DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 217

[Docket No. 240605–0153]

RIN 0648–BM11

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

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

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

SUMMARY: NMFS received a request from SouthCoast Wind Energy LLC (SouthCoast) (formerly Mayflower Wind Energy LLC), for Incidental Take Regulations (ITR) and an associated Letter of Authorization (LOA) pursuant to the Marine Mammal Protection Act (MMPA). The requested regulations would govern the authorization of take, by Level A harassment and Level B harassment, of small numbers of marine mammals over the course of five years (2027–2032) incidental to construction of the SouthCoast Wind Project (SouthCoast Project) offshore of Massachusetts within the Bureau of Ocean Energy Management (BOEM) Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS) Lease Area OCS–A 0521 (Lease Area) and associated Export Cable Corridors (ECCs). Specified activities expected to result in incidental take are pile driving (impact and vibratory), unexploded ordnance or munitions and explosives of concern (UXO/MEC) detonation, and site assessment surveys using high-resolution geophysical (HRG) equipment. NMFS requests comments on this proposed rule. NMFS will consider public comments prior to making any final decision on the promulgation of the requested ITR and issuance of the LOA; agency responses to public comments will be summarized in the final rule. The regulations, if promulgated, would be effective April 1, 2027 through March 31, 2032.

DATES: Comments and information must be received no later than July 29, 2024.

ADDRESSES: A plain language summary of this proposed rule is available at *https://www.regulations.gov/docket/* NOAA–NMFS–2024–0074. Submit all electronic public comments via the Federal e- Portal. Visit *https://www.regulations.gov* and type NOAA–NMFS–2024–0074 in the Rulemaking Search box. Click on the ''Comment'' icon, complete the required fields, and enter or attach your comments.

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

A copy of SouthCoast's Incidental Take Authorization (ITA) application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-other-energy-activities-renewable.* In case of problems accessing these documents, please call the contact listed below (see **FOR FURTHER INFORMATION CONTACT**).

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

SUPPLEMENTARY INFORMATION:

Purpose and Need for Regulatory Action

This proposed rule, if promulgated, would provide a framework under the authority of the MMPA (16 U.S.C. 1361 *et seq.*) to allow for the authorization of take of marine mammals incidental to construction of the SouthCoast Project within the Lease Area and along ECCs to landfall locations in Massachusetts. NMFS received a request from SouthCoast for 5-year regulations and a LOA that would authorize take of individuals of 16 species of marine mammals by harassment only (4 species by Level A harassment and Level B harassment and 12 species by Level B harassment only) incidental to SouthCoast's construction activities. No mortality or serious injury is anticipated or proposed for authorization. Please see the *Legal Authority for the Proposed Action* section below for relevant definitions.

Legal Authority for the Proposed Action

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

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

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

- *U.S. Citizen*—individual U.S. citizens or any corporation or similar entity if it is organized under the laws of the United States or any governmental unit defined in 16 U.S.C. 1362(13); 50 CFR 216.103);
- *Take*—to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal (16 U.S.C. 1362(13); 50 CFR 216.3);
- *Incidental harassment, Incidental taking, and incidental, but not intentional, taking*—an accidental taking. This does not mean that the taking is unexpected, but rather it includes those takings that are infrequent, unavoidable or accidental (50 CFR 216.103);
- *Serious Injury*—any injury that will likely result in mortality (50 CFR 216.3);
- *Level A harassment*—any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild (16 U.S.C. 1362(18); 50 CFR 216.3); and
- *Level B harassment*—any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the

wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (16 U.S.C. 1362(18); 50 CFR 216.3).

Summary of Major Provisions Within the Proposed Rule

The major provisions of this proposed rule are:

- Allowing NMFS to authorize, under a LOA, the take of small numbers of marine mammals by Level A harassment and/or Level B harassment incidental to the SouthCoast Project and prohibiting take of such species or stocks in any manner not permitted (*e.g.,* mortality or serious injury);
- Establishing a seasonal moratorium on foundation installation within 20 kilometers (km) (12.4 miles (mi)) of the 30-m isobath on the western side of Nantucket Shoals which, for purposes of this proposed rule, is hereafter referred to as the North Atlantic Right Whale Enhanced Mitigation Area (NARW EMA), from October 16–May 31, annually;
- Establishing a seasonal moratorium on foundation installation throughout the rest of the Lease Area January 1–May 15 and a restriction on foundation pile driving in December unless Southcoast requests and NMFS approves piling driving in December, which would require SouthCoast to implement enhanced mitigation and monitoring to minimize impacts to North Atlantic right whales (*Eubalaena glacialis*);
- Establishing enhanced North Atlantic right whale monitoring, clearance, and shutdown procedures SouthCoast must implement in the NARW EMA August 1–October 15, and throughout the rest of the Lease Area May 16–31 and December 1–31;
- Establishing a seasonal moratorium on the detonation of unexploded ordnance or munitions and explosives of concern (UXO/MEC) December 1–April 30 to minimize impacts to North Atlantic right whales;
- Requirements for UXO/MEC detonations to only occur if all other means of removal are exhausted (*i.e.,* As Low As Reasonably Practicable (ALARP) risk mitigation procedure) and conducting UXO/MEC detonations during daylight hours only and limiting detonations to 1 per 24 hour period;
- Conducting both visual and passive acoustic monitoring (PAM) by trained, NMFS-approved Protected Species Observers (PSOs) and PAM operators before, during, and after select in-water construction activities;
- Requiring training for all SouthCoast Project personnel to ensure marine mammal protocols and procedures are understood;
- Establishing clearance and shutdown zones for all in-water construction activities to prevent or reduce the risk of Level A harassment and to minimize the risk of Level B harassment, including a delay or shutdown of foundation impact pile driving and delay to UXO/MEC detonation if a North Atlantic right whale is observed at any distance by PSOs or acoustically detected within certain distances;
- Establishing minimum visibility and PAM monitoring zones during foundation impact pile driving and detonations of UXO/MECs;
- Requiring use of a double bubble curtain during all foundation pile driving installation activities and UXO/MEC detonations to reduce noise levels to those modeled assuming a broadband 10 decibel (dB) attenuation;
- Requiring sound field verification (SFV) monitoring during pile driving of foundation piles and during UXO/MEC detonations to measure in situ noise levels for comparison against the modeled results and ensure noise levels assuming 10 dB attenuation are not exceeded;
- Requiring SFV during the operational phase of the SouthCoast Project;
- Implementing soft-starts during pile driving and ramp-up during the use of high-resolution geophysical (HRG) marine site characterization survey equipment;
- Requiring various vessel strike avoidance measures;
- Requiring various measures during fisheries monitoring surveys, such as immediately removing gear from the water if marine mammals are considered at-risk of interacting with gear;
- Requiring regular and situational reporting, including, but not limited to, information regarding activities occurring, marine mammal observations and acoustic detections, and sound field verification monitoring results; and
- Requiring monitoring of the North Atlantic right whale sighting networks, Channel 16, and PAM data as well as reporting any sightings to NMFS.

Through adaptive management, NMFS Office of Protected Resources may modify (*e.g.,* remove, revise, or add to) the existing mitigation, monitoring, or reporting measures summarized above and required by the LOA.

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

National Environmental Policy Act (NEPA)

On February 15, 2021, SouthCoast submitted a Construction and Operations Plan (COP) to BOEM for approval to construct and operate the SouthCoast Project, which has been updated several times since, as recently as September 2023. On November 1, 2021, BOEM published in the **Federal Register** a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for the COP (86 FR 60270). On February 17, 2023, BOEM published and made its SouthCoast Draft Environmental Impact Statement (DEIS) for Commercial Wind Lease OCS–A 0521 available for public comment for 45 days, February 17, 2023 to April 3, 2023 (88 FR 10377). On April 4, 2023, BOEM extended the public comment period by 15 days through April 18, 2023 (88 FR 19986). Additionally, BOEM held three virtual public hearings on March 20, March 22, and March 27, 2023.

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216–6A, NMFS must evaluate the potential impacts on the human environment of the proposed action (*i.e.,* promulgating the regulations and subsequently issuing a 5-year LOA to SouthCoast) and alternatives to that action. Accordingly, NMFS is a cooperating agency on BOEM's Environmental Impact Statement (EIS) and proposes to adopt the EIS, provided our independent evaluation of the document finds that it includes adequate information analyzing the effects on the human environment of promulgating the proposed regulations and issuing the LOA.

Information in the SouthCoast ITA application, this proposed rule, and the BOEM EIS mentioned above collectively provide the environmental information related to proposed promulgation of these regulations and associated LOA for public review and comment. NMFS will review all comments submitted in response to this proposed rulemaking prior to concluding the NEPA process or making a final decision on the request for an ITA.

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

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

SouthCoast's proposed project is listed on the Permitting Dashboard, where milestones and schedules related to the environmental review and permitting for the project can be found: *https://www.permits.performance.gov/permitting-project/southcoast-wind-energy-llc-southcoast-wind.*

Summary of Request

On March 18, 2022, Mayflower Wind Energy LLC (Mayflower Wind) submitted a request for the promulgation of regulations and issuance of an associated 5-year LOA to take marine mammals incidental to construction activities associated with the Mayflower Wind Project offshore of Massachusetts in the Lease Area OCS–A–0521. On February 1, 2023, Mayflower Wind notified NMFS that it changed its company name and project name to SouthCoast Wind Energy LLC and SouthCoast Wind Project, respectively. SouthCoast's request is for the incidental, but not intentional, taking of a small number of 16 marine mammal species (comprising 16 stocks) by Level B harassment (for all 16 species or stocks) and by Level A harassment (for four species or stocks). No serious injury or mortality is expected to result from the specified activities, nor is any proposed for authorization.

In response to our questions and comments and following extensive information exchange between SouthCoast and NMFS, SouthCoast submitted revised applications on April 23, June 24, and August 16, 2022, and a final revised application on September 14, 2022, which NMFS deemed adequate and complete on September 19, 2022. On October 17, 2022, NMFS published a notice of receipt (NOR) of SouthCoast's adequate and complete application in the **Federal Register** (87 FR 62793), requesting comments and soliciting information related to SouthCoast's request during a 30-day public comment period. During the NOR public comment period, NMFS received comment letters from one member of the public, Seafreeze, Ltd, and two environmental non-governmental organizations: Conservation Law Foundation and Oceana. NMFS has reviewed all submitted material and has taken the material into consideration during the drafting of this proposed rule.

Following publication of the NOR (87 FR 62793, October 17, 2022), NMFS further assessed potential impacts of SouthCoast's proposed activities on North Atlantic right whales that utilize foraging habitat within and near the Lease Area and consulted with SouthCoast to develop enhanced mitigation and monitoring measures that would reduce the likelihood of these potential impacts. On March 15, 2024, following extensive information exchange, SouthCoast submitted a North Atlantic Right Whale Enhanced Mitigation Plan and Monitoring Plan and revised application on March 15, 2024, which NMFS accepted on March 19, 2024.

NMFS previously issued two Incidental Harassment Authorizations (IHAs) to Mayflower Wind and one IHA to SouthCoast Wind authorizing the taking of marine mammals incidental to marine site characterization surveys (using HRG equipment) of SouthCoast's Lease Area (OCS–A 0521) (see 85 FR 45578, July 29, 2020; 86 FR 38033, July 19, 2021; 88 FR 31678, May 18, 2023). To date, SouthCoast has complied with all IHA requirements (*e.g.,* mitigation, monitoring, and reporting). Information regarding SouthCoast's monitoring results, which were utilized in take estimation, may be found in the Estimated Take section, and the full monitoring reports can be found on NMFS' website: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-other-energy-activities-renewable.*

On August 1, 2022, NMFS announced proposed changes to the existing North Atlantic right whale vessel speed regulations to further reduce the likelihood of mortalities and serious injuries to endangered right whales from vessel collisions, which are a leading cause of the species' decline and a primary factor in an ongoing Unusual Mortality Event (87 FR 46921). Should a final vessel speed rule be promulgated and become effective during the effective period of these proposed regulations (or any other MMPA incidental take authorization), the authorization holder would be required to comply with any and all applicable requirements contained within such final vessel speed rule. Specifically, where measures in any final vessel speed rule are more protective or restrictive than those in this or any other MMPA authorization, authorization holders would be required to comply with the requirements of such rule. Alternatively, where measures in this or any other MMPA authorization are more restrictive or protective than those in any final vessel speed rule, the measures in the MMPA authorization would remain in place. The responsibility to comply with the applicable requirements of any vessel speed rule would become effective immediately upon the effective date of any final vessel speed rule and, when notice is published of the effective date, NMFS would also notify SouthCoast if the measures in such speed rule were to supercede any of the measures in the MMPA authorization.

Description of the Specified Activities

Overview

SouthCoast has proposed to construct and operate an up to 2,400 megawatt (MW) offshore wind energy facility (SouthCoast Project) in state and Federal waters in the Atlantic Ocean in Lease Area OCS–A–0521. This lease area is located within the Massachusetts Wind Energy Area (MA WEA), 26 nautical miles (nm, 48 km) south of Martha's Vineyard and 20 nm (37 km) south of Nantucket, Massachusetts. Development of the offshore wind energy facility would be divided into two projects, each of which would be developed in separate years. Project 1 and Project 2 would occupy the northeastern and southwestern halves (approximately) of the Lease Area, respectively. Each Project would have the potential to generate approximately 1,200 MW of renewable energy. Once operational, SouthCoast would allow the State of Massachusetts to advance Federal and State offshore wind targets as well as reduce greenhouse gas emissions, increase grid reliability, and support economic development and growth in the region.

