DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[RTID 0648–XA881]

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

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

ACTION: Notice; issuance of an incidental harassment authorization.

SUMMARY: In accordance with the regulations implementing the Marine Mammal Protection Act (MMPA) as amended, notification is hereby given that NMFS has issued an incidental harassment authorization (IHA) to Vineyard Wind 1, LLC (Vineyard Wind) to take, by Level A harassment and Level B harassment, marine mammals during construction of a commercial wind energy project offshore Massachusetts.

DATES: The IHA is valid from May 1, 2023 through April 30, 2024.

FOR FURTHER INFORMATION CONTACT: Jaclyn Daly, Office of Protected Resources, NMFS, (301) 427–8401. Electronic copies of the application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.* In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

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

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

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

Summary of Request

On September 7, 2018, NMFS received a request from Vineyard Wind for an IHA to take marine mammals incidental to pile driving associated with the construction of an offshore wind energy project south of Massachusetts. Vineyard Wind submitted revised versions of the application on October 11, 2018 and on January 28, 2019. The application was deemed adequate and complete on February 15, 2019. A notice of proposed IHA was published in the **Federal Register** on April 30, 2019 (84 FR 18346). In response to Vineyard Wind's request and in consideration of public comments, NMFS has authorized the taking of 15 species of marine mammals by harassment. Neither Vineyard Wind nor NMFS expects serious injury or mortality to result from this activity and, therefore, an IHA is appropriate.

Description of Activity

Vineyard Wind proposes to construct an 800 megawatt (mw) offshore wind energy project in the northern portion of Lease Area OCS–A 0501, offshore Massachusetts (Figure 1). In its request for an IHA, Vineyard Wind states that the project would consist of up to 100 offshore wind turbine generators (WTGs) and one or more electrical service platforms (ESPs), an onshore substation, offshore and onshore cabling, and onshore operations and maintenance facilities. Take of marine mammals may occur incidental to the construction of the project due to in-water noise exposure resulting from pile driving activities associated with installation of WTG and ESP foundations.

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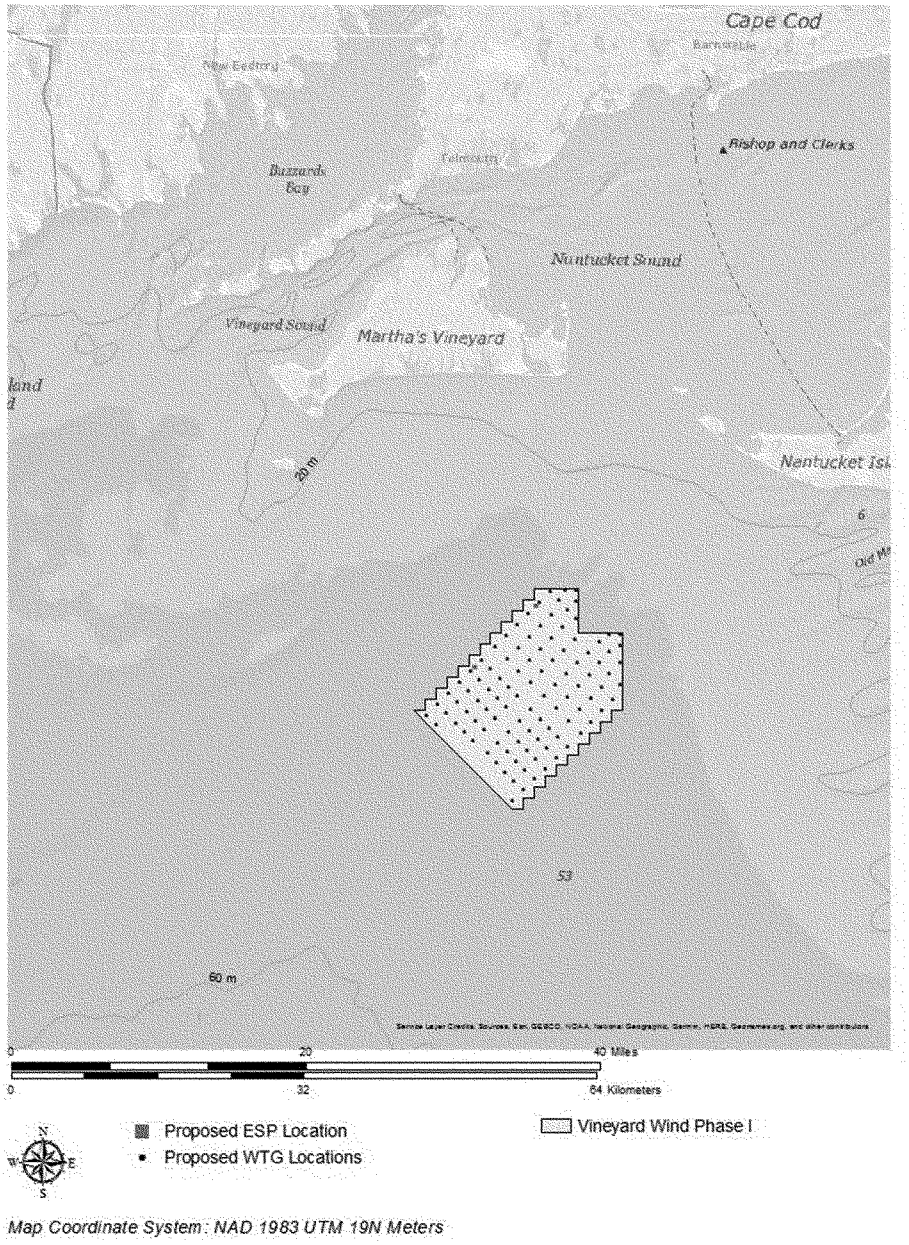

Figure 1. Location of the Vineyard Wind WDA within the northern portion of Lease Area OCS-A 0501

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Vineyard Wind plans to install the WTGs and ESPs between May and November in the northeast portion of the 675 square kilometer (km²) (166,886 acre) Lease Area, referred to as the Wind Development Area (WDA) (See Figure 1 in the IHA application). At its nearest point, the WDA is just over 23 km (14 mi) from the southeast corner of Martha's Vineyard and a similar distance from Nantucket. Water depths in the WDA range from approximately 37–49.5 meters (m) (121–162 feet (ft)). Construction of the project is planned to commence in May 2023. Up to 102 days of pile driving may occur between May 1 and November 30. Pile driving in December would only occur if unforeseen circumstances arise such that construction is not complete by November and the Bureau of Ocean Energy Management (BOEM) approves pile driving during December. No pile driving activities would occur from January 1 through April 30 under any circumstances.

Two potential foundation types are proposed for the project: Monopiles and jackets. A monopile is a single, hollow cylinder fabricated from steel that is secured in the seabed while the jacket design concept consists of three to four steel piles, a large lattice jacket structure, and a transition piece. Piles for monopile foundations would be constructed for specific locations with maximum diameters ranging from ~8 m (26.2 ft) up to 10.3 m (33.8 ft) and an expected median diameter of ~9 m (29.5 ft). The piles for the monopile foundations are up to 95 m (311.7 ft) in length and will be driven to a penetration depth of 20–45 m (65.6–147.6 ft) (mean penetration depth 30 m

(98.4 ft)). A schematic diagram showing potential heights and dimensions of the various components of a monopile foundation are shown in Figure 2 of the IHA application. Jacket foundations each require the installation of three to four jacket securing piles, known as jacket pin piles, of ~3 m (9.8 ft) diameter. The 3 m (9.8 ft) diameter jacket piles for the jacket foundations are up to ~65 m (213.3 ft) in length and would be driven to a penetration depth of 30–75 m (98.4–196.9 ft) (mean penetration depth of 45 m (147. ft)). A schematic diagram showing potential heights and dimensions of the various components of a jacket foundation are shown in Figure 3 of the IHA application.

WTGs and ESPs may be placed on either type of foundation. Vineyard Wind has proposed that up to 100 WTG foundations may be constructed and that, of those 100 foundations, no more than 10 may be jackets. In addition, either one or two ESPs would be built on a jacket foundation (each foundation is comprised of four piles). Therefore up to 108 piles may be installed in the WDA. Vineyard Wind has incorporated more than one design scenario in their planning of the project. This approach, called the ''design envelope'' concept, allows for flexibility on the part of the developer, in recognition of the fact that offshore wind technology and installation techniques are constantly evolving and exact specifications of the project are not yet certain as of the publishing of this document. Variables that are not yet certain include the number, size, and configuration of WTGs and ESPs and their foundations, and the number of foundations that may be installed per day (a maximum of two foundations would be installed per day). The flexibility provided in the envelope concept is important because it precludes the need for numerous authorization modifications as infrastructure or construction techniques evolve after authorizations are granted but before construction commences. Under the maximum design scenario in Vineyard Wind's IHA application, where 100 WTGs are installed on monopiles, a total of as many as 108 piles may be driven (*i.e.,* 100 monopiles for WTG foundations and 8 pin piles for two ESPs). Specifications for both foundation types are shown in Table 1.

TABLE 1—FOUNDATION TYPES AND SPECIFICATIONS FOR THE VINEYARD WIND PROJECT

Foundation type	Pile diameter	Pile length	Penetration depth	Maximum number that may be installed *
Monopile	~8 to ~10.3 m (26.2 to 33.8 ft)	~60 m up to ~95 m (196.9–311.7 ft).	20–45 m (65.6–147.6 ft)	100
Jacket (4 piles each)	3 m (9.8 ft)	~65 m (213.3 ft)	30–75 m (98.4–196.9 ft)	2

* The total number of foundations installed would not exceed 102.

For monopile installation, a typical pile driving operation is expected to take less than approximately three hours to achieve the target penetration depth. It is anticipated that a maximum of two monopiles could potentially be driven into the seabed per day. Concurrent driving (*i.e.,* the driving of more than one pile at the same time) would not occur.

A detailed description of Vineyard Wind's planned construction activities is provided in the notice of proposed IHA (84 FR 18346; April 30, 2019). Since that time, Vineyard Wind has not proposed any changes to its construction activities through the IHA process. Therefore, a detailed description is not provided here. Please refer to that notice for the detailed description of the specified activity. Mitigation, monitoring, and reporting measures are described in detail later in this document (please see Mitigation and Monitoring and Reporting below). Modifications and additions to the mitigation and monitoring measures have occurred since the proposed IHA. All changes since the proposed IHA have been summarized in the Changes From Proposed IHA to Final IHA section and described in detail in their respective sections and/or the Comment Responses below.

Comments and Responses

A notice of proposed IHA was published in the **Federal Register** on April 30, 2019 (84 FR 18346). During the 30-day public comment period, NMFS received comment letters from the Atlantic Offshore Lobstermen's Association (AOLA), the Marine Mammal Commission (Commission), Gatzke Dillon & Ballance LLP representing ACK Residents Against Turbines, and a group of environmental non-governmental organizations (ENGOs) including Conservation Law Foundation, National Wildlife Federation, Natural Resources Defense Council, Defenders of Wildlife, Humane Society of the United States, Humane Society Legislative Fund, Whale and Dolphin Conservation, International Fund for Animal Welfare, Mass Audubon, NY4WHALES, and Inland Ocean Coalition. NMFS has posted the comments online at: *www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-other-energy-activities-renewable.* Please see those letters for full detail regarding the commenters' recommendations and underlying rationale.

Comment 1: The Commission recommended that NMFS (1) authorize takes of the various marine mammal species that could occur during vibratory pile driving and (2) require Vineyard Wind conduct and report sound source and sound propagation measurements during vibratory pile driving and adjust the Level A and B harassment zones, as needed.

Response: According to Vineyard Wind, vibratory driving is not planned and would only be used in extraordinary circumstances in the event that impact driving is not sufficient to ensure pile stability. Vineyard Wind is using a pile gripper to hold the pile in place during impact hammering. If that pile gripper fails (which is not anticipated), Vineyard Wind would either stand-down and fix the pile gripper or be forced to bring in a vibratory hammer to install the pile deep enough so that it is stable before moving to an impact hammer to finish installing the pile. This is an extremely unlikely scenario. As described in Vineyard Wind's application, if it becomes necessary to use a vibratory hammer, the average driving time to get the pile stabilized is anticipated to be 10 minutes (with a rare case of up to 30 minutes). Because use of a vibratory hammer would be extremely costly, this option would be utilized only if absolutely necessary and for the minimum amount of time possible (as

necessary to repair the pile gripper). For those limited number of piles partially installed with a vibratory hammer, less strikes of the impact hammer would be required to fully install the pile. Because of stability issues, use of a vibratory hammer and impact hammer would occur on the same day.

As vibratory driving is not considered likely to occur and, if it did occur, less impact driving would be necessary, we have determined that additional modelling specifically to generate an estimate of take for this unlikely, brief activity is not warranted. If this vibratory driving were to occur, and if any small number of marine mammals not already disturbed by the impact driving in the same day were taken, the existing conservative amount of take authorized is adequate to account for any take that may occur during vibratory pile driving. Likewise, we have determined that a requirement for vibratory driving sound source verification is not warranted given that it is unlikely that this activity will occur and, if it did, would occur only temporarily on a limited number of piles for a limited duration (approximately 10 minutes per pile). We anticipate that if Vineyard Wind determines that the unexpected use of a vibratory hammer is necessary, they will consult with NMFS upon making that decision.

Comment 2: The Commission recommended that NMFS consult with external scientists and acousticians to determine the appropriate accumulation time that action proponents should use to determine the extent of the Level A harassment zones based on the associated [cumulative sound exposure level] SELcum thresholds for the various types of sound sources, including stationary sound sources and that NMFS make the issue a priority.

Response: NMFS concurs with this recommendation and has prioritized the issue. As identified in the Commission's letter, NMFS has formed an internal committee to identify a more sophisticated approach for determining the extent of Level A harassment zones and is developing a proposal upon which additional internal and external review will be sought. Specific to this IHA, the Commission takes issue that the Level A harassment isopleth for jacket foundation installation (based on the installation of 4 piles in a 24-hour period) is greater than the Level B harassment isopleth and based on the extent of those zones, it is assumed that an animal would experience permanent threshold shift (PTS) before responding behaviorally and leaving or avoiding the area. However, the Commission simplifies application of the zone with such assumption in that they consider if an animal enters the Level A harassment zone, it would incur PTS upon entering, similar to how we consider the potential for Level B harassment to occur. This in fact is not the case, as the distance to the PTS isopleth represents the distance at which the animal would have to remain during installation of all four piles. NMFS recognizes calculating a zone based on work occurring over 24 hours is highly conservative; however, the zone does not represent the area in which PTS would occur simply if an animal enters the zone, as interpreted by the Commission. Further, Vineyard Wind conducted modeling using sophisticated sound propagation and animat modeling. The Commission identified in its letter that it supports the 24-hour approach if an action proponent is able to conduct more sophisticated sound propagation and animat modeling. Therefore, the Commission is contradictory in its comment specific to this action. NMFS has determined the modeling results represent likely zones by which we identify the potential for PTS and behavioral harassment to occur; however, NMFS appropriately considers the temporal component associated with the Level A harassment zone when considering the potential for PTS to occur.

Comment 3: The Commission recommended that NMFS reassess the numbers of Level A harassment takes for low-frequency cetaceans and revise authorized take numbers such that the Level A harassment takes account for 77 percent of total takes for installation of monopiles and 100 percent of the total takes for jacket piles.

Response: The Commission suggests that the ratio of authorized takes by Level A harassment to takes by Level B harassment for low-frequency cetaceans should exactly match the ratio of the Level A harassment to Level B harassment zone sizes. However, as noted in the Commission's comment, takes by Level A harassment and takes by Level B harassment are modeled differently, with the Level A harassment zones calculated with dual metrics (*i.e.,* SELcum and peak sound pressure level (SPL)). The Level A harassment zone cited by the Commission in their comment (*i.e.,* 3,191 m for impact driving for low-frequency cetaceans) is calculated with the SELcum metric and thereby incorporates a time component. As described in our response to comment 2 above, while this zone based on the SELcum metric is used as a conservative tool for modeling potential exposures above the Level A harassment threshold, an animal documented within that zone does not necessarily mean that animal was taken by Level A harassment when observed within that zone. In contrast, the takes by Level B harassment are based on an instantaneous step function wherein the animal could experience Level B harassment as soon as it is exposed to sound levels above the 160 dB re 1 microPascal (μPa) root mean square (rms) threshold. Therefore, directly comparing zone sizes is not an appropriate approach. Moreover, suggesting the amount of take allocated to Level A harassment and Level B harassment should be proportional to zone sizes is not reflective of what the zones represent and therefore would be a misrepresentation of potential effects on marine mammals. In addition, as noted in the proposed IHA and as described below, the authorized number of takes by Level A harassment are already considered conservative, as there were 0 takes by Level A harassment modeled for the majority of species (including with the SELcum metric) and, in some cases, we increased the authorized number of takes by Level A harassment from 0 to mean group size based on a conservative assumption that a group of each species may be taken despite the modeling results. Further, take estimate modeling does not account for mitigation and monitoring measures included in the IHA. Thus, we reject the Commission's recommendation as the authorized numbers of takes by Level A harassment are sufficient and do not warrant revision.

Comment 4: The Commission recommends that NMFS reassess the numbers of Level B harassment takes for all species and authorize an appropriate number of takes relative to the extent of the Level B harassment zones, each species' occurrence in the area, and the 102 days that activities are proposed to occur.

Response: The current numbers of takes by Level B harassment authorized are considered conservative for several reasons: Takes were modeled separately for each species through exposure modeling which was run for four separate construction scenarios and the largest resulting exposure number from the four scenarios was carried forward. Thus the number that was carried forward was from the ''maximum case scenario'' in terms of possible construction scenarios. All of the construction scenarios used in the modeling assumed 102 foundations would be installed when ultimately fewer foundations, resulting in fewer pile driving days, may be installed. For comparison, takes by Level B

harassment were also calculated for each species using Vineyard Wind's observer data from site characterization surveys. Vineyard Wind reviewed monitoring data recorded during site characterization surveys in the WDA from 2016–2018 and calculated a daily sighting rate (individuals per day) for each species in each year, then multiplied the maximum sighting rate from the three years by the number of pile driving days under the Maximum Design scenario (*i.e.,* 102 days). This method assumes that the largest average group size for each species observed during the three years of surveys may be present during piling on each day. Then, the larger of the two take numbers calculated for each species (*i.e.,* through exposure modeling or calculated based on Vineyard Wind's monitoring data) was then carried forward as the authorized take number. For these reasons, the authorized take numbers by Level B harassment are sufficient, and we have determined that no revision to authorized numbers of takes by Level B harassment are warranted (aside from the minor revisions described in the Estimated Take section below).

With respect to comparing the authorized amount of take here with HRG surveys, we find the Commission inappropriately compared the amount of take associated with HRG surveys to pile driving activities. The Commission made this recommendation based on the number of days without considering the daily amount of hours during which the activities occur. For example, 40 days of HRG surveys occur over a 24-hour period daily while pile driving associated with the Vineyard Wind project is limited to the installation of one to two piles per day (approximately 3 hours of pile driving per pile which is significantly less than 24 hours). While the number of hours of work per day is not part of the take calculation, it does play a role in making a direct comparison between take allocated for the two activities (*i.e.,* site characterization versus pile driving). Moreover, many delphinid species (*e.g.,* bottlenose dolphins) are attracted to HRG vessels, resulting in unavoidable take during the surveys. Impact pile driving; however, is not an activity expected to attract marine mammals. To compare the amount of take authorized from the proposed project to HRG surveys is inappropriate. Finally, while the Commission identifies the amount of take authorized to Bay State Wind for HRG surveys for some species (*e.g.,* bottlenose dolphins), the subsequent monitoring report required under Bay State Wind's IHA showed detections of only a small fraction of the number of marine mammals authorized for Level B harassment take (Bay State Wind, 2019). For the reasons stated above, we find the authorized amount of take to Vineyard Wind, by Level B harassment, is sufficient considering the scope of the project.

Comment 5: The Commission recommended that NMFS require Vineyard Wind to (1) submit the results of the sound source measurements taken during installation of the first monopile for which sound attenuation devices are used and adjust the Level A and B harassment zones accordingly prior to proceeding with installation of any additional monopiles and (2) conduct sound source measurements at least monthly to ensure that the sound attenuation device continues to provide at least a 6-dB reduction in sound levels.

Response: The IHA includes extensive acoustic monitoring requirements. The IHA requires that sound field measurements must be conducted during pile driving of the first monopile and first jacket foundation installed over the course of the project and that Vineyard Wind must provide the initial results of the field measurements to NMFS as soon as they are available. In the event that subsequently driven piles are installed that have a larger diameter, or, are installed with a larger hammer or greater hammer energy than the first monopile and jacket pile, sound field measurements must be conducted for those subsequent piles. If initial acoustic field measurements indicate distances to the isopleths corresponding to Level A and/or Level B harassment thresholds are greater than the distances predicted by modeling (as presented in the IHA application), Vineyard Wind must implement additional sound attenuation measures prior to conducting additional pile driving. Additionally, in the event that field measurements indicate distances the isopleths corresponding to Level A harassment and Level B harassment thresholds are greater than the distances predicted by modeling, Vineyard Wind must implement additional attenuation devices such that modeled harassment threshold distances (or smaller) based on a 6 dB reduction are realized in the field. If an additional device(s) still does not achieve the model results and Vineyard Wind has no other means to reduce noise levels (*e.g.,* reduced hammer energy), Vineyard Wind must expand the harassment zones to reflect field measurements, in consultation with NMFS.

Regarding the Commission's recommendation to require Vineyard Wind to conduct sound source measurements at least monthly to ensure that the sound attenuation device continues to provide at least a 6-dB reduction in sound levels, we do not agree this is warranted. Vineyard Wind is required to conduct acoustic monitoring upon commencement of installing each foundation type and demonstrate that the piles monitored are done so under conditions that are reflective of conditions for other piles installed across the WDA (*e.g.,* similar substrate, hammer energy, etc.). If Vineyard Wind finds noise levels associated with the project are higher than modeled (assuming 6 dB attenuation), mitigative action is required and acoustic monitoring must continue. If noise levels are less than those predicted, Vineyard Wind must conduct monitoring on at least 3 monopiles and again demonstrate the pile monitored are installed under conditions representative of future piles to ensure any variability is captured. These measures are sufficient to ensure the sound field produced during pile driving is well understood throughout construction.

Comment 6: The Commission recommended that NMFS require Vineyard Wind to conduct passive acoustic monitoring (PAM) at all times during which pile-driving activities occur and implement shutdowns when NARWs are detected within Level A harassment zones.

Response: Vineyard Wind is required to conduct passive acoustic monitoring before, during and after all pile driving events. Pile driving must be delayed upon a confirmed PAM detection of a NARW, if the detection is confirmed to have been located within the relevant PAM clearance zones (Table 16a). Vineyard Wind is also required, in consideration of safety and pile integrity, that pile driving for both monopile and jacket foundation piles be shut down should a NARW be observed within 3.2 kms of the pile being driven; this distance represents the Level A harassment zone for monopiles (Table 16b). Because the Level A harassment zone for a jacket foundation represents the energy needed to incur PTS from the installation of four piles, implementing a shutdown zone based on this amount of work over the amount of time it takes to install four piles is unreasonable and not appropriate.

Comment 7: The Commission recommended that NMFS require Vineyard Wind to cease activities if any marine mammal comes within 10 m of the equipment, particularly during pile placement; implement delay and shutdown procedures, if a species for

which authorization has not been granted or if a species for which authorization has been granted but the authorized takes are met, approaches or is observed within the Level A and/or B harassment zone; and extrapolate the total number of marine mammals taken based on the distance to which visual observations can be made accurately and the extents of the Level A and B harassment zones.

Response: Regarding the recommendation that NMFS require Vineyard Wind to cease activities if any marine mammal comes within 10 m of the equipment, we agree and have implemented this requirement in the IHA. The Commission provided a footnote (14) that this distance should be increased due to the size of Vineyard Wind piles; however, given the large clearance and shutdown zones in addition to the large bubble curtain encompassing the piles at distances greater than 10 m, we do not believe this recommendation is warranted simply because the piles are large. Regarding the recommendation that NMFS require Vineyard Wind to delay or shutdown pile driving if a species for which authorization has not been granted or if a species for which authorization has been granted but the authorized takes are met, approaches or is observed within the Level A harassment and/or B harassment zones, we have included a measure that Vineyard Wind must shutdown pile driving (as technically feasible) if such circumstances arise.

Regarding the recommendation that NMFS require Vineyard Wind to extrapolate the total number of marine mammals taken based on the distance to which visual observations can be made accurately and the extents of the Level A and B harassment zones, we do not concur with the Commission's recommendation and do not adopt it as stated.

The Commission does not explain why it believes Vineyard Wind should be required to extrapolate the total number of marine mammals taken other than it is ''standard'' which it is not. While NMFS previously included a requirement to report estimated takes based on an undefined extrapolation method in some inshore, estuarine construction project IHAs, we realized the assumptions and uncertainty surrounding this requirement preclude any meaningful analysis. Further, in those IHAs, NMFS did not consider those estimated takes to count against the total take authorized given the high degree of uncertainty surrounding the simplistic approach of estimating take based on the visible area compared to the estimated harassment area. The Commission does not provide recommendations for methods of generating such estimates in a manner that would lead to credible results.

NMFS does believe that Vineyard Wind should report visibility and has included this requirement in the final authorization. NMFS is also requiring Vineyard Wind to report several details related to all observations of marine mammals, including if observed animals occurred within the Level B harassment zone during pile driving. These pieces of information—numbers of individuals of each species detected within the harassment zones and the estimated visibility—may be used to glean an approximate understanding of whether Vineyard Wind may have exceeded the amount of take authorized. Although the Commission does not explain its reasoning for offering these recommendations, NMFS recognizes the basic need to understand whether an IHA-holder may have exceeded its authorized take. The need to accomplish this basic function of reporting does not necessitate that NMFS require applicants to use methods we do not have confidence in to generate estimates of ''total take'' that cannot be considered reliable. To do so would require a number of assumptions resulting in a high degree of uncertainty regarding take and there would be very limited circumstances in which one could assume take occurred.

