on active duty monitoring during HRG surveys conducted during daylight (*i.e.,* from 30 minutes prior to civil sunrise through 30 minutes following civil sunset) and at least two PSOs must be on activity duty monitoring during HRG surveys conducted at night;

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

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

(5) 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. Off-effort PSO monitoring must be reflected in the monthly PSO monitoring reports.

(f) *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.

(g) *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.,* vibratory installation/removal, impact pile driving, construction survey), use of any noise attenuation device(s), and specific phase of activity (*e.g.,* ramp-up of HRG equipment, HRG acoustic source on/off, soft-start for pile driving, active pile driving, *etc.*); 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 LOA issued under §§ 217.276 and 217.277;

(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–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, MMSI 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; 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 (*e.g.,* days and duration of impact and vibratory pile driving, days and number of UXO/MEC detonations, days and amount of HRG survey effort); any PAM systems used; the results, effectiveness, and which noise attenuation systems were used during relevant activities (*i.e.,* impact pile driving, and UXO/MEC detonations); 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. 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 and UXO/MEC detonations 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 and each UXO/MEC detonation event as soon as they are available and prior to a subsequent detonation or foundation installation, but no later than 48 hours

after each completed foundation installation event and 48 hours after a detonation. 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 ($R_{95\%}$ SEL and $R_{95\%}$ SPL_{rms}) to compare with the real-world sound field measurements; the estimated UXO/MEC charge size (or physical size if charge size is unknown) and donor charge size in trinitrotoluene (TNT) equivalent weight for either high (donor charge used to detonate/destroy UXO/MEC) or low order (*e.g.,* deflagration where donor charge disrupts/consumes UXO/MEC) detonations and description of UXO/MEC (*e.g.,* munition type, state of submergence, approximate age); 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 acoustic 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 UXO/MEC 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 and all UXO/MEC detonation must be submitted as soon as possible, but no later than 90 days following completion of SFV measurements for each activity. 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 must 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 TL 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 and UXO/MEC detonation 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 charge weights and other relevant characteristics of UXO/MEC detonations; the hydrophone equipment and methods (*i.e.,* recording device, bandwidth/sampling rate; distance from the pile and UXO/MEC 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 and UXO/MEC charge; a description of the noise abatement system and operational parameters (*e.g.,* bubble flow rate, distance deployed from the pile and/or UXO/MEC, *etc.*), and any action taken to adjust the noise abatement system. 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. The final results of SFV measurements during wind turbine operations must include source levels at 10 m from the foundation; received levels at 50 m, 100 m, and 250 m from the foundation; operational parameters (*i.e.,* direct drive/gearbox information, turbine rotation rate); sea state conditions, and any nearby anthropogenic activities;

(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 (or UXO/MEC is detonated), 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 conclusion of activities requiring PAM for mitigation. 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.* The full acoustic recordings from all real-time hydrophones must also be sent to the NCEI for archiving within 90 calendar

days after pile driving has ended and instruments have been pulled from the water;

(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 (*http://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 must be sent to NMFS Greater Atlantic Regional Fisheries (*nmfs.gar.incidental-take@noaa.gov*), NMFS Office of Protected Resources, and NMFS Northeast Fisheries Science Center (*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); 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) LOA Holder must provide NMFS Office of Protected Resources with notification of planned UXO/MEC detonation as soon as possible but at least 48 hours prior to the planned detonation, unless this 48-hour notification would create delays to the detonation that would result in imminent risk of human life or safety. This notification must include the coordinates of the planned detonation, the estimated charge size, and any other information available on the characteristics of the UXO/MEC. If any UXO/MEC detonation occurs, within 72 hours after a detonation but before the next detonation, whichever is sooner, LOA Holder must report to NMFS Office of Protected Resources the time, date, location (latitude/longitude Decimal Degrees), charge weight size, justification on why detonation was necessary and other means of removal or avoidance could not occur, all detections of marine mammals within the UXO/MEC zones, and any mitigative action taken;

(v) 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 Greater Atlantic Regional Fisheries Office (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; and

(vi) 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; and

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

§ 217.276 Letter of Authorization.

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

(b) An LOA, unless suspended or revoked, may be effective for a period of time not to exceed November 19, 2028, the expiration date of this subpart.

(c) In the event of projected changes to the activity or to mitigation and monitoring measures required by an LOA, LOA Holder must apply for and obtain a modification of the LOA as described in § 217.277.

(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 is consistent with the findings made for the total taking allowable under the regulations of this subpart.

(f) Notice of issuance or denial of an LOA must be published in the **Federal Register** within 30 days of a determination.

§ 217.277 Modifications of Letter of Authorization.

(a) A LOA issued under § 217.276, and this section for the activities identified in § 217.270(c) shall be modified upon request by LOA Holder, provided that:

(1) The 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 modified LOA in the **Federal Register**, including the associated analysis of the change, and solicit public comment before issuing the LOA.

(c) An LOA issued under § 217.276 or this section for the activities identified in § 217.270(c) 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 LOA Holder regarding the practicability of the modifications), if doing so creates a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring;

(i) Possible sources of data that could contribute to the decision to modify the mitigation, monitoring, or reporting measures in an LOA include, but are not limited to:

(A) Results from LOA Holder's monitoring(s);

(B) Results from other marine mammals and/or sound research or studies; and

(C) Any information that reveals marine mammals may have been taken in a manner, extent, or number not authorized by the regulations in this subpart or subsequent LOA.

(ii) If, through adaptive management, the modifications to the mitigation, monitoring, or reporting measures are substantial, NMFS Office of Protected Resources shall publish a notice of proposed LOA in the **Federal Register** and solicit public comment.

(2) If NMFS Office of Protected Resources determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in the LOA issued pursuant to §§ 217.272 and 217.276 or this section, an LOA may be modified without prior notice or opportunity for public comment. Notice would be published in the **Federal Register** within 30 days of the action.

§§ 217.278–217.279 [Reserved]

Subparts CC through KK [Reserved]

■ 3. Add and reserve subparts CC through KK.

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