The SouthCoast Project would consist of several different types of permanent offshore infrastructure: wind turbine generators (WTGs), offshore substation platforms (OSPs), associated WTG and OSP foundations, inter-array and ECCs, and offshore cabling. Onshore substation and converter stations, onshore interconnection routes, and operations and maintenance (O&M) facilities are also planned. There are 149 positions in OSP foundations (totaling no more than 149) would be installed.

The number of WTG foundations installed would vary by project. SouthCoast has not yet determined the exact number of OSPs necessary to support each project, but the total across projects would not exceed five. Project 1 would include up to 85 WTG foundations, and Project 2 would include up to 73 WTG foundations for a maximum of 147 WTG foundations for both Project 1 and Project 2. Project 1 foundations would be installed in two distinct areas. Subject to extensive mitigation, including extended seasonal restrictions and monitoring, SouthCoast would install up to 54 foundations within the NARW EMA, defined as the northeastern portion of the lease area within 20 km (9.3 mi) of the 30-m (98.4 ft) isobath along the western side of Nantucket Shoals (see Figure 2 in the *Specified Geographical Area* section for more detail). The remaining foundations for Project 1 (out of a maximum of 85) would be installed in positions immediately southwest of the NARW EMA.

SouthCoast is considering three foundation types for WTGs and OSPs: monopile, piled jacket, and suction-bucket jacket. SouthCoast would install up to two different foundation types for WTGs (*i.e.,* piled jacket and monopiles), and potentially a third concept for OSPs (*e.g.,* suction bucket jacket). However, due to economic and technical infeasibility, suction-bucket jackets are no longer under consideration for Project 1. Geotechnical investigations at Project 2 foundation locations are ongoing, and SouthCoast will need to assess the data to determine whether it would be feasible to install suction-bucket jacket foundations, rather than monopile or jacket foundations. However, due to predicted installation complexities, this is not the preferred foundation type. If suction bucket foundations are selected for Project 2, pile driving would not be necessary.

SouthCoast is considering multiple installation scenarios for each project, which differ by foundation type and number, and installation method. For Project 1, SouthCoast plans to install either all monopile WTG (Project 1, Scenario 1; P1S1: 71 WTGs) or pin-piled jacket (Project 1, Scenario 2; P1S2: 85 WTGs) foundations by impact pile driving only. For Project 2, unless suction bucket jackets are selected as the preferred type, foundation installation would also include either all monopile or all piled jacket WTG foundations, which would be installed using impact pile driving only (Project 2, Scenario 1; P2S1: 68 WTGs) or a combination of vibratory and impact (Project 2, Scenario 2; P2S2, 73 WTGs; Project 2 Scenario 3; P2S3 62 WTGs) pile driving. Each WTG and OSP would be supported by a single foundation. OSP monopile or piled jacket foundations would be installed using only impact pile driving. SouthCoast is considering three OSP designs: modular, integrated, and DC-converter. Should they elect to install piled jacket foundations to support OSPs, the number of jacket legs and pin piles would vary depending on the OSP design. SouthCoast currently identifies installation of one DC-converter OSP per project, each supported by a piled jacket foundation, as the most realistic scenario.

Inter-array cables will transmit electricity from the WTGs to the OSP. Export cables would transmit electricity from each OSP to a landfall site. All offshore cables will connect to onshore export cables, substations, and grid connections, which would be located at landfall locations. SouthCoast is proposing to develop one preferred ECC for both Project 1 and Project 2, making landfall and interconnecting to the ISO New England Inc. (ISO–NE) grid at Brayton Point, in Somerset, Massachusetts (*i.e.,* the Brayton Point Export Cable Corridor (Brayton Point ECC)). For Project 2, SouthCoast is proposing an alternative export cable corridor which, if utilized, would make landfall and interconnect to the ISO–NE grid in the town of Falmouth, MA (the Falmouth ECC) in the event that technical, logistical, grid interconnection, or other unforeseen challenges arise during the design and engineering phase that prevent Project 2 from making interconnection at Brayton Point.

Specified activities would also include temporary installation of up to four nearshore gravity-based structures (*e.g.,* gravity cell or gravity-based cofferdam) and/or dredged exit pits to connect the offshore export cables to onshore facilities; vessel-based site characterization and assessment surveys using high-resolution geophysical active acoustic sources with frequencies of less than 180 kilohertz (kHz) (HRG surveys); detonation of up to 10 unexploded ordnances or Munitions and Explosives of Concern (UXO/MEC) of different charge weights; several types of fishery and ecological monitoring surveys; site preparation work (*e.g.,* boulder removal); the placement of scour protected; trenching, laying, and burial activities associated with the installation of the export cable from OSPs to shore-based switching and substations and inter-array cables between turbines; transit within the Lease Area and between ports and the Lease Area to transport crew, supplies, and materials to support pile installation via vessels; and WTG operation.

Based on the current project schedule, SouthCoast anticipates WTGs would become operational for Project 1 beginning in approximately Q2 2029 and Project 2 by Q4 2031, after installation is completed and all necessary components, such as array cables, OSPs, ECCs, and onshore substations are installed. Turbines would be commissioned individually by personnel on location, so the number of commissioning teams would dictate how quickly turbines would become operational. SouthCoast expects that all turbines will be commissioned by Q4 2031.

Marine mammals exposed to elevated noise levels during impact and vibratory pile driving during foundation installation, detonations of UXO/MECs, or HRG surveys may be taken by Level A harassment and/or Level B harassment depending on the specified activity. No serious injury or mortality is anticipated or proposed for authorization.

Dates and Duration

The specified activities would occur over approximately 6 years, starting in the fourth quarter of 2026 and continuing through the end of 2031. SouthCoast anticipates that the specified activities with the potential to result in take by harassment of marine mammals would begin in the second quarter of 2027 and occur throughout all 5 years of the proposed regulations which, if issued, would be effective from April 1, 2027–March 31, 2032.

The general schedule provided in table 1 includes all of the major project components, including those that may result in harassment of marine mammals (*i.e.,* foundation installation, HRG surveys, and UXO/MEC detonation) and those that are not expected to do so (shown in italics). Projects 1 and 2 will be developed in separate years, which may not be consecutive. To allow flexibility in the final design and during the construction period, SouthCoast has not identified specific years in which each Project would be installed.

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

Specified activity	Estimated schedule	Activity timing
HRG Surveys	Q2 2027–Q3 2031	Any time of the year, up to 112.5 days per year during construction of Project 1 and Project 2, and up to 75 days per year during non-construction years.
Scour Protection Pre- or Post-Installation	Q1 2027–Q3 2029	Any time of the year.
WTG and OSP Foundation Installation, Project 1.	Q2–Q4 2028 or Q2–Q4 2029[1 2]	Approximately 6 months.
WTG and OSP Foundation Installation, Project 2.	Q2–Q4 2030[1 2 3]	Approximately 6 months.
Horizontal Directional Drilling at Cable Landfall Sites.	Project 1 Q4 2026–Q1 2027 Project 2 Q4 2029–Q1 2030	Approximately 6 months per project.
UXO/MEC Detonations	Q2–Q4 2028, 2029, and 2030[4]	Up to 5 days for Project 1 and up to 5 days for Project 2. No more than 10 days total.
Inter-array Cable Installation	Project 1: 2028–2029 Project 2: 2029–2030	Project 1: up to 16 months. Project 2: up to 12 months.
Export Cable Installation and Termination	Project 1: 2027–2029 Project 2: 2029–2030	Project 1: up to 30 months. Project 2: up to 12 months.
Fishery Monitoring Surveys	Before, during, and after construction of Projects 1 and 2.	Any time of year.
Turbine Installation and Operation	Initial turbines operational 2030, all turbines operational by 2032.	

[1] SouthCoast does not currently know in which of these years Project 1 and Project 2 construction would occur but estimates that each Project would be completed in a single year (2 years total).

[2] NMFS is proposing seasonal restriction mitigation measures that would limit pile driving to June 1 through October 15 in the NARW EMA and May 16 through December 31 in the rest of the Lease Area (although proposing requiring NMFS' prior approval to install foundations in December).

[3] Should SouthCoast decide to install suction bucket foundations for Project 2, installation would occur Q2 2030–Q2 2031. This activity would not be seasonally restricted because installation of this foundation type does not require pile driving.

[4] NMFS is proposing seasonal restriction mitigation measures UXO/MEC detonations from December 1 through April 30.

[5] Activities in italics are not expected to result in incidental take of marine mammals.

Specific Geographical Region

Most of SouthCoast's specified activities would occur in the Northeast U.S. Continental Shelf Large Marine Ecosystem (NES LME), an area of approximately 260,000 km^2 (64,247,399.2 acres), spanning from Cape Hatteras in the south to the Gulf of Maine in the north. More specifically, the Lease Area and ECC would be located within the Mid-Atlantic Bight subarea of the NES LME, which extends between Cape Hatteras, North Carolina, and Martha's Vineyard, Massachusetts, and eastward into the Atlantic to the 100-m (328.1 ft) isobath.

The Lease Area and ECCs are located within the Southern New England (SNE) sub-region of the Northeast U.S. Shelf Ecosystem, at the northernmost end of the Mid-Atlantic Bight (MAB), which is distinct from other regions based on differences in productivity, species assemblages and structure, and habitat features (Cook and Auster, 2007). Weather-driven surface currents, tidal mixing, and estuarine outflow all contribute to driving water movement through the area (Kaplan, 2011), which is subjected to highly seasonal variation in temperature, stratification, and productivity. The Lease Area, OCS–A 0521, is part of the Massachusetts Wind Energy Area (MA WEA) (3,007 square kilometers (km^2) (742,974 acres)) (Figure 1). Within the MA WEA, the Lease Area covers approximately 516 km^2 (127, 388 acres) and is located approximately 30 statute miles (mi) (26 nm; 48 km) south of Martha's Vineyard, Massachusetts, and approximately 23 mi (20 nm, 37 km) south of Nantucket, Massachusetts. At its closest point to land, the Lease Area is approximately 45 mi (39 nm, 72 km) south from the mainland at Nobska Point in Falmouth, Massachusetts.

During construction, the Project will require support from temporary construction laydown yard(s) and construction port(s). The operational phase of the Project will require support from onshore O&M facilities. While a final decision has not yet been made, SouthCoast will likely use more than one marshalling port for the SouthCoast Project. The following ports are under consideration: New Bedford, MA; Fall River, MA; South Quay, RI; Salem Harbor, MA; Port of New London, CT; Port of Charleston, SC; Port of Davisville, RI; Sparrows Point Port, Maryland; and Sheet Harbor, Canada.

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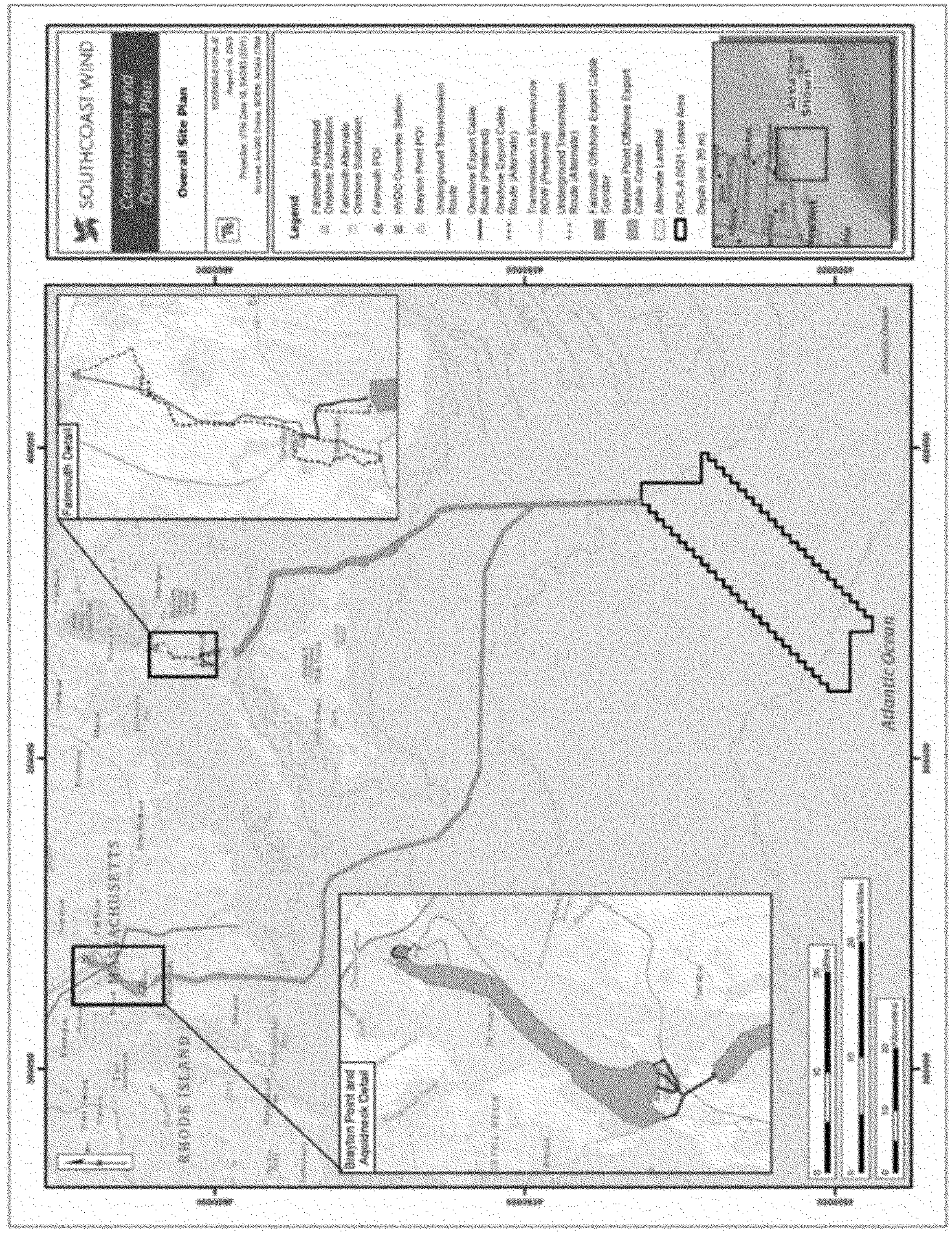

Figure 1 – SouthCoast Project Location

The Brayton Point ECC and the Falmouth ECC would traverse Federal and state territorial waters of Massachusetts and Rhode Island, making landfall at Brayton Point in Somerset, Massachusetts or at Falmouth, Massachusetts, respectively. Within the Brayton Point ECC, up to six submarine offshore export cables, including up to four power cables and up to two dedicated communications cables, would be installed from one or more OSPs within the lease area in Federal waters and run through the Sakonnet River, make intermediate landfall on Aquidneck Island in Portsmouth, Rhode Island, which includes an underground onshore export cable route, and then into Mount Hope Bay to make landfall at Brayton Point in Somerset, Massachusetts. Within the Falmouth export cable corridor, up to five submarine offshore export cables, including up to four power cables and up to one dedicated communications cable, would be installed from one or more OSPs within the Lease Area and run through Muskeget Channel into Nantucket Sound in Massachusetts state waters to make landfall in Falmouth, Massachusetts.