Comment 8: The Commission recommended that NMFS refrain from using the proposed renewal process for Vineyard Wind's authorization and that NMFS provide the Commission and other reviewers the full 30-day comment opportunity.

NMFS *Response:* Regarding renewals, NMFS issued a one-year IHA with the understanding that Vineyard Wind can complete the planned work for which the IHA authorizes take within the one-year period. As necessary, NMFS makes the decision of whether or not to issue a Renewal after one is requested based on current information, the best available science, and the renewal criteria described in the notice of the proposed IHA (84 FR 18346; April 30, 2019). NMFS may issue a one-time, one-year Renewal IHA if, upon review of the request for Renewal, the status of the affected species or stocks, and any other pertinent information, NMFS determines that there are no more than minor changes in the activities, the mitigation and monitoring measures will remain the same and appropriate, and the findings in the initial IHA remain valid. If and when Vineyard Wind were to request a Renewal, NMFS would fully consider the best available information available at the time of the request (2023 or 2024) and whether the Renewal criteria could be met. NMFS did not include language in the final IHA related to Renewal. While this does not necessarily preclude a Renewal, we think a Renewal is unlikely in this case, given the potential for changes over the next three years that could affect our analyses.

The Commission expressed concern that a renewal for complex projects would hinder the ability for the public to comment within the 15-day public comment period if a renewal is sought by the initial IHA Holder. NMFS maintains that the public has at least 30 days to comment on all proposed IHAs, with a cumulative total of 45 days for IHA Renewals. The Request for Public Comments section in the proposed IHA made clear that the agency was seeking comment on both the initial proposed IHA and the potential issuance of a Renewal for this project. Because any Renewal (as explained in the Request for Public Comments section) is limited to another year of identical or nearly identical activities in the same location (as described in the Description of Proposed Activity section) or the same activities that were not completed within the one-year period of the initial IHA, reviewers have the information needed to effectively comment on both the immediate proposed IHA and a possible one-year Renewal, should the IHA Holder choose to request one. While additional documents would be required should any such Renewal request be submitted, these would be limited to documentation that NMFS would make available and use to verify that the activities are identical to those in the initial IHA, are nearly identical such that the changes would have either no effect on impacts to marine mammals or decrease those impacts, or are a subset of activities already analyzed and authorized but not completed under the initial IHA. NMFS would also confirm, among other things, that the activities will occur in the same location; involve the same species and stocks; provide for continuation of the same mitigation, monitoring, and reporting requirements; and that no new information has been received that would alter the prior analysis. The Renewal request would also need to contain a preliminary monitoring report, specifically to verify that effects from the activities do not indicate impacts of a scale or nature not previously analyzed. The additional 15-day public comment period provides the public an opportunity to review these few documents, provide any additional pertinent information and

comment on whether they think the criteria for a Renewal have been met. Between the initial 30-day comment period on these same activities and the additional 15 days, the total comment period for a Renewal is 45 days.

In addition to the IHA Renewal process being consistent with all requirements under section 101(a)(5)(D), it is also consistent with Congress' intent for issuance of IHAs to the extent reflected in statements in the legislative history of the MMPA. Through the provision for Renewals in the regulations, description of the process and express invitation to comment on specific potential Renewals in the Request for Public Comments section of each proposed IHA, the description of the process on NMFS' website, further elaboration on the process through responses to comments such as these, posting of substantive documents on the agency's website, and provision of 30 or 45 days for public review and comment on all proposed initial IHAs and Renewals respectively, NMFS has ensured that the public is ''invited and encouraged to participate fully in the agency decision-making process.''

Lastly, in prior responses to comments about IHA Renewals (*e.g.,* 84 FR 52464; October 02, 2019 and 85 FR 53342, August 28, 2020), NMFS has explained how the Renewal process, as implemented, is consistent with the statutory requirements contained in section 101(a)(5)(D) of the MMPA, provides additional efficiencies beyond the use of abbreviated notices, and, further, promotes NMFS' goals of improving conservation of marine mammals and increasing efficiency in the MMPA compliance process.

Comment 9: ACK Residents Against Turbines (represented by Gatzke Dillon & Ballance LLP) stated that NMFS' analysis focused solely on construction-related impacts on marine mammals (*e.g.,* noise effects from pile-driving) and failed to evaluate the extent to which the operation of the project could affect marine mammals.

Response: Vineyard Wind's request for authorization to take marine mammals was specific to one-year during construction of the project. The activities considered under this request are those associated with pile driving, which includes the use of vessels necessary to support pile installation. As required under 101(a)(5)(D) of the MMPA, NMFS assessed the impacts of the construction in supporting the issuance of an incidental take authorization for the construction phase. Vineyard Wind has not submitted a request for authorization to take marine mammals incidental to the operational phase of their project. Further, the IHA is valid for one-year, during which time operations would not occur. The MMPA is specific in that upon request, NMFS shall authorize, for periods of not more than one year, the incidental taking of marine mammals while engaging in a specified activity (in this case construction of the project) provided NMFS makes the necessary findings. NMFS has made the necessary findings (see Negligible Impact Analysis and Determination section) and therefore, in accordance with the MMPA, and upon request by Vineyard Wind, NMFS has issued a 1-year IHA for the take of marine mammals incidental to construction of the Vineyard Wind Project.

In addition to our analysis under the MMPA related to the specified activity (*i.e.,* construction of the project), NMFS Greater Atlantic Regional Fisheries Office (GARFO) issued a Biological Opinion on September 11, 2020 that fully evaluated the effects of the construction, operation, maintenance, and decommissioning of the Vineyard Wind Project on ESA-listed species, including marine mammals. The Biological Opinion includes an assessment of the potential effects from WTG operations and concluded that noise from turbines operations is expected to be at or below ambient levels at relatively short distances from the foundations and that if ESA-listed marine mammals are exposed to operational noise, the effects on ESA-listed whales are considered insignificant (*i.e.,* so minor that the effect cannot be meaningfully evaluated or detected). Supporting activities such as vessel and aircraft operation would also occur during operation. The 2020 Biological Opinion concluded that ESA-listed marine mammals are either not likely to respond to vessel noise or are not likely to measurably respond in ways that would significantly disrupt normal behavior patterns that include, but are not limited to, breeding, feeding or sheltering. Therefore, the effects of vessel noise on ESA-listed marine mammals were also deemed to be insignificant. A similar finding was made for exposure to aircraft noise.

In addition, NMFS is a cooperating agency on BOEM's EIS for the project and a co-signatory to the associated Record of Decision (ROD), issued on May 10, 2021. Under the National Environmental Policy Act (NEPA), BOEM, in coordination with NMFS, evaluated the direct, indirect, and cumulative effects of the proposed action which include construction, operation and decommissioning. See National Environmental Policy Act section below.

Comment 10: ACK Residents Against Turbines stated that NMFS' analysis does not assess cumulative impacts on marine mammals, when considered in conjunction with other threats to marine mammals, including those posed by the other proposed wind farms adjacent to the Vineyard Wind leasehold.

Response: Neither the MMPA nor NMFS' codified implementing regulations specifically call for consideration of other unrelated activities and their impacts on marine mammal populations. The preamble for 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. Section 101(a)(5)(D) of the MMPA requires NMFS to modify, suspend, or revoke the IHA if it finds that the activity is having more than a negligible impact on the affected species or stocks of marine mammals. NMFS will closely monitor baseline conditions before and during the period when the IHA is effective and will exercise this authority if appropriate.

Section 101(a)(5)(D) of the MMPA requires NMFS to make a determination that the take incidental to a ''specified activity,'' as opposed to other activities not specified in the request, 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)(D) is generally defined and described by the applicant. Here, Vineyard Wind was the applicant for the IHA, and we are responding to the specified activity as described in their application (and making the necessary findings on that basis).

Through the response to public comments in the 1989 implementing regulations, we also indicated (1) that NMFS would consider cumulative effects that are reasonably foreseeable

when preparing a NEPA analysis, and (2) that reasonably foreseeable cumulative effects would also be considered through the section 7 consultation for ESA-listed species. In this case, cumulative impacts have been adequately addressed under NEPA in BOEM's Environmental Impact Statement regarding Vineyard Wind's proposed project. NMFS is a cooperating agency under NEPA on that EIS and has adopted the Final Environmental Impact Statement (FEIS) for purposes of issuing the IHA to Vineyard Wind. In addition, NMFS was a signatory to the associated Record of Decision issued on May 10, 2021.

Separately, NMFS engaged in intra-agency consultation under section 7 of the ESA, which determined that NMFS' action of issuing the IHA is not likely to adversely affect listed marine mammals or their critical habitat. The resulting Biological Opinion considered activities both within and outside the scope of NMFS' IHA (*e.g.,* operation and decommissioning) and included Terms and Conditions aimed at reducing the potential impacts of the project on marine mammals, including NARWs.

Comment 11: ACK Residents Against Turbines stated that the analysis of impacts to marine mammals from vessel strikes is inadequate and is based on an assumption that mitigation to prevent vessel strikes will be 100 percent effective.

Response: Vineyard Wind did not request authorization for takes from vessel strikes and NMFS has not authorized any. NMFS analyzed the potential for vessel strikes to occur during construction and determined that vessel strike is unlikely to occur (not that there is no collision threat at all, as suggested by AKC), based on a combination of the low probability of a ship strike generally, and the extensive mitigation and monitoring included. The IHA also includes a provision that NMFS may modify, suspend or revoke the IHA if the holder fails to abide by the conditions prescribed herein (including, but not limited to, failure to comply with monitoring or reporting requirements), or if NMFS determines: (1) The authorized taking is likely to have or is having more than a negligible impact on the species or stocks of affected marine mammals or (2) the prescribed measures are likely not or are not effecting the least practicable adverse impact on the affected species or stocks and their habitat. We find that the prescribed measures are effecting the least practicable adverse impact on marine mammals; however, should an unanticipated ship strike occur (to any marine mammal), the IHA could be modified, suspended, or revoked.

Vineyard Wind is planning on running a limited number of crew transfer vessels during construction and proposed a very conservative suite of mitigation measures related to vessel strike avoidance, including measures specifically designed to avoid impacts to right whales. Section 4(l) in the IHA contains a suite of non-discretionary requirements pertaining to ship strike avoidance, including vessel operational protocols and monitoring. Construction of the project will be based out of New Bedford, Massachusetts, which is a 50 to 60-mile (80 to 97 kilometers (km)) trip by vessel to the WDA. Vineyard Wind has indicated that during construction, the number of crew transfer vessels will be limited to two and that each of those vessels will make only one round trip per day (for a total of two round trips).

To date, NMFS is not aware of a wind industry vessel (*e.g.,* marine site characterization survey vessel or wind energy vessels used in European wind project construction and operation) reporting a ship strike. When considered in the context of the low overall probability of any vessel strike given the limited additional vessel traffic, the comprehensive visual and PAM monitoring required in transit lanes, and that construction would occur during the time of year when NARW density is lowest, NMFS believes these measures are adequately protective to avoid ship strike; thus, we did not authorize take from ship strike. These measures are described fully in the Mitigation section below, and include, but are not limited to training for all vessel observers and captains, daily monitoring of the NARW Sighting Advisory System, WhaleAlert app, and USCG Channel 16 for whale presence awareness, communications protocols if whales are observed by any Vineyard Wind personnel, vessel speed restrictions at certain times of year or if certain monitoring requirements are not met, vessel operational protocols should any marine mammal be observed, and visual and passive acoustic monitoring to clear transit routes and WDA of NARWs.

We have determined the mitigation measures in the IHA provide the means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for subsistence uses.

Comment 12: ACK Residents Against Turbines stated that the proposed mitigation measures are ''inadequate and unenforceable'' and that the proposed seasonal moratorium on pile driving (*i.e.,* from January through April) is ''far too short.''

Response: The mitigation measures included in the final IHA, including seasonal closures, are adequate and appropriate for the protection of NARWs and are enforceable. Despite the commenters' suggestion, NMFS does not intend to rely on the wind energy industry to police itself. If Vineyard Wind fails to implement any mitigation measure in the IHA and an unauthorized take occurs, Vineyard Wind will be in violation of the MMPA. NOAA's Office of Law Enforcement is responsible for investigating all violations of the MMPA, including any unauthorized takes that may occur during this project.

In concluding the proposed seasonal pile driving moratorium of January through April is ''far too short'' the commenters incorrectly state that NARW densities are higher in May, June, and December than in January. However, as shown in Table 9, NARW densities during the months of the seasonal closure identified in the IHA (January: 0.510 per 100 km^2; February: 0.646 per 100 km^2; March: 0.666 per 100 km^2; April: 0.599 per 100 km^2) are higher than in May (0.204 per 100 km^2), June (0.016 per 100 km^2) and December (0.274 per 100 km^2)) and, in fact, are by far the highest in those four months compared to any other months of the year (December has the next highest density at 0.274 per 100 km^2). In addition, Vineyard Wind has agreed to not pile drive in December unless extraordinary circumstances arise necessitating pile driving in December, and this is notified to and approved by BOEM. This measure is included in the IHA. Thus, the seasonal moratorium in the IHA minimizes the exposure of right whales to pile driving noise while allowing the project to move forward (*i.e.,* is practicable). In addition to the seasonal moratorium, enhanced mitigation measures for right whales (which are fully described in the Mitigation section below) include, but are not limited to, the following for times of year when pile driving may occur:

- Pile driving must be delayed upon visual observation of a NARW by protected species observers (PSOs) on the pile driving vessel at any distance from the pile;
- Pile driving must be delayed upon a confirmed PAM detection of a NARW, if the detection is confirmed to have been located within the relevant PAM clearance zone;

- From May 1 through May 14 and November 1 through December 31 an extended clearance zone of 10 km is established for NARWs, monitored using real-time PAM, and an aerial or vessel-based survey must also be conducted that covers the 10 km extended clearance zone;
- From May 1 through May 14 and November 1 through December 31, if a NARW is confirmed via visual observation or PAM within the 10 km extended clearance zone, pile driving must be delayed or shut down until the following day; and
- Pile driving must shut down, if feasible, if a marine mammal enters a designated shut down zone.

The commenters do not provide any recommendations regarding additional or different mitigation measures, or specifically explain why they believe the measures are unenforceable. NMFS has determined the mitigation measures in the IHA provide the means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for subsistence uses (see Mitigation section below).

Comment 13: AOLA commented that the IHA should consider the entire life cycle of the wind turbine generators (WTGs) and all potential sources of take (*i.e.,* acoustics, vessel strike, habitat changes, etc.) applicable to those phases.

Response: As described above (Comment 9), we analyzed the potential for the take of marine mammals to occur during pile driving activities associated with the construction phase of the project, as identified in Vineyard Wind's application. We have therefore authorized the requested take as a result of the construction phase of the project, specifically pile driving activities. However, we note that the potential impacts of other phases of the project are fully analyzed in BOEM' Final EIS, which NMFS has adopted to satisfy our obligations under NEPA (see National Environmental Policy Act section, above) as well as NMFS 2020 Biological Opinion associated with this action for ESA-listed species. Vineyard Wind has the opportunity to submit an IHA application for operation or decommissioning activities, if appropriate.

Comment 14: AOLA requested that NMFS consider recent survey data and any pre-construction data being collected in the analysis of risk to marine mammals.

Response: We have relied on the best available scientific evidence in our analysis of potential impacts of the project on marine mammals and the development of take estimates, including recent survey data. For example, where survey data indicated take estimates may be higher than those modeled, we adjusted to represent the higher potential for take. We note that after the proposed IHA was published, updated NARW density data (Roberts et al., 2020) became available that incorporated more recent survey data (through 2018) and that for the first time included data from the 2011–2015 surveys of the Massachusetts and Rhode Island (M/RI) Wind Energy Areas (WEA) (Kraus et al. 2016) as well as the 2017–2018 continuation of those surveys, known as the Marine Mammal Surveys of the Wind Energy Areas (MMS–WEA) (Quintana et al., 2018). As this data represented new information that was deemed the best available information on NARW density in the project area, we based the exposure modeling for right whales in the final IHA on this new density data, for all possible construction scenarios, to confirm whether the incorporation of the new density data would result in a change to modeled exposure numbers. This is described in more detail in the Estimated Take section below. In addition, Pace et al. (2021) describes that the stock abundance of NARW is lower than that considered when the proposed IHA was published and we have evaluated that new information. In developing the final IHA, NMFS also consulted the NARW sighting database, WhaleMap, which aggregates both visual and acoustic sighting information from 2010 to present day. Contributors to the database include the Department of Fisheries and Oceans Canada, Transport Canada, NOAA's Protected Species Branch, Woods Hole Oceanographic Institution/robots4whales, New England Aquarium, Center for Coastal Studies, Candadian Whale Institute, Mingan Island Cetacean Study, Ocean Tracking Network, Dalhouise University, University of New Brunswick, and Nike Hawkins Photography, making it an extensive database and useful tool in identifying spatial and temporal occurrence of whales as well as locations and timing of management actions such as implementation of Dynamic Management Areas (DMAs).

NMFS invests heavily in conserving NARWs and, in analyzing the impacts to NARWs from project construction, has considered and leveraged the wealth of data collected by NOAA and partners to make conservative management decisions in consideration of our statutory authority under the MMPA. Despite the changes in density and population numbers noted above, when the proposed IHA was issued, the status of NARWs was critically endangered and this remains true today. We have applied the best available (and most recent) science and have made the determinations necessary to issue the IHA.

Comment 15: AOLA commented that it was concerned that the real-time PAM system has not yet been developed and will only be ''used to inform visual monitoring during construction; no mitigation actions would be required on PAM detection alone'' and asked whether the IHA would be contingent on vetting the design and operation of the currently hypothetical system by experts in the field.

Response: As described in the Mitigation section, the real-time PAM system will not only be used to inform visual monitoring, but will also trigger required mitigation actions under certain circumstances. For instance, as described above and as described more fully under the Mitigation section below, from May 1 through May 14, an extended clearance zone of 10 km must be established for NARWs using real-time PAM, and any detection of a NARW via real-time PAM within that 10 km clearance zone would trigger immediate delay or shutdown of pile driving. Regarding the request that the design of the real-time PAM system be vetted by experts in the field, while the commenters do not provide any specific recommendations regarding who should be consulted on the design and operation, we note that the IHA requires that a Passive Acoustic Monitoring Plan, which must describe all proposed PAM equipment, procedures, and protocols including those related to real-time PAM, must be submitted to NMFS for review and approval at least 90 days prior to the planned start of pile driving.

Comment 16: AOLA recommended NOAA or BOEM create a third-party certification program for PSOs, similar to the system used for fishery observers, which sets universal standards for all wind projects and requires reporting after each construction activity/trip.

Response: At this time, NMFS is not creating a third-party certification program for PSOs. Each IHA requires all PSOs must be approved by NMFS, and that Vineyard Wind must submit PSO resumes to NMFS for approval at least 60 days prior to commencing pile driving activity. A full list of qualifications required of PSOs is included in Vineyard Wind's IHA. For

example, PSO must have a degree in biological sciences and experience and/or training working as a PSO. The lead PSO must have experience as a PSO in an offshore environment. All PSO qualification requirements can be found in the Monitoring and Reporting section and the issued IHA. BOEM and NMFS are also working on developing consistent data reporting requirements for the offshore wind industry.

Comment 17: AOLA recommended that all pile driving activity should cease when a NARW is observed within 5 miles (8 km) of a pile being driven, and that all shutdowns called for by a PSO should be reported to NOAA daily with detailed explanation when shutdowns were not deemed feasible. AOLA also recommended that further mitigation should be immediately required if NMFS finds continued pile driving to cause unauthorized risk to marine mammals.

Response: The commenters' recommendation for a 5 mile (8 km) shutdown zone is not supported or warranted. First, we have already included a requirement in the IHA that pile driving be delayed upon a visual detection of a NARW by PSOs on the pile driving platform at any distance from the pile, at any time of year. In addition, as noted above and as described fully in the Mitigation section below, the IHA also requires a 10 km clearance zone (larger than the zone recommended by the commenters) during the seasons when NARW abundance is greatest (November–December (although VW would avoid pile driving in December except in unforeseen, extraordinary circumstances) and May 1 through May 14). Further, during these periods, if a NARW is detected within the 10 km extended clearance zone (via visual observation or PAM), pile driving must be delayed. Pile driving must not resume until the following day, or, until a follow-up aerial or vessel-based survey is able to confirm all right whale(s) have departed the 10 km extended clearance zone, as determined by the lead PSO. NMFS also added a minimum shutdown distance of 3.2 km, which is a conservative estimate to the Level A harassment isopleth, more than half the distance to the Level B harassment isopleth for NARWs, and is a practicable shutdown zone.

Regarding the recommendation that all shutdowns called for by a PSO should be reported to NOAA daily with detailed explanation when shutdowns were not deemed feasible, we have determined that this is not necessary as the IHA requires weekly and monthly monitoring reports which will include a summary of any mitigation-related actions (*e.g.,* delay, shutdown, etc.) called for by PSOs but not implemented, and the reason why the mitigation-related action was not implemented.

Regarding the recommendation that further mitigation should be immediately required if NMFS finds continued pile driving to cause unauthorized risk to marine mammals, we note that the IHA explicitly identifies that the taking by serious injury or death of any of the species for which take is authorized or any taking of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of the IHA. 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 Level B harassment zone, Vineyard Wind is required to delay or shutdown pile driving activities (when technically feasible) to avoid unauthorized take. Further, the IHA may be modified, suspended, or withdrawn if Vineyard Wind fails to abide by the conditions prescribed in the IHA, or, if NMFS determines that the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals.

Comment 18: AOLA recommended that the IHA require a mandatory 10 nautical miles per hour (knots; kts) (18.52 nautical km per hour) speed restriction on all vessels in all leased areas of the RI/MA WEA when right whales are present.

Response: As noted above (see Comment 11) and as described fully in the Mitigation section below, we have included a suite of mitigation measures related to vessel speed to minimize potential impacts to marine mammals and to NARWs in particular. The mitigation measures in the IHA prescribe the 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.

Comment 19: The ENGOs recommended that NMFS: (1) Fund analyses of recently collected sighting and acoustic data for all data-holders; and (2) continue to fund and expand surveys and studies to improve our understanding of distribution and habitat use of marine mammals off Rhode Island and Massachusetts, including the Project area, as well as the broader region, in the very near future.

Response: We note that this is a general comment not specific to Vineyard Wind's IHA. NMFS executes, funds, and coordinates several marine mammal studies throughout the Northeast to improve our understanding of marine mammals distribution and habitat use. The primary entity charged with doing so is the Northeast Fisheries Science Center; however, NMFS Office of Protected Resources and GARFO also contribute to studies on marine mammals. These are continuing ongoing efforts. For example, through the Atlantic Marine Assessment Program for Protected Species (AMAPPS), the NEFSC is developing models and tools to provide seasonal abundance estimates that incorporate environmental habitat characteristics for marine mammals and other protected species in the western North Atlantic Ocean, including Rhode Island and Massachusetts.

With respect to funding analyses of recently collected sighting and acoustic data for all data-holders, the ENGOS did not identify which data holders or which data they are referring to. Because data on marine mammals in the project area are collected in different ways (*e.g.,* from PSOs, systematic aerial surveys, anecdotal sightings, stranding reports); it is not possible to integrate all the data on marine mammals. Therefore, it is unclear what type of analyses the ENGOs are referring to. However, NMFS is committed to improving our understanding of distribution and habitat use of marine mammals. NMFS and its many partners (including the government of Canada) already, and continue to, submit all survey reports (effort and sightings) to the NARW Consortium Database maintained by the University of Rhode Island for inclusion in the sightings database and those with photographs are also submitted to the New England Aquarium for integration into a unified photo-identification catalog. Most field research teams match their photographs to this catalog during their field efforts. In addition, NMFS is developing systematic data collection methods, where possible, to maximize the use of those data in conservation and management decisions. For example, with funding from the Marine Mammal Commission, NMFS is currently working with the New England Aquarium to analyze offshore wind site characterization survey PSO data and how those data compare to more systematic, line transect surveys. The results of this project will include recommendations about how PSO data can be collected to provide the greatest conservation value for protected species and recommendations about how PSO data can be utilized for regulatory/

management and scientific purposes. More information on this project can be found at *https://www.mmc.gov/grants-and-research-survey/grant-awards/2020-grant-awards/*.

Comment 20: Regarding NMFS' requirement that pile driving be postponed until the following day if a NARW is detected by real-time PAM or a vessel-based or aerial survey within 10 km of the pile driving location from May 1–May 14, the ENGOs recommended NMFS remove the exception that allows the activity to resume the same day if an aerial or vessel-based survey could confirm that the extended clearance zone is free of right whales. They assert that as many NARW sightings go unseen, resuming the same day is too risky.

Response: NMFS disagrees that PAM and a visual survey (either vessel or aerial) would not result in adequate protections for NARWs. First, the ENGOs do not acknowledge there will be additional monitoring efforts. PSOs at the pile driving vessel will monitor for NARWs, Vineyard Wind is required to monitor the NARW sighting network, USCG Channel 16, etc., and all Vineyard Wind vessels will have observers. The project area is a known foraging area but it is also a migratory corridor and we anticipate NARWs may remain in the area or pass through rather quickly. If a whale(s) remains, it is likely to be detected by PAM, vessel or aerial surveys, or the pile driving PSO in which case pile driving would not commence. If it is migrating, there is no reason for pile driving to be delayed an additional day as animals may move quickly through the area. For example, in 2000, one whale was photographed in Florida waters on January 12th, then again 11 days later (January 23rd) in Cape Cod Bay, less than a month later off Georgia (February 16th), and back in Cape Cod Bay on March 23rd, effectively making the round-trip migration to the Southeast and back at least twice during the winter season (Brown and Marx 2000). Further, if any animal is missed and pile driving does begin while the NARW is within the Level B harassment zone, we have analyzed the impacts to that individual and have concluded any impacts would be minor in that no fitness consequences are likely (see Negligible Impact Analysis and Determination section). We have also identified that pushing any pile driving to times when NARWs are more likely to be present in greater numbers would result in unnecessary impacts as the potential for take is higher and pile driving could occur over a longer timeframe.

Comment 21: The ENGOs recommended that PAM be required for 60 minutes prior to commencement of pile driving.

Response: We agree with the recommendation and have incorporated this requirement in the IHA. The IHA requires that acoustic monitoring begin at least 60 minutes prior to initiation of pile driving. See the Mitigation section below for details.

Comment 22: The ENGOs recommended that the mitigation requirements include NARW acoustic detections as a shutdown trigger.

Response: We agree with the recommendation and have incorporated this requirement in the IHA. The IHA requires that pile driving be delayed or shut down upon a confirmed acoustic detection of a NARW within the relevant exclusion zone. See the Mitigation section and Table 16 for details.

Comment 23: The ENGOs recommended that between November 1 and May 14, upon a confirmed sighting of a NARW, vessels should be required to reduce their speed to 10 kts or less for the remainder of the day, and to use real-time PAM in order to more accurately detect the presence of right whales. They also recommended PAM be used in transit corridors.

Response: The IHA includes several scenarios under which vessels are required to travel at 10 kts or less and requires use of real-time PAM at all times. The IHA requires that from November 1 through May 14, all vessels, regardless of size, must travel at less than 10 kts within the WDA. In the transit corridor, crew transfer vessels must reduce speed to 10kts if the PAM system within the corridor detects a NARW or one is sighted from the vessel. Further, any vessel traveling over 10 kts is required to have a dedicated observer(s) on board at all times. Crew transfer vessels traveling within any designated DMA must travel at 10 kts or less, unless NARWs are clear of the transit route and WDA for two consecutive days, as confirmed by vessel based surveys conducted during daylight hours and real-time PAM, or, by an aerial survey, conducted once the lead aerial observer determines adequate visibility. If confirmed clear by one of the measures above, vessels transiting within a DMA must employ at least two visual observers to monitor for NARWs. Vineyard Wind is required to submit a Vessel Strike Avoidance Plan to NMFS for approval no later than 90 days prior to utilizing vessels which will include details regarding monitoring and the PAM systems in both the WDA and transit corridors. We note submission of such a plan was not included in the proposed IHA.

Comment 25: The ENGOs recommended that the IHA require reporting of NARW sightings to NMFS within 2 hours of the sighting.

Response: We agree with the recommendation that NARW sightings be reported as soon as possible to NMFS. The IHA requires that if a NARW is observed at any time by PSOs or personnel on any project vessels, during any project-related activity or during vessel transit, Vineyard Wind must report sighting information to the NMFS NARW Sighting Advisory System, the U.S. Coast Guard via channel 16, and WhaleAlert app as soon as feasible but no longer than 24 hours after the sighting. We anticipate that most sightings will be reported within the 2 hour timeframe recommended by the ENGOs; however, we also recognize that communications at sea can sometimes be interrupted (*e.g.,* poor cellular or satellite service); therefore, we are allowing 24 hours maximum (with the caveat they report a sighting as soon as feasible) in case such. We note that given the gravity of a situation associated with an unauthorized take from a ship strike, the IHA requires Vineyard Wind to report any such taking to NMFS immediately, dedicating all resources to ensure that incident is reported. Such dedication, including immediately ceasing activities (as required if a ship strike occurs) is not necessary for a sighting report.

See the Mitigation section below for details.

Comment 26: The ENGOs recommended that the take analysis be updated to reflect the best available scientific information to account for evidence supporting the importance of the waters off Massachusetts and Rhode Island as NARW foraging habitat, and to more accurately reflect times that right whales are likely to be present in the area. The ENGOs further recommended that NMFS consider any initial data from state monitoring efforts, passive acoustic monitoring data, opportunistic marine mammal sightings data, and other data sources, and to take steps to develop a dataset that more accurately reflects marine mammal presence so it is in hand for future authorizations.

Response: As noted above, updated NARW density data (Roberts et al., 2020) that incorporated more recent survey data and that for the first time included survey data from the MA and RI/MA WEAs (Kraus et al. 2016; Quintana et al., 2018) became available after the proposed IHA was published. The exposure modeling for NARWs in the final IHA was updated to

incorporate this more recent and more accurate density data which reflects year-round presence in the project area (albeit highest densities are when pile driving would not occur). Habitat use is indirectly considered in density estimates as the estimates are based on sighting data and those data would reflect if animals are remaining (*i.e.,* present) within an area for prolonged periods; thereby, increasing density. If animals are remaining in the area, it can be assumed they are engaging in critical behaviors such as foraging. We note; however, habitat use is directly considered in our Negligible Impact Analysis and Determination section. We have used the best scientific information available as the basis for generating take numbers for all marine mammal species. This is described in more detail in the Estimated Take section below. In our negligible impact analysis (see Negligible Impact Analysis and Determinations section), we identify how habitat use is factored into our determinations given the type and amount of take authorized.

Regarding the recommendation to consider initial data from other monitoring efforts and to take steps to develop a dataset that more accurately reflects marine mammal presence so it is in hand for future authorizations, we considered all data sources and did not solely rely upon density data when estimating take as the ENGOs suggested we did. For example, we increased the amount of take authorized for some species from the modelling results in consideration of HRG survey monitoring data previously collected by Vineyard Wind. In other cases, when model results suggested take was less than average group size, take was increased. NMFS will continue to rely on the best available scientific information in both the analysis of potential impacts to marine mammals and in the development of exposure estimates and our findings.

Comment 27: The ENGOs recommended that vessel strikes be incorporated into the take analysis. The ENGOs also recommended that the potential for vessel strike resulting from displacement as a result of project-related noise be considered.

Response: NMFS analyzed the potential for vessel strikes to occur during Vineyard Wind's construction and determined that it is not likely to occur. We do not authorize any take of marine mammals by vessel strike incidental to Vineyard Wind's planned construction activities under this IHA. Also as described under Comment 10 above, we have included a conservative suite of mitigation measures related to vessel strike avoidance, including measures specifically designed to avoid impacts to NARWs. These measures (*e.g.,* reduced vessel speed) also provide protection for other marine mammals. All ship strike avoidance measures are described fully in the Mitigation section below.

Regarding the commenters' recommendation to consider displacement as a result of project-related noise to result in vessel strike, we have considered this possibility and have concluded that while short-term displacement from the project area is a possibility, there is no evidence to suggest that any short-term displacement would result in a change to the likelihood of vessel strike occurring for any marine mammal species. The amount of vessels utilized by Vineyard Wind during the effective period of the IHA results in only a small increase in vessel traffic over baseline (*e.g.,* two crew transfer vessels making one round trip per day).

Comment 28: The ENGOs recommended that NMFS avoid describing potential changes resulting from offshore wind development as ''beneficial,'' as it is unclear what implications these changes may have on the wider ecosystem, and instead use terminology such as ''increase,'' ''decrease,'' and ''change.''

Response: In the proposed IHA notice, NMFS identified that impacts from the permanent structures (*i.e.,* WTGs) on marine mammal habitat may be beneficial as a result of increased presence of prey due to the WTGs acting as artificial reefs (Russell et al., 2014). However, we recognize, the long-term impact from foundation presence is outside the scope of the effective period of the IHA and that this analysis is more appropriate in the context of the ESA consultation and NEPA analysis as it relates to marine mammal habitat. Regarding the EIS, we agree that the long term ecosystem effects from offshore wind development in the Northwest Atlantic are still being evaluated and that those ecosystem effects are likely to be complex. Accordingly, we acknowledge that documentation of a change that may appear ''beneficial'' (*i.e.,* an increased number of a particular species documented within a wind development area) does not necessarily equate to overall beneficial impacts to a species or ecosystem. BOEM's FEIS describes impacts to coastal and benthic habitats as being adversely negligible to moderate, as defined in the FEIS. That said, just as there are potential negative impacts to marine mammals from noise associated with offshore wind construction, there are also potential benefits that may result from the presence of wind turbine foundations in marine mammal habitat. Thus, BOEM also concluded that some impacts from the Project can be moderately beneficial for those habitats. Thus, while we acknowledge that there is currently insufficient information to draw a conclusion regarding longer term impacts to marine mammals, we disagree with the commenters that the term ''beneficial'' should be avoided altogether when describing potential outcomes of offshore wind for marine mammals.

Comment 29: The ENGOs recommended that NMFS' negligible impact determination consider potential cumulative impacts arising from the construction of the proposed project and additional offshore wind projects that are expected to be installed in the future. Specifically, they recommended a cumulative effects analysis include consideration of repeated disturbance from the same activity over time and space, interactions between different types of potential impacts, multiple wind energy development projects, and the broader context of other ocean uses within the leasing area and that may be encountered by transboundary and migratory species during their life cycles.

Response: NMFS agrees that consideration of repeated disturbance from the same activity (as identified in the application) over time and space should be incorporated into a negligible impact determination and we have done so as the impact of the specified activity on marine mammals must be considered in accordance with 101(a)(5)(D) of the MMPA. However, neither the MMPA nor NMFS' codified implementing regulations require NMFS to consider impacts from other unrelated activities (such as the construction and operation of additional wind farms) and their impacts on populations. The preamble for 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 current stressors. In addition, we consider these factors as relevant contextual elements of the analysis. See

the Negligible Impact Analysis and Determinations section of this notice for full detail.

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, and will not result in an unmitigable adverse impact on the availability of marine mammals for taking for subsistence uses. NMFS' implementing regulations require applicants to include in their request a detailed description of the specified activity 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)(D) is generally defined and described by the applicant. Here, Vineyard Wind is the applicant and we are responding to the specified activity as described in their petition (and making the necessary findings on that basis).

Our 1989 final rule for the MMPA implementing regulations also addressed public comments regarding cumulative effects from future, unrelated activities. There we stated that such effects are not considered in making findings under section 101(a)(5) concerning negligible impact. We indicated (1) that NMFS would consider cumulative effects that are reasonably foreseeable when preparing a NEPA analysis, and (2) that reasonably foreseeable cumulative effects would also be considered under section 7 of the ESA for ESA-listed species.

In addition to above considerations, BOEM's 2021 FEIS, of which NMFS was a cooperating agency, NMFS adopted, and was a co-signatory to the joint Record of Decision, analyzes cumulative impacts from the construction and operation of the Vineyard Wind Project when combined with other past, present and reasonably foreseeable future actions, including development of other wind energy areas and other stressors (*e.g.,* ship strike, entanglement, climate change). That analysis included an assessment of whether the predicted level and amount of take from construction would have meaningful biological consequences at a species or population level. NMFS, therefore, assessed and integrated other contextual factors (*e.g.,* species' life history and biology, distribution, abundance, and status of the stock; mitigation and monitoring; characteristics of the surveys and sound sources) in determining the overall impact of issuance of the IHA to Vineyard Wind. While exposure to noise during construction could temporarily affect marine mammals, the extensive mitigation (including those measures designed to avoid vessel strike) would minimize the severity and amount of harassment such that no meaningful biological consequences would occur.

Similar findings were made in NMFS' 2020 Biological Opinion related to this action. The effects of the action analyzed in the 2020 Biological Opinion reflect all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. It considered whether the action will result in reductions in reproduction, numbers or distribution of these species and then considered whether any reductions in reproduction, numbers or distribution resulting from the action would reduce appreciably the likelihood of both the survival and recovery of these species. The Biological Opinion concluded the proposed action, which included NMFS' action of issuing an IHA to Vineyard Wind, may adversely affect ESA-listed marine mammals but would not likely jeopardize the continued existence of those species or adversely modify or destroy their critical habitat. We note the analysis in BOEM's FEIS and Biological Opinion extends over the duration of the project while our IHA is limited to one year, and to harassment during construction of the project.

Comment 30: The ENGOs recommended NMFS expand its analysis to better consider repeated exposure to the same stressor over multiple days, as well as masking and acoustic habitat impacts.

Response: As described above, the potential impacts from repeat exposures are incorporated into our negligible impact analysis. As described in the Negligible Impact Determination and Analysis section below, although some animals may be disturbed repeatedly from pile driving over multiple days, we anticipate the impact on marine mammals from resulting behavioral reactions such as temporary avoidance of the ensonified area during pile driving would not result in impacts to reproductive success of any individual marine mammal, much less annual rates of recruitment and survival. For large whales, including the NARW, we authorize only a small number of Level B harassment takes. For example, Vineyard Wind is authorized for 20 takes by Level B harassment of NARW. Each take represents exposure of one NARW above NMFS behavioral harassment threshold (and the expected associated behavioral disturbance) occurring within one day. While 20 instances of take is the maximum anticipated and authorized, we do not know whether these 20 takes occur to 20 different individual NARWs (each taken on one day) or if some individuals might be taken on more than one day, but we do know that the product of individual whales times days of disturbance cannot exceed 20 (*e.g.,* 20 different whales disturbed on 1 day each, 10 different whales disturbed on two days each, etc.), and given the number, it is unlikely that any single whale would be disturbed on more than a few days. Given Vineyard Wind would be pile driving primarily June through October (with limited pile driving in May and November) it is highly unlikely that any single whale would be taken 20 times. Thus any instances of repeated disturbance would be minimal. For smaller cetaceans, their populations are relatively large compared to baleen whales and they have large habitat ranges; therefore, repeated disturbance to a degree that would cause impacts to annual rates and survival to those populations is also unlikely.

The impacts of masking and impacts to marine mammal acoustic habitat from the specified activity were fully considered in the **Federal Register** notice announcing the proposed IHA (see sections entitled Auditory Masking and Potential Effects of the Specified Activity for discussions on masking; see section entitled Anticipated Effects on Marine Mammal Habitat for discussion on potential impacts to acoustic habitat). That analysis was integrated into our negligible impact finding decision-making. For example, we found that impacts from masking would be insignificant and any masking event that could possibly rise to Level B harassment under the MMPA would occur concurrently within the zones of behavioral harassment already estimated for impact pile driving, and which have already been taken into account in the exposure analysis. The temporary elevated noise levels caused by the project would impact acoustic habitat; however, similar to masking, these elevated noise areas are captured in the behavioral harassment zones established in our analysis.

Comment 31: The ENGOs believe that NMFS' use of a Renewal IHA process does not allow for adequate public comment because NMFS supplies no legal rationale for why it is authorized to issue an identical IHA for a second year while cutting in half the comment period the statute requires. They state that should the agency wish to establish its new IHA renewal process as a reasonable interpretation of an

ambiguous statutory provision, it should do so through notice-and-comment rulemaking or comparable process with the appropriate indicia of formality. NMFS must also explain why applicants whose activities may result in the incidental harassment of marine mammals over more than one year should not be required to apply for authorization to do so through the incidental take regulation procedure established by sec. 101(a)(5)(A)(i), and justify how its extension process, with a curtailed comment period, is consistent with both statutorily-established processes.

Response: In prior responses to comments about IHA Renewals (*e.g.,* 84 FR 52464; October 02, 2019 and 85 FR 53342, August 28, 2020), NMFS has explained how the Renewal process, as implemented, is consistent with the statutory requirements contained in section 101(a)(5)(D) of the MMPA and promotes NMFS' goals of improving conservation of marine mammals and increasing efficiency in the MMPA compliance process. Also, please see our response to Comment 8 for additional information.

The ENGOs recommended we utilize a stand-alone rulemaking process to solicit input on the renewal process so that it is open to public comment. However, using the 30-day public comment period for an IHA to provide relevant explanations of the Renewal process and also announce the option to issue a Renewal to an applicant for a specific project is an effective and efficient way for NMFS to provide information to the reader, solicit focused input from the public, and ultimately affords the same opportunities for public comment as a stand-alone rulemaking would. The ENGOs have the opportunity to comment on the potential Renewal, and, by default, the process during the proposed IHA phase. There is no reason to undertake a rulemaking process to carry out a process that is afforded under the MMPA and for which NMFS has discretion to carry out. The eNGOs have not provided reason why the 30 day public comment period during the proposed IHA phase plus the additional 15-day public comment during a proposed Renewal IHA phase (which generally occurs less than one year after the initial 30-day public comment period) for a total public comment period of 45 days does not meet the requirements of the MMPA.

The Renewal process does not allow for an IHA to cover applicants intending on conducting activities for more than one year, as mistakenly interpreted by the eNGOs. Rather, the FR notice for the initial 30-day comment period for the proposed IHA asks the public to review and provide input on both the initial proposed IHA, as well as the potential for a Renewal should the Renewal conditions be met, following an additional 15-day comment period. It would be unnecessary and inefficient for both the applicant and NMFS to require them to go through a rulemaking process in case their project extended beyond the expiration date of their IHA. The most common cases of issuing a Renewal IHA is when there are unforeseen circumstances that prevent the applicant from completing the analyzed activity from being completed before the expiration date of the original IHA. As noted in the response to Comment 8 above, there are strict criteria NMFS has set forth that an applicant must meet prior to being granted a Renewal IHA. Specific to the Vineyard Wind IHA, any request for a Renewal by Vineyard Wind, will be considered against established and transparent Renewal criteria, including the careful consideration of any changes in the status of the affected species or stocks and whether they would change our findings.

Changes From Proposed IHA to Final IHA

Since publication of the Proposed IHA (83 FR 18346, April 30, 2019), Vineyard Wind has split into separate corporate entities, Vineyard Wind, LLC (the applicant identified in the IHA application), and Vineyard Wind 1, which now holds assets associated with the project. While the application and the proposed IHA identify Vineyard Wind, LLC as the potential IHA Holder, NMFS has issued, upon request from Vineyard Wind, LLC, the IHA to Vineyard Wind 1.

In the final IHA, NMFS Office of Protected Resources adopted the Terms and Conditions of the November 2020 Biological Opinion for the Vineyard Wind Project and made other modifications as a result of public input on the proposed IHA, which resulted in several changes to mitigation and monitoring measures from proposed to final. We provide a summary here, and the changes are also described in the specific applicable sections below (*e.g.,* Mitigation). A complete list of final measures may be found in the issued IHA (available at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-other-energy-activities-renewable*).

Vineyard Wind has committed to adding December to the seasonal pile driving moratorium window. However, to be practicable, in the case of unanticipated delays due to weather or technical problems that require extension of pile-driving activities, pile driving may occur in December if BOEM is notified and approves.

In consideration of the best available science and public input, NMFS has increased clearance zone sizes from the proposed IHA to ensure Level A take of NARWs is avoided and that any Level B harassment is minimized to the maximum extent practicable. During all times of the year, if a PSO on the pile driving vessel observes a NARW, at any distance, pile driving will be delayed. However, we recognize in certain circumstances, weather may impede visibility. From June 1 through October 31, we increased the minimum clearance zone (*i.e.,* the zone that must be visibly clear of NARWs for 30 minutes prior to commencing pile driving) from 1 km (which Vineyard Wind had proposed as a result of their Agreement with NGOs) to 2 km. In addition, we have imposed a 5 km PAM clearance zone during the same time of year. In addition to modifications to the clearance zone, we have extended the shutdown zone (*i.e.,* the zone in which Vineyard Wind must shut down pile driving if a NARW approaches or enters, except if not deemed feasible for human safety or structural integrity) for NARW from 1 km to 3.2 kms. The 3.2 km shutdown zone represents the modeled Level A harassment zone assuming a 6 dB of attenuation from the sound attenuation systems. That is, this distance represents where a NARW could incur PTS if it remains at that distance for the number of strikes considered in the model (*i.e.,* the maximum number of strikes for installing a pile). To be conservative, we have identified this distance as the initial shutdown zone; however, should sound source verification (SSV) monitoring determine the Level A harassment isopleth is less than 3.2 km, NMFS may modify the shutdown zone upon receipt of a SSV report detailing measurements from, at minimum, three piles representing conditions reflective of future piles driving scenarios (*e.g.,* similar substrate, hammer energy, etc.).

The final IHA also incorporates all Terms and Conditions of the 2021 Vineyard Wind Biological Opinion. These include not starting to install a new pile less than 1.5 hours prior to civil sunset and that pile driving may only occur at night if pile driving began during daylight hours and the relevant visual and PAM clearance zone were clear of NARWs. We also carried over the suite of vessel strike avoidance measures considered part of the

proposed action in the Biological Opinion. These include mandatory ship speeds and separation distances, use of trained dedicated observers, PAM in the transit corridors, and monitoring of the NARW Sighting Network.

From proposed to final IHA, we modified take numbers for sperm whales. The proposed IHA allocated two takes, by Level A harassment (*i.e.,* PTS) of sperm whales incidental to pile driving, as it was requested by Vineyard Wind. However, after further examination, we have determined the potential for Level A harassment (PTS) for this species is *de minimis* and we have not authorized take by Level A harassment. The area is not a preferred sperm whale habitat as they prefer deeper waters and bathymetric features such as canyons. The monopile and jacket foundation Level A harassment distance for sperm whales is very small (less than 75 m). It is highly unlikely that a sperm whale would remain within this area during the entire duration of pile driving necessary to incur PTS and we have required clearance and shut down zones greater than 75 m. In addition, in the 2020 Biological Opinion, NMFS concluded take of sperm whales by Level A harassment was not reasonably certain to occur and determined no take by injury (PTS) will be exempted in the corresponding Incidental Take Statement issued under the ESA. The final IHA identifies the amount of take authorized for non-listed marine mammals should Vineyard Wind install 100 WTG monopile foundations and two jacket foundations for the ESPs (the maximum design envelope), though fewer WTG foundations will be installed. The ESA incidental take statement (ITS), which NMFS Office of Protected Resources is required to implement, will be scaled so that the amount of ESA-listed marine mammal take authorized will correspond with the actual amount of piles planned to be installed. Thus, if Vineyard Wind installs fewer piles, it will be exempted from the ESA section 9 prohibition on take for a fewer number of ESA-listed marine mammals (see Endangered Species Act section below). The amount of take authorized for non-listed marine mammals is not scaled.

NMFS did not include language in the final IHA related to a Renewal. This does not necessarily preclude a Renewal, but as described above, we think a Renewal is unlikely in this case, given the potential for changes over the next three years that could affect our analyses.

Description of Marine Mammals in the Area of Specified Activities

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

There are 26 marine mammal species that could potentially occur in the project area and that are included in Table 3 of the IHA application. However, the temporal and/or spatial occurrence of several species listed in Table 3 of the IHA application is such that take of these species is not expected to occur nor authorized, and they are therefore not discussed further beyond the explanation provided here. Take of these species is not anticipated either because they have very low densities in the project area, or because they are not expected to occur in the project area due to their more likely occurrence in habitat that is outside the WDA, based on the best available information. There are two pilot whale species (long-finned and short-finned (*Globicephala macrorhynchus*)) with distributions that overlap in the latitudinal range of the WDA (Hayes et al., 2020). Because it is difficult to discriminate between the two species at sea, sightings, and thus the densities calculated from them, are generally reported together as *Globicephala* spp. (Hayes et al., 2020; Roberts et al., 2016). 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., 2018). Therefore, we assume that any take of pilot whales would be of long-finned pilot whales. Blue whales (*Balaenoptera musculus musculus*), dwarf and pygmy sperm whales (*Kogia sima* and *K. breviceps*), Cuvier's beaked whale (*Ziphius cavirostris*), striped dolphins (*Stenella coeruleoalba*) and four species of Mesoplodont beaked whale (*Mesoplodon* spp.), also occur in deepwater habitat that is further offshore than the project area (Hayes et al., 2020, Roberts et al., 2016). Likewise, Atlantic spotted dolphins (*Stenella frontalis*) primarily occur near the continental shelf edge and continental slope, in waters that are further offshore than the project area (Hayes et al., 2019).

Between October 2011 and June 2015 a total of 76 aerial surveys were conducted throughout the MA and RI/MA Wind Energy Areas (WEAs) (the WDA is contained within the MA WEA along with several other offshore renewable energy lease areas). Between November 2011 and March 2015, Marine Autonomous Recording Units (MARU; a type of static PAM recorder) were deployed at nine sites in the MA and RI/MA WEAs. The goal of the study was to collect visual and acoustic baseline data on distribution, abundance, and temporal occurrence patterns of marine mammals (Kraus et al., 2016). Further, between 2004–2014, acoustic detections of four species of baleen whales were examined that show important distributional changes over the range of baleen whales (Davis et al., 2020). That study showed blue whales were more frequently detected in the northern latitudes of the study area after 2010 and no detections occurred in the project area in spring, summer, and fall when pile driving would occur (Davis et al., 2020). In addition, during recent Vineyard Wind marine site characterization surveys, none of the aforementioned species were observed during marine mammal monitoring (Vineyard Wind, 2021). The lack of sightings of any of the species listed above reinforces the fact that these species are not expected to occur in the project area. As these species are not expected to occur in the project area during the planned activities, they are not discussed further in this document.

We expect that the species listed in Table 2 will potentially occur in the project area and will potentially be taken as a result of the project. Table 2 summarizes information related to the population or stock, including regulatory status under the MMPA and ESA and potential biological removal (PBR), where known. For taxonomy, we follow the Committee on Taxonomy (2018). PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (as described in NMFS' SARs). While no mortality is anticipated or authorized here, PBR is included here as a gross indicator of the status of the species and other threats. Four marine mammal species that are listed under the Endangered Species Act (ESA) may be present in the project area and may be taken incidental to the planned

activity: The NARW, fin whale, sei whale, and sperm whale.