As described in further detail below, SouthCoast proposed mitigation and monitoring measures that would apply throughout the Lease Area, as well as enhanced measures applicable to a portion of the Lease Area that overlaps with the NARW EMA. The 30-m (98.4 ft)) isobath represents bathymetry defining the edge of Nantucket Shoals and corresponds with the predicted location of tidal mixing fronts in this region (Simpson and Hunter, 1974; Wilkin, 2006) and observations of high productivity and North Atlantic right whale foraging (Leiter *et al.,* 2017; White *et al.,* 2020).

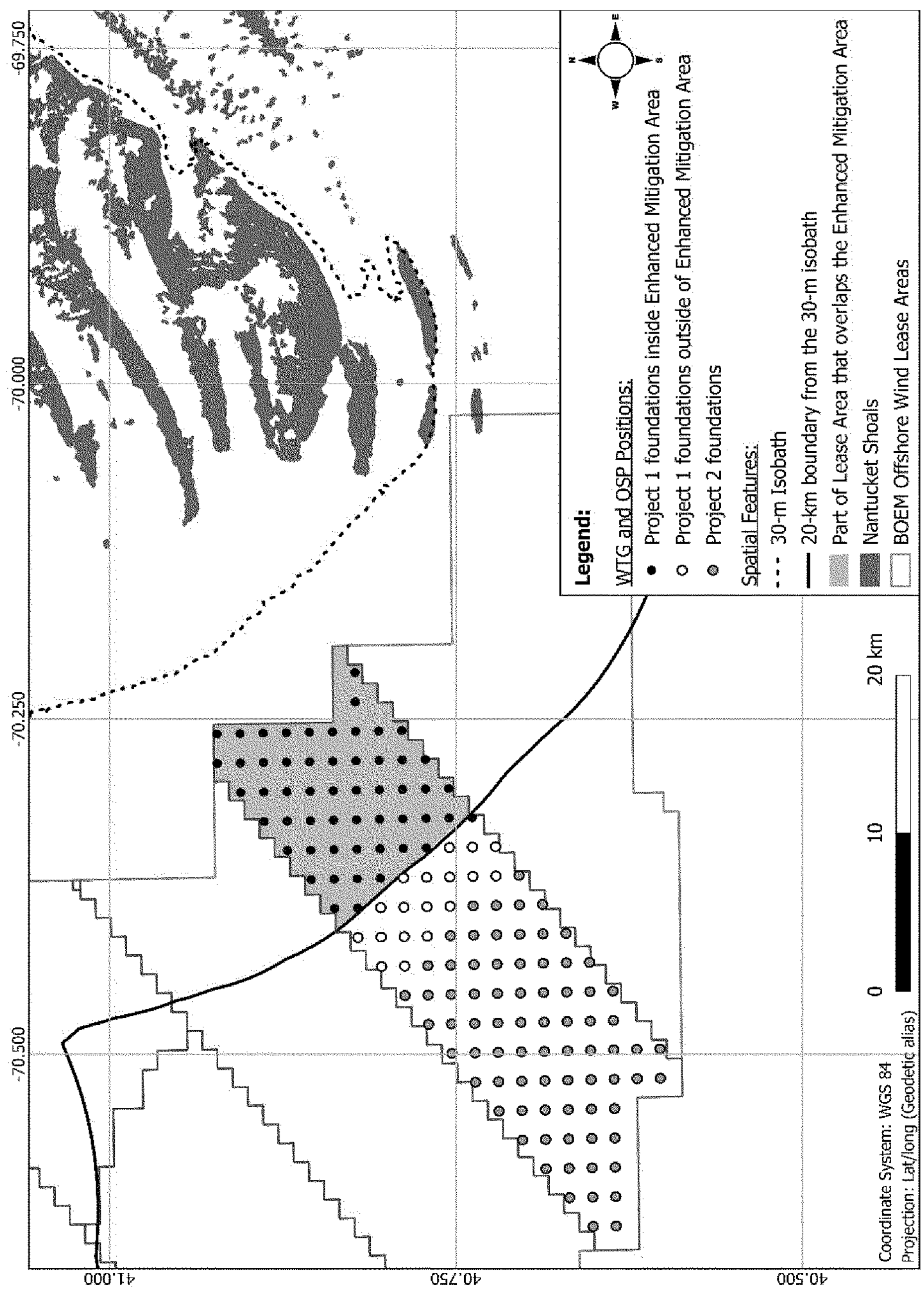

Figure 2 – Map of Foundation Locations in the SouthCoast Lease Area, Including Those in Project 1 (Black and White Circles), Project 2 (Gray Circles), and Inside the NARW EMA (Black Circles).

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Water depths in the project area (which includes the lease area, cable corridors, vessel transit lanes and ensonified area above NMFS thresholds) span from less than 1 meter ((m); 3.28 feet (ft)), near the landfall sites, to approximately 64 m at the deepest location in the lease area. Water depths in the lease area, in relation to Mean Lower Low Water (MLLW), range from approximately 37.1 to 63.5 m (121.7–208.3 ft). Of the 149 foundation locations, 101 are located in waters depths less than 54 m (177 ft) and the remaining 48 are located in water depths from 54–64 m (177–210 ft). Water depths along the Brayton Point and Falmouth ECCs range from 0–41.5 m (0–136.2 ft) MLLW. The cable landfall construction areas would be approximately 2.0–10.0 m (6.6–32.8 ft) deep in Somerset and 5.0 to 8.0 m (16.4–26.3 ft) deep in Falmouth.

Geological conditions in the project area, including sediment composition, are the result of glacial processes. The pattern of sediment distribution in the Mid-Atlantic Bight is relatively simple. The continental shelf south of New England is broad and flat, dominated by fine-grained sediments. Sediment composition is primarily dominated by sand, but varies by location, comprising various sand grain sizes sand to silt. Seafloor conditions in the Lease Area align with the findings at nearby locations in the RI/MA and MA WEAs showing little relief and low complexity (*i.e.,* mostly homogeneous) (section 6.6.1.6.1, SouthCoast Wind COP, 2024; Epsilon, 2018). Data collected as part of SouthCoast's benthic surveys indicate varying levels of surficial sediment mobility throughout the Lease Area and ECCs, evidenced by the ubiquitous presence of bedforms (ripples), both large and small. The deeper shelf waters of the Lease Area and ECCs are characterized by predominantly rippled sand and soft bottoms. Where the Falmouth ECC would enter Muskeget Channel and Nantucket Sound, the surface sediments become coarser sand with gravel and hard bottoms. The coarser sediments represent reworked glacial materials. No large-scale seabed topographic features or bedforms were found within the Lease Area (SouthCoast Wind COP, 2024). Moraine deposits related to the formation of Martha's Vineyard and Nantucket Island have resulted in boulder fields along portions of both ECCs (Baldwin *et al.,* 2016; Oldale, 1980). The Brayton Point ECC also crosses moraine features represented by the Southwest Shoal off Martha's Vineyard and Browns Ledge off the Elizabeth Island in Rhode Island Sound (section 3.1, SouthCoast Wind COP, 2024).

The species that inhabit the benthic habitats of the Lease Area and OCS are typically described as infaunal species, those living in the sediments (*e.g.,* polychaetes, amphipods, mollusks), and epifaunal species, those living on the seafloor surface (mobile, *e.g.,* sea starts, sand dollars, sand shrimp) or attached to substrates (sessile organisms; *e.g.,* barnacles, anemones, tunicates). These organisms are important food sources for several commercially important northern groundfish species.

The SouthCoast Lease Area is located adjacent to Nantucket Shoals, a broad shallow and sandy shelf that extends southeast of Nantucket Island. Waters from the Gulf of Maine, the Great South Channel, and Nantucket Sound converge in this area, creating a well-mixed water column throughout the year (Limeburner and Beardsley, 1982).

The shoals area has an underwater dunelike topography and strong tidal currents (PCCS, 2005). Surface currents become stronger during the spring and summer as heating and stratification increase (Brookes, 1992; PCCS, 2005). Due to wind and tidal mixing, a persistent tidal front occurs along the western edge of Nantucket Shoals, (Chen *et al.,* 1994a; b). This frontal region typically spans approximately 10–20 km (6.2–12.4 mi) (Potter and Lough, 1987; Lough and Manning, 2001; Ullman and Cornillon, 2001; White and Veit, 2020), with its strength and cross-isobath flow potentially influenced by regional winds (Ullman and Cornillon, 2001). The estimated location of this front varies from the 50-m (164-ft) isobath to inshore of the 30-m (98.4-ft) isobath (Ullman and Cornillon, 2001; Wilkin, 2006).

The ecology of the Nantucket Shoals region is unique in that it supports recurring enhanced aggregations of zooplankton that provide prey for North Atlantic right whales and other species migrating to the region to forage (Quintana-Rizzo *et al.,* 2021). The region is characterized by complex hydrodynamics and ecology. The hydrodynamics of this region result from processes at variable spatial scales that extend from oceanic (Gulf Stream warm core rings) to local (tidal mixing) and timescales of seasonal (stratification) to decadal (National Academy of Sciences (NAS), 2023). The physical oceanographic and bathymetric features (*i.e.,* shallow, well-lit, well-mixed) provide for year-round high phytoplankton biomass. Strong tidal currents create thorough mixing of the water column, distributing nutrients, which enhances and concentrates productivity of phytoplankton and zooplankton (PCCS, 2005; White *et al.,* 2020). High productivity in the area is also stimulated by a local tidal pump generated by the tidal dissipation between Nantucket Sound and the shoals so significantly that this tidal pump creates one of the largest tidal dispensation areas in New England (Chen *et al.,* 2018; Quintana-Rizzo *et al.,* 2021). Hydrographic features, such as circulation patterns and tides, result in the flow of zooplankton into area from source regions outside, rather than increased primary productivity due to upwelling (Kenney and Wishner, 1995; PCCS, 2005). The persistent frontal zone on the western side of Nantucket Shoals, with an estimated location that varies from the 50-m isobath to inshore of the 30-m (98.4-ft) isobath (Ullman and Cornillon, 2001; Wilkin, 2006), aggregates zooplankton prey whose distributions are dependent on hydrodynamics and frontal features (White *et al.,* 2020). These aggregations not only draw North Atlantic right whales but also other marine vertebrates that forage on the resulting dense prey patches, such as schooling fish and sea ducks and white-winged scooters (Scales *et al.,* 2014; White *et al.,* 2020). The frontal zone is also associated with a wide diversity of mollusk, crustacean, and echinoderm species, as well as surf clams, quahogs, and ''intense winter aggregations'' of Gammarid amphipods (White *et al.,* 2020).

Detailed Description of Specified Activities

Below, we provide detailed descriptions of SouthCoast's specified activities, explicitly noting those that are anticipated to result in the take of marine mammals and for which incidental take authorization is requested. Additionally, a brief explanation is provided for those activities that are not expected to result in the take of marine mammals. For more information beyond that provided here, see SouthCoast's ITA application.

WTG and OSP Foundation Installation

SouthCoast proposes to install a maximum of 149 foundations composed of a combination of up to 147 WTG and up to 5 OSP foundations, conforming to spacing on a 1 nm x 1 nm (1.9 km x 1.9 km) grid layout, oriented east-west and north-south). SouthCoast would be restricted from pile driving in the NARW EMA from October 16 through May 31 and January 1 through May 15 in the remainder of the Lease Area. SouthCoast should avoid pile driving in December (*i.e.,* it should not be planned), and it may only occur with prior approval by NMFS and implementation of enhanced mitigation and monitoring measures. SouthCoast must notify NMFS in writing by September 1 of that year, indicating that circumstances are expected to necessitate pile driving in December.

Project 1 would include installation of up to 86 foundations (85 WTG, 1 OSP), including 54 foundations located within the NARW EMA and up to 32 foundations immediately to the southwest of the NARW EMA. Foundation installation would begin in the northeast portion of the Project 1 area (Figure 2) no earlier than June 1, 2028, given NMFS' proposed pile driving seasonal restriction. By installing foundations in this portion of the Project 1 area first (beginning June 1), SouthCoast would begin conducting work closest to Nantucket Shoals and then progressing towards the southwest and moving away from Nantucket Shoals. SouthCoast would complete foundation installations in the NARW EMA by October 15, prior to when North Atlantic right whale occurrence is expected to begin increasing in eastern southern New England (*e.g.,* Davis *et al.,* 2024). The number of WTG foundations available for Project 2 depends on the final footprint for Project 1, but the combined number for both projects would not exceed 147. SouthCoast would install Project 2 foundations in the portion of the Lease Area southwest of Project 1.

SouthCoast would install foundations using impact pile driving only for Project 1 and a combination of impact and vibratory pile driving for Project 2. Vibratory setting, a technique wherein the pile is initially installed with a vibratory hammer until an impact hammer is needed, is particularly useful when soft seabed sediments, such as those previously described for SouthCoast's project area in the *Specified Geographic Region* section, are not sufficiently stiff to support the weight of the pile during the initial installation, increasing the risk of 'pile run' (*i.e.,* where a pile sinks rapidly through seabed sediments). Piles subject to pile run can be difficult to recover and pose significant safety risks to the personnel and equipment on the construction vessel. The vibratory hammer mitigates this risk by forming a hard connection to the pile using hydraulic clamps, thereby acting as a lifting/handling tool as well as a vibratory hammer. The tool is inserted into the pile on the construction vessel deck, and the connection made. The pile is then lifted, upended, and lowered into position on the seabed using the vessel crane. After the pile is lowered into position, vibratory pile installation will commence, whereby piles are driven into soil using a longitudinal vibration motion. The vibratory hammer installation method can continue until the pile is inserted to a depth that is sufficient to fully support the structure, and then the impact hammer can be positioned and operated to complete the pile installation. This can be accomplished using a single installation vessel equipped with both hammer types or two separate vessels, each equipped with either the vibratory or impact hammer.

For each Project, SouthCoast expects to install foundations within a 6-month period each year for two years. However, it is possible that foundation installation could continue into a second year for either Project, depending on construction logistics and local and environmental conditions that may influence SouthCoast's ability to maintain the planned construction schedule. Regardless of shifts in the construction schedule, the seasonal restrictions on pile driving would apply.

SouthCoast has proposed to initiate pile driving any time of day or night. Once construction begins, SouthCoast would proceed as rapidly as possible while implementing all required mitigation and monitoring measures, to reduce the total duration of construction. NMFS acknowledges the benefits of completing construction quickly during times when North Atlantic right whales are unlikely to be in the area but also recognizes challenges associated with monitoring during reduced visibility conditions, such as at night. SouthCoast is currently conducting a review of available, systematically collected data on the efficacy of technology to monitor (visually and acoustically) marine mammals during nighttime and in reduced visibility conditions during daytime. Should SouthCoast submit, and NMFS approve, an Alternative Monitoring Plan (which includes nighttime pile driving monitoring), pile driving may be initiated at night.

While the majority of foundation installations would be sequential (*i.e.,* one at a time), SouthCoast proposed concurrent pile driving (*i.e.,* two installation vessels installing foundations at the same time) for a small number of foundations, limited to the few days on which both OSP and WTG foundations are installed simultaneously. Using a single installation vessel, SouthCoast anticipates that a maximum of two monopile foundations could be sequentially driven into the seabed per day, assuming 24-hour pile driving operations; however, installation of one monopile per day is expected to be more common and the installation schedule assumed for the take estimation analyses reflects this (table 2). For jacket foundation installation, SouthCoast estimates that no more than four pin piles (supporting one jacket foundation) could be installed per 24 hours on days limited to sequential installation. SouthCoast anticipates that, on days with concurrent pile driving using two installation vessels, up to, 1) two WTG monopiles or four WTG pin piles (by one installation vessel) and, 2) four OSP pin piles (by a second vessel, working simultaneously) could be installed in 24 hours.

As described previously, SouthCoast is considering several foundation options. For Project 1, SouthCoast is considering installation of two types of WTG foundations, monopile or pin-piled jacket, which would be installed by impact pile driving only. SouthCoast is also considering these foundation types for Project 2 but may use a combination of vibratory and/or impact pile driving for their installation. Finally, suction-bucket jacket foundations may provide an alternative to monopile and pin-piled jacket foundations to support WTGs for Project 2. However, installing this third foundation type does not require impact or vibratory pile driving, and it is not anticipated to result in noise levels that would cause harassment to marine mammals. Therefore, suction-bucket jacket foundations are not discussed further beyond the brief explanation below.

Although considering three foundation types for Projects 1 and 2, for the purposes of estimating the maximum impacts to marine mammals that could occur incidental to WTG and OSP foundation installation, SouthCoast assumed WTGs would be supported by monopile or pin-piled jacket foundations and that OSPs would be supported by pin-piled jacket foundations. For both Project 1 and Project 2 acoustic and exposure modeling of the potential acoustic impacts resulting from installation of monopiles and pin piles (see Estimated Take section), SouthCoast proposed multiple WTG and OSP foundation installation scenarios for Projects 1 and 2, distinguished by foundation type and number, installation method (*i.e.,* impact only; vibratory and impact pile driving), order (*i.e.,* sequential or concurrent) and construction schedule (table 2).

TABLE 2—POTENTIAL INSTALLATION SCENARIOS FOR PROJECT 1 AND PROJECT 2 [1]

Installation order and method	Number of piles				Total foundations		Total days
	9/16-m monopile 1/day	9/16-m monopile 2/day	4.5-m pin piles WTG jacket piles 4/day	4.5-m pin piled OSP jacket 4/day			
Project 1 (IMPACT ONLY)							
Project 1 Scenario 1 (P1S1)							
Sequential (IMPACT)	44	24			71 WTG	1 OSP	59
Concurrent (IMPACT)	3			12			
Project 1 Scenario 2 (P1S2)							
Sequential (IMPACT)			324		85 WTG	1 OSP	85
Concurrent (IMPACT)			16	16			
Project 2 (VIBE AND/OR IMPACT)							
Project 2 Scenario 1 (P2S1)							
Sequential (IMPACT)	35	30			68 WTG	1 OSP	53
Concurrent (IMPACT)	3			12			
Project 2 Scenario 2 (P2S2)							
Sequential (IMPACT)	3				73 WTG	1 OSP	49
Sequential (VIBE+IMPACT)	19	48					
Concurrent (IMPACT)	3			12			
Project 2 Scenario 3 (P2S3)							
Sequential (IMPACT)			40		62 WTG	1 OSP	62
Sequential (VIBE+IMPACT)			192				
Concurrent (IMPACT)			16	16			

[1] Installation schedules vary based on foundation type (WTG monopile or pin-piled jacket, OSP pin-piled jacket) and number, installation method (impact, or combination of vibratory and impact), and installation order (sequential or concurrent).

As described previously, SouthCoast considered two WTG foundation installation scenarios for Project 1 and one scenario for Project 2 that would employ impact pile driving only (I), and two scenarios for Project 2 that would require a combination of vibratory and impact pile driving (V/I):

- Project 1
  - Scenario 1 (I): 71 monopile WTG, 1 pin-piled jacket OSP
  - Scenario 2 (I): 85 pin-piled jacket WTG, 1 pin-piled jacket OSP
- Project 2
  - Scenario 1 (I): 68 monopile WTG, 1 pin-piled jacket OSP
  - Scenario 2 (V/I): 73 monopile WTG, 1 pin-piled jacket OSP
  - Scenario 3 (V/I): 62 pin-piled jacket WTG, 1 pin-piled jacket OSP

For each Project, only one scenario would be implemented. For example, SouthCoast could choose to install Scenario 1 for Project 1 (P1S1; 71 monopile WTG foundations, 1 pin-piled jacket OSP foundation) and Scenario 1 for Project 2 (P2S1; 68 monopile WTG foundations, 1 pin-piled jacket OSP foundation) for a total of 139 WTG monopile and 2 OSP pin-piled jacket foundations, or 141 foundations overall (table 2). Alternatively, SouthCoast could install Scenario 2 for Project 1 (P1S2; 85 WTG pin-piled jacket foundations, and 1 OSP pin-piled jacket) and Scenario 3 for Project 2 (P2S3; 62 pin-piled jacket foundation, 1 pin-piled jacket OSP foundation), for a total of 147 WTG and 2 OSP foundations (or 149 foundations overall). Both of these combinations fall within SouthCoast's PDE, which specifies that SouthCoast would install no more than up to 147 WTG foundations and up to 5 OSP foundations. Given this limitation, there are Project 2 scenarios that can not be combined with scenarios for Project 1 because the total WTG foundation number would exceed 147 (*i.e.,* the total number of WTG foundations would be 153 should SouthCoast combine the Project 1 Scenario 2 (85 pin-piled jacket WTG foundations) with Project 2 Scenario 1 (68 monopile WTG foundations) or 158 if combined with Project 2 Scenario 2). Thus, SouthCoast's selection of a scenario for Project 2 will depend on their scenario choice for Project 1.

WTG Foundations

Monopile

SouthCoast proposed three scenarios that include monopile installations to support WTGs. A monopile foundation normally consists of a single steel tubular section with several sections of rolled steel plate welded together. Secondary structures on each WTG monopile foundation would include a boat landing or alternative means of safe access, ladders, a crane, and other ancillary components. Figure 3 in SouthCoast's application provides a conceptual example of a monopile. SouthCoast would install up to 147 WTG monopile foundations with a maximum diameter tapering from 9 m (2.7 ft) above the waterline to 16 m (52.5 ft) below the waterline (9⁄16-m monopile). A typical impact pile driven monopile installation sequence begins with transport of the monopiles either directly to the Lease Area or to the construction staging port by an installation vessel or a feeding barge. At the foundation location, the main installation vessel upends the monopile in a vertical position in the pile gripper mounted on the side of the vessel. The impact hammer is then lifted on top of the pile and pile driving commences with a 20-minute minimum soft-start, where lower hammer energy is used at the beginning of each pile installation to allow marine mammal and prey to move away from the sound source before noise levels increase to the maximum extent. Piles are driven until the target embedment depth is met, then the pile hammer is removed and the monopile is released from the pile gripper. SouthCoast would install WTG monopiles using an impact pile driver with a maximum hammer energy of 6,600 kJ (model NNN 6600) for a total of 7,000 strikes (including soft-start hammer strikes) at a rate of 30 strikes per minute to a total maximum penetration depth of 50 m (164 ft). As described previously, for pile installations utilizing vibratory pile driving as well, this impact installation sequence would be preceded by use of a vibratory hammer to drive the pile to a depth that is sufficient to fully support the structure before beginning the soft-start and subsequent impact hammering. For these piles, SouthCoast would use a vibratory hammer (model HX–CV640) followed by a maximum of 5,000 impact hammer strikes (including soft-start) using the same hammer and parameters specified above.

SouthCoast is proposing to install the majority of monopile foundations consecutively using a single vessel and on a small number of days, concurrently with OSP piled jacket pin piles using two vessels (see Dates and Duration section). Under typical conditions, impact installation of a single monopile foundation is estimated to require up to 4 hours of active impact pile driving (7,000 strikes/30 strikes per minute equals approximately 233 minutes, or 3.9 hours), which can occur either in a continuous 4-hour interval or intermittently over a longer time period. For installations requiring vibratory and impact pile driving, the installation duration is also expected to last approximately 4 hours, beginning with 20 minutes of active vibratory driving, followed by short period during which the hammer set-up would be changed from vibratory to impact, after which impact installation would begin with a 20-minute soft-start (5,000 strikes/30 strikes per minute equals approximately 167 minutes, or 2.8 hours). Following monopile installation completion, SouthCoast anticipates it would then take approximately 4 hours to move to the next piling location. Once at the new location, a 1-hour marine mammal monitoring period would occur such that there would be a minimum of 5 hours between pile installations. Based on this schedule, SouthCoast estimates a maximum of two monopiles could be sequentially driven per day using a single installation vessel, assuming a 24-hour pile driving schedule.

For Project 1 Scenario 1, it is assumed that all 71 WTG monopiles would be installed using only an impact hammer (*i.e.,* no vibratory pile driving), requiring a maximum of 284 hours (71 WTGs × 4 hours each) of active impact pile driving. Similarly, for Project 2 Scenario 1, it is assumed that all 68 monopiles would be installed using the same approach, for a total of 272 hours of impact hammering. However, for Project 2 Scenario 2, it is assumed that 67 (out of a total of 73) monopiles would be installed using a combination of vibratory and impact pile driving, and 6 monopiles would be installed using only impact pile driving. Installation of all WTG foundations for Project 2 Scenario 2 would require a total of approximately 212 hours (6 WTGs × 4 hours plus 67 WTGs × 2.8 hours each) of impact and 23 hours (67 WTGs × 20 minutes each) of vibratory pile driving.

Pin-Piled Jacket

As an alternative to monopiles, SouthCoast proposed one scenario for each Project (P1S2 and P2S3) that, when combined, would include installation of 147 pin-piled jacket foundations to support WTGs. Jackets are large lattice structures made of steel tubes welded together and supported by securing piles (*i.e.,* pin piles). Figure 4 of SouthCoast's application provides a conceptual example of this type of foundation. For the SouthCoast Project, each WTG piled jacket foundation would have up to four legs supported by one pin pile per leg, for a total of up to 588 pin piles to support 147 WTGs. Each pin pile would have a maximum diameter of 4.5 m (14.7 ft). Pin-piled jacket foundation installation is a multi-stage process, beginning with preparation of the seabed by clearing any debris. The WTG jacket foundations are expected to be pre-piled, meaning that pin piles would be installed first, and the jacket structure would be set on those pre-installed piles. Once the piled-jacket foundation materials are delivered to the Lease Area, a reusable template would be placed on the prepared seabed to ensure accurate positioning of the pin piles that will be installed to support the jacket. Pin piles would be individually lowered into the template and driven to the target penetration depth using the same approach described for monopile installation. For installations requiring only impact pile driving (*e.g.,* P1S2), SouthCoast would install pin piles using an impact pile driver with a maximum hammer energy of 3,500 kJ (MHU 3500S) for a total of 4,000 strikes (including soft-start hammer strikes) at a rate of 30 strikes per minute to a maximum penetration depth of 70 m (229.6 ft). When installations require both types of pile driving, this impact pile driving sequence would only begin after SouthCoast utilized a vibratory hammer (S–CV640) to set the pile to a depth providing adequate stability. Subsequent impact hammering (using the same hammer specified) above would require fewer strikes (n=2,667) to drive the pile to the final 70-m maximum penetration depth.