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 SARs. All values presented in Table 2 are the most recent available at the time of publication and, except as otherwise noted, are available in the 2019 Atlantic SARs (Hayes *et al.,* 2019), available online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments.*

TABLE 2—MARINE MAMMALS KNOWN TO OCCUR IN THE PROJECT AREA THAT MAY BE AFFECTED BY VINEYARD WIND'S ACTIVITY

Common name (scientific name)	Stock	MMPA and ESA status; strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	Predicted abundance (CV) [3]	PBR [4]	Annual M/SI [4]	Occurrence and seasonality in project area
Toothed whales (Odontoceti)							
Sperm whale (*Physeter macrocephalus*).	North Atlantic	E; Y	4,349 (0.28; 3,451; 2019)	5,353 (0.12)	3.9	0	Rare.
Long-finned pilot whale (*Globicephala melas*).	W North Atlantic	-; N	39,219 (0.3; 30,627; n/a)	[5] 18,977 (0.11)	306	21	Rare.
Atlantic white-sided dolphin (*Lagenorhynchus acutus*).	W North Atlantic	-; N	93,233 (0.71; 54,443; 2019)	37,180 (0.07)	544	26	Common year round.
Bottlenose dolphin (*Tursiops truncatus*).	W North Atlantic, Offshore.	-; N	62,851 (0.23; 51,914; 2019)	[5] 97,476 (0.06)	519	28	Common year round.
Common dolphin (*Delphinus delphis*).	W North Atlantic	-; N	172,974 (0.21; 145,216; 2019).	86,098 (0.12)	1,452	399	Common year round.
Risso's dolphin (*Grampus griseus*).	W North Atlantic	-; N	35,493 (0.19; 30,298; 2019)	7,732 (0.09)	303	54.3	Rare.
Harbor porpoise (*Phocoena phocoena*).	Gulf of Maine/ Bay of Fundy.	-; N	95,543 (0.31; 74,034; 2019)	* 45,089 (0.12)	851	217	Common year round.
Baleen whales (Mysticeti)							
NARW (*Eubalaena glacialis*)	W North Atlantic	E; Y	368 (0; 356; 2020) [6]	* 535 (0.45)	[6] 0.8	[6] 18.6	Year round in continental shelf and slope waters, seasonally.
Humpback whale (*Megaptera novaeangliae*).	Gulf of Maine	-; N	1,393 (0.15; 1,375; 2019)	* 1,637 (0.07)	22	58	Common year round.
Fin whale (*Balaenoptera physalus*).	W North Atlantic	E; Y	6,802 (0.24; 5,573; 2019)	4,633 (0.08)	11	2.35	Year round in continental shelf and slope waters, occur seasonally.
Sei whale (*Balaenoptera borealis*).	Nova Scotia	E; Y	6,292 (1.02; 3,098; 2019)	* 717 (0.30)	6.2	1.2	Year round in continental shelf and slope waters, occur seasonally.
Minke whale (*Balaenoptera acutorostrata*).	Canadian East Coast.	-; N	21,968 (0.31; 17,002; n/a) ...	* 2,112 (0.05)	170	10.6	Year round in continental shelf and slope waters, occur seasonally.
Earless seals (Phocidae)							
Gray seal [7] (*Halichoerus grypus*).	W North Atlantic	-; N	27,131 (0.19; 23,158; 2019)	n/a	1,389	4,729	Common year round.
Harbor seal (*Phoca vitulina*)	W North Atlantic	-; N	75,834 (0.15; 66,884; 2019)	n/a	2,006	350	Common year round.
Harp seal (*Pagophilus groenlandicus*).	W North Atlantic	-; N	7,411,000 [8] (unk.; unk; 2019)	n/a	unk	232,422	Rare.

[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 (see footnote 3) 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] Stock abundance as reported in NMFS marine mammal stock assessment reports (SAR) except where otherwise noted. SARs available online at: *www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments.* CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance. In some cases, CV is not applicable. For certain stocks, abundance estimates are actual counts of animals and there is no associated CV. The most recent abundance survey that is reflected in the abundance estimate is presented; there may be more recent surveys that have not yet been incorporated into the estimate. All values presented are from the 2019 Atlantic SARs.

[3] This information represents species- or guild-specific abundance predicted by recent habitat-based cetacean density models (Roberts *et al.,* 2016, 2017, 2018, 2020). These models provide the best available scientific information regarding predicted density patterns of cetaceans in the U.S. Atlantic Ocean, and we provide the corresponding abundance predictions as a point of reference. Total abundance estimates were produced by computing the mean density of all pixels in the modeled area and multiplying by its area. For those species marked with an asterisk, the available information supported development of either two or four seasonal models; each model has an associated abundance prediction. Here, we report the maximum predicted abundance.

[4] Potential biological removal, defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population size (OSP). Annual mortality or serious injury (M/SI), found in NMFS' SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.,* commercial fisheries, subsistence hunting, ship strike). Annual M/SI values often cannot be determined precisely and is in some cases presented as a minimum value. All M/SI values are as presented in the draft 2019 Atlantic SARs.

[5] Abundance estimates are in some cases reported for a guild or group of species when those species are difficult to differentiate at sea. Similarly, the habitat-based cetacean density models produced by Roberts *et al.* (2016) are based in part on available observational data which, in some cases, is limited to genus or guild in terms of taxonomic definition. Roberts *et al.* (2016) produced density models to genus level for *Globicephala* spp. and produced a density model for bottlenose dolphins that does not differentiate between offshore and coastal stocks.

[6] Abundance source is Pace *et al.* (2021). PBR and annual M/SI source is draft 2020 SAR (Hayes *et al.* 2020). Because PBR is based on the minimum population estimate, we anticipate it will be slightly lower than what is presented here given the Pace *et al.* (2021) abundance; however, the 2020 SARs are not yet finalized. Regardless of final numbers, NMFS recognizes the NARW stock is critically endangered with a low PRB and high annual M/SI rate due primarily to ship strikes and entanglement.

[7] NMFS stock abundance estimate applies to U.S. population only, actual stock abundance is approximately 505,000.
[8] The stock abundance of harp seal is considered unknown in the draft 2020 SAR; however, the abundance reflected here is the most recent available.

A detailed description of the species for which take has been authorized, including brief introductions to the relevant stocks as well as available information regarding population trends and threats, and information regarding local occurrence, were provided in the **Federal Register** notice for the proposed IHA (84 FR 18346; April 30, 2019). Since that time, the status of some species and stocks have been updated, most notably for large whales. Table 2 includes the most recent population, PBR and annual mortality and serious injury (M/SI) rates for all species. We refer the reader to the proposed IHA **Federal Register** notice for basic descriptions on each species status and provide a summary of updates below where necessary. Please also refer to NMFS' website (*https://www.fisheries.noaa.gov/find-species*) for generalized species accounts.

As described in the proposed IHA notice, beginning in 2017, elevated mortalities in the NARW population have been documented, primarily in Canada but some in the U.S., and were collectively declared an Unusual Mortality Event (UME). As of May 2021, 34 NARWs have been confirmed dead and an additional 15 have been determined to be seriously injured. Entanglement and vessel strikes are the primary causes of M/SI. In addition, Pace et al. (2021) has identified a reduction in NARW abundance since the proposed IHA (451 to 368) and Oleson et al. (2020) have established the project area as year-round foraging habitat.

Since the proposed IHA, the annual rate of mortality and serious injury for humpback whales belonging to the Gulf of Maine stock increased from 12.5 to 58. This dramatic increase is a result of changing how the rate is modeled; 12.5 was observed M/SI while 58 represents a model approach considering the observed rate. The draft 2020 SAR applies a new hierarchical Bayesian, state-space model used to estimate mortality (Hayes et al., 2020). The estimated rate is based on the observed rate of serious injury and mortality and an estimated detection rate. The estimated annual rate of total mortality using this modeling approach is 57.6 animals for the period 2011–2015. The IHA does not authorize serious injury or mortality of humpback whales.

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, 2019) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.,* low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 decibel (dB) threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. Marine mammal hearing groups and their associated hearing ranges are provided in Table 3.

TABLE 3—MARINE MAMMAL HEARING GROUPS

[NMFS, 2018]

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

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

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (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. Fifteen marine mammal species (twelve cetacean and three pinniped (all phocid species)) have the reasonable potential to co-occur with the planned activities. Please refer to Table 2. Of the cetacean species that may be present, five are classified as low-frequency cetaceans (*i.e.,* all mysticete species), six are classified as mid-frequency cetaceans (*i.e.,* all delphinid species and the sperm whale), and one is classified as a high-frequency cetacean (*i.e.,* harbor porpoise).

Potential Effects of Specified Activities on Marine Mammals and Their Habitat

The effects of underwater noise from Vineyard Wind's construction activities have the potential to result in behavioral harassment of marine mammals in the vicinity of the project area. The notice of proposed IHA (84 FR 18346; April 30, 2019) included a discussion of the effects of anthropogenic noise on marine mammals and the potential effects of underwater noise from Vineyard Wind's construction activities on marine

mammals and their habitat. That information and analysis is incorporated by reference into this final IHA determination and is not repeated here; please refer to the notice of proposed IHA (84 FR 18346; April 30, 2019).

Estimated Take

This section provides an estimate of the number of incidental takes authorized through this IHA, which will inform both NMFS' consideration of ''small numbers'' and the negligible impact determination. As noted in the Summary of Changes from Proposed to Final, a small change was made for Level A harassment for fin whales and sperm whales.

Harassment is the only type of take expected to result from these activities. Except with respect to certain activities not pertinent here, section 3(18) of the MMPA defines ''harassment'' as any act of pursuit, torment, or annoyance, which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Authorized takes are primarily by Level B harassment, as noise from pile driving has the potential to result in disruption of behavioral patterns for individual marine mammals, either directly or as a result of masking or temporary hearing impairment (also referred to as temporary threshold shift (TTS), as described in the notice of proposed IHA (83 FR 18346, April 30, 2019)). There is also some potential for auditory injury (Level A harassment) to result for select marine mammals. Mitigation and monitoring measures are expected to minimize the severity of such taking to the extent practicable. No marine mammal mortality is anticipated or authorized for this activity. Below we describe how the take is estimated.

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

Acoustic Thresholds

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

Level B Harassment—Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source (*e.g.,* frequency, predictability, duty cycle), the environment (*e.g.,* bathymetry), and the receiving animals (hearing, motivation, experience, demography, behavioral context) and can be difficult to predict (Southall *et al.,* 2007, Ellison *et al.,* 2012). Based on what the available science indicates and the practical need to use a threshold based on a factor that is both predictable and measurable for most activities, NMFS uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. NMFS predicts that marine mammals are likely to be behaviorally harassed in a manner we consider Level B harassment when exposed to underwater anthropogenic noise above received levels of 160 dB re 1 μPa (rms) for impulsive and/or intermittent sources (*e.g.,* impact pile driving). Quantifying Level B harassment in this manner is also expected to capture any qualifying changes in behavioral patterns that may result from TTS.

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). The components of Vineyard Wind's planned activity that may result in the take of marine mammals include the use of impulsive sources.

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

TABLE 4—THRESHOLDS IDENTIFYING THE ONSET OF PERMANENT THRESHOLD SHIFT

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

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

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

Ensonified Area

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

As described above, Vineyard Wind requested NMFS evaluate project construction activity (specifically pile driving) involving installation of up to 100 WTGs and up to two ESPs in the WDA (*i.e.,* a maximum of 102 foundations). Two types of foundations may be used in the construction of the project and were therefore considered in the acoustic modeling study conducted to estimate the potential number of marine mammal exposures above relevant harassment thresholds: Monopile foundations varying in size with a maximum of 10.3 m (33.8 ft.) diameter piles and jacket-style foundations using three or four 3 m (9.8 ft.) diameter piles per foundation.

As described above, Vineyard Wind has incorporated more than one design scenario in their planning of the project. This approach, called the ''design envelope'' concept, allows for flexibility on the part of the developer, in recognition of the fact that offshore wind technology and installation techniques are constantly evolving and exact specifications of the project are not yet certain as of the publishing of this document. Variables that are not yet certain include the number, size, and configuration of WTGs and ESPs and their foundations, and the number of foundations that may be installed per day (though a maximum of two foundations would be installed per day).

In recognition of the need to ensure that the range of potential impacts to marine mammals from the various potential scenarios within the design envelope are accounted for, potential design scenarios were modeled separately in order to conservatively assess the impacts of each scenario. The two installation scenarios modeled are shown in Table 5 and consist of:

(1) The ''maximum design'' scenario consisting of 10010.3 m (33.8 ft.) WTG monopile foundations, 0 jacket foundations, and 2 jacket foundations for ESPs (*i.e.,* eight jacket pin piles); and

(2) The ''most likely design'' scenario consisting of 90 10.3 m (33.8 ft.) WTG monopile foundations, 10 WTG jacket foundations (*i.e.,* 40 total jacket pin piles), and 2 jacket foundations for ESPs (*i.e.,* eight jacket pin piles).

TABLE 5—POTENTIAL CONSTRUCTION DESIGN SCENARIOS MODELED

Design scenario	WTG monopiles (pile size: 10.3 m (33.8 ft))	WTG jacket foundations (pile size: 3 m (9.8 ft))	ESP jacket foundations [1] (pile size: 3 m (9.8 ft))	Total number of piles	Total number of installation locations
Most likely design scenario	90	10	2	138	102
Maximum design scenario [3]	100	0	2	108	102

[1] Each ESP jacket foundation consists of four pin piles each.
[2] To be conservative and in alignment with Vineyard Wind's request, we considered the maximum design scenario in the IHA; however, the amount of take for ESA-listed species will be contingent upon that authorized in the ITS.

Vineyard Wind's IHA application requested authorization to take marine mammals incidentally while driving 100 monopiles and 2 jacket foundations in the WDA, but other information suggests that Vineyard Wind may actually drive fewer monopiles, which would result in fewer impacts to marine mammals. In December 2020, Vineyard Wind announced it would likely reduce the total number of turbines to 62, and on May 5, 2021, BOEM signed a Record of Decision authorizing the construction of no more than 84 turbines (in addition to the foundations required to construct the two ESPs (for a total of 92 individual piles)). As Vineyard Wind has not amended its original proposal of 102 foundations in its IHA application and because evaluating the impacts from driving those foundations allows for the conservative assessment of the relevant statutory criteria, NMFS finds it appropriate to evaluate the impact of 102 foundations in this IHA.

Vineyard Wind may install either one or two monopiles per day, both the ''maximum design'' and ''most likely design'' scenarios were modeled assuming the installation of one foundation per day and two foundations per day distributed across the same calendar period. No more than one jacket would be installed per day thus one jacket foundation per day (four piles) was assumed for both scenarios. No concurrent pile driving (*i.e.,* driving of more than one pile at a time) would occur and therefore concurrent driving was not modeled. The pile driving schedules for modeling were created based on the number of expected suitable weather days available per month (based on weather criteria determined by Vineyard Wind) in which pile driving may occur to better understand when the majority of pile driving is likely to occur throughout the year. The number of suitable weather days per month was obtained from historical weather data. The modeled pile-driving schedule for the Maximum Design scenario is shown in Table 2 of the IHA application.

Monopile foundation would have maximum diameters ranging from ~8 m (26.2 ft) up to ~10.3 m (33.8 ft) and an expected median diameter of ~9 m (29.5 ft). The 10.3-m (33.8 ft) monopile foundation is the largest potential pile diameter that may be used for the project and was therefore used in acoustic modeling to be conservative. Jacket foundations each require the installation of three to four piles, known as jacket pin piles, of ~3 m (9.8 ft) diameter. All modeling assumed 10.3-m piles would be used for monopiles and 3 m piles would be used for jacket foundations (other specifications associated with monopiles and jacket pin piles are shown in Figures 2 and 3 in the IHA application).

Representative hammering schedules of increasing hammer energy with increasing penetration depth were modeled, resulting in, generally, higher intensity sound fields as the hammer energy and penetration increases. For both monopile and jacket structure models, the piles were assumed to be vertical and driven to a penetration depth of 30 m and 45 m, respectively. While pile penetrations across the site would vary, these values were chosen as reasonable penetration depths. The estimated number of strikes required to drive piles to completion were obtained from drivability studies provided by Vineyard Wind. All acoustic modeling was performed assuming that only one pile is driven at a time.

Additional modeling assumptions for the monopiles were as follows:

- 1,030 cm steel cylindrical piling with wall thickness of 10 cm.
- Impact pile driver: IHC S–4000 (4000 kilojoules (kJ) rated energy; 1977 kips (kN) ram weight).

• Helmet weight: 3234 kN.

Additional modeling assumptions for the jacket pile are as follows:

• 300 cm steel cylindrical pilings with wall thickness of 5 cm.

• Impact pile driver: IHC S–2500 (2500 kJ rated energy; 1227 kN ram weight).

• Helmet weight: 2401 kN.

• Up to four jacket pin piles installed per day.

Sound fields produced during 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).

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 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 geoacoustic 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. This component incorporates bathymetry and underwater sound speed as a function of depth with a simplified representation of the sea bottom, as subbottom layers have a negligible influence on the propagation of acoustic waves with frequencies above 1 kHz. MONM–BELLHOP accounts for horizontal directivity of the source and vertical variation of the source beam pattern. 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).

The sound field radiating from the pile was simulated using a vertical array of point sources. Because sound itself is an oscillation (vibration) of water particles, acoustic modeling of sound in the water column is inherently an evaluation of vibration. For this study, synthetic pressure waveforms were computed using FWRAM, which is JASCO's acoustic propagation model capable of producing time-domain waveforms.

Models are more efficient at estimating SEL than rms SPL. Therefore, conversions may be necessary to derive the corresponding rms SPL. Propagation was modeled for a subset of sites using a full-wave RAM PE model (FWRAM), from which broadband SEL to SPL conversion factors were calculated. The FWRAM required intensive calculation for each site, thus a representative subset of modeling sites were used to develop azimuth-, range-, and depth-dependent conversion factors. These conversion factors were used to calculate the broadband rms SPL from the broadband SEL prediction.

Two locations within the WDA were selected to provide representative propagation and sound fields for the project area (see Table 6). The two locations were selected to span the region from shallow to deep water and varying distances to dominant bathymetric features (*i.e.,* slope and shelf break). Water depth and environmental characteristics (*e.g.,* bottom-type) are similar throughout the WDA (Vineyard Wind, 2018), and therefore minimal difference was found in sound propagation results for the two sites (see Appendix A of the IHA application for further detail).

TABLE 6—LOCATIONS USED IN PROPAGATION MODELING

Site	Location (UTM Zone 19N)		Water depth (m)	Sound sources modeled
	Easting	Northing		
P1	382452	4548026	38	Monopile, Jacket pile.
P2	365240	4542200	46	Monopile, Jacket pile.

Estimated pile driving schedules were used to calculate the SEL sound fields at different points in time during pile driving. The pile driving schedule for monopiles is shown in Tables A–3 and A–4 in the IHA application. For each hammer energy level, the pile penetration is expected to be 20 percent of the total depth.

The sound propagation modeling incorporated site-specific environmental data that describes the bathymetry, sound speed in the water column, and seabed geoacoustics in the construction area. Sound level estimates are calculated from three-dimensional sound fields and then collapsed over depth to find the ranges to predetermined threshold levels (see the IHA application; Appendix A.3.2). Contour maps (see the IHA application; Appendix A.14) show the planar distribution of the limits of the areas affected by levels that are higher than the specific sound level thresholds.

The modeled source spectra are provided in Figures 11 and 12 of the IHA application. For both pile diameters, the dominant energy is below 100 Hz. The source spectra of the 10.3 m (33.8 ft) pile installation contain more energy at lower frequencies than for the smaller 3 m (9.8 ft) piles. Please see Appendix A of the IHA application for further details on the modeling methodology.

Noise attenuation systems, such as bubble curtains, are used to decrease the sound levels radiated from an underwater 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, Denes, MacDonnell, & Warner, 2016; Koschinski & 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 & Lüdemann, 2013; Nehls, Rose, Diederichs, Bellmann, & Pehlke, 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. A California Department of Transportation (CalTrans) study tested several systems and found that the best attenuation systems resulted in 10–15 dB of attenuation (Buehler *et al.,* 2015). Similarly, Dähne et al. (2017) found that single bubble curtains reduced sound levels by 7 to 10 dB and reduced the overall sound level by ~12 dB when combined as a double bubble curtain for 6 m steel monopiles in the North Sea. In August 2018, Norther NV started the construction of an offshore wind farm at about 13 NM from Zeebrugge. The diameter of the 45 monopiles installed for that project ranged from 7.2 to 7.8 m. The pile driving was done using a 3500 kJ hydraulic hammer. Monitoring results demonstrated the big bubble curtain achieved 6–7 dB of reduction and, in combination with an additional sound attenuation device, a 10–12 dB reduction was achieved (Degraer et al., 2019). In modeling the sound fields for the planned project, hypothetical broadband attenuation levels of 6 dB and 12 dB were modeled to gauge the effects on the ranges to thresholds given these levels of attenuation.

The acoustic thresholds for impulsive sounds (such as pile driving) contained in the Technical Guidance (NMFS, 2018) are presented as dual metric acoustic thresholds using both SEL_{cum} and peak sound pressure level metrics. As dual metrics, NMFS considers onset of PTS (Level A harassment) to have occurred when either one of the two metrics is exceeded (*i.e.,* metric resulting in the largest isopleth). The SEL_{cum} metric considers both level and duration of exposure, as well as auditory weighting functions by marine mammal hearing group.

Table 7 shows the modeled radial distances to the dual Level A harassment thresholds using NMFS (2018) frequency weighting for marine mammals, with 0 dB, 6 dB, and 12 dB sound attenuation incorporated. For the peak level, the greatest distances expected are shown, typically occurring at the highest hammer energies. The distances to SEL thresholds were calculated using the hammer energy schedules for driving one monopile or four jacket pin piles, as shown. The radial distances shown in Table 7 are the maximum distances from the piles, averaged between the two modeled locations.

TABLE 7—RADIAL DISTANCES (m) TO LEVEL A HARASSMENT THRESHOLDS FOR EACH FOUNDATION TYPE WITH 0, 6, AND 12 dB SOUND ATTENUATION INCORPORATED

Foundation type	Hearing group	Level A harassment (peak)			Level A harassment (SEL)		
		No attenuation	6 dB attenuation	12 dB attenuation	No attenuation	6 dB attenuation	12 dB attenuation
10.3 m (33.8 ft) monopile	LFC	34	17	8.5	5,443	3,191	1,599
	MFC	10	5	2.5	56	43	0
	HFC	235	119	49	101	71	71
	PPW	38	19	10	450	153	71
Four, 3 m (9.8 ft) jacket pin piles.	LFC	7.5	4	2.5	12,975	7,253	3,796
	MFC	2.5	1	0.5	71	71	56
	HFC	51	26	13.5	1,389	564	121
	PPW	9	5	2.5	2,423	977	269

Note:* Radial distances were modeled at two different representative modeling locations as described above. Distances shown represent the average of the two modeled locations.

Table 8 shows the modeled radial distances to the Level B harassment threshold with no attenuation, 6 dB and 12 dB sound attenuation incorporated. Acoustic propagation was modeled at two representative sites in the WDA as described above. The radial distances shown in Table 8 are the maximum distance to the Level B harassment threshold from the piles, averaged between the two modeled locations, using the maximum hammer energy.

TABLE 8—RADIAL DISTANCES (m) TO THE LEVEL B HARASSMENT THRESHOLD

Foundation type	No attenuation	6 dB attenuation	12 dB attenuation
10.3 m (33.8 ft) monopile	6,316	4,121	2,739
Four, 3 m (9.8 ft) jacket pin piles	4,104	3,220	2,177

Please see Appendix A of the IHA application for further detail on the acoustic modeling methodology.

Marine Mammal Occurrence

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

We note that NARW density estimates used to inform take estimates have been updated since the proposed IHA was published to include more recent surveys (Roberts et al., 2020).

The best available information regarding marine mammal densities in the project area is provided by habitat-based density models produced by the Duke University Marine Geospatial Ecology Laboratory (Roberts *et al.,* 2016, 2017, 2018, 2020). Density models were originally developed for all cetacean taxa in the U.S. Atlantic (Roberts et al., 2016); more information, including the model results and supplementary information for each model, is available at *seamap.env.duke.edu/models/Duke-EC-GOM-2015/.* In subsequent years, certain models have been updated on the basis of additional data as well as certain methodological improvements. Our evaluation of the changes leads to a conclusion that these represent the best scientific evidence available. Marine mammal density estimates in the WDA (animals/km^2) were obtained using these model results (Roberts *et al.,* 2016, 2017, 2018, 2020). As noted, the updated models incorporate additional sighting data, including sightings from the NOAA Atlantic Marine Assessment Program for Protected Species (AMAPPS) surveys, which included some aerial surveys over the RI/MA & MA WEAs (NEFSC & SEFSC, 2011b, 2012, 2014a, 2014b, 2015, 2016), and the 2020 update to the NARW density model (Roberts *et al.,* 2020) that for the first time includes data from the 2011–2015 surveys of the MA and RI/MA WEAs (Kraus et al. 2016) as well as the 2017–2018 continuation of those surveys, known as the Marine Mammal Surveys of the Wind Energy Areas (MMS–WEA) (Quintana et al., 2018).

Mean monthly densities for all animals were calculated using a 13 km (8 mi) buffered polygon around the WDA perimeter and overlaying it on the density maps from Roberts et al. (2016, 2017, 2018, 2020). Please see Figure 13 in the IHA application for an example of a density map showing Roberts et al. (2016, 2017, 2018, 2020) density grid cells with a 13 km buffer overlaid on a map of the WDA. The 13 km (8 mi) buffer is conservative as it encompasses and extends beyond the estimated distances to the isopleth corresponding to the Level B harassment (with no attenuation, as well as with 6 dB and 12 dB sound attenuation) for all hearing groups using the unweighted threshold of 160 dB re 1 μPa (rms) (Table 8). The 13 km buffer incorporates the maximum area around the WDA with the potential to result in behavioral disturbance for the 10.3 m (33.8 ft) monopile installation using (Wood, Southall, & Tollit, 2012) threshold criteria.

The mean density for each month was determined by calculating the unweighted mean of all 10 × 10 km (6.2 × 6.2 mi) grid cells partially or fully within the buffer zone polygon. Densities were computed for the months of May to December to coincide with planned pile driving activities (as described above, no pile driving would occur from January through April). In cases where monthly densities were unavailable, annual mean densities (*e.g.,* pilot whales) and seasonal mean densities (*e.g.,* all seals) were used instead. Table 9 shows the monthly marine mammal density estimates for each species incorporated in the exposure modeling analysis.

TABLE 9—MONTHLY MARINE MAMMAL DENSITY ESTIMATES FOR EACH SPECIES INCORPORATED IN EXPOSURE MODELING ANALYSIS

Species	Monthly densities (animals/100 km^2) [1]												Annual	May to Dec
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean	Mean
Fin whale	0.151	0.115	0.122	0.234	0.268	0.276	0.26	0.248	0.197	0.121	0.12	0.131	0.187	0.203
Humpback whale	0.033	0.018	0.034	0.204	0.138	0.139	0.199	0.109	0.333	0.237	0.078	0.049	0.131	0.16
Minke whale	0.052	0.064	0.063	0.136	0.191	0.171	0.064	0.051	0.048	0.045	0.026	0.037	0.079	0.079
North Atlantic right whale [2]	0.510	0.646	0.666	0.599	0.204	0.016	0.002	0.001	0.002	0.007	0.053	0.274	0.248	0.070
Sei whale	0.001	0.002	0.001	0.033	0.029	0.012	0.003	0.002	0.003	0.001	0.002	0.001	0.007	0.007
Atlantic white sided dolphin	1.935	0.972	1.077	2.088	4.059	3.742	2.801	1.892	1.558	1.95	2.208	3.281	2.297	2.686
Bottlenose dolphin	0.382	0.011	0.007	0.497	0.726	2.199	5.072	3.603	4.417	4.46	2.136	1.216	2.061	2.979
Pilot whales	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555
Risso's dolphin	0.006	0.003	0.001	0.001	0.005	0.005	0.01	0.02	0.016	0.006	0.013	0.018	0.009	0.012
Short beaked dolphin	7.734	1.26	0.591	1.613	3.093	3.153	3.569	6.958	12.2	12.727	9.321	16.831	6.588	8.482
Sperm whale *	0.001	0.001	0.001	0.001	0.003	0.006	0.029	0.033	0.012	0.012	0.008	0.001	0.009	0.013
Harbor porpoise	3.939	6.025	12.302	6.959	3.904	1.332	0.91	0.784	0.717	0.968	2.609	2.686	3.595	1.739
Gray seal [3]	6.844	8.291	8.621	15.17	19.123	3.072	0.645	0.372	0.482	0.687	0.778	3.506	5.633	3.583
Harbor seal [3]	6.844	8.291	8.621	15.17	19.123	3.072	0.645	0.372	0.482	0.687	0.778	3.506	5.633	3.583
Harp seal [3]	6.844	8.291	8.621	15.17	19.123	3.072	0.645	0.372	0.482	0.687	0.778	3.506	5.633	3.583

[1] Density estimates from habitat-based density modeling of the entire Atlantic EEZ from Roberts et al. (2016, 2017, 2018, 2020).
[2] NARW density estimates have been updated from the Notice of Proposed IHA based on data from 2010 through 2018 (Roberts et al, 2020).
[3] All seal species are grouped together in the density models presented by Roberts et al. (2018).

JASCO's Animal Simulation Model Including Noise Exposure (JASMINE) animal movement model was used to predict the probability of marine mammal exposure to project-related sound. Sound exposure models like JASMINE use simulated animals (also known as ''animats'') to forecast behaviors of animals in new situations and locations based on previously documented behaviors of those animals. 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 animals (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 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 density of animals (Table 9) results in the mean number of animals expected to be exposed over the duration of the project. Due to the probabilistic nature of the process, fractions of animals may be predicted to exceed threshold. If, for example, 0.1 animals are predicted to

exceed threshold in the model, that is interpreted as a 10 percent chance that one animal will exceed a relevant threshold during the project, or equivalently, if the simulation were re-run ten times, one of the ten simulations would result in an animal exceeding the threshold. Similarly, a mean number prediction of 33.11 animals can be interpreted as re-running the simulation where the number of animals exceeding the threshold may differ in each simulation but the mean number of animals over all of the simulations is 33.11. A portion of an animal cannot be taken during a project, so it is common practice to round mean number animal 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.

Sound fields 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 15 marine mammal species expected to occur in the project area during the planned activity. 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); when literature on these behaviors was not available for a particular species, it was extrapolated from a similar species for which behaviors would be expected to be similar to the species of interest. See Appendix B of the IHA application for a description of the species that were used as proxies when data on a particular species was not available. The parameters used in JASMINE describe animal movement in both the vertical and horizontal planes. The parameters relating to travel in these two planes are briefly described below:

Travel sub-models:

• Direction—determines an animat's choice of direction in the horizontal plane. Sub-models are available for determining the heading of animats, allowing for movement to range from strongly biased to undirected. A random walk model can be used for behaviors with no directional preference, such as feeding and playing. A directional bias can also be incorporated in the random walk for use in situations where animals have a preferred absolute direction, such as migration.

• Travel rate—defines an animat's rate of travel in the horizontal plane. When combined with vertical speed and dive depth, the dive profile of the animat is produced.

Dive sub-models:

• Ascent rate—defines an animat's rate of travel in the vertical plane during the ascent portion of a dive.

• Descent rate—defines an animat's rate of travel in the vertical plane during the descent portion of a dive.

• Depth—defines an animat's maximum dive depth.

• Bottom following—determines whether an animat returns to the surface once reaching the ocean floor, or whether it follows the contours of the bathymetry.

• Reversals—determines whether multiple vertical excursions occur once an animat reaches the maximum dive depth. This behavior is used to emulate the foraging behavior of some marine mammal species at depth. Reversal-specific ascent and descent rates may be specified.

• Surface interval–determines the duration an animat spends at, or near, the surface before diving again.

An individual animat's received sound exposure levels are summed over a specified duration, such as 24 hours, to determine its total received energy, and then compared to the threshold criteria described above. As JASMINE modeling includes the movement of animats both within as well as in and out of the modeled ensonified area, some animats enter and depart the modeled ensonified area within a modeled 24 hour period; however, it is important to note that the model accounts for the acoustic energy that an animat accumulates even if that animat departs the ensonified area prior to the full 24 hours (*i.e.,* even if the animat departs prior to a full 24 hour modeled period, if that animat accumulated enough acoustic energy to be taken, it is accounted for in the take estimate). Also note that animal aversion was not incorporated into the Jasmine model runs that were the basis for the take estimate for any species. See Figure 14 in the IHA application for a depiction of animats in an environment with a moving sound field. See Appendix B of the IHA application for more details on the JASMINE modeling methodology, including the literature sources used for the parameters that were input in JASMINE to describe animal movement for each species that is expected to occur in the project area.

Take Calculation and Estimation

Here we describe how the information provided above is brought together to produce a quantitative take estimate. We note the only change from proposed to final IHA was the removal of two Level A takes for sperm whales. The following steps were performed to estimate the potential numbers of marine mammal exposures above Level A and Level B harassment thresholds as a result of the planned activity:

(1) The characteristics of the sound output from the planned pile-driving activities were modeled using the GRLWEAP (wave equation analysis of pile driving) model and JASCO's PDSM;

(2) Acoustic propagation modeling was performed using JASCO's MONM and FWRAM that combined the outputs of the source model with the spatial and temporal environmental context (*e.g.,* location, oceanographic conditions, seabed type) to estimate sound fields;

(3) Animal movement modeling integrated the estimated sound fields with species-typical behavioral parameters in the JASMINE model to estimate received sound levels for the animals that may occur in the operational area; and

(4) The number of potential exposures above Level A and Level B harassment thresholds was calculated for each potential scenario within the project design envelope.

As described above, two project design scenarios were modeled: The ''maximum design'' consisting of 100 10.3-m (33.8 ft) WTG monopile foundationsand two jacket foundations for ESPs, and the ''most likely design'' consisting of 90 10.3-m (33.8 ft) WTG monopile foundations, 10 WTG jacket foundations, and two ESP jacket foundations (Table 5). Both of these design scenarios were also modeled with either one or two monopile foundations installed per day. All scenarios were modeled with both 6 dB sound attenuation and 12 dB sound attenuation incorporated. Results of marine mammal exposure modeling of these scenarios is shown in Tables 10–13. Note that while fractions of an animal cannot be taken, these tables are meant simply to show the modeled exposure numbers, versus the actual take estimate. Authorized take numbers are shown below in Table 15.

TABLE 10—MEAN NUMBERS OF MARINE MAMMALS ESTIMATED TO BE EXPOSED ABOVE LEVEL A AND LEVEL B HARASSMENT THRESHOLDS USING THE MAXIMUM DESIGN SCENARIO AND ONE FOUNDATION INSTALLED PER DAY

Species	0 dB attenuation			6 dB attenuation			12 dB attenuation		
	Level A (SEL)	Level A (peak)	Level B	Level A (SEL)	Level A (peak)	Level B	Level A (SEL)	Level A (peak)	Level B
Fin Whale	0.25	16.78	49.76	0.1	4.13	33.11	0.02	0.29	21.78
Humpback Whale	0.12	27.25	45.33	0.03	9.01	30.1	0.01	1	19.66
Minke Whale	0.12	2.72	17.74	0.04	0.22	12.21	0	0.07	7.9
North Atlantic Right Whale*	0.04	2.99	9.03	0.02	0.63	5.97	0	0.04	3.94
Sei Whale	0.01	0.57	1.63	0	0.14	1.09	0	0.01	0.74
Atlantic White-Sided Dolphin	0	0	706.25	0	0	449.2	0	0	277.82
Bottlenose Dolphin	0.33	0	159.14	0	0	96.21	0	0	62.21
Pilot Whales	0	0	0	0	0	0	0	0	0
Risso's Dolphin	0.01	0	2.48	0	0	1.61	0	0	1.04
Common Dolphin	1.58	0	1603.82	0.1	0	1059.97	0.1	0	703.81
Sperm Whale	0	0	0	0	0	0	0	0	0
Harbor Porpoise	8.85	0.27	236.74	4.23	0.17	150.13	1.54	0	91.96
Gray Seal	0.61	0.6	314.75	0.11	0.3	196.4	0.04	0.07	118.06
Harbor Seal	0.82	0.81	340.11	0.36	0.21	214.04	0.33	0.07	136.33
Harp Seal	1.53	2.08	349.08	0.73	0.87	217.35	0	0.04	132.91

Note: * NARW exposure estimates have been revised from the Notice of Proposed IHA based on updated density estimates for the species in the project area (Roberts et al., 2020).

TABLE 11—MEAN NUMBERS OF MARINE MAMMALS ESTIMATED TO BE EXPOSED ABOVE LEVEL A HARASSMENT AND LEVEL B HARASSMENT THRESHOLDS USING THE MAXIMUM DESIGN SCENARIO AND TWO FOUNDATIONS INSTALLED PER DAY

Species	0 dB attenuation			6 dB attenuation			12 dB attenuation		
	Level A (SEL)	Level A (peak)	Level B	Level A (SEL)	Level A (peak)	Level B	Level A (SEL)	Level A (peak)	Level B
Fin Whale	0.29	18.09	41.57	0.1	4.49	29.71	0	0.41	20.57
Humpback Whale	0.15	27.65	38.91	0.03	9.59	27.23	0	1.09	18.48
Minke Whale	0.09	2.87	16.05	0.03	0.23	11.52	0	0.05	7.76
North Atlantic Right Whale*	0.03	3.02	7.42	0.01	1.39	5.32	0	0.05	3.6
Sei Whale	0.01	0.57	1.32	0	0.14	0.93	0	0.01	0.65
Atlantic White-Sided Dolphin	0.25	0	632.3	0.13	0	428.23	0	0	272.67
Bottlenose Dolphin	0.17	0	103.3	0	0	67.71	0	0	43.87
Pilot Whales	0	0	0	0	0	0	0	0	0
Risso's Dolphin	0	0	1.95	0	0	1.38	0	0	0.95
Common Dolphin	0.89	0	1260.46	0.44	0	897.91	0.1	0	622.78
Sperm Whale	0	0	0	0	0	0	0	0	0
Harbor Porpoise	8.24	0.33	183.1	4.23	0.17	125.23	1.85	0.06	82.28
Gray Seal	1.32	1.12	209.52	0.29	0.47	145.2	0.04	0.25	96.41
Harbor Seal	2.45	1.62	235.29	1.01	0.86	164.48	0.16	0.39	110.25
Harp Seal	1.36	2.6	238.09	0.38	0.53	162.03	0.17	0.04	108.19

Note: * NARW exposure estimates have been revised from the Notice of Proposed IHA based on updated density estimates for the species in the project area (Roberts et al., 2020).

TABLE 12—MEAN NUMBERS OF MARINE MAMMALS ESTIMATED TO BE EXPOSED ABOVE LEVEL A AND LEVEL B HARASSMENT THRESHOLDS USING THE MOST LIKELY SCENARIO AND ONE FOUNDATION INSTALLED PER DAY

Species	0 dB attenuation			6 dB attenuation			12 dB attenuation		
	Level A (SEL)	Level A (peak)	Level B	Level A (SEL)	Level A harassment (peak)	Level B harassment	Level A (SEL)	Level A harassment (peak)	Level B harassment
Fin Whale	0.26	11.86	46.71	0.11	2.84	29.85	0.02	0.23	19.43
Humpback Whale	0.13	20.26	41.32	0.04	6.54	26.27	0.01	0.83	17.08
Minke Whale	0.12	1.7	15.41	0.04	0.13	10.28	0	0.06	6.77
North Atlantic Right Whale*	0.03	1.59	7.38	0.02	0.31	4.6	0	0.02	3.01
Sei Whale	0.01	0.4	1.48	0	0.09	0.95	0	0.01	0.65
Atlantic White-Sided Dolphin	0	0	630.06	0	0	380.82	0	0	236.77
Bottlenose Dolphin	0.37	0	165	0	0	98.56	0	0	64.19
Pilot Whales	0	0	0	0	0	0	0	0	0
Risso's Dolphin	0.01	0	2.37	0	0	1.48	0	0	0.94
Common Dolphin	1.55	0	1480.84	0.01	0	941.41	0.01	0	617.01
Sperm Whale	0	0	0	0	0	0	0	0	0
Harbor Porpoise	8.12	0.15	221.91	3.86	0.14	134.88	1.38	0	80.89
Gray Seal	0.37	0.02	292.13	0	0.01	176.92	0	0	104.6
Harbor Seal	0.68	0.35	312.37	0.34	0.01	191.06	0.34	0	120.64
Harp Seal	1.43	0.76	320.84	0.72	0.72	193.65	0	0	116.13

Note: * NARW exposure estimates have been revised from the Notice of Proposed IHA based on updated density estimates for the species in the project area (Roberts et al., 2020).

TABLE 13—MEAN NUMBERS OF MARINE MAMMALS ESTIMATED TO BE EXPOSED ABOVE LEVEL A AND LEVEL B HARASSMENT THRESHOLDS USING THE MOST LIKELY SCENARIO AND TWO FOUNDATIONS INSTALLED PER DAY

Species	0 dB attenuation			6 dB attenuation			12 dB attenuation		
	Level A harassment (SEL)	Level A harassment (peak)	Level B harassment	Level A harassment (SEL)	Level A harassment (peak)	Level B harassment	Level A harassment (SEL)	Level A harassment (peak)	Level B harassment
Fin Whale	0.3	13.31	37.62	0.11	3.24	26.07	0	0.36	18.08
Humpback Whale	0.16	20.71	34.21	0.04	7.18	23.09	0	0.93	15.77
Minke Whale	0.09	1.86	13.57	0.03	0.15	9.53	0	0.04	6.62
North Atlantic Right Whale*	0.03	1.63	5.7	0.01	0.32	3.91	0	0.03	2.66
Sei Whale	0.01	0.4	1.15	0	0.09	0.78	0	0.01	0.55
Atlantic White-Sided Dolphin	0.28	0	548.53	0.14	0	357.71	0	0	231.09
Bottlenose Dolphin	0.19	0	102.67	0	0	66.75	0	0	43.72
Pilot Whales	0	0	0	0	0	0	0	0	0
Risso's Dolphin	0	0	1.78	0	0	1.22	0	0	0.84
Common Dolphin	0.79	0	1099.62	0.39	0	761.48	0.01	0	527.04
Sperm whale	0	0	0	0	0	0	0	0	0
Harbor Porpoise	7.44	0.22	163.17	3.86	0.14	107.61	1.72	0.07	70.29
Gray Seal	1.1	0.56	183.32	0.19	0.19	123.97	0	0.18	82.23
Harbor Seal	2.37	1.19	203.98	1.01	0.68	139.82	0.17	0.34	93.67
Harp Seal	1.26	1.29	206.08	0.36	0.36	136.45	0.18	0	90.56

Note: *NARW exposure estimates have been revised from the Notice of Proposed IHA based on updated density estimates for the species in the project area (Roberts et al., 2020).

As shown in Tables 10–13, the greatest potential number of marine mammal exposures above the Level B harassment threshold occurs under the Maximum Design scenario with one monopile foundation installed per day (Table 10) while the greatest potential number of marine mammal exposures above the Level A harassment thresholds occurs under the Maximum Design scenario with two monopile foundations installed per day (Table 11). With the inclusion of more jacket foundations, which would require more piles and more overall pile driving, marine mammal exposure estimates for the Maximum Design scenario (Tables 10 and 11) are higher than under the Most Likely scenario (Tables 12 and 13). In all scenarios, the maximum number of jacket foundations modeled per day was one (four jacket pin piles). Modeling indicates that whether one monopile foundation is installed per day or two makes little difference with respect to estimated Level A harassment exposures; total exposures above the Level A harassment threshold differed by less than one exposure over the duration of the project, for each species. For exposures above the Level B harassment threshold, exposure estimates for one monopile foundation per day are somewhat higher than for two monopile foundations per day. With two monopile foundations per day, there are half as many days of pile driving so there is likewise a reduced number of overall predicted Level B harassment exposures over the duration of the project.

Exposure modeling indicated that no Level A harassment takes are expected for several species (*i.e.,* minke whale, sei whale, and all small cetaceans and pinnipeds). However, Vineyard Wind requested Level A harassment takes for most species as a precautionary measure, based on the fact that shutdown of pile driving may not be technically feasible once pile driving has begun, thus if a marine mammal were to enter the Level A harassment zone after pile driving has commenced Vineyard Wind may not be able to avoid that animal(s) being taken by Level A harassment. Vineyard Wind requested Level A harassment takes for these species based on mean group size for each respective species, assuming that if one group member were to be exposed, it is likely that all animals in the same group would receive a similar exposure level, especially in a scenario with a larger area ensonified above the Level A harassment threshold. Thus, for the species for which exposure modeling indicated less than the number of individuals in a mean group size would be taken (by either Level A or Level B harassment), Vineyard Wind increased the value from the exposure modeling results to equal one mean group size, rounded up to the nearest integer, for species with predicted exposures of less than one mean group size (with the exception of NARWs, as described below). Mean group sizes for species were derived from Kraus et al. (2016), where available, as the best representation of expected group sizes within the RI/MA & MA WEAs. These were calculated as the number of individuals sighted, divided by the number of sightings summed over the four seasons (see Tables 5 and 19 in Kraus et al., 2016). Sightings for which species identification was considered either definite or probable were used in the Kraus et al. (2016) data. For species that were observed very rarely during the Kraus et al. (2016) study (*i.e.,* sperm whales and Risso's dolphins) or observed but not analyzed (*i.e.,* pinnipeds), data derived from AMAPPS surveys (Palka et al., 2017) were used to evaluate mean group size. For sperm whales and Risso's dolphins, the number of individuals divided by the number of groups observed during 2010–2013 AMAPPS NE summer shipboard surveys and NE aerial surveys during all seasons was used (Appendix I of Palka et al., 2017). Though pinnipeds congregate in large numbers on land, at sea they are generally foraging alone or in small groups. For harbor and gray seals, Palka et al. (2017) report sightings of seals at sea during 2010–2013 spring, summer, and fall NE AMAPPS aerial surveys. Those sightings include both harbor seals and gray seals, as well as unknown seals, and thus a single group size estimate was calculated for these two species. Harp seals are occasionally recorded south of the RI/MA & MA WEAs on Long Island, New York, and in the nearshore waters, usually in groups of one or two individuals. During 2002–2018, the Coastal Research and Education Society of Long Island (CRESLI) reported seven sightings of harp seals (CRESLI, 2018). Five of these were of single individuals and two were of two animals. Calculated group sizes for all species are shown in Table 14.

TABLE 14—MEAN GROUP SIZES OF MARINE MAMMAL SPECIES IN THE PROJECT AREA

Species	Mean group size
Fin Whale	1.8
Humpback Whale	2
Minke Whale	1.2
North Atlantic Right Whale	2.4
Sei Whale	1.6
Atlantic White-Sided Dolphin	27.9
Common Bottlenose Dolphin	7.8
Pilot whale	8.4
Risso's Dolphin	5.3
Short-Beaked Common Dolphin	34.9
Sperm Whale	1.5
Harbor Porpoise	2.7
Gray Seal	1.4
Harbor Seal	1.4
Harp Seal	1.3

Vineyard Wind requested Level B take numbers for some species that differ from the numbers modeled and were instead based on monitoring data from site characterization surveys conducted at the same location. Vineyard Wind reviewed monitoring data recorded during site characterization surveys in the WDA from 2016–2018 and calculated a daily sighting rate (individuals per day) for each species in each year, then multiplied the maximum sighting rate from the three years by the number of pile driving days under the Maximum Design scenario (*i.e.,* 102 days). This method assumes that the largest average group size for each species observed during the three years of surveys may be present during piling on each day. Vineyard Wind used this method for all species that were documented by protected species observers (PSOs) during the 2016–2018 surveys. For sei whales, this approach resulted in the same number of estimated Level B harassment takes as Level A harassment takes (two), so to be conservative Vineyard Wind doubled the Level A harassment value to arrive at their requested number of Level B harassment takes. Risso's dolphins and harp seals were not documented by PSOs during those surveys, so Vineyard Wind requested take based on two average group sizes for those species. The Level B harassment take calculation methodology described here resulted in higher take numbers than those modeled (Table 10) for 10 out of 15 species expected to be taken.

We have authorized take numbers that are slightly different than the numbers requested by Vineyard Wind for some species. Vineyard Wind's requested take numbers for Level A harassment authorization are based on an expectation that 12 dB sound attenuation will be effective during the planned activity. NMFS reviewed the CalTrans bubble curtain ''on and off'' studies conducted in San Francisco Bay in 2003 and 2004. Based on 74 measurements (37 with the bubble curtain on and 37 with the bubble curtain off) at both near (<100 m) and far (>100 m) distances, the linear averaged received level reduction is 6 dB (CalTrans, 2015). Nehls et al. (2016) reported that attenuation from use of a bubble curtain during pile driving at the Borkum West II offshore wind farm in the North Sea was between 10 dB and 17 dB (mean 14 dB) (peak).

Based on the best available information, we believe it reasonable to assume some level of effective attenuation due to implementation of noise attenuation during impact pile driving. Vineyard Wind did not provide information regarding the attenuation system that will ultimately be used during the planned activity (*e.g.,* what size bubbles and in what configuration a bubble curtain would be used, whether a double curtain will be employed, whether hydro-sound dampers, noise abatement system, or some other alternate attenuation device will be used, etc.) to support their conclusion that 12 dB effective attenuation can be expected. In the absence of this information regarding the attenuation system that will be used, and in consideration of the available information on attenuation that has been achieved during impact pile driving, we conservatively assume that 6 dB of sound attenuation will be achieved. We further recognize that the pile size and hammer strength ultimately chosen by Vineyard Wind may be less than that considered under the maximum design scenario. Regardless, in absence of *in situ* data, NMFS conservatively assumes the sound field generated from pile driving will resemble that of the model assuming 6dB of attenuation and the amount of take we have authorized reflects that assumption.

In some cases Vineyard Wind's site characterization survey monitoring efforts revealed species presence at lower values than the Level B harassment exposure numbers modeled (assuming 6 dB of attenuation) based on marine mammal densities reported by Roberts et al. (2016, 2017, 2018, 2020) (Table 10). While we agree that Vineyard Wind's use of visual observation data as the basis for Level B harassment take requests is generally sound, we believe that, to be conservative, the higher of the two calculated take numbers (*i.e.,* take numbers based on available visual observation data, or, based on modeled exposures above threshold) should be used to estimate Level B exposures. Therefore, for species for which the Level B harassment exposure numbers modeled based on marine mammal densities reported by Roberts et al. (2016, 2017, 2018, 2020) with 6 dB sound attenuation applied (Table 10) were higher than the take numbers based on visual observation data (*i.e.,* fin whale, bottlenose dolphin, harbor porpoise, harbor seal and harp seal) we authorize take numbers based on those modeled using densities derived from Roberts et al. (2016, 2017, 2018, 2020) with 6 dB sound attenuation applied.

As noted above, there were zero takes of sperm whales modeled under all modeling scenarios (Table 10, 11, 12 and 13) and sightings of sperm whales were extremely rare in the Kraus et al (2016) data. However, Vineyard Wind requested Level A takes of sperm whales based on the potential for there to be one group of average size exposed to noise above the Level A harassment threshold and we proposed to authorize 2 takes of sperm whales by Level A harassment in the notice of proposed IHA (84 FR 18346; April 30, 2019). However, through the analysis conducted during ESA section 7 consultation, we determined the likelihood of a sperm whale to incur PTS (Level A harassment) is *de minimis* because the area is not a preferred sperm whale habitat as they prefer deeper waters and bathymetric features such as canyons and the monopile and jacket foundation Level A harassment distances for sperm whales is very small (less than 75 m). It is highly unlikely that a sperm whale would remain within this area during the entire duration of pile driving necessary to incur PTS and we have required clearance and shut down zones greater than 75 m. Accordingly, the Biological Opinion's ITS does not include an exemption for any takes by Level A harassment of sperm whales. For these reasons, we did not authorize take by Level A harassment of sperm whales.