Under typical conditions, impact-only installation (applicable to P1S2, and all OSP pin-piled jacket foundations) of each pin pile is estimated to require approximately 2 hours of active impact pile driving (4,000 strikes/30 strikes per minute equals approximately 133 minutes, or 2.2 hours), for a maximum of 8.8 hours total for a single WTG or OSP pin- piled jacket foundation supported by 4 pin piles. For each pin pile requiring vibratory and impact pile driving (applicable to P2S3 WTG pin-piled jacket foundations only), the installation would begin with 90 minutes of vibratory hammering per pin pile, and would require fewer hammer strikes per pile over a shorter duration compared to impact-only installations (2,667 strikes/30 strikes per minute equals approximately 89 minutes, or 1.5 hours), for a total of 6 hours for each installation method (12 hours total). Pile driving would occur continuously or intermittently, with installations requiring both methods of pile driving punctuated by the time required to change from the vibratory to impact hammer. SouthCoast estimates that they could install a maximum of four pin piles per day, assuming use of a single installation vessel and 24-hour pile driving operations. Following pin pile installations, a vessel would install the jacket to the piles, either directly after the piling vessel completes operations or up to one year later.

For Project 1 Scenario 2, it is assumed that all 85 WTG pin-piled jacket foundations (for a total of 340 pin piles) would be installed using only an impact hammer (*i.e.,* no vibratory pile driving), requiring a maximum of 680 hours (85 WTGs × 8 hours each) of active impact pile driving. For Project 2 Scenario 3, it is assumed that 48 (out of a total of 62) pin-piled jacket foundations (or 192 out of 248 pin piles) would be installed using a combination of vibratory and impact pile driving, and 14 pin-piled jacket foundations (or 56 pin piles) would be installed using only impact pile driving. Installation of all WTG foundations for Project 2 Scenario 3 would require a total of approximately 184 hours (14 WTGs × 8 hours plus 48 WTGs × 1.5 hours each) of impact and 72 hours (48 WTGs × 90 minutes (or 1.5 hours) each) of vibratory pile driving.

Installation of WTG monopile and pin-piled jacket foundations is anticipated to result in take of marine mammals due to noise generated during pile driving. Therefore, SouthCoast has requested, and NMFS proposes to authorize, take by Level A harassment and Level B harassment of marine mammals incidental to this activity.

Suction Bucket

Suction bucket jackets have a similar steel lattice design to the piled jacket described previously, but the connection to the seafloor is different (see Figure 5 in SouthCoast's application for a conceptual example of the WTG suction bucket jacket foundation). These substructures use suction-bucket foundations instead of piles to secure the structure to the seabed; thus, no impact driving would be used for installation of WTG suction bucket jackets. Should SouthCoast select this foundation type for Project 2, each of the suction-bucket jacket substructures, including four buckets per foundation (one per leg), would be installed as described below. Similar to monopiles and pin-piled jackets, the number of suction-bucket jacket foundations will depend on the final design for Project 1. For suction-bucket jackets, the jacket is lowered to the seabed, the open bottom of the bucket and weight of the jacket embeds the bottom of the bucket in the seabed. To complete the installation and secure the foundation, water and air are pumped out of the bucket creating a negative pressure within the bucket, which embeds the foundation buckets into the seabed. The jacket can also be leveled at this stage by varying the applied pressure. The pumps will be released from the suction buckets once the jacket reaches its designed penetration. The connection of the required suction hoses is typically completed using a remotely operated vehicle (ROV).

As previously indicated, installation of suction bucket foundations is not expected to result in take of marine mammals; thus, this activity is not further discussed.

Offshore Substation Platform (OSP)

Each construction scenario SouthCoast defined includes installation of a pin-piled jacket foundation to support a single OSP per Projects 1 and 2, However, in the ITA application, SouthCoast indicates that their project design envelope includes the potential installation of up to a total of 5 OSPs, situated on the same 1 nm x 1 nm (1.9 km x 1.9 km) grid layout as the WTG foundation, and describes three OSP designs (*i.e.,* modular, integrated, or Direct Current (DC) Converter) that are under consideration (see Figures 6, 7, and 8 in SouthCoast's ITA application). The number of OSPs installed would vary based upon design. Based on the COP PDE, SouthCoast could install a minimum of a single modular OSP on a monopile foundation, and a maximum of five DC Converter OSPs, each with nine pin-piled jacket foundations secured by three pin piles each, for a total of 135 pin piles. All OSP monopile and pin-piled jacket foundations would be installed using only impact pile driving.

Installation of an OSP monopile foundation would follow the same parameters (*e.g.,* pile diameter, hammer energy, penetration depth) and procedure as previously described for WTG monopiles. OSP piled jacket foundations would be similar to that described for WTG piled jacket foundations but would be installed using a post-piling, rather than pre-piling, installation sequence. In this sequence, the seabed is prepared, the jacket is set on the seafloor, and the piles are driven through the jacket legs to the designed penetration depth (dependent upon which OSP design is selected). The piles are connected to the jacket via grouted and/or swaged connections. A second vessel may perform grouting tasks, freeing the installation vessel to continue jacket installation at a subsequent OSP location, if needed. Pin piles for each jacket design would be installed using an impact hammer with a maximum energy of 3,500 kJ. A maximum of four OSP pin piles could be installed per day using a single vessel, assuming 24-hour pile driving operations. All impact pile driving activity of pin piles would include a 20-minute soft-start at the beginning of each pile installation. Installation of a single OSP piled jacket foundation by impact pile driving (the only proposed method) would vary by design and the associated number of supporting pin piles, each of which would require 2 hours of impact hammering.

The ''Modular OSP'' design would sit on any one of the three types of substructure designs (*i.e.,* monopile, piled jacket, or suction bucket) similar in size and weight to those described for the WTGs (see Section 1.1.1 in SouthCoast's ITA application), with the topside connected to a transition piece (TP). This Modular OSP design is an AC solution and will likely hold a single transformer with a single export cable. This option is a relatively small design relative to other options and, thus, has benefits related to manufacture, transportation, and installation. An example of the Modular OSP on a jacket substructure is shown in Figure 6 of SouthCoast's ITR application. The Modular OSP design assumes an OSP topside height ranging from 50 m (164 ft) to 73.9 m (242.5 ft). A Modular OSP piled jacket foundation would be the smallest and include three to four legs with one to two pin piles per leg (three to eight total pin piles per piled jacket). Pin piles would have a diameter of up to 4.5 m (14.7 ft) and would be installed using up to a 3,500-kJ hammer to a target penetration depth of 70 m (229.6 ft) below the seabed.

The ''Integrated OSP'' design would have a jacket substructure and a larger topside than the Modular OSP. This OSP option is also an AC solution and is designed to support a high number of inter-array cable connections as well as the connection of multiple export cables. This design differs from the Modular OSP in that it is expected to contain multiple transformers and export cables integrated into a single topside. The Integrated OSP design assumes the same topside height indicated for the Modular design. Depending on the final weight of the topside and soil conditions, the jacket substructure may be four- or six-legged and require support from one to three piles per leg (up to 16 pin piles). The larger size of the Integrated OSP would provide housing for a greater number of electrical components as compared to smaller designs (such as the Modular OSP), reducing the number of OSPs required to support the proposed Project. An example of the integrated OSP design is shown in Figure 7 of SouthCoast's ITR application.

SouthCoast may install one or more ''DC Converter OSPs.'' This OSP option would serve as a gathering platform for inter-array cables and then convert power from high-voltage AC to high-voltage DC or it could be connected to one or more AC gathering units (Modular or Integrated OSPs) and serve to convert power from AC to DC prior to transmission on an export cable. The DC Converter OSP would be installed on a piled jacket foundation with four legs, each supported by three to four 3.9-m (12.8-ft) pin piles per leg (up to 16 total pin piles per jacket), installed using a 3,500-kJ hammer to a target penetration depth of 90 m (295.3 ft) below the seabed. Please see Figure 8 in SouthCoast's ITR application for example of a DC jacket OSP design. Although SouthCoast has not yet selected an OSP design or finalized their foundation installation plan, they anticipate that they would only install only two of the five OSPs included in the PDE, one per Project. Each OSP would be supported by a piled jacket foundation with four legs anchored by three to four pin piles (for a total of up to 16 pin piles per OSP piled jacket). SouthCoast plans to install a maximum of four OSP jacket pin piles per day, so an OSP jacket foundation requiring 16 pin piles would be installed over four days (intermittently). For all three OSP piled jacket options (modular, integrated and DC-converter), installation of a single pin pile is anticipated to take up to 2 hours of pile driving. It is anticipated that a maximum of eight pin piles could be driven into the seabed per day assuming 24-hour pile driving operation. Pile driving activity will include a soft-start at the beginning of each pin pile installation. Impacts of pile-driving noise incidental to OSP piled jacket foundation installation have been evaluated based on the use of a 3,500 kJ hammer, as this is representative of the maximum hammer energy included in the PDE.

Installation of OSP foundations is anticipated to result in take of marine mammals due to noise generated during pile driving. Therefore, SouthCoast has requested, and NMFS proposes to authorize, take by Level A harassment and Level B harassment of marine mammals incidental to OSP foundation installation.

HRG Surveys

SouthCoast would conduct HRG surveys to identify any seabed debris and to support micrositing of the WTG and OSP foundations and ECCs. These surveys may utilize active acoustic equipment such as multibeam echosounders, side scan sonars, shallow penetration sub-bottom profilers (SBPs) (*e.g.,* parametric Compressed High-Intensity Radiated Pulses (CHIRP) SBPs and non-parametric SBP), medium penetration sub-bottom profilers (*e.g.,* sparkers and boomers), and ultra-short baseline positioning equipment, some of which are expected to result in the take of marine mammals. Surveys would occur annually, with durations dependent on the activities occurring in that year (*i.e.,* construction years versus non-construction years).

HRG surveys will be conducted using up to four vessels. On average, 80-line km (49.7-mi) will be surveyed per vessel each survey day at approximately 5.6 km/hour (3 knots) on a 24-hour basis although some vessels may only operate during daylight hours (~12-hour survey vessels).

During the 2-year construction phase, an estimated 4,000 km (2,485 mi) may be surveyed within the Lease Area and 5,000 km (3,106 mi) along the ECCs in water depth ranging from 2 m (6.5 ft) to 62 m (204 ft). A maximum of four vessels will be used concurrently for surveying. While the final survey plans will not be completed until construction contracting commences, HRG surveys are anticipated to operate at any time of year for a maximum of 112.5 survey days per year.

During non-construction periods (3 of the 5 years within the effective period of the regulations), SouthCoast would survey an estimated 2,800 km (1,7398 mi) in the Lease Area and 3,200 km (1,988.4 mi) along the ECCs each year for three years (n=18,000 km total). Using the same estimate of 80 km (49.7 mi) of surveys completed each day per vessel, approximately 75 days of surveys would occur each year, for a total of up to 225 active sound source days over the 3-year operations period.

Of the HRG equipment types proposed for use, the following sources have the potential to result in take of marine mammals:

• Shallow penetration sub-bottom profilers (SBPs) to map the near-surface stratigraphy (top 0 to 5 m (0 to 16 ft) of sediment below seabed). A CHIRP system emits sonar pulses that increase in frequency over time. The pulse length frequency range can be adjusted to meet Projectvariables. These are typically mounted on the hull of the vessel or from a side pole.

• Medium penetration SBPs (boomers) to map deeper subsurface stratigraphy as needed. A boomer is a broad-band sound source operating in the 3.5 Hz to 10 kHz frequency range. This system is typically mounted on a sled and towed behind the vessel.

• Medium penetration SBPs (sparkers) to map deeper subsurface stratigraphy as needed. A sparker creates acoustic pulses from 50 Hz to 4 kHz omni-directionally from the source that can penetrate several hundred meters into the seafloor. These are typically towed behind the vessel with adjacent hydrophone arrays to receive the return signals.

Table 3 identifies all the representative survey equipment that operate below 180 kilohertz (kHz) (*i.e.,* at frequencies that are audible and have the potential to disturb marine mammals) that may be used in support of planned geophysical survey activities and is likely to be detected by marine mammals given the source level, frequency, and beamwidth of the equipment. Equipment with operating frequencies above 180 kHz (*e.g.,* SSS, MBES) and equipment that does not have an acoustic output (*e.g.,* magnetometers) will also be used but are not discussed further because they are outside the general hearing range of marine mammals likely to occur in the Lease Area and ECCs. No take is expected from the operation of these sources; therefore, they are not discussed further.

TABLE 3—SUMMARY OF REPRESENTATIVE HRG SURVEY EQUIPMENT AND OPERATING PARAMETERS

Equipment type	Representative model	Operating frequency (kHz)	Source Level SPL_{rms} (dB)	Source $Level_{0\text{-}pk}$ (dB)	Pulse duration (ms)	Repetition rate (Hz)	Beamwidth (degrees)	Information source
Sub-bottom Profiler	EdgeTech 3100 with SB 2–16[1] towfish.	2–16	179	184	10	9.1	51	CF.
	EdgeTech DW–106[1]	1–6	176	183	14.4	10	66	CF.
	Knudson Pinger[2]	15	180	187	4	2	71	CF.
	Teledyn Benthos CHIRP III—TTV 170[3].	2–7	199	204	10	14.4	82	CF.
Sparker[4]	Applied Acoustics Dura-Spark UHD (400 tips, 800 J).	0.01–1.9	203	213	3.4	2	Omni	CF.
	Geomarine Geo-Spark (400 tips, 800 J).	0.01–1.9	203	213	3.4	2	Omni	CF.
Boomer	Applied Acoustics triple plate S-Boom (700–1,000 J).	0.1–5	205	211	0.9	3	61	CF.