For NARWs, exposure modeling presented in the IHA application was based on the best available density data available at the time (*i.e.,* Roberts et al. 2016, 2017, 2018). Because takes by Level B harassment calculated based on Vineyard Wind's PSO data were higher than those modeled using the best available density data, in the proposed IHA (84 FR 18346; April 30, 2019) we proposed to authorize Level B harassment based on the numbers calculated from Vineyard Wind's PSO data (*i.e.,* 20 takes by Level B harassment). After the proposed IHA

was published, NARW density data (Roberts et al., 2020) was updated to incorporate more recent survey data (through 2018) including those data from the 2011–2015 surveys of the MA and RI/MA WEAs (Kraus et al. 2016) as well as the 2017–2018 continuation of those surveys, known as the Marine Mammal Surveys of the Wind Energy Areas (MMS–WEA) (Quintana et al., 2018) (Table 9). As this data represented new information that was deemed the best available information on NARW density in the project area, we requested that Vineyard Wind re-run the exposure modeling for NARWs using this new density data, for all possible construction scenarios, to confirm whether the incorporation of the new density data would result in a change to modeled exposure numbers. The resulting modeled number of takes by Level B harassment of right whales were lower under all four potential construction scenarios than the numbers that had been previously modeled and presented in the IHA application and the proposed IHA, and, remained lower under all four potential construction scenarios than the number calculated using Vineyard Wind's PSO data. To be conservative in our impact assessment and given the year-round presence of NARWs in the project area (albeit still very low in the summer months as indicated in the density estimates), the number of authorized takes by Level B harassment of right whales in the IHA remains at 20 (the same number of authorized takes proposed in the proposed IHA (84 FR 18346; April 30, 2019)) based on calculations using Vineyard Wind's PSO data. Modeled NARW exposure numbers (based on the newer density data (Roberts et al., 2020)) for all construction scenarios are shown in Tables 10–13. The updated NARW density data incorporated in the revised exposure modeling (Roberts et al., 2020) is shown in Table 9.

For NARWs, one exposure above the Level A harassment threshold was modeled over the duration of the planned project based on the Maximum Design scenario and 6 dB effective attenuation (Tables 10 and 11). However, exposure modeling does not consider mitigation and Vineyard Wind requested no authorization for Level A harassment takes of NARWs based on an expectation that any potential exposures above the Level A harassment threshold will be avoided through enhanced mitigation and monitoring measures implemented specifically to minimize potential NARW exposures. As described in the notice of proposed IHA, based on the enhanced mitigation and monitoring measures implemented specifically for NARWs (described below, see ''Mitigation''), including, but not limited to, the seasonal moratorium on construction from January through April, delay of pile driving upon any sighting of a NARW at any distance by observers on the pile driving platform, extended PAM clearance and monitoring zones beyond the Level B harassment zone, and pile driving shutdown called for at the Level A harassment distance, any potential take of right whales by Level A harassment will be avoided. Therefore, we do not authorize any takes of NARWs by Level A harassment.

Estimates of take by Level A harassment are based on exposure modeling with 6 dB sound attenuation applied rather than Vineyard Wind's PSO data. However, for all species for which the modeled number of takes by Level A harassment was lower than the estimated mean group size (Table 9), we proposed to authorize takes by Level A harassment based on mean group size to be conservative (except for NARWs, for which no takes by Level A harassment were proposed because of the enhanced mitigation protocols). There were three species for which estimated takes by Level A harassment based on exposure modeling were higher than the estimated mean group size, and therefore the proposed number of takes by Level A harassment were based on exposure modeling rather than mean group size: Fin whale, humpback whale and harbor porpoise. Thus for these three species, we recalculated takes by Level A harassment based on exposure modeling assuming a scenario of 100 piles driven with 6 dB attenuation and two piles driven with no attenuation. This resulted in the following change to takes by Level A harassment from the proposed IHA (84 FR 18346; April 30, 2019): Fin whale takes by Level A harassment increased from 4 to 5 (recalculation of Level A harassment takes for humpback whale and harbor porpoise did not result in a change to the estimated Level A harassment take number). Although no unattenuated pile driving will occur, we have issued the amount of take of fin whales in Table 15 to be conservative. This take also aligns with the amount of take exempted in the Biological Opinion and associated ITS. Authorized take numbers are shown in Table 15.

TABLE 15—TOTAL AMOUNT OF TAKE AUTHORIZED, BY SPECIES

Species	Takes by Level A harassment	Takes by Level B harassment	Total takes authorized	Total takes as a percentage of stock taken [2]
Fin whale [1]	5	33	38	0.5
Humpback Whale	10	56	66	4.7
Minke Whale	2	98	100	0.4
North Atlantic Right Whale [1]	0	20	20	5.4
Sei Whale [1]	2	4	6	0.1
Sperm whale [1]	0	5	5	0.1
Atlantic White-Sided Dolphin	28	1,107	1,135	1.2
Bottlenose Dolphin	8	96	104	0.2
Long-finned Pilot Whale	9	91	100	0.3
Risso's Dolphin	6	12	18	0.1
Common Dolphin	35	4,646	4,681	2.7
Harbor porpoise	4	150	155	0.2
Gray seal	2	414	416	1.5
Harbor seal	2	214	216	0.3
Harp seal	2	217	219	0.0

[1] Here we present take numbers of ESA-listed marine mammals provided Vineyard Wind installs 102 foundations. Ultimately this take is contingent upon the amount of take authorized in the associated Incidental Take Statement which is scaled based on final design.

[2] Calculations of percentage of stock taken are based on the Nbest abundance estimate as shown in Table 2. For all other species the best available abundance estimates are derived from the most recent NMFS Stock Assessment Reports (Hayes et al., 2020).

The take numbers authorized (Table 15) are considered conservative for the following reasons:

- Authorized take numbers are based on an assumption that all installed monopiles would be 10.3 m in diameter, when some or all monopiles ultimately installed may be smaller;
- Authorized take numbers are based on an assumption that 102 foundations would be installed, when ultimately the total number installed may be lower;
- Authorized take numbers are based on a scenario that includes up to 10 jacket foundations, when it is possible that fewer than 10 jacket foundations may be installed;
- Authorized Level A take numbers do not account for the likelihood that marine mammals will avoid a stimulus when possible before that stimulus reaches a level that would have the potential to result in injury;
- Authorized take numbers do not account for the effectiveness of mitigation and monitoring measures in reducing the number of takes (with the exception of NARWs, for which mitigation and monitoring measures are factored into the Level A harassment take number);
- For 9 of 15 species, no Level A takes were predicted based on modeling, however Level A take numbers have been conservatively increased from zero to mean group size for these species.

Mitigation

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

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

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

(2) the practicability of the measures for applicant implementation, which may consider such things as cost and impact on operations.

The mitigation strategies described below are consistent with those required and successfully implemented under previous incidental take authorizations issued in association with in-water pile-driving activities (*e.g.,* ramp-up, establishing harassment zone, implementing shutdown zones, etc.). Additional measures have also been incorporated to account for the fact that the planned activities would occur offshore. Modeling was performed to estimate zones of influence (ZOI; see ''Estimated Take''); these ZOI values were used to inform mitigation measures for pile driving activities to minimize Level A harassment and Level B harassment to the extent possible, while providing estimates of the areas within which Level B harassment might occur. Several measures have been added or modified since the proposed IHA was published, and are identified and described in detail below.

In addition to the specific measures described later in this section, Vineyard Wind would conduct briefings for construction supervisors and crews, the marine mammal and acoustic monitoring teams, and Vineyard Wind staff prior to the start of all pile driving activity, and when new personnel join the work, in order to explain responsibilities, communication procedures, the marine mammal monitoring protocol, and operational procedures. Vineyard Wind must use available sources of information on right whale presence, including, at least, daily monitoring of the Right Whale Sightings Advisory System, monitoring of Coast Guard VHF Channel 16 throughout the day to receive notifications of any sightings, and information associated with any Dynamic Management Areas and Slow Zones to plan pile driving to minimize the potential for exposure of any right whales to pile driving noise. This measure was not included in the proposed IHA and affords increased protection of NARWs by raising awareness of NARW presence in the area by both visual and passive acoustic monitoring efforts outside of Vineyard Wind's efforts and allows for planning of pile driving to minimize potential impacts.

Seasonal Restriction

As described in the proposed IHA, no pile driving activities may occur between January 1 and April 30. More recently, as identified in the final IHA, Vineyard Wind has also committed to avoiding pile driving in December except under unforeseen, extraordinary circumstances that require them to do so to complete the project and they may only do so upon approval from BOEM. This seasonal restriction is established to minimize the potential for NARWs to be exposed to pile driving noise. Based on the best available information (Kraus et al., 2016; Roberts et al., 2017, 2020), the highest densities of right whales in the project area are expected during the months of December through April. This restriction is expected to greatly reduce the potential for NARW exposure to pile driving noise associated with the planned project.

Clearance Zones

Vineyard Wind must use PSOs to establish clearance zones around the pile driving equipment to ensure these zones are clear of marine mammals prior to the start of pile driving. The purpose of ''clearance'' of a particular zone is to prevent potential instances of auditory injury and potential instances of more severe behavioral disturbance as a result of exposure to pile driving noise (serious injury or death are unlikely outcomes even in the absence of mitigation measures) by delaying the activity before it begins if marine mammals are detected within certain pre-defined distances of the pile driving equipment. The primary goal in this case is to prevent auditory injury (Level A harassment) of NARWs and reduce the risk of PTS to other marine mammals where there is potential it may occur. The clearance zones are

larger than the modeled distances to the isopleths corresponding to Level A harassment (based on peak SPL) for all marine mammal functional hearing groups, assuming an effective 6 dB attenuation of pile driving noise. For NARWs, a detection at any distance by a PSO on the pile driving vessel will trigger a delay. The clearance zone identified in Table 16a is the minimum zone that must be visible and clear prior to commence pile driving; however, PSO will be able to detect a whale at farther distances on clear days. Further, at all times of year, any large whale sighted by a PSO within 1,000 m of the pile that cannot be identified to species must be treated as if it were a NARW, triggering a delay in pile driving.

The proposed IHA identified a pile driving clearance zone of 1,000 m (1 km) for NARWs from May 15 through October 31. In the final IHA, the clearance zone for NARWs during this time period was greatly expanded to 5 km and a minimum visibility zone was established. The clearance zones for non-NARWs species remained as proposed in the final IHA. Clearance zones apply to both monopile and jacket installation. These zones vary depending on species and are shown in Table 16 for all piles. All distances to clearance zones are the radius from the center of the pile.

TABLE 16a AND b—REQUIRED NARW CLEARANCE ZONES (16a) AND SHUTDOWN ZONES (16b)

Clearance and PAM Monitoring Zones				
Time of year	Pile type	Minimum visual clearance zone [1 2]	PAM clearance zone [5]	PAM monitoring zone (km)
May 1–May 14	All	10 km	10 km [6]	10
May 15–May 31	monopile/jacket	2 km/1.6 km [3 4]	5 km/3.2 km [3]	10
June 1–Oct 31	monopile/jacket	2 km/1.6 km [3 4]	5 km/3.2 km [3 6]	[7] 5
Nov 1–Dec 31	monopile/jacket	2 km/1.6 km [3]	10 km [6]	10

[1] At any time of year, a visual detection of a NARW by a PSO at the pile driving platform triggers a delay in pile driving.
[2] At all times of year, any large whale sighted by a PSO within 1,000 m of the pile that cannot be identified to species must be treated as if it were a NARW.
[3] Upon receipt of an interim SSV report, NMFS may adjust the clearance zones to reflect SSV measurements such that the minimum visual clearance zones represent the Level A (SELcum) zones and the PAM clearance zones represent the Level B harassment zones. However, zone sizes will not be decreased less than 1 km from June 1–Oct 31 and not less than 2 km during May 15–May 31 or if a DMA or Slow Zone is established that overlaps with the Level B harassment zone.
[4] If a DMA or Slow Zone overlaps the Level B harassment zone, Vineyard Wind will employ a third PSO at the pile driving platform such that 3 PSOs will be on duty. The primary duty of the 3rd PSO is to observe for NARWs.
[5] At any time of year, a PAM detection (75 percent confidence) within the clearance zone must be treated as a visual detection, triggering a delay in pile driving.
[6] From May 1–14 and Nov 1–Dec 31, the PAM system must be operated 24/7 if pile driving will occur and must not be less than 10 km.
[7] If a DMA or Slow Zone overlaps the Level B zone, the PAM system must be extended to the largest practicable detection zone to increase situational awareness but must not be smaller than the Level B zone.

NARW shutdown zone (visual and PAM)	
Pile type	Shutdown zone [1 2] (km)
Monopile/Jacket	3.2

[1] If a marine mammal is observed entering or within the respective clearance zone after pile driving has commenced, a shutdown of pile driving must be implemented when technically feasible.
[2] Upon receipt of an interim SSV report, NMFS may adjust the shutdown zone.

TABLE 17—REQUIRED NON-NARW CLEARANCE AND SHUTDOWN ZONES

Species group	Clearance and shutdown zones (m)
Non-NARW mysticete whales (including humpback, sei, fin and minke) and sperm whale	500
Harbor porpoise	120
All other marine mammals (including dolphins and pinnipeds)	50

If a marine mammal is observed within or entering the relevant clearance zones prior to the start of pile driving operations, pile driving activity must be delayed until either the marine mammal has voluntarily left the respective clearance zone and been visually confirmed beyond that clearance zone, or, 30 minutes have elapsed without re-detection of the animal in the case of mysticetes, sperm whales, Risso's dolphins and pilot whales, or 15 minutes have elapsed without re-detection of the animal in the case of all other marine mammals.

Prior to the start of pile driving activity, the clearance zones will be monitored for 60 minutes to ensure that they are clear of the relevant species of marine mammals. Pile driving may only commence once PSOs and PAM operators have declared the respective clearance zones clear of marine mammals. Marine mammals observed within a clearance zone must be allowed to remain in the clearance zone (*i.e.,* must leave of their own volition), and their behavior will be monitored and documented. The clearance zones may only be declared clear, and pile driving started, when the entire clearance zones are visible (*i.e.,* when not obscured by dark, rain, fog, etc.) for a full 30 minutes prior to pile driving.

From May 1 through May 14 an extended clearance zone of 10 km (radial distance from the pile being driven) must be established for NARWs. This zone must be monitored using real-time PAM. An aerial or vessel-based survey must also be conducted that covers the 10 km extended clearance zone during this period. Vessel-based surveys must not begin until the lead PSO on duty determines there is adequate visibility. Aerial surveys must not begin until the lead PSO on duty determines adequate visibility and at least one hour after sunrise (on days with sun glare). From November 1 through December 31 an extended clearance zone of 10 km (radial distance from the pile being driven) must be established for NARWs. This zone must be monitored using real-time PAM (no survey is required prior to pile driving during this period).

From May 1 through May 14 and November 1 through December 31, if a NARW is confirmed via visual observation or PAM within the 10 km extended clearance zone, pile driving must be delayed (if it has not yet

commenced) or shut down (if it has already begun, and if technically feasible) and must not resume until the following day or until a survey confirms NARWs are no longer in the zone. From May 15 through May 31 an extended PAM monitoring zone of 10 km must be established for NARWs. While the clearance zone is 5 km, a confirmed PAM detection of a NARW from 5 to 10 km does not trigger delay or shutdown of pile driving but must be immediately relayed to visual PSOs to increase situational awareness. From June 1 through October 31, the PAM clearance and monitoring zone is 5 km.

NMFS did consider a 5 km minimum visibility clearance zone; however, to do so during a time of year when NARW density is very low, and in consideration of all the enhanced mitigation and monitoring measures, we determined a zone of that size would only delay the project such that pile driving would be pushed to the shoulder seasons when NARWs are present in higher densities. Further, a 5 km minimum visibility clearance zone is impracticable as it would likely result in a delay in construction. According to Vineyard Wind, the project must be constructed in one construction season to meet the commercial operations date under its contractual obligations and maintain the commercial viability of the project. Vineyard Wind is planning for a 6-month construction season. Of the hours available for pile driving during the 6-month construction season, almost 60 percent are lost due to prohibitions on pile driving at night and pile driving not being allowed to begin until at least one hour after sunrise and not before 1.5 hours of civil sunset. Further restricting the available hours for pile driving are wind and wave conditions that preclude the ability to work safely offshore. Overall, Vineyard Wind estimates that of the total available hours for pile driving, an average of 75 percent are lost due to regulatory restrictions and sea/weather conditions. This does not account for lost time due to technical difficulties or stoppages for protected species. If we were to increase the minimum visual clearance zone to 5 km, the project would likely not be completed within the time necessary and therefore the measure is impracticable. Further, pushing pile driving to times when NARWs are more abundant (but still within the pile driving window), could result in adverse and unnecessary impacts to NARWs. Finally, we have included a minimum 5 km PAM clearance zone which is not impacted by weather/visibility.

Additional Measures for North Atlantic Right Whales

Enhanced measures for right whales, including extended clearance zones during certain times of year, are included in the IHA and are designed to further minimize the potential for right whales to be exposed to pile driving noise. Extended clearance zones are required during times of year that are considered to be ''shoulder seasons'' in terms of NARW presence in the project area (November, December and May). While NARW presence during these times of year is considered less likely than during the required seasonal closure (January through April), based on the best available information right whales may occur in the project area during these times of year (Roberts et al, 2017, 2020; Kraus et al. 2016). Extended clearance zones must be maintained through PAM, as well as by visual observation conducted on aerial or vessel-based surveys during certain seasons, as described below.

Pile driving must be delayed upon visual observation of a NARW by PSOs on the pile driving vessel at any distance from the pile. We note that in the proposed IHA, the delay in pile driving was triggered from May 15–October 31 by a detection within 1km of the pile; therefore, the measure in the final IHA is more protective of NARWs. Pile driving must be delayed upon a confirmed PAM detection of a NARW, if the detection is confirmed to have been located within the relevant clearance zone (Table 16). Any large whale visually observed by a PSO within 1,000 m of the pile that cannot be identified to species must be treated as if it were a NARW for clearance purposes (we note this measure was not included in the IHA). Any sighting of a NARW by Vineyard Wind personnel or by personnel contracted by Vineyard Wind (including vessel crews and construction personnel) must be immediately reported to the lead PSO on duty.

Real-time acoustic monitoring must begin at least 60 minutes prior to pile driving. The real-time PAM system must be designed and established such that detection capability extends to 10 km from the pile driving location. The real-time PAM system must ensure that acoustic detections can be classified (*i.e.,* potentially originating from a NARW) within 30 minutes of the original detection. The PAM operator must be trained in identification of mysticete vocalizations. The PAM operator responsible for determining if the acoustic detection originated from a NARW within the 10 km PAM monitoring zone would be required to make such a determination if they have at least 75 percent confidence that the vocalization within 10 km of the pile driving location originated from a North Atlantic right whale. A record of the PAM operator's review of any acoustic detections must be reported to NMFS.

If a NARW is observed at any time by PSOs or personnel on any project vessels, during any project-related activity or during vessel transit, Vineyard Wind must report sighting information to the NMFS NARW Sighting Advisory System, to the U.S. Coast Guard via channel 16, and through the WhaleAlert app (*http://www.whalealert.org/*) as soon as feasible but no longer than 24 hours after the sighting. If a NARW is detected via PAM, a report of the detection must be submitted to NMFS as soon as feasible but no longer than 24 hours after the detection. In addition, within 48 hours, metadata associated with the detection must be submitted to the NMFS NARW Passive Acoustic Reporting System website. None of these reporting requirements were included in the proposed IHA and offer additional protection to marine mammals via increased awareness for all mariners.

Soft Start

The use of a soft start procedure is believed to provide additional protection to marine mammals by warning marine mammals or providing them with a chance to leave the area prior to the hammer operating at full capacity, and typically involves a requirement to initiate sound from the hammer at reduced energy followed by a waiting period. Vineyard Wind must utilize soft start techniques for impact pile driving by performing an initial set of three strikes from the impact hammer at a reduced energy level followed by a 1 minute waiting period. We note that it is difficult to specify the reduction in energy for any given hammer because of variation across drivers and, for impact hammers, the actual number of strikes at reduced energy will vary because operating the hammer at less than full power results in ''bouncing'' of the hammer as it strikes the pile, resulting in multiple ''strikes''; however, Vineyard Wind has proposed that they will target less than 40 percent of total hammer energy for the initial hammer strikes during soft start. The soft start process would be conducted a total of three times prior to driving each pile (*e.g.,* three single strikes followed by a one minute delay, then three additional single strikes followed by a one minute delay, then a final set of three single strikes followed by an additional one

minute delay). Soft start would be required at the beginning of each day's impact pile driving work and at any time following a cessation of impact pile driving of thirty minutes or longer.

Shutdown

The purpose of a shutdown is to prevent some undesirable outcome, such as auditory injury or behavioral disturbance of sensitive species, by halting the activity. The proposed IHA included a shutdown zone equal to the proposed clearance zones (*i.e.,* 1 km for NARWs, 500 m for all other mysticetes, 120 m for harbor porpoise, and 50 m for all other marine mammals). However, after further consideration, we determined that a shutdown zone equal to the Level A harassment zone for monopiles was warranted for NARWs year-round. This expansion of the shutdown zone affords additional protection to NARWs from both Level A harassment (*e.g.,* PTS) and reduces the severity of Level B harassment as a received level at 3.2 km will be much less than that at 1km. The shutdown zones for all other marine mammals remain as proposed. If a marine mammal is observed entering or within the respective clearance zones (Table 16) after pile driving has begun, the PSO will request a temporary cessation of pile driving. Vineyard Wind has proposed that, when called for by a PSO, shutdown of pile driving would be implemented when feasible but that shutdown would not always be technically practicable once driving of a pile has commenced as it has the potential to result in pile instability. We therefore require that shutdown would be implemented when technically feasible, with a focus on other mitigation measures as the primary means of minimizing potential impacts on marine mammals from noise related to pile driving. If shutdown is called for by a PSO, and Vineyard Wind determines a shutdown to be technically feasible, pile driving would be halted immediately.

In situations when shutdown is called for but Vineyard Wind determines shutdown is not practicable due to human safety or operational concerns, reduced hammer energy would be implemented when practicable. In cases where pile driving is already started and a PSO calls for shutdown, the lead engineer on duty will evaluate the following to determine whether shutdown is technically feasible: (1) Use the site-specific soil data and the real-time hammer log information to judge whether a stoppage would risk causing piling refusal at re-start of piling; and (2) Check that the pile penetration is deep enough to secure pile stability in the interim situation, taking into account weather statistics for the relevant season and the current weather forecast. Determinations by the lead engineer on duty will be made for each pile as the installation progresses and not for the site as a whole.

If a shutdown is called for by PSOs but Vineyard Wind determines shutdown is not technically feasible due to human safety concerns or to maintain installation feasibility then reduced hammer energy must be implemented, when the lead engineer determines it is technically feasible.

Following a shutdown, pile driving may not commence until either the animal has voluntarily left and been visually confirmed beyond the relevant clearance zone or when 30 minutes have elapsed without re-detection (for mysticetes, sperm whales, Risso's dolphins and pilot whales) or 15 minutes have elapsed without re-detection (for all other marine mammals), or if required to maintain installation feasibility.

Visibility Requirements

The proposed IHA included a measure that pile driving must not be initiated after sunset or at nighttime. The final IHA affords additional protection to marine mammals in that no pile driving may begin until at least one hour after (civil) sunrise and no pile driving may begin within 1.5 hours of (civil) sunset, after sunset or at nighttime. Pile driving may continue after dark only when the installation of the same pile began during daylight (within 1.5 hours of (civil) sunset) when clearance zones were fully visible for at least 30 minutes immediately prior to pile driving. Pile driving must not be initiated at night, or, when the full extent of all relevant clearance zones cannot be confirmed to be clear of marine mammals, as determined by the lead PSO on duty. The clearance zones may only be declared clear, and pile driving started, when the full extent of all clearance zones are visible (*i.e.,* when not obscured by dark, rain, fog, etc.) for a full 30 minutes prior to pile driving. During periods of obscured visibility, alternative detection devices (*e.g.,* night vision, thermal, infrared) must be used.

Sound Attenuation

The proposed IHA indicated Vineyard Wind may drive unattenuated piles to identify the effectiveness of the bubble curtain and confirm that at least a 6dB attenuation was being achieved using such devices. After further consideration, we determined that driving such large piles to meet the 6dB attenuation requirement was not warranted. Instead, Vineyard Wind is prohibited from driving unattenuated piles and instead must ensure such devices are achieving the anticipated harassment isopleths based on modeling assuming 6 dB reduction. This measure results in reduced noise levels, benefiting all marine mammals. The final IHA states that Vineyard Wind must implement a noise attenuation device(s) during all impact pile driving. The attenuation system may include one of the following or some combination of the following: A Noise Mitigation System, Hydro-sound Damper, Noise Abatement System, and/or bubble curtain. Vineyard Wind would also have a second back-up attenuation device (*e.g.,* bubble curtain or similar) available, if needed, to ensure the harassment zones do not exceed those modeled (assuming at least a 6dB reduction), pending results of sound field verification testing. A Pile Driving Plan including a complete description of the sound attenuation systems planned for use must be submitted to NMFS for approval no less than 90 days prior to commencement of pile driving. We note that submission of such a plan was not included in the proposed IHA. We have also included additional requirements related to field measurements (see Monitoring and Reporting section below).

Marine Mammal Monitoring Protocols

Monitoring would be conducted before, during, and after pile driving activities. In addition, observers will record all incidents of marine mammal occurrence, regardless of distance from the construction activity, and monitors will document any behavioral reactions in concert with distance from piles being driven. Observations made outside the clearance zones will not result in delay of pile driving; that pile segment may be completed without cessation, unless the marine mammal approaches or enters the clearance zone, at which point pile driving activities would be halted when practicable, as described above. Pile driving activities include the time to install a single pile or series of piles, as long as the time elapsed between uses of the pile driving equipment is no more than 30 minutes.

Vessel Strike Avoidance

The IHA contains numerous vessel strike avoidance measures. Vineyard Wind is required to comply with these measures except under circumstances when doing so would create an imminent and serious threat to a person or vessel or to the extent that a vessel

is restricted in its ability to maneuver and, because of the restriction, cannot comply.

Vineyard Wind must submit a NARW strike avoidance plan 90 days prior to commencement of vessel use. The plan will, at minimum, describe how the required vessel, PAM, or aerial based monitoring will be conducted to ensure the transit corridor is clear of NARWs. The plan will also provide details on the vessel-based observer protocol on transiting vessels and PAM required between November 1 and May 14. Submission of this plan was not included in the proposed IHA.

Additional measure included in the final IHA that was not included in the proposed IHA includes one that states, year-round, vessel operators will use all available sources of information on right whale presence, including at least daily monitoring of the Right Whale Sightings Advisory System, WhaleAlert app, and monitoring of Coast Guard VHF Channel 16 throughout the day to receive notifications of any sightings and/or consideration of information associated with any Dynamic Management Areas to plan vessel routes to minimize the potential for co-occurrence with any right whales.

Vessel operators and crews must maintain a vigilant watch for all marine mammals and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any marine mammal. A visual observer aboard the vessel must monitor a vessel strike avoidance zone around the vessel (distances stated below). Visual observers monitoring the vessel strike avoidance zone may be third-party observers (*i.e.,* PSOs) or crew members, but crew members responsible for these duties must be provided sufficient training to distinguish marine mammals from other phenomena and broadly to identify a marine mammal as a right whale, other whale (defined in this context as sperm whales or baleen whales other than right whales), or other marine mammal. Vineyard Wind must adhere to the following measures:

Whenever multiple vessels are operating, any visual observations of ESA-listed marine mammals must be communicated to a PSO and/or vessel captains associated with other vessels. Under any condition, vessel speeds will immediately be reduced to 10 kts or less if a NARW is sighted by the observer or anyone on the vessel.

From November 1 through May 14, all vessels, regardless of size, must travel at less than 10 kts within the WDA. From November 1 through May 14, when transiting to or from the WDA, vessels must either travel at less than 10 kts, or, must implement visual surveys with at least one visual observer to monitor for NARWs (with the exception of vessel transit within Nantucket Sound unless a DMA is in place).

In the event that any DMA is established that overlaps with an area where a vessel would operate, that vessel, regardless of size, will transit that area at 10 kts or less unless it is a crew transfer vessel and certain monitoring conditions are met.

Crew transfer vessels traveling within any designated DMA must travel at 10 kts (18.5 km/hr.) or less, unless NARWs are clear of the transit route and WDA for two consecutive days, as confirmed by vessel-based surveys conducted during daylight hours and real-time PAM, or, by an aerial survey, conducted once the lead aerial observer determines adequate visibility. If confirmed clear by one of the measures above, vessels transiting within a DMA over 10 kts must employ at least two visual observers to monitor for NARWs. If a NARW is observed within or approaching the transit route, vessels must operate at less than 10 kts until clearance of the transit route for 2 consecutive days.

Since the proposed IHA was released, NMFS has developed the NARW ''Slow Zone'' Program. This program notifies vessel operators of areas where maintaining speeds of 10 kts or less can help protect right whales from vessel collisions. Maintaining speeds of 10 kts or less in a Slow Zone is voluntary (*i.e.,* there is no requirement any mariner reduce speeds). All DMAs (triggered by the visual detection of three or more NARWs) fall under the Slow Zone program. Slow Zones may also be triggered by acoustic detections on PAM systems meeting certain criteria. Acoustically-triggered Slow Zones are in place for 15 days (similar to a DMA) and extend 20 miles from the recorder on which the NARW was detected. NMFS determined that measures associated with Slow Zones that are acoustically triggered should be included in the final IHA. Therefore, crew transfer vessels travelling over 10 kts within an acoustically-triggered Right Whale Slow Zone must employ an additional observer (for a total of two similar to a DMA) or other enhanced detection methods (*e.g.,* thermal cameras) to monitor for NARWs in addition to PAM monitoring in the transit corridor.

All vessels greater than or equal to 65 ft (19.8 m) in overall length must comply with the 10 kt speed restriction in any Seasonal Management Area (SMA).

Crew transfer vessels may travel at over 10 kts if, in addition to the required dedicated observer, real-time PAM of transit corridors is conducted prior to and during transits. If a NARW is detected via visual observation or PAM within or approaching the transit route, all crew transfer vessels must travel at 10 kts or less for the remainder of that day. All vessels will reduce vessel speed to 10 kts or less when any large whale, any mother/calf pairs, pods, or large assemblages of non-delphinoid cetaceans are observed near (within 100 m (330 ft.)) an underway vessel.

NMFS did consider whether all vessels associated with Vineyard Wind's specified activity should travel at 10 kts or less at all times of the year under all conditions (except when there is risk to human and vessel safety). NMFS finds this measure both impracticable and unnecessary. First and foremost, to limit vessel speeds during a time when NARW presence is extremely low could result in delays to the project that push work into times of year when NARW presence is higher. In addition, given the 50–60 mile distance from port to the WDA, traveling at 10kts or less would take approximately 4.5 to 5 hours each way (9–10 hours total). Vineyard Wind has indicated that workers are limited to a 12-hour workday, including transit time. Therefore, 10 hours of their 12 hour workday would be taken up by transit, which is not feasible when workers are limited to a 12 hour work day.

All vessels must maintain a minimum separation distance of 500 m (1,640 ft) from a NARW. If a whale is observed but cannot be confirmed as a species other than a right whale, the vessel operator must assume that it is a right whale and take appropriate action. If underway, vessels must steer a course away from any sighted NARW at 10 kts or less such that the 500 m (1,640 ft.) minimum separation distance is not violated. If a NARW is sighted within 500 m (1,640 ft.) of an underway vessel, the underway vessel must shift the engine to neutral. Engines will not be engaged until the right whale has moved outside of the vessel's path and beyond 500 m.

All vessels must maintain a minimum separation distance of 100 m from sperm whales and non-NARW baleen whales. If one of these species is sighted within 100 m (330 ft.) of an underway vessel, the underway vessel must shift the engine to neutral. Engines will not be engaged until the whale has moved outside of the vessel's path and beyond 100 m.

All vessels must, to the maximum extent practicable, attempt to maintain a

minimum separation distance of 50 m (164 ft) from all delphinoid cetaceans and pinnipeds, with an exception made for those that approach the vessel (*e.g.,* bowriding dolphins). If a delphinoid cetacean or pinniped is sighted within 50 m (164 ft.) of an underway vessel, the underway vessel must shift the engine to neutral, with an exception made for those that approach the vessel (*e.g.,* bowriding dolphins). Engines will not be engaged until the animal(s) has moved outside of the vessel's path and beyond 50 m.

When marine mammals are sighted while a vessel is underway, the vessel must take action as necessary to avoid violating the relevant separation distances, *e.g.,* attempt to remain parallel to the animal's course, avoid excessive speed or abrupt changes in direction until the animal has left the area. If marine mammals are sighted within the relevant separation distance, the vessel must reduce speed and shift the engine to neutral, not engaging the engines until animals are clear of the area. This does not apply to any vessel towing gear or any vessel that is navigationally constrained.

All vessels underway will not divert or alter course in order to approach any marine mammal. Any vessel underway will avoid excessive speed or abrupt changes in direction.

Project-specific training must be conducted for all vessel crew prior to the start of in-water construction activities. Confirmation of the training and understanding of the requirements must be documented on a training course log sheet. Vineyard Wind must ensure that vessel operators and crew maintain a vigilant watch for marine mammals by slowing down or stopping the vessel to avoid striking marine mammals. When not on active watch duty, members of the monitoring team must consult NMFS' NARW advisory systems for the presence of NARWs in the project area at least once a day.

With the measure described herein, we have prescribed the means of effecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Monitoring and Reporting

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

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

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

Visual Marine Mammal Observation

Vineyard Wind will collect sighting data and behavioral responses to pile driving activity for marine mammal species observed in the region of activity during the period of activity. All observers will be trained in marine mammal identification and behaviors and are required to have no other construction-related tasks while conducting monitoring. PSOs will monitor all clearance zones at all times. PSOs will also monitor Level B harassment zones (*i.e.,* 4,121 m for monopiles and 3,220 m for jacket pin piles) and will document any marine mammals observed within these zones, to the extent practicable (noting that some distances to these zones are too large to fully observe). Vineyard Wind will conduct monitoring 60 minutes before, during, and 30 minutes after pile driving, with observers located at the best practicable vantage points on the pile driving vessel. Full details regarding marine mammal monitoring must be included in a Marine Mammal Monitoring Plan that, under the IHA, Vineyard Wind is required to submit to NMFS for approval at least 90 days in advance of commencement of pile driving. We note submission of this plan was not included in the proposed IHA.

Monitoring will be conducted by qualified, trained PSOs, who will be placed on the installation vessel, which represents the best vantage point to monitor for marine mammals and implement shutdown procedures when applicable. The proposed IHA included a measure that a minimum of two PSOs will be on-watch from 60 minutes prior to commencement of pile driving, throughout the time required to drive a pile, and for 30 minutes following the conclusion of pile driving. The final IHA carries this measure over but includes an enhanced measure in that, if a DMA or Slow Zone is in place that overlaps the Level B harassment zone, an additional PSO will be required (for a total of three PSOs on active duty on the pile driving vessel). PSOs may not exceed four consecutive watch hours; must have a minimum two hour break between watches; and may not exceed a combined watch schedule of more than 12 hours in a 24- hour period. Monitoring will be conducted. PSOs will have no other construction-related tasks while conducting monitoring.

All PSOs must be approved by NMFS. Vineyard Wind must submit resumes of the initial set of PSO resumes necessary to commence the project to NMFS for approval at least 60 days prior to the first day of pile driving activity.

PSOs must have the following minimum qualifications:

(1) Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water's surface with ability to estimate target size and distance; use of binoculars may be necessary to correctly identify the target;

(2) Ability to conduct field observations and collect data according to assigned protocols;

(3) Experience or training in the field identification of marine mammals, including the identification of behaviors;

(4) Sufficient training, orientation, or experience with the construction

operation to provide for personal safety during observations;

(5) Writing skills sufficient to document observations including, but not limited to: The number and species of marine mammals observed; dates and times when in-water construction activities were conducted; dates and times when in-water construction activities were suspended to avoid potential incidental injury of marine mammals from construction noise within a defined shutdown zone; and marine mammal behavior; and

(6) Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.

Observer teams employed by Vineyard Wind in satisfaction of the mitigation and monitoring requirements described herein must meet the following additional requirements:

- Be independent observers (*i.e.,* not construction personnel) are required;
- At least one observer must have prior experience working as an observer in an offshore environment;
- Other observers may substitute education (degree in biological science or related field) or training for experience;
- One observer will be designated as lead observer or monitoring coordinator. The lead observer must have prior experience working as an observer; and
- NMFS will require submission and approval of observer resumes.

Vineyard Wind must conduct briefings between construction supervisors and crews and the PSO team prior to the start of all pile driving activities, and when new personnel join the work, in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures. An informal guide must be included with the Marine Mammal Monitoring Plan to aid in identifying species if they are observed in the vicinity of the project area. PSOs must be located at best vantage point(s) in order to observe the entire clearance zones and must record all incidents of marine mammal occurrence, regardless of distance from the construction activity. PSOs must document any behavioral reactions of marine mammals in concert with distance from the pile being driven. During all pile driving, PSOs must use high-magnification (25X), as well as standard handheld (7X) binoculars, and the naked eye to search continuously for marine mammals. During periods of poor visibility, PSOs must use alternative monitoring technologies to monitor clearance zones (*e.g.,* night vision devices, IR/Thermal camera). A full description of this technology will be included in Vineyard Wind's Alternative Monitoring Plan which will be submitted to NMFS no later than 90 days prior to the commencement of pile driving. We note submission of this plan was not included in the proposed IHA. Monitoring distances must be measured with range finders or reticule binoculars. Distances to marine mammals observed must be based on the best estimate of the PSO, relative to known distances to objects in the vicinity of the PSO. Bearings to animals shall be determined using a compass.

When monitoring is required during vessel transit (as described above), the PSO(s) will be stationed on vessels at the best vantage points to ensure maintenance of standoff distances between marine mammals and vessels (as described above). Vineyard Wind would implement the following measures during vessel transit when there is an observation of a marine mammal:

- PSOs will record the vessel's position and speed, water depth, sea state, and visibility will be recorded at the start and end of each observation period, and whenever there is a change in any of those variables that materially affects sighting conditions.
- PSOs will record the time, location, speed, and activity of the vessel, sea state, and visibility.

Individuals implementing the monitoring protocol will assess its effectiveness using an adaptive approach. PSOs will use their best professional judgment throughout implementation and seek improvements to these methods when deemed appropriate. Any modifications to the protocol will be coordinated between NMFS and Vineyard Wind.

Data Collection

We require that observers use standardized data forms. Among other pieces of information, Vineyard Wind will record detailed information about any implementation of delays or shutdowns, including the distance of animals to the pile and a description of specific actions that ensued and resulting behavior of the animal, if any. The following information will be collected by PSOs during pile driving:

- Date and time that monitored activity begins or ends;
- Construction activities occurring during each observation period;
- Weather parameters (*e.g.,* wind speed, percent cloud cover, visibility);
- Water conditions (*e.g.,* sea state, tide state);
- Species, numbers, and, if possible, sex and age class of marine mammals;
- Description of any observable marine mammal behavior patterns, including bearing and direction of travel and distance from pile driving activity;
- Distance and bearing of each marine mammal observed relative to the pile being driven for each sighting and time spent within harassment zone (if pile driving was occurring at time of sighting);
- Description of any marine mammal behavioral observations (*e.g.,* observed behaviors such as feeding or traveling), including an assessment of behavioral responses thought to have resulted from the activity;
- Type of construction activity (*e.g.,* monopile or jacket pile installation) when marine mammals are observed;
- Description of implementation of mitigation measures (*e.g.,* delay or shutdown) or why mitigation was not implemented;
- Locations of all marine mammal observations; and
- Other human activity in the area.

Marine Mammal Passive Acoustic Monitoring

Vineyard Wind would utilize a PAM system to supplement visual monitoring. The PAM system would be monitored by a minimum of one acoustic PSO beginning at least 60 minutes prior to ramp-up of pile driving and at all times during pile driving. Acoustic PSOs must immediately communicate all detections of marine mammals to visual PSOs, including any determination regarding species identification, distance, and bearing and the degree of confidence in the determination. The PAM system would not be located on the pile installation vessel.

Acoustic PSOs may be on watch for a maximum of four consecutive hours followed by a break of at least two hours between watches. Acoustic PSOs would be required to demonstrate that they have completed specialized training for operating PAM systems. PSOs can act as acoustic or visual observers (but not simultaneously) as long as they demonstrate that their training and experience are sufficient to perform each task. Acoustic PSO(s) must immediately communicate all detections of marine mammals to visual PSOs, including any determination regarding species identification, distance, and bearing and the degree of confidence in the determination.

A Passive Acoustic Monitoring Plan must be submitted to NMFS and BOEM for review and approval at least 90 days prior to the planned start of pile driving.

The Plan must describe all proposed PAM equipment, procedures, and protocols. We note submission of this plan was not included in the proposed IHA.

Sound Field Verification Acoustic Monitoring

Vineyard Wind will also conduct hydroacoustic monitoring during pile driving of the first monopile and first jacket foundation installed over the course of the project, with noise attenuation activated. We note the proposed IHA did not specify that the first of these piles were to be monitored. In the event that subsequently driven piles are installed that have a larger diameter, or, are installed with a larger hammer or greater hammer energy than the first monopile and jacket pile, sound field measurements must be conducted for those subsequent piles. A Sound Field Verification Plan must be submitted to NMFS for review and approval at least 90 days prior to planned start of pile driving (this measure was not included in the proposed IHA). This plan must describe how Vineyard Wind will ensure that the location selected is representative of the rest of the piles of that type to be installed and, in the case that it is not, how additional sites will be selected for sound field verification, or, how the results from the first pile can be used to predict actual installation noise propagation for subsequent piles. The plan must describe how the effectiveness of the sound attenuation methodology will be evaluated based on the results. Vineyard Wind must provide the initial results of the field measurements to NMFS as soon as they are available.

Vineyard Wind would be required to empirically determine the distances to the isopleths corresponding to the Level A and Level B harassment thresholds either by extrapolating from *in situ* measurements conducted at several points from the pile being driven, or by direct measurements to locate the distance where the received levels reach the relevant thresholds or below. Isopleths corresponding to the Level A and Level B harassment thresholds would be empirically verified for impact driving of the largest diameter monopile used over the duration of the IHA, and impact driving of the largest diameter jacket pile used over the duration of the IHA. For verification of the extent of the Level B harassment zone, Vineyard Wind would be required to report the measured or extrapolated distances where the received levels SPLrms decay to 160-dB, as well as integration time for such SPLrms. If initial acoustic field measurements indicate distances to the isopleths corresponding to Level A and/or Level B harassment thresholds are greater than the distances predicted by modeling (Tables 5 and 6), Vineyard Wind must implement additional sound attenuation measures prior to conducting additional pile driving. Additionally, in the event that field measurements indicate distances the isopleths corresponding to Level A and Level B harassment thresholds are greater than the distances predicted by modeling, NMFS may expand the relevant clearance and shutdown zones. We note that none of these measures regarding specific action based on results of the acoustic monitoring were included in the proposed IHA. The acoustic monitoring report would include: Peak sound pressure level (SPLpk), root-mean-square sound pressure level that contains 90 percent of the acoustic energy (SPLrms), single strike sound exposure level, integration time for SPLrms, SELss spectrum, and 24-hour cumulative SEL extrapolated from measurements. All these levels would be reported in the form of median, mean, max, and minimum. The sound levels reported would be in median and linear average (*i.e.,* taking averages of sound intensity before converting to dB). The acoustic monitoring report would also include a description of depth and sediment type at the recording location.

Recording would also occur when no construction activities are occurring in order to establish ambient sound levels. Vineyard Wind would also conduct real-time PAM during certain times of year to facilitate mitigation (as described above).

Reporting

The proposed IHA included a measure that, similar to other coastal pile driving projects, Vineyard Wind would submit a final report to NMFS within 90 days after expiration of the IHA that contained both marine mammal and pile driving acoustic monitoring data. Since that time, NMFS determined more frequent review of Vineyard Wind's pile driving activities and monitoring data was warranted. In the final IHA, Vineyard Wind is required to submit weekly and monthly marine mammal monitoring reports in addition to submitting a draft final marine mammal monitoring report to NMFS within 90 days of the completion of monitoring activities (not 90 days upon expiration of the IHA). The reports would include marine mammal observations pre-activity, during-activity, and post-activity during pile driving days, and would also provide descriptions of any behavioral responses to construction activities by marine mammals. The reports would detail the monitoring protocol, summarize the data recorded during monitoring including an estimate of the number of marine mammals that may have been harassed during the period of the report, and describe any mitigation actions taken (*i.e.,* delays or shutdowns due to detections of marine mammals, and documentation of when shutdowns were called for but not implemented and why). The reports would also include results from marine mammal passive acoustic monitoring including dates and times of all detections, types and nature of sounds heard, whether detections were linked with visual sightings, water depth of the hydrophone array, bearing of the animal to the vessel (if determinable), species or taxonomic group (if determinable), spectrogram screenshot, a record of the PAM operator's review of any acoustic detections, and any other notable information. The weekly reports would contain a summary of this information while the final report would contain more detailed information. After receipt of the 90-day draft final report, NMFS will provide comments on the report, if necessary, to Vineyard Wind. Vineyard Wind must submit a final report within 30 days following resolution of comments on the draft report.

The final IHA also requires Vineyard Wind to submit results of pile driving sound field verification to NMFS as soon as possible but no later than within 30 days following completion of acoustic monitoring.

Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.,* population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be ''taken'' through harassment, NMFS considers other factors, such as the likely nature of any responses (*e.g.,* intensity, duration), the context of any responses (*e.g.,* critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness

of the mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS's implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.,* as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

Pile driving activities associated with the project, as described previously, have the potential to disturb or temporarily displace marine mammals. Specifically, the specified activities may result in take, in the form of Level A harassment (potential injury) or Level B harassment (potential behavioral disturbance) from underwater sounds generated from pile driving. Potential takes could occur if individual marine mammals are present in the ensonified zone when pile driving is occurring.

To avoid repetition, the majority of our analyses apply to all the species listed in Table 2, given that many of the anticipated effects of the planned project on different marine mammal stocks are expected to be relatively similar in nature. Where there are meaningful differences between species or stocks—as is the case of the NARW—they are included as separate sub-sections below. As noted above, some new data and literature have become available since the Proposed IHA was published (*e.g.,* NARW abundance and distribution information), and this information has been considered fully in the analysis below.

North Atlantic Right Whales

NARWs are currently threatened by low population abundance, higher than average mortality rates and lower than average reproductive rates. Pace et al. (2021) recently released an update of his NARW abundance model. From 1990–2014, the female apparent survival rate fluctuated around 0.96. In 2014, survival decreased to approximately 0.93 and hit an all-time low of 0.89 in 2017. However, in 2018, survival increased dramatically back to around 0.95. The average survival rate, based on the Pace et al. (2021) regime model from 2014–2018 is approximately 0.93, slightly lower than the average long term rate from 1990–2014 (0.96). Since 1990, the estimated number of new entrants (which can be used as a proxy for recruitment rates) has widely fluctuated between 0 and 39 (Pace et al., 2021, NMFS 2021). In the last 10 years (2011–2020), the average number of calves born into the population is approximately 11. Unfortunately, not all calves born into the population survive. Most recently, a dead NARW calf was reported stranded on February 13, 2021, along the Florida coast. On December 22, 2020, a newborn calf was sighted off El Hierro, an island in the Canary Islands, but has not been subsequently detected with its mother suggesting it did not survive.

As described above, the project area represents part of an important migratory area for NARWs. Core year-round foraging habitats have also been identified south of Martha's Vineyard and Nantucket within and around the project area (Oleson et al., 2020); however, abundance in this area in summer months remains low compared to winter. It also appears the majority of sightings between the June–October timeframe (when Vineyard Wind would be conducting most if not all of its pile driving work) are concentrated approximately 20–30 kms west of the WDA boundary line on Nantucket Shoals (which triggered DMAs in 2019 and 2020) with occasional, random sightings east of the project area. In general, due to the current status of NARWs, and the spatial overlap of the planned project with an area of biological significance for right whales, the potential impacts of the planned project on right whales warrant particular attention.

The IHA includes nine overarching mitigation measures related to pile driving. The following measures are related to pile driving: (1) Time of year restrictions; (2) time of day restrictions; (3) implementation of pre-pile driving clearance zones; (4) implementation of shutdown zones; (5) use of soft-start; (6) use of sound attenuation systems; (7) use of PSOs to visually observe for NARWs (with any detection triggering delay or shutdown); (8) use of PAM to acoustically detect NARWs (with any detection within designated zones triggering delay or shutdown); and (9) requirement to monitor NARW sighting network platforms to be aware of NARW presence within or near the project area and transit corridors. The specifics regarding these measures are dependent upon the time of year.

As described in Oleson et al. (2020), NARWs respond to environmental changes and may use habitat intermittently over time. They have been known to nearly abandon a frequently used foraging habitat only to come back in future years in large numbers. In recent years, the whales have demonstrated actual shifts in distribution, frequenting previously unrecognized foraging habitats. Sighting data also indicate that NARWs may investigate a previously preferred habitat, but not stay if the prey resource is insufficient, so some habitats previously used no longer have high densities of NARWs (Davies et al. 2019; Davis et al. 2017). As described above, NARW presence in the project area is year-round; however, abundance during summer months is low compared to winter months with spring and fall serving as ''shoulder seasons'' wherein abundance waxes (fall) or wanes (spring). During aerial surveys conducted from 2011–2015 in the project area, NARW sightings occurred only December through April, with no sightings from May through November (Kraus et al., 2016). There was not significant variability in sighting rate among years, indicating consistent annual seasonal use of the area by right whales during those years (Kraus et al., 2016). More recently, seasonal distribution patterns of right whales have been less consistent, with right whales observed near the project area in late summer and fall. For example, in 2019 and 2020, NARWs were observed in August and September around Nantucket Shoals, triggering NMFS to establish a DMA that last several weeks each year; however, these sightings around Nantucket Shoals are approximately 20–30 kms east of the most eastern edge of the project area and outside the Level B harassment zones created by the activities. Figure 2 provides a map of all sightings from June 1 through November 31, annually, for the years 2010 through 2020 as well as 2021 to date (Johnson, 2018). The 2019 and 2020 cluster of sightings around Nantucket Shoals is prominent. Given this year-round habitat usage and in recognition where whales may actually occur during pile driving is largely influenced by unpredictable, patchy prey availability, NMFS has included a suite of mitigation measures designed to reduce impacts to NARWs to the maximum extent practicable. However, even in consideration of these recent habitat-use and distribution shifts, Vineyard Wind would be conducting pile driving when presence of NARWs is lower than in winter months, as reflected in the density data (Roberts et al., 2020; Table 9).