Note: J = joule; kHz = kilohertz; dB = decibels; SL = source level; UHD = ultra-high definition; rms = root-mean square; µPa = microPascals; re = referenced to; SPL = sound pressure level; PK = zero-to-peak pressure level; Omni = omnidirectional source; CF = Crocker and Fratantonio (2016).

[1] The EdgeTech Chirp 512i measurements and specifications provided by Crocker and Fratantonio (2016) were used as a proxy for the Edgetech 3100 with SB–216 towfish and EdgeTech DW–106.

[2] The EdgeTech Chirp 424 as a proxy for source levels as the Chirp 424 has similar operation settings as the Knudsen Pinger SBP.
[3] The Knudsen 3202 Echosounder measurements and specifications provided by Crocker and Fratantonio (2016) were used as a proxy for the Teledyne Benthos Chirp III TTV 170.
[4] The SIG ELC 820 Sparker, 5 m source depth, 750 J setting was used a proxy for both the Applied Acoustics Dura-Spark UHD (400 tips, 800 J) and Geomarine Geo-Spark (400 tips, 800 J).

Based on the operating frequencies of HRG survey equipment in table 3 and the hearing ranges of the marine mammals that have the potential to occur in the Lease Area and ECCs, HRG survey activities have the potential to result in take by Level B harassment of marine mammals. No take by Level A harassment is anticipated as a result of HRG survey activities.

UXO/MEC Detonations

SouthCoast anticipates encountering UXO/MECs during Project construction in the Lease Area and along the ECCs. UXO/MECs include explosive munitions such as bombs, shells, mines, torpedoes, *etc.,* that did not explode when they were originally deployed or were intentionally discarded in offshore munitions dump sites to avoid land-based detonations. SouthCoast plans to remove any UXO/MEC encountered, else, the risk of incidental detonation associated with conducting seabed-altering activities, such as cable laying and foundation installation in proximity to UXO/MECs, would potentially jeopardize the health and safety of Projectparticipants.

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

SouthCoast is currently conducting a study to more accurately determine the number of UXO/MECs that may be encountered during the specified activities (see section 1.1.5 in SouthCoast's ITA application). Based on estimates for other offshore wind projects in southern New England, SouthCoast assumes that up to ten UXO/MEC 454-kg (1000 pounds; lbs) charges, which is the largest charge that is reasonably expected to be encountered, may require *in situ* detonation. Although it is highly unlikely that all ten charges would weigh 454 kg, this approach was determined to be the most conservative for the purposes of impact analysis. All charged detonations would occur on different days (*i.e.,* only one detonation would occur per day). In the event that high-order detonation is determined to be the preferred and safest method of disposal, all detonations would occur during daylight hours. SouthCoast proposed a seasonal restriction on UXO/MEC detonations from December 1–April 30, annually.

UXO/MEC activities have the potential to result in take by Level A harassment and Level B harassment of marine mammals. No non-auditory take by Level A harassment is anticipated due to proposed mitigation and monitoring measures.

Cable Landfall Construction

Installation of the SouthCoast export cables at the designated landfall sites will be accomplished using horizontal directional drilling (HDD) methodology. HDD is a ''trenchless'' process for installing cables or pipes which enables the cables to remain buried below the beach and intertidal zone while limiting environmental impact during installation. Drilling activities would occur on land with the borehole extending under the seabed to an exit point offshore, outside of the intertidal zone. There will be up to two ECCs, both exiting the Lease Area in the northwestern corner. These then split, with one making landfall at Brayton Point in Somerset, MA (Brayton Point ECC) and the other in Falmouth, MA (Falmouth ECC). The Brayton Point ECC is anticipated to contain up to six export cables, bundled where practicable, while the Falmouth ECC is anticipated to contain up to five export cables. HDD seaward exit points will be sited within the defined ECCs at the Brayton Point and intermediate Aquidneck Island landfall sites and at the Falmouth landfall site(s). The exit points will be within approximately 3,500 ft (1,069 m) of the shoreline for the Falmouth ECC landfall(s), and within approximately 1,000 ft (305 m) of the shoreline for the Brayton Point landfalls.

At the seaward exit point, construction activities may include installation of either a temporary gravity-based structure (*i.e.,* gravity cell or gravity-based cofferdam) or a dredged exit pit, neither of which would require pile driving or hammering. Additionally, a conductor pipe may be installed at the exit point to support the drilling activity. Conductor pipe installation would include pushing or jetting rather than pipe ramming.

For the Falmouth landfall locations, the proposed HDD trajectory is anticipated to be approximately 0.9 mi (1.5 km) in length with a cable burial depth of up to approximately 90 ft (27.4 m) below the seabed. HDD boreholes will be separated by a distance of approximately 33 ft (10 m). Each offshore export cable is planned to require a separate HDD, with an individual bore and conduit for each export cable. The number of boreholes per site will be equal to the number of power cables installed. The Falmouth ECC would include up to four power cables with up to four boreholes at each landfall site. There may be up to one additional communications cable; however, the communications cable would be installed within the same bore as one of the power cables, likely within a separate conduit.

For the Brayton Point and Aquidneck Island intermediate landfall locations, the proposed HDD trajectory is anticipated to be approximately 0.3 mi (0.5 km) in length with a cable burial depth of up to approximately 90 ft (27.4 m) below the seabed. HDD bores will be separated by a distance of approximately 33 ft (10 m). It is anticipated the high-voltage DC cables will be unbundled at landfall. Each high-voltage DC power cable is planned to require a separate HDD, with an individual bore and conduit for each power cable. The Brayton Point and Aquidneck Island ECCs will include up to four power cables for a total of up to four boreholes at each landfall site. Each dedicated communications cable may be installed within the same bore as a power cable, likely within a separate conduit.

In collaboration with the HDD contractor, SouthCoast will further assess the potential use of a dredged exit pit and/or gravity cell at each landfall location. The specifics of each site will be evaluated in detail, in terms of soil and metocean conditions (*i.e.,* current), suitability for maintaining a dredged exit pit for the duration of the HDD construction, and other construction planning factors that may affect the HDD operation.

The relatively low noise levels generated by installation and removal of gravity-cell cofferdams, dredged exit pits, and conductor pipe are not expected to result in Level A harassment or Level B harassment of marine mammals. SouthCoast is not requesting, and NMFS is not proposing to authorize, take associated with landfall construction activities. Therefore, these activities are not analyzed further in this document.

Cable Laying and Installation

Cable burial operations would occur both in the Lease Area for the inter-array cables connecting WTGs to OSPs and in the ECCs for cables carrying power from the OSPs to shore. The offshore export cables would be buried in the seabed at a target depth of up to 1.0 to 4.0 m (3.2 to 13.1 ft) while the inter-array cables would be buried at a target depth up to 1.0 to 2.5 m (3.2 to 8.2 ft). Both cable types would be buried onshore up to the transition joint bays. All cable burial operations would follow installation of the monopile foundations as the foundations must be in place to provide connection points for the export cable and inter-array cables. Cable laying, cable installation, and cable burial activities planned to occur during the construction of the SouthCoast Project May include the following: jetting; vertical injection; leveling; mechanical cutting; plowing (with or without jet-assistance); pre-trenching; boulder removal; and controlled flow excavation. Installation of any required protection at the cable ends is typically completed prior to cable installation from the vessel.

Some dredging may be required prior to cable laying due to the presence of sandwaves. Sandwave clearance may be undertaken to provide a level bottom to install the export cable. The work could be undertaken by traditional dredging methods such as a trailing suction hopper. Alternatively, controlled flow excavation or a water-injection dredger could be used. In some cases, multiple passes may be required. The method of sand wave clearance SouthCoast chooses would be based on the results from the site investigation surveys and cable design.

As the noise levels generated from cable laying and installation work are low, the potential for take of marine mammals to result is discountable. SouthCoast is not requesting, and NMFS is not proposing to authorize, take associated with cable laying activities. Therefore, cable laying activities are not analyzed further in this document.

Vessel Operation

SouthCoast will utilize various types of vessels over the course of the 5-year proposed regulations for surveying, foundation installation, cable installation, WTG and OSP installation, UXO/MEC detonation, and support activities. SouthCoast anticipates operating an average of 15 to 35 vessels daily depending on construction phase, with an expected maximum of 50 vessels in the Lease Area at one time during the foundation installation period. Table 4 provides a list of the vessel types, number of each vessel type, number of expected trips, and anticipated years each vessel type will be in use. All vessels will follow the vessel strike avoidance measures as described in the Proposed Mitigation section.

To support offshore construction, assembly and fabrication, crew transfer and logistics, as well as other operational activities, SouthCoast has identified several existing domestic port facilities located in Massachusetts (Ports of Salem, New Bedford, Fall River), Rhode Island (Ports of Providence and Davisville), Connecticut (Port of New London), and to a lesser extent Maryland (Sparrows Point Port), South Carolina (Port of Charleston), and Texas (Port of Corpus Cristi).

The largest vessels are expected to be used during the foundation installation phase with heavy transport vessels, heavy lift crane vessels, cable laying vessels, supply and crew vessels, and associated tugs and barges transporting construction equipment and materials. A large service operation vessel would have the ability to stay in the lease area and house crews overnight. These larger vessels will generally move slowly over a short distance between work locations, within the Lease Area and along ECCs. Smaller vessels would be used to transfer crew and smaller dimension Project materials to and from, as well as within, the Lease Area. Transport vessels will travel between several ports and the Lease Area over the course of the construction period following mandatory vessel speed restrictions (see Proposed Mitigation section). These vessels will range in size from smaller crew transport to tug and barge vessels. Construction crews responsible for assembling the WTGs would hotel onboard installation vessels at sea, thus limiting the number of crew vessel transits expected during the construction period. WTG and OSP foundation installation vessels may include jack-up, DP, or semi-submersible vessels. Jack-up vessels lower their legs into the seabed for stability and then lift out of the water, whereas DP vessels utilize computer-controlled positioning systems and thrusters to maintain their station. SouthCoast is also considering the use of heavy lift vessels, barges, feeder vessels, and roll-on lift-off vessels to transport WTG components to the Lease Area for installation by the WTG installation vessel. Fabrication and installation vessels may include transport vessels, feeder vessels, jack-up vessels, and installation vessels.

Sounds from vessels associated with the proposed Project are anticipated to be similar in frequency to existing levels of commercial traffic present in the region. Vessel sound would be associated with cable installation vessels and operations, piling installation vessels, and general transit to and from WTG or OSP locations during construction. During construction, it is estimated that multiple vessels may operate concurrently at different locations throughout the Lease Area or ECCs. Some of these vessels may maintain their position (using DP thrusters) during pile driving or other construction activities. The dominant underwater sound source on DP vessels arises from cavitation on the propeller blades of the thrusters (Leggat et al., 1981). The noise power from the propellers is proportional to the number of blades, propeller diameter, and propeller tip speed. Sound levels generated by vessels using DP are dependent on the operational state and weather conditions.

All vessels emit sound from propulsion systems while in transit. The SouthCoast Project would be constructed in an area that consistently experiences extensive marine traffic. As such, marine mammals in the general region are regularly subjected to vessel activity and would potentially be habituated to the associated underwater noise as a result of this exposure (BOEM, 2014b). Because noise from vessel traffic associated with construction activities is likely to be similar to background vessel traffic noise, the potential risk of impacts from vessel noise to marine life is expected to be low relative to the risk of impact from pile-driving sound.

Sound produced through use of DP thrusters is considered a continuous sound source and similar to that produced by transiting vessels. DP thrusters are typically operated either in a similarly predictable manner or used intermittently for short durations around stationary activities. Sound produced by DP thrusters would be preceded by and associated with sound from ongoing vessel noise and would be similar in nature. Any marine mammals in the vicinity of the activity would be aware of the vessel's presence, thus making it unlikely that the noise source would elicit a startle response. Construction-related vessel activity, including the use of dynamic positioning thrusters, is not expected to result in take of marine mammals. SouthCoast did not request, and NMFS does not propose to authorize, take associated with vessel activity.

During operations, SouthCoast will use crew transfer vessels (CTVs) and service operations vessels (SOVs). The number of each vessel type, number of trips, and potential ports to be used during operations and maintenance are provided in table 4. The operations vessels will follow the vessel strike avoidance measures as described in the Proposed Mitigation section.

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

Vessel types	Estimated number of vessel type	Supply trips to port from lease area (or point of entry in U.S., where applicable [1])	Anticipated years in use
Vessel Use During Construction			
Heavy Lift Crane Vessel	1–5	70	2028–2031 (P1 and 2).
Heavy Transport Vessel	1–20	65	2027–2031 (P1 and 2).
Tugboat	1–12	655	2028–2031 (P1 and 2).
Crew Transfer Vessel	2–5	1,608	2028–2031 (P1 and 2).
Anchor Handling Tug	1–10	16	2028–2031 (Projects 1 and 2).
Scour Protection Installation Vessel	1–2	40	2028–2030 (P1 and P2).
Cable Laying Barge	1–3	20	2027–2028 (Project 1). 2029–2030 (Project 2).
Cable Transport and Lay Vessel	1–5	88	2028–2029 Project 1 and Project 2.
Maintenance Crew/CTVs	2–5	1,608	2028–2031 (P1 and 2).
Dredging Vessel	1–5	100	2026–2027 (P1) 2029–2030 (P2).
Survey Vessel	1–5	26	2027–2031 (P1 and P2).
Barge	1–6	510	2028–2031 (P1 and P2).
Jack-up Accommodation Vessel	1–2	14	2029–2030 (P1 and P2).
DP Accommodation Vessel	1–2	16	2029–2030 (P1 and P2).
Service Operation Vessel	1–4	480	2029–2031 (P1 and P2).
Multi-purpose Support Vessel/Service Operation Vessel.	1–8	660	2027–2031 (P1 and P2).
Vessel Use During Operations			
Maintenance Crew/Crew Transfer Vessels (CTVs)	1–2	15,015	2028–2031.
Service Operation Vessel	1–2	1,638	

While vessel strikes cause injury or mortality of marine mammals, NMFS does not anticipate such taking to occur from the specified activity due to general low probability and proposed extensive vessel strike avoidance measures (see Proposed Mitigation section). SouthCoast has not requested, and NMFS is not proposing to authorize, take from vessel strikes.

Seabed Preparation

Seabed preparations will be the first offshore activity to occur during the construction phase of the SouthCoast Project, and may include scour (*i.e.,* erosion) protection, sand leveling, sand wave removal, and boulder removal. Scour protection is the placement of materials on the seafloor around the substructures to prevent the development of scour, or erosion, created by the presence of structures. Each substructure used for WTGs and OSPs may require individual scour protection, thus the type and amount utilized will vary depending on the final substructure type selected for installation. For a substructure that utilizes seabed penetration in the form of piles or suction caissons, the use of scour protectant to prevent scour development results in minimized substructure penetration. Scour protection considered for Projects 1 and 2 may include rock (rock bags), concrete mattresses, sandbags, artificial seaweeds/reefs/frond mats, or self-deploying umbrella systems (typically used for suction-bucket jackets). Installation activities and order of events of scour protection will depend on the type and material used. For rock scour protection, a rock placement vessel may be deployed. A thin layer of filter stones would be placed prior to pile driving activity while the armor rock layer would be installed following completion of foundation installation. Frond mats or umbrella-based structures may be pre-attached to the substructure, in which case the pile and scour protection would be installed simultaneously. For all types of scour protection materials considered, the results of detailed geological campaigns and assessments will support the final decision of the extent of scour protection required. Placement of scour protection may result in suspended sediments and a minor conversion of marine mammal prey benthic habitat conversion of the existing sandy bottom habitat to a hard bottom habitat as well as potential beneficial reef effects (see Section 1.3 of the ITA application).

Seabed preparation may also include leveling, sand wave removal, and boulder removal. SouthCoast may utilize equipment to level the seabed locally in order to use seabed operated cable burial tools to ensure consistent burial is achieved. If sand waves are present, the tops may be removed to provide a level bottom to install the export cable. Sand wave removal may be conducted using a trailing suction hopper dredger (or similar), a water injection dredge in shallow areas, or a constant flow excavator. Any boulder discovered in the cable route during pre-installation surveys that cannot be easily avoided by micro-routing may be removed using non-explosive methods such as a grab lift or plow. If deemed necessary, a pre-lay grapnel run will be conducted to clear the cable route of buried hazards along the installation route to remove obstacles that could impact cable installation such as abandoned mooring lines, wires, or fishing equipment. Site-specific conditions will be assessed prior to any boulder removal to ensure that boulder removal can safely proceed. Boulder clearance is a discreet action occurring over a short duration resulting in short term direct effects.

Sound produced by Dynamic Positioning (DP) vessels is considered non-impulsive and is typically more dominant than mechanical or hydraulic noises produced from the cable trenching or boulder removal vessels and equipment. Therefore, noise produced by a pull vessel with a towed plow or a support vessel carrying a boulder grab would be comparable to or less than the noise produced by DP vessels, so impacts are also expected to be similar. Boulder clearance is a discreet action occurring over a short duration resulting in short term direct effects. Additionally, sound produced by boulder clearance vessels and equipment would be preceded by, and associated with, sound from ongoing vessel noise and would be similar in nature. presence, further reducing the potential for startle or flight responses on the part of marine mammals. Monitoring of past projects that entailed use of DP thrusters has shown a lack of observed marine mammal responses as a result of exposure to sound from DP thrusters (NMFS 2018). As DP thrusters are not expected to result in take of marine mammals, these activities are not analyzed further in this document.

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

NMFS does not expect site preparation work, including boulder removal and sand leveling, to generate noise levels that would cause take of marine mammals. Underwater noise associated with these activities is expected to be similar in nature to the non-impulsive sound produced by the DP cable lay vessels used to install inter-array cables in the Lease Area and export cables along the ECCs. Boulder clearance is a discreet action occurring over a short duration resulting in short term direct effects.

Southcoast did not request take of marine mammals incidental to this activity, and based on the activity, NMFS neither expects nor proposes to authorize take of marine mammals incidental to this activity. Thus, this activity will not be discussed further.

Fisheries and Benthic Monitoring

SouthCoast has developed a fisheries monitoring plan (FMP) focusing on the Lease Area, an inshore FMP that focuses on nearshore portions of the Brayton Point ECC (*i.e.,* the Sakonnet River), and a benthic monitoring plan that covers both offshore and inshore portions of the Lease Area and ECCs. The fisheries and benthic monitoring plans for the SouthCoast Project were developed following guidance outlined in ‘‘Guidelines for Providing Information on Fisheries for Renewable Energy Development on the Atlantic Outer Continental Shelf’’ (BOEM, 2019) and the Responsible Offshore Science Alliance (ROSA) ‘‘Offshore Wind Project Monitoring Framework and Guidelines’’ (2021).

SouthCoast is working with the University of Massachusetts Dartmouth's School for Marine Science and Technology (SMAST) (in partnership with the Massachusetts Lobstermen's Association) and Inspire Environmental to develop and conduct surveys as a cooperative research program using local fishing vessels and knowledge. SouthCoast intends to conduct their research on contracted commercial and recreational fishing vessels whenever practicable.

Offshore fisheries monitoring will likely include the following types of surveys: trawls, ventless trap, drop camera, neuston net, and acoustic telemetry with tagging of highly migratory species (*e.g.,* blue sharks). Inshore fisheries monitoring surveys will also include acoustic telemetry targeting commercially and recreationally important fish species (*e.g.,* striped bass) and trap survey targeting whelk. Benthic monitoring plans are under development and may include grab samples and collection of imagery. Because the gear types and equipment used for the acoustic telemetry study, benthic habitat monitoring, and drop camera monitoring surveys do not have components with which marine mammals are likely to interact (*i.e.,* become entangled in or hooked by), these activities are unlikely to have any impacts on marine mammals. Therefore, only trap and trawl surveys, in general, have the potential to result in harassment to marine mammals. However, based on proposed mitigation and monitoring measures, taking marine mammals from this specified activity is not anticipated. A full description of mitigation and monitoring measures can be found in the Proposed Mitigation and Proposed Monitoring sections.

Given the planned implementation of the mitigation and monitoring measures, SouthCoast did not request, and NMFS is not proposing to authorize, take of marine mammals incidental to research trap and trawl surveys. Any lost gear associated with the fishery surveys will be reported to the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division (GARFO PRD) as soon as possible. Therefore, take from fishery surveys will not be discussed further.

Description of Marine Mammals in the Specified Geographical Region

Thirty-eight marine mammal species and/or stocks under NMFS' jurisdiction have geographic ranges within the western North Atlantic OCS (Hayes *et al.,* 2023). In the ITA application, SouthCoast identified 31 of those species that could potentially occur in the Lease Area and surrounding waters. However, for reasons described below, SouthCoast has requested, and NMFS proposes to authorize, take of only 16 species (comprising 16 stocks) of marine mammals. Section 4 of SouthCoast's ITA application summarizes available information regarding status and trends, distribution and habitat preferences, and behavior and life history of the species included in SouthCoast's take estimation analyses, except for the Atlantic spotted dolphin as it was unintentionally excluded from this section but included in Section 6 Take Estimates for Marine Mammals. Given previous observations of the species in the RI/MA and MA WEAs, SouthCoast included Atlantic spotted dolphins take analyses (and Table 5), and is requesting Level B harassment take of the species incidental to foundation installation, UXO/MEC detonation, and HRG surveys, which NMFS is proposing for authorization. NMFS fully considered all available information for the potentially affected species, and we refer the reader to Section 4 of the ITA application for more details about each species (except the Atlantic spotted dolphin) instead of reprinting the information. A description of Atlantic spotted dolphin distribution, population trends, and life history can be found in the NMFS SAR (Hayes et al., 2019) (*https://media.fisheries.bnoaa.gov/dam-migration/2019_sars_atlantic_atlanticbspottedbdolphin.pdf*).

Additional information regarding population trends and threats may be found in NMFS' Stock Assessment Reports (SARs; *https://www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports*) and more general information about these species (*e.g.,* physical and behavioral descriptions) may be found on NMFS' website (*https://www.fisheries.noaa.gov/find-species).*

Of the 31 marine mammal species (comprising 31 stocks) SouthCoast determined have geographic ranges that include the project area, 14 are considered rare or unexpected based on the best scientific information available (*i.e.,* sighting and distribution data, low predicted densities, and lack of preferred habitat) for a given species. SouthCoast did not request, and NMFS is not proposing to authorize, take of these species and they are not discussed further in this proposed rulemaking: Dwarf and pygmy sperm whales (*Kogia sima* and *K. breviceps*), Cuvier's beaked whale (*Ziphius cavirostris*), four species of Mesoplodont beaked whales (*Mesoplodon densitostris, M. europaeus, M. mirus,* and *M. bidens*), killer whale (*Orcinus orca*), short-finned pilot whale (*Globicephalus macrohynchus*), white-beaked dolphin (*Lagenorhynchus albirotris*), pantropical spotted dolphin (*Stenella attenuate*), and the, striped dolphin (*Stenella coeruleoalba*). Two species of phocid pinnipeds are also uncommon in the project area, including: harp seals (*Pagophilus groenlandica*) and hooded seals (*Cystophora cristata*).

In addition, the Florida manatee (*Trichechus manatus;* a sub-species of the West Indian manatee) has been previously documented as a rare visitor to the Northeast region during summer months (U.S. Fish and Wildlife Service (USFWS), 2022). However, manatees are managed by the USFWS and are not considered further in this document. More information on this species can be found at the following website: *https://www.fws.gov/species/manatee-trichechus-manatus.*

Table 5 lists all species or stocks for which take is likely and proposed for authorization for this action and summarizes information related to the species or stock, including regulatory status under the MMPA and Endangered Species Act (ESA) and potential biological removal (PBR), where known. PBR is defined as ''the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population'' (16 U.S.C. 1362(20)). While no mortality is anticipated or proposed for authorization, PBR and annual serious injury and mortality from anthropogenic sources are included here as gross indicators of the status of the species or stocks and other threats.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS' stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. All managed stocks in this region are assessed in NMFS' U.S. Atlantic and Gulf of Mexico SARs. All values presented in table 5 are the most recent available at the time of publication and, unless noted otherwise, use NMFS' draft 2023 SARs (Hayes *et al.,* 2024) available online at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports.*

TABLE 5—MARINE MAMMAL SPECIES [1] THAT MAY OCCUR IN THE SPECIFIED GEOGRAPHICAL REGION AND BE TAKEN BY HARASSMENT

Common name [1]	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [2]	Stock abundance (CV, N_{min}, most recent abundance survey) [3]	PBR	Annual M/SI [4]
Order Artiodactyla—Cetacea—Superfamily Mysticeti (baleen whales)						
Family Balaenidae:						
North Atlantic right whale	*Eubalaena glacialis*	Western Atlantic	E, D, Y	340 (0; 337; 2021); 356 (346–363, 2022) [5].	0.7	[6] 27.2
Family Balaenopteridae (rorquals):						
Blue whale	*Balaenoptera musculus*	Western North Atlantic	E, D, Y	UNK (UNK; 402; 1980–2008)	0.8	0
Fin whale	*Balaenoptera physalus*	Western North Atlantic	E, D, Y	6,802 (0.24; 5,573; 2021)	11	2.05
Sei whale	*Balaenoptera borealis*	Nova Scotia	E, D, Y	6,292 (1.02; 3,098; 2021)	6.2	0.6
Minke whale	*Balaenoptera acutorostrata*	Canadian Eastern Coastal	-, -, N	21,968 (0.31; 17,002; 2021)	170	9.4
Humpback whale	*Megaptera novaeangliae*	Gulf of Maine	-, -, Y	1,396 (0; 1,380; 2016)	22	12.15
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Physeteridae:						
Sperm whale	*Physeter macrocephalus*	North Atlantic	E, D, Y	5,895 (0.29; 4,639; 2021)	9.28	0.2
Family Delphinidae:						
Atlantic white-sided dolphin.	*Lagenorhynchus acutus*	Western North Atlantic	-, -, N	93,233 (0.71; 54,433; 2021)	544	28
Atlantic spotted dolphin	*Stenella frontalis*	Western North Atlantic	-, -, N	31,506 (0.28; 25,042; 2021)	250	0
Bottlenose dolphin [7]	*Tursiops truncatus*	Western North Atlantic Offshore.	-, -, N	64,587 (0.24; 52,801; 2021) [7]	507	28
Long-finned pilot whale [8]	*Globicephala melas*	Western North Atlantic	-, -, N	39,215 (0.3; 30,627; 2021)	306	5.7
Common dolphin (short-beaked).	*Delphinus delphis*	Western North Atlantic	-, -, N	93,100 (0.21; 59,817; 2021)	1,452	414
Risso's dolphin	*Grampus griseus*	Western North Atlantic	-, -, N	44,067 (0.19; 30,662; 2021)	307	18
Family Phocoenidae (porpoises):						

TABLE 5—MARINE MAMMAL SPECIES [1] THAT MAY OCCUR IN THE SPECIFIED GEOGRAPHICAL REGION AND BE TAKEN BY HARASSMENT—Continued

Common name [1]	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [2]	Stock abundance (CV, N_{min}, most recent abundance survey) [3]	PBR	Annual M/SI [4]
Harbor porpoise	*Phocoena phocoena*	Gulf of Maine/Bay of Fundy	-, -, N	85,765 (0.53; 56,420; 2021)	649	45
Order Carnivora—Superfamily Pinnipedia						
Family Phocidae (earless seals):						
Gray seal [9]	*Halichoerus grypus*	Western North Atlantic	-, -, N	27,911 (0.20; 23,624; 2021)	1,512	4,570
Harbor seal	*Phoca vitulina*	Western North Atlantic	-, -, N	61,336 (0.08; 57,637; 2018)	1,729	339

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

[2] ESA status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR, is declining and likely to be listed under the ESA within the foreseeable future, or listed under the ESA. A marine mammal species or population is considered depleted under the MMPA if it is below its optimum sustainable population (OSP) level, or is listed as endangered or threatened under the ESA.