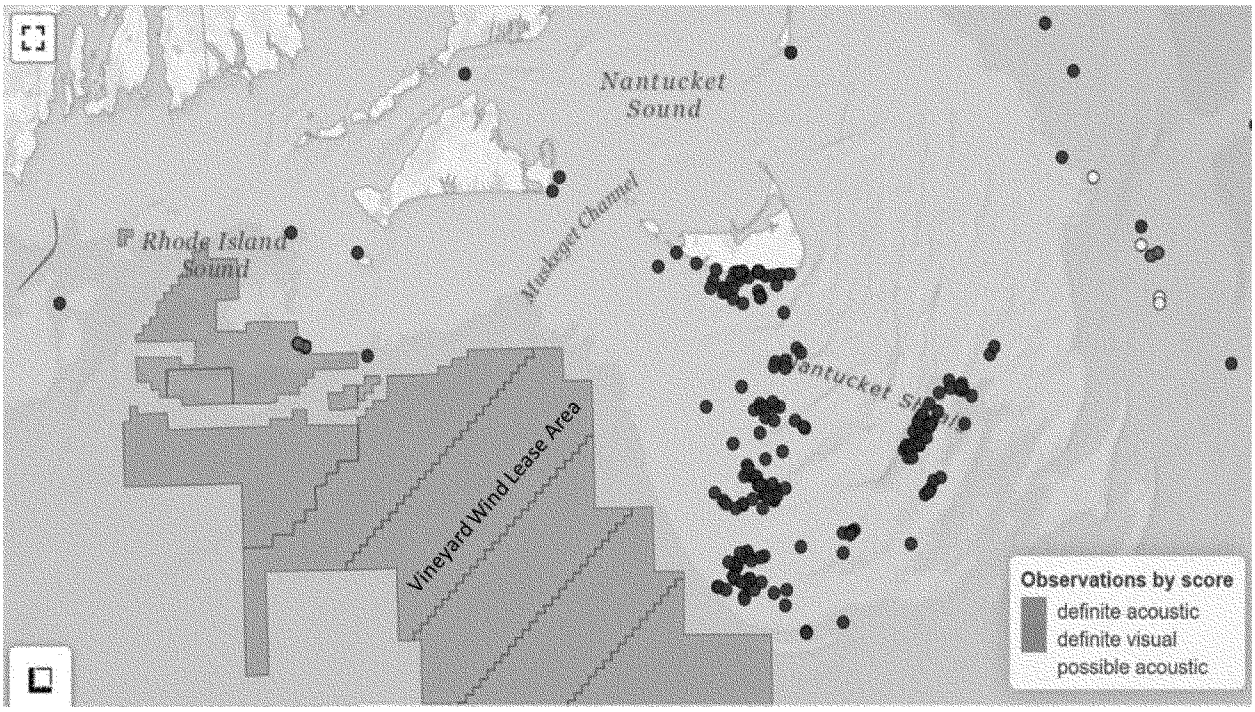

Figure 2. All NARW detections (both visual and acoustic) from June 1 through November 31, annually, 2010 through 2021. (Source: WhaleMap Accessed May 2021)

The most significant measure in minimizing impacts to right whales is the seasonal pile driving moratorium that would occur from January through April, when NARW abundance in the project area is expected to be greatest. NMFS has also included a measure that no pile will occur in December (a time when NARW density is lower than January–April; however, is greater than summer and fall through November) unless unforeseen circumstances arise that require Vineyard Wind to complete the project. We also expect these measures to greatly reduce the potential for mother-calf pairs to be exposed to project-related noise above the Level B harassment threshold during their annual migration through the project area. In addition, mitigation and monitoring measures outside of those months will greatly minimize any takes that may otherwise occur.

When pile driving does occur, Vineyard Wind is committed to reducing the noise levels generated by pile driving to the lowest levels practicable such that they do not exceed a noise footprint above that which was modeled assuming a 6 dB attenuation. Use of a soft start will allow animals to move away from (*i.e.,* avoid) the sound source prior to reaching the hammer energy needed to install the pile (Vineyard Wind will not use a hammer energy greater than necessary to install piles). To reduce the amount of time the area may be ensonified (and thereby decrease exposure risk), Vineyard Wind will drive no more than two monopiles or four jacket pin piles per day.

We expect that any avoidance of the project area by NARWs would be temporary in nature and that any NARW that avoids the project area during construction would not be permanently displaced. The IHA authorizes 20 takes of NARWs based on the maximum design scenario. This may be comprised of 20 individuals taken once or less than 20 individuals taken on multiple days. The most likely scenario is some combination wherein a few individuals are taken only once and a few individuals are taken on more than one day. For those individuals where take is limited to one day, behavioral disturbance and other Level B harassment impacts that may occur during exposure to elevated noise levels (*e.g.,* masking, stress) is likely insignificant. As described in the notice of proposed IHA, nearly all Population Consequences of Disturbance (PCOD) studies and experts agree that infrequent exposures from a single day or less are unlikely to impact individual fitness, let alone lead to population-level effects.

There is potential for the same individual NARW to be exposed on multiple days; however, the risk is low. Pile driving is limited per day and would only begin in the absence of NARWs detected from PSOs on the pile driving vessel (at any distance) or within the designated PAM clearance zone. If pile driving has commenced, we anticipate NARWs would avoid the area, utilizing nearby habitats not impacted by the project. Further, during times of the year NARWs are most likely to be in the area, the clearance zones are much greater than the Level B harassment zone. However, should a NARW be exposed to pile driving noise above the Level B harassment threshold, pile driving would be shut down (if safe) thereby minimizing the duration and intensity of exposure. We anticipate if NARWs go undetected and they are exposed to pile driving noise, it would be to noise levels only slightly above the Level B harassment threshold as it is likely a NARW would not approach pile driving locations to the degree they would purposely expose themselves to very high noise levels. The implementation of a soft start would provide an opportunity for whales to move away from the source. Given any given exposure would likely involve noise levels on the low end of the Level B harassment spectrum and that animals would likely be at some great distance to the source, the magnitude of any Level B harassment is expected to be low.

There are no known NARW mating or calving areas within the project area; however, as described above, it is as part of a larger core foraging area (Oleson et al., 2020). If a NARW does avoid foraging within the project area, there is ample foraging habitat for it adjacent to the project area that is not ensonified by the project's pile driving noise. For example, in the fall of 2019 and 2020, NARWs were particularly attracted to Nantucket Shoals, a known foraging hot spot. The nearest NARWs detections were approximately 30 kms away from the most western edge of the project area where pile driving would occur. Therefore, any noise from the project would not have impacted NARW foraging in this habitat should it have been occurring at the time.

Prey for NARWs are mobile and broadly distributed throughout the project area; therefore, right whales that may be temporarily displaced during Vineyard Wind's pile driving activities are expected to be able to resume foraging once they have moved away from areas with disturbing levels of underwater noise. Because of the temporary nature of the disturbance and the availability of similar habitat and resources in the surrounding area, the impacts to right whales and the food sources that they utilize are not expected to cause significant or long-term consequences for individual right whales or their population. Even repeated Level B harassment of some smaller number (<20) of individuals as a subset of the overall stock over several days is unlikely to result in any significant realized decrease in viability for the affected individuals, and thus would not result in any adverse impact to the stock as a whole.

With respect to potential vessel strike, the IHA includes an extensive suite of mitigation measures designed to avoid ship strike and close approaches, including, but not limited it, separation distances, limiting vessel speed to 10 kts (18.5 km/hr) (except in the case of transiting crew transfer vessels in the transit route under specific conditions), use of observers and PAM for crew transfer vessels travelling in excess of 10 kts (18.5 km/hr), training and communication protocols, and NARW observation system monitoring. As described above, given anticipated effectiveness of these measures on top of the already very low probability of a vessel strike, take from vessel strike is not anticipated or authorized.

As described above, NARWs are experiencing an ongoing UME. The loss of even one individual could significantly impact the population. However, no mortality, serious injury or injury of right whales as a result of the project is expected or authorized. Any disturbance to NARWs due to exposure to pile driving noise (Level B harassment) is expected to result in temporary avoidance of the immediate area of construction. As no injury or mortality is expected or authorized, and Level B harassment of NARWs will be reduced to the level of least practicable adverse impact through use of mitigation measures, the authorized takes of right whales would not exacerbate or compound the ongoing UME in any way.

NMFS concludes that exposures to NARWs would be greatly reduced due to the seasonal restrictions, and 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. With implementation of the mitigation requirements, take by Level A harassment is unlikely and is 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 or potential alteration of vocalizations. Although unlikely given the NARW-specific mitigation, temporary threshold shift is another potential form of Level B harassment and could result in brief periods of slightly reduced hearing sensitivity that could affect behavioral patterns by making it more difficult to hear or interpret acoustic cues in the frequency range of pile driving (and slightly above)—however, it is unlikely that any individuals would be exposed to piling noise at a distance or duration that would have more than brief and minor impacts, which would not be expected to affect the fitness of any individuals.

In order to evaluate whether or not individual behavioral responses, in combination with other stressors, impact animal populations, scientists have developed theoretical frameworks which can then be applied to particular case studies when the supporting data are available. One such framework is the Population Consequences of Disturbance Model (PCoD), which attempts to assess the combined effects of individual animal exposures to stressors at the population level (NAS 2017). Nearly all PCoD studies and experts agree that infrequent exposures of a single day or less are unlikely to impact individual fitness, let alone lead to population level effects (Booth et al. 2016; Booth et al. 2017; Christiansen and Lusseau 2015; Farmer et al. 2018; Harris et al. 2017; Harwood and Booth 2016; King et al. 2015; McHuron et al. 2018; NAS 2017; New et al. 2014; Pirotta et al. 2018; Southall et al. 2007; Villegas-Amtmann et al. 2015). Since NMFS expects that any exposures would be brief, and the likelihood or repeat exposures to the same individuals is low (but possible), any behavioral responses that would occur due to animals being exposed to pile driving noise are expected to be temporary, with behavior returning to a baseline state shortly after the acoustic stimuli ceases. Given this, and NMFS' evaluation of the available PCoD studies, any such behavioral responses are not expected to impact individual animals' health or have effects on individual animals' survival or reproduction, thus no detrimental impacts at the population or stock level are anticipated. NARWs may temporarily avoid the immediate area but are not expected to permanently abandon the area. Further, while the project area may be used as foraging habitat, the surrounding area, including Nantucket Shoals where NARWs are most likely to congregate, is approximately 20–30 kms west of the project area. Therefore, noise from the project in this area will be minimal to none and well below the 160 dB rms Level B harassment threshold. In addition, the amount of Level B take authorized in the IHA is limited to 20. Under the ITS, less take is authorized if fewer piles are ultimately installed, meaning the authorized level of take may be lower for NARW.

In our IHA, up to 20 NARW individuals could be behaviorally disturbed or some fewer number of individual right whales could be behaviorally disturbed on more than one day, but no more than 20 instances of take would occur. Given most pile driving would occur during a time when NARW is much lower than January through May (when pile driving is, under no circumstances, allowed to proceed) and given the required mitigation and monitoring, it is highly unlikely a single NARW would absorb all the authorized take (*i.e.,* the same whale taken on 20 different days). Because the project area is both a migratory corridor and foraging area, it is likely a subset of whales will be exposed only once and some subset would be exposed on more than one day.

While there may be temporary impacts to behaviors such as foraging near pile driving activities, meaningful shifts in habitat use, distribution, or foraging success are not anticipated. Given the suite of mitigation measures in the IHA, if a NARW is exposed to

noise levels that may result in Level B harassment, this exposure would occur at distance. Because sound loses energy as it moves away from the source, received levels at distance would be low and any resulting behavioral changes are anticipated to be low in severity. We also expect NARWs to avoid areas with high noise levels. NMFS does not anticipate NARW harassment that may result from Vineyard Wind's planned pile driving would impact the reproduction or survival of any individual NARWs, much less annual rates of recruitment or survival.

All Other Marine Mammal Species

Impact pile driving has source characteristics (short, sharp pulses with higher peak levels and sharper rise time to reach those peaks) that are potentially injurious or more likely to produce severe behavioral reactions. However, modeling indicates there is limited potential for injury even in the absence of the mitigation measures, with several species predicted to experience no Level A harassment based on modeling results (Tables 10–13). In addition, the potential for injury is expected to be greatly minimized through implementation of mitigation measures including soft start, use of a sound attenuation system, and the implementation of clearance zones that would facilitate a delay of pile driving if marine mammals were observed approaching or within areas that could be ensonified above sound levels that could result in auditory injury. Given sufficient notice through use of soft start, marine mammals are expected to move away from a sound source that is annoying prior to it becoming potentially injurious (*i.e.,* PTS) or resulting in more severe behavioral reactions. The requirement that pile driving can only commence when the full extent of all clearance zones are fully visible to PSOs will ensure a high marine mammal detection capability, enabling a high rate of success in implementation of clearance zones to avoid injury.

We expect that any take resulting from exposures above the Level A harassment threshold would be in the form of slight PTS, *i.e.,* minor degradation of hearing capabilities within regions of hearing that align most completely with the energy produced by pile driving (*i.e.,* the low-frequency region below 2 kHz), not severe hearing impairment. If hearing impairment occurs, 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. However, given sufficient notice through use of soft start, marine mammals are expected to move away from a sound source that is annoying prior to it becoming potentially injurious or resulting in more severe behavioral reactions.

Additionally, the numbers of exposures above the Level A harassment authorized are relatively low for all marine mammal stocks and species: For 13 of 15 stocks, we authorize no more than 10 takes by Level A harassment over the duration of Vineyard Wind's planned pile driving activities; for the other two stocks we propose to authorize no more than 35 takes by Level A harassment. As described above, we expect that marine mammals would be likely to move away from a sound source that represents an aversive stimulus, especially at levels that would be expected to result in PTS, given sufficient notice through use of soft start, thereby minimizing the degree of PTS that would be incurred. Any PTS incurred would likely be a slight shift in hearing threshold and be limited to lower frequencies produced by pile driving.

NMFS has authorized an amount of Level B harassment take for all marine mammal species based on either sophisticated modeling or information reflected in field data (*e.g.,* monitoring reports, group sizes). To be conservative, NMFS authorized whichever method resulted in a greater amount of take). This take reflects behavioral disturbance directly in response to noise exposure (*e.g.,* avoidance) or indirectly from associated impacts such as TTS or masking. Both the amount and intensity of Level B harassment will be reduced to the level of least practicable adverse impact through use of mitigation measures and, if sound produced by pile driving is sufficiently disturbing, marine mammals are likely to simply avoid the area while the activity is occurring. Effects on individuals that are taken by Level B harassment, on the basis of reports in the literature as well as monitoring from other similar activities, will likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring) (*e.g.,* Thorson and Reyff, 2006; HDR, Inc., 2012; Lerma, 2014). Most likely, individuals will simply move away from the sound source and temporarily avoid the area where pile driving is occurring. Therefore, we expect that animals annoyed by project sound would simply avoid the area during pile driving in favor of other, similar habitats. We expect that any avoidance of the project area by marine mammals would be temporary in nature and that any marine mammals that avoid the project area during construction would not be permanently displaced.

Feeding behavior is not likely to be significantly impacted, as prey species are mobile and are broadly distributed throughout the project area and likely only respond temporarily to exposure to pile driving noise; therefore, marine mammals that may be temporarily displaced during construction activities are expected to be able to resume foraging once they have moved away from areas with disturbing levels of underwater noise. Soft starts would allow prey to move away from the source prior to any noise levels that may physically injure prey and the use of the noise attenuation devices would reduce noise levels to the degree any mortality or injury of prey is also minimized. Use of bubble curtains, for example, is a key mitigation measure in reducing injury and mortality of ESA-listed salmon on the west coast. However, we recognize some mortality, physical injury and hearing impairment in marine mammal prey may occur but we anticipate the amount of prey impacted in this manner is minimal compared to overall availability. Any behavioral responses by marine mammal prey are expected to be brief. For example, Jones et al. (2020) found that when squid (*Doryteuthis pealeii*) were exposed to impulse pile driving noise, body pattern changes, inking, jetting, and startle responses were observed and nearly all squid exhibited at least one response. However, these responses occurred primarily during the first eight impulses and diminished quickly, indicating potential rapid, short-term habituation. We expect that other impacts such as stress or masking would occur in fish that serve as marine mammals prey (Thomas et al. 2006); however, those impacts would be limited to the duration of pile driving and, if prey were to move out the area in response to noise, these impacts would be minimized.

Because of the temporary nature of the disturbance and the availability of similar habitat and resources in the surrounding area, the impacts to marine mammals and the food sources that they utilize are not expected to cause significant or long-term consequences for individual marine mammals or their populations. There are no notable areas of biological significance for non-NARW marine mammal feeding activity known to exist within the WDA. A fin whale BIA (foraging; March–October) is delineated to the east of the WDA and a minke whale BIA (foraging, March–

November) is delineated west of the WDA. While marine mammals may be able to detect pile driving noise within the edges of the BIAs closest to pile driving activities, it is unlikely noise levels would rise to the level where any foraging behavior is anticipated to be impacted from pile driving activities. In addition, there are no rookeries or mating or calving areas known to be biologically important to marine mammals within the project area.

Repeated exposures of individuals to relatively low levels of sound outside of preferred habitat areas are unlikely to significantly disrupt critical behaviors. Thus, even repeated Level B harassment of some small subset of an overall stock is unlikely to result in any significant realized decrease in viability for the affected individuals, and thus would not result in any adverse impact to the stock as a whole.

NMFS concludes that exposures to marine mammals due to Vineyard Wind's activity would result in only short-term effects to individuals exposed to pile driving. Marine mammals may temporarily avoid the immediate area but are not expected to permanently abandon the area. Impacts to breeding, feeding, sheltering, resting, or migration are not expected, nor are shifts in habitat use, distribution, or foraging success. NMFS does not anticipate the marine mammal takes that would result from the planned activity would impact annual rates of recruitment or survival.

As described in the notice of proposed IHA (84 FR 18346; April 30, 2019), humpback whales, minke whales, and gray, harbor and harp seals are experiencing ongoing UMEs. For minke whales and seals, although the ongoing UME is under investigation (as occurs for all UMEs), this event does not provide cause for concern regarding population level impacts. The minke whale population abundance is greater than 20,000 whales. Even though the PBR value is based on an abundance for U.S. waters that is negatively biased and a small fraction of the true population abundance, annual M/SI does not exceed the calculated PBR value for minke whales. For harbor seals, the population abundance is over 75,000 and annual M/SI (345) is well below PBR (2,006) (Hayes et al., 2018). For gray seals, the population abundance is over 27,000, and abundance is likely increasing in the U.S. Atlantic EEZ and in Canada (Hayes et al., 2018). For harp seals, the current population trend in U.S. waters is unknown, as is PBR (Hayes et al., 2018), however the population abundance is over 7 million seals, suggesting that the UME is unlikely to result in population-level impacts (Hayes et al., 2018). With regard to humpback whales, the population is facing a UME wherein elevated strandings have occurred since 2016 and are ongoing. A portion of the whales have shown evidence of pre-mortem vessel strike; however, this finding is not consistent across all whales examined and investigations are ongoing. Animals involved in this UME primarily belong to the West Indies Distinct Population Segment (DPS) of which the Gulf of Maine stock is a part. While the MMPA designated Gulf of Maine stock is relatively small (n = 1,393), the most recent population estimate for the ESA-designated West Indies DPS (of which animals belonging to the Gulf of Maine stock also belong) is approximately 10,400 animals (Smith et al, 2009). The UME is a cause for concern to the Gulf of Maine stock; however, the taking associated with the issuance of the IHA is not anticipated to contribute to the UME or impact the stock such that it would affect annual rates or recruitment or survival. Authorized takes by Level A harassment for all species are very low (*i.e.,* no more than 10 takes by Level A harassment authorized for any of these species) and as described above, any Level A harassment would be expected to be in the form of slight PTS, *i.e.,* minor degradation of hearing capabilities which is not likely to meaningfully affect the ability to forage or communicate with conspecifics. Even absent mitigation, no serious injury or mortality from pile driving is anticipated. The suite of measures for vessel operation and monitoring ensure risk of serious injury or mortality from ship strikes is minimized such that the probability of a strike is *de minimus.* Mortality and serious injury is neither expected nor authorized, and Level B harassment of humpback whales and minke whales and gray, harbor and harp seals will be reduced to the level of least practicable adverse impact through implementation of mitigation measures. As such, the authorized takes of these species would not exacerbate or compound the ongoing UMEs in any way.

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

- No mortality or serious injury is anticipated or authorized and no Level A take of ESA-listed marine mammals is authorized;
- Instances of Level A harassment are limited for all impacted species and would be in the form of a slight PTS;
- Level B harassment would be in the form of behavioral disturbance, primarily resulting in avoidance of the project area around where pile driving is occurring, and some low-level TTS and masking that may limit the detection of acoustic cues for relatively brief amounts of time.
- Repeated disturbance to some individuals, including a very limited number of NARWs, may occur; however, any resulting behavioral reactions from exposure to pile driving noise (*e.g.,* avoidance, short-term cessation of foraging) are not expected to result in impacts to any stock's reproduction or survival.
- Total authorized takes as a percentage of population are very low for all species and stocks impacted (*i.e.,* less than 5.5 percent for all stocks, and less than 1 percent for 10 of 15 stocks);
- Areas of similar habitat value are available for marine mammals that may temporarily vacate the project area during construction;
- Effects on species that serve as prey for marine mammals from the activity are expected to be short-term and are not expected to result in significant or long-term consequences for individual marine mammals, or to contribute to adverse impacts on their populations;
- A biologically important migratory area exists for NARWs, however the required seasonal moratorium on construction is expected to largely avoid impacts to the NARW migration, as described above. The project area encompasses a subset of a core year-round foraging habitat; however, there are areas within this core foraging habitat that would not be impacted by project noise. Further, any noise within the project area would be temporary given the limitation to the amount of pile driving and time of day pile driving could occur. Moreover, potential for exposure from noise causing behavioral disruptions such as a cessation of foraging is also more reduced through implementation of the required mitigation measures (*e.g.,* requiring a delay in pile driving should a NARW be observed at any distance by PSOs on the pile driving vessel would limit any disruption of foraging).
- There are no known important feeding, breeding or calving areas in the project area for all other marine mammals within the project area. A foraging BIA exists for fin and minke whales in the general region of southern New England; however, any received levels within these areas would be low given their distance from the WDA and

therefore exposure to these low levels (while possibly audible) are not expected to result in disruption of foraging within the BIAs.

• The required mitigation measures, including visual and acoustic monitoring, clearance zones, and soft start, are expected to minimize potential impacts to marine mammals and effect the least practicable adverse impact on all marine mammals.

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

Small Numbers

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

We authorize incidental take of 15 marine mammal stocks. The total amount of taking authorized is less than 5.5 percent for five of these stocks, and less than 1 percent for the remaining 10 stocks (Table 15), which we consider to be relatively small percentages and we find are small numbers of marine mammals relative to the estimated overall population abundances for those stocks.

Based on the analysis contained herein of the planned activity (including the mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS finds that small numbers of marine mammals will be taken relative to the population size of all affected species or stocks.

Unmitigable Adverse Impact Analysis and Determination

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

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216–6A, NMFS must review our proposed action (*i.e.,* the issuance of an incidental harassment authorization) with respect to potential impacts on the human environment. In compliance with NEPA, as implemented by the regulations published by the Council on Environmental Quality (40 CFR parts 1500–1508 (1978)), the Bureau of Ocean Energy Management (BOEM) prepared an Environmental Impact Statement (EIS) to consider the direct, indirect and cumulative effects to the human environment resulting from the Vineyard Wind project. NMFS has participated as a cooperating agency on BOEM's EIS and provided technical expertise to BOEM in development of the document as it pertains to NMFS trust resources, including marine mammals. BOEM's Draft EIS was made available for public comment from December 7, 2018 to February 22, 2019. A Supplement to the Draft EIS was subsequently made available for public comment from June 12, 2020 to July 27, 2020; both the Draft EIS and Supplement to the Draft EIS were made available online at: *www.boem.gov/Vineyard-Wind.* BOEM published a Notice of Availability of the Final EIS on March 8, 2021. As a cooperating agency, NMFS reviewed and provided comments related to NMFS trust resources, including marine mammals, on the Draft EIS, Supplement to the Draft EIS and cooperating agency review draft of the Final EIS. In compliance with NEPA and the CEQ regulations (40 CFR 1506.3), as well as NOAA Administrative Order 216–6 and its Companion Manual, NMFS has reviewed BOEM's Final EIS, determined it to be sufficient, and adopted that Final EIS which adequately evaluates the direct, indirect and cumulative impacts of NMFS's proposed action to issue an IHA under the MMPA to Vineyard Wind for its offshore commercial wind project. NMFS has further determined that its comments and suggestions as a cooperating agency have been satisfied and recirculation of BOEM's EIS is therefore unnecessary (40 CFR 1506.3(c)). NMFS signed a joint Record of Decision (ROD) on May 10, 2021.

Endangered Species Act

Section 7(a)(2) of the Endangered Species Act of 1973 (ESA: 16 U.S.C. 1531 *et seq.*) requires that each Federal agency insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. To ensure ESA compliance for the issuance of IHAs, NMFS consults internally, in this case with the NMFS Greater Atlantic Regional Fisheries Office (GARFO), whenever we propose to authorize take for endangered or threatened species.

The NMFS Office of Protected Resources Permits and Conservation Division is authorizing the incidental take of four species of marine mammals which are listed under the ESA: The North Atlantic right, fin, sei and sperm whale. We requested initiation of consultation under Section 7 of the ESA with NMFS GARFO on April 26, 2019, for the issuance of this IHA. On September 11, 2020, NMFS GARFO issued a Biological Opinion concluding that these activities may adversely affect but are not likely to jeopardize the continued existence of North Atlantic right, fin, sei and sperm whales.

The ITS issued with the Biological Opinion authorizes take of ESA-listed species based on the number of turbines that will actually be constructed. This means that if fewer turbines are constructed, fewer takes of ESA-listed species are authorized by the ITS. This scaled approach reflects how NMFS GARFO chose to satisfy requirements under ESA. Under Section 7 of the ESA, a biological opinion reviews a proposed action, as reasonably defined by the action agency, and assesses the ''effects of the action.'' BOEM sought consultation on its proposed action, which it defined using a reasonable ''maximum design envelope.'' The maximum design envelope, however, was not necessarily what would actually be constructed. Under regulations implementing Section 7 of the ESA, ''effects of the action'' include all consequences to listed species caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. In the Biological Opinion, NMFS GARFO evaluated effects from driving a range of piles up to the design envelope's maximum number of pile foundations (57 to 102) and then scaled the take numbers in the ITS based on the number of turbines that will be constructed so that the amount of

incidental take that is reasonably certain to occur and, therefore, commensurate with the actual construction. Without scaling, the ITS would have exempted more incidental take of ESA-listed species than is reasonably certain to occur. Since the scaled approach is a function of the ITS for this project, it only applies to ESA-listed marine mammals in the IHA.

Consultation has been reinitiated on the September 11, 2020 Biological Opinion and ITS. However, they remain valid and effective until reinitiated consultation is completed.

Authorization

NMFS has issued an IHA to Vineyard Wind authorizing take of marine mammals incidental to pile driving associated with the construction of the proposed wind project offshore of Massachusetts, for a period of one year, from May 1, 2023 through April 30, 2024. Vineyard Wind is required to abide by all mitigation, monitoring, and reporting requirements in the IHA.

Dated: June 15, 2021.

Catherine Marzin,

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

[FR Doc. 2021–13501 Filed 6–24–21; 8:45 am]

BILLING CODE 3510–22–P