[3] *CV* is the coefficient of variation; Nmin is the minimum estimate of stock abundance.

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

[5] The current SAR includes an estimated population (N_{best} 340) based on sighting history through November 2021 (Hayes *et al.,* 2024). In October 2023, NMFS released a technical report identifying that the North Atlantic right whale population size based on sighting history through 2022 was 356 whales, with a 95 percent credible interval ranging from 346 to 363 (Linden, 2023).

[6] Total annual average observed North Atlantic right whale mortality during the period 2017–2021 was 7.1 animals and annual average observed fishery mortality was 4.6 animals. Numbers presented in this table (27.2 total mortality and 176 fishery mortality) are 2016–2020 estimated annual means, accounting for undetected mortality and serious injury.

[7] There are two morphologically and genetically distinct common bottlenose morphotypes, the Western North Atlantic Northern Migratory Coastal stock and the Western North Atlantic Offshore stock. The western North Atlantic offshore stock is primarily distributed along the outer shelf and slope from Georges Bank to Florida during spring and summer and has been observed in the Gulf of Maine during late summer and fall (Hayes *et al.* 2020), whereas the northern migratory coastal stock is distributed along the coast between southern Long Island, New York, and Florida (Hayes *et al.,* 2018). Given their distribution, only the offshore stock of bottlenose dolphins is likely to occur in the project area.

[8] There are two pilot whale species, long-finned (*Globicephala melas*) and short-finned (*Globicephala macrorhynchus*), with distributions that overlap in the latitudinal range of the SouthCoast Project (Hayes *et al.,* 2020; Roberts *et al.,* 2016). Because it is difficult to differentiate between the two species at sea, sightings, and thus the densities calculated from them, are generally reported together as *Globicephala* spp. (Roberts *et al.,* 2016; Hayes *et al.,* 2020). However, based on the best available information, short-finned pilot whales occur in habitat that is both further offshore on the shelf break and further south than the project area (Hayes *et al.,* 2020). Therefore, NMFS assumes that any take of pilot whales would be of long-finned pilot whales.

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

As indicated above, all 16 species and stocks in table 5 temporally and spatially co-occur with the activity to the degree that take is likely to occur. Five of the marine mammal species for which take is requested are listed as endangered under the ESA: North Atlantic right, blue, fin, sei, and sperm whales. In addition to what is included in sections 3 and 4 of SouthCoast's ITA application (*https://www.fisheries.noaa.gov/action/incidental-take-authorization-southcoast-wind-llc-construction-southcoast-wind-offshore-wind*), the SARs (*https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*), and NMFS' website (*https://www.fisheries.noaa.gov/species-directory/marine-mammals*), we provide further detail below informing the baseline for select species (*e.g.,* information regarding current UMEs and known important habitat areas, such as Biologically Important Areas (BIAs; *https://oceannoise.noaa.gov/biologically-important-areas*) (Van Parijs *et al.,* 2015)). There are no ESA-designated critical habitats for any species within the project area.

Under the MMPA, a UME is defined as "a stranding that is unexpected; involves a significant die-off of any marine mammal population; and demands immediate response" (16 U.S.C. 1421h(6)). As of May 20, 2024, four UMEs are active. Below we include information for species that are listed under the ESA, have an active or recently closed UME occurring along the Atlantic coast, or for which there is information available related to areas of biological significance within the project area.

North Atlantic Right Whale

The North Atlantic right whale has been listed as Endangered since the ESA's enactment in 1973. The species was recently uplisted from Endangered to Critically Endangered on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Cooke, 2020). The uplisting was due to a decrease in population size (Pace *et al.,* 2017), an increase in vessel strikes and entanglements in fixed fishing gear (Daoust *et al.,* 2017; Davis & Brillant, 2019; Knowlton *et al.,* 2012; Knowlton *et al.,* 2022; Moore *et al.,* 2021; Sharp *et al.,* 2019), and a decrease in birth rate (Pettis *et al.,* 2021; Reed *et al.,* 2022). There is a recovery plan (NOAA Fisheries, 2005) for the North Atlantic right whale and, in November 2022, NMFS completed the 5-year review and concluded that no change to this listing status is warranted. (*https://www.fisheries.noaa.gov/resource/document/north-atlantic-right-whale-5-year-review*). Designated by NMFS as a Species in the Spotlight, the North Atlantic right whale is considered among the species with the greatest risk of extinction in the near future (*https://www.fisheries.noaa.gov/topic/endangered-species-conservation/species-in-the-spotlight*).

The North Atlantic right whale population had only a 2.8-percent recovery rate between 1990 and 2011 and an overall abundance decline of 23.5 percent from 2011–2019 (Hayes *et al.,* 2023). Since 2010, the North Atlantic right whale population has been in decline; however, the sharp decrease observed from 2015 to 2020 appears to have slowed, though the North Atlantic right whale population continues to experience annual mortalities above recovery thresholds (Pace *et al.,* 2017; Pace *et al.,* 2021; Linden, 2023). North Atlantic right whale calving rates dropped from 2017 to 2020 with zero births recorded during the 2017–2018 season. The 2020–2021 calving season had the first substantial calving increase in 5 years with 20 calves born, followed by 15 calves during the 2021–2022 calving season and 12 births in the 2022–2023 calving season. As of May 20, 2024, the 2023–2024 calving season includes 19 births. However, mortalities continue to outpace births, including three calf mortalities/presumed mortalities during the 2024 calving season, and the best estimates indicate fewer than 70 reproductively active females remain in the population (Hayes *et al.,* 2024). North Atlantic right whale total annual mortality and serious injury (M/SI) estimates have fluctuated in recent years, as presented in annual stock assessment reports. The estimate for 2022 (31.2) was a marked increase over the previous year. In the 2022 SARs, Hayes *et al.,* (2023) report the total annual North Atlantic right whale mortality increased from 8.1 (which represents 2016–2020) to 31.2 (which represents 2015–2019), however, this updated estimate also accounted for undetected mortality and serious injury (Hayes *et al.,* 2024). Presently, the best available peer-reviewed population estimate for North Atlantic right whales is 340 per the draft 2023 SARs (Hayes *et al.,* 2024). Approximately, 42 percent of the population is known to be in reduced health (Hamilton *et al.,* 2021) likely contributing to smaller body sizes at maturation, making them more susceptible to threats and reducing fecundity (Moore *et al.,* 2021; Reed *et al.,* 2022; Stewart *et al.,* 2022; Pirotta *et al.,* 2024). Body size is generally positively correlated to reproductive potential. Pirrota *et al.* (2024) found North Atlantic right whale body size was strongly associated with the probability of giving birth to a calf, such that smaller body size was associated with lower reproductive output. In turn, shorter females that do calve tend to produce offspring with a limited maximum size, likely through a combination of genetics and the influence of body condition during gestation and weaning (Pirotta *et al.,* 2024). When combined with other factors (*e.g.,* health deterioration due to sublethal effects of entanglement), this feedback loop has led to a decrease in overall body length and fecundity over the past 50 years (Pirotta *et al.,* 2023; Pirotta *et al.,* 2024).

Since 2017, dead, seriously injured, sublethally injured, or ill North Atlantic right whales along the United States and Canadian coasts have been documented, necessitating a UME declaration and investigation. The leading category for the cause of death for this ongoing UME is ''human interaction,'' specifically from entanglements or vessel strikes. As of May 20, 2024, there have been 39 confirmed mortalities (dead, stranded, or floaters), 1 pending mortality, and 34 seriously injured free-swimming whales for a total of 74 whales. The UME also considers animals with sublethal injury or illness (*i.e.,* ''morbidity''; n=51) bringing the total number of whales in the UME from 71 to 122. More information about the North Atlantic right whale UME is available online at *https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2023-north-atlantic-right-whale-unusual-mortality-event.*

The project area both spatially and temporally overlaps the migratory corridor BIA, within which a portion of the North Atlantic right whale population migrates south to calving grounds, generally in November and December, followed by a northward migration into feeding areas east and north of the project area in March and April (LaBrecque *et al.,* 2015; Van Parijs *et al.,* 2015). While the Project does not overlap previously identified critical feeding habitat or a feeding BIA, it is located within a recently described important feeding area south of Martha's Vineyard and Nantucket, primarily along the western side of Nantucket Shoals (Kraus *et al.,* 2016; O'Brien *et al.,* 2022, Quintano-Rizzo *et al.,* 2021). Finally, the Project overlaps the currently established November 1 through April 30th Block Island Seasonal Management Area (SMA) (73 FR 60173, October 10, 2008) and the proposed November 1 through May 30 Atlantic Seasonal Speed Zone (87 FR 46921, August 1, 2022), which may be used by North Atlantic right whales for various activities, including feeding and migration. Due to the current status of North Atlantic right whales and the overlap of the proposed Project with areas of biological significance (*i.e.,* a migratory corridor, feeding habitat, SMA), the potential impacts of the proposed SouthCoast project on North Atlantic right whales warrant particular attention.

Recent research indicates that the overall understanding of North Atlantic right whale movement patterns remains incomplete, and not all of the population undergoes a consistent annual migration (Davis *et al.,* 2017; Gowan *et al.,* 2019; Krzystan *et al.,* 2018; O'Brien *et al.,* 2022; Estabrook *et al.,* 2022; Davis *et al.,* 2023; van Parijs *et al.,* 2023). The seasonal migration between northern feeding grounds, mating grounds, and southern calving grounds off Florida and Georgia involves a part of the population while the remaining whales overwinter in other widely distributed areas (Morano *et al.,* 2012, Cole *et al.,* 2013, Bort *et al.,* 2015, Davis *et al.,* 2017). The results of multistate temporary emigration capture-recapture modeling, based on sighting data collected over the past 22 years, indicate that non-calving females may remain in the feeding habitat during winter in the years preceding and following the birth of a calf to increase their energy stores (Gowen *et al.,* 2019). O' Brien *et al.* (2022) hypothesized that North Atlantic right whales might gain an energetic advantage by summertime foraging in southern New England on sub-optimal prey patches rather than engaging in the extensive migration required to access more high-quality prey patches in northern feeding habitats (*e.g.,* Gulf of St. Lawrence). These observations of transitions in North Atlantic right whale habitat use, variability in seasonal presence in identified core habitats, and utilization of habitat outside of previously focused survey effort prompted the formation of a NMFS' Expert Working Group, which identified current data collection efforts, data gaps, and provided recommendations for future survey and research efforts (Oleson *et al.,* 2020).

North Atlantic right whale distribution and demography has been shown to depend on the distribution and density of zooplankton, which varies spatially and temporily. North Atlantic right whales feed on high-density patches of different zooplankton species (*e.g.,* calanoid copepods, *Centrophages spp., Pseudocalanus spp.*), but primarily on aggregations of late-stage *Calanus finmarchicus,* a species whose seasonal availability and distribution has changed both spatially and temporally over the last decade due to an oceanographic regime shift that has ultimately been linked to climate change (Meyer-Gutbrod *et al.,* 2021; Meyer-Gutbrod *et al.,* 2023; Record *et al.,* 2019; Sorochan *et al.,* 2019). This distribution change in prey availability has led to shifts in North Atlantic right whale habitat-use patterns over the same time period (Davis *et al.,* 2020; Meyer-Gutbrod *et al.,* 2022; Quintano-Rizzo *et al.,* 2021; O'Brien *et al.,* 2022) with reduced use of foraging habitats in the Great South Channel and Bay of Fundy and increased use of habitat within Cape Cod Bay (Stone *et al.,* 2017; Mayo *et al.,* 2018; Ganley *et al.,* 2019; Record *et al.,* 2019; Meyer-Gutbrod *et al.,* 2021; O'Brien *et al.,* 2022; Davis *et al.,* 2017). North Atlantic right whales have recolonized areas that have not had large numbers of right whales since the whaling era, likely in response to changes in zooplankton distribution (*e.g.,* Gulf of St. Lawrence, Simard *et al.,* 2019; Nantucket Shoals, *e.g.,* Kraus *et al.,* 2016; Quintana-Rizzo *et al.,* 2021; O'Brien *et al.,* 2022; Davis *et al.,* 2023; Ganley *et al.,* 2022; Van Parijs *et al.,* 2023).

Pendleton *et al.* (2022) found that peak use of North Atlantic right whale foraging habitat in Cape Cod Bay, north of the Lease Area, has shifted over the past 20 years to later in the spring, likely due to variations in seasonal conditions. However, initial yearly sightings of individual North Atlantic right whales in Cape Cod Bay have started earlier in the year concurrent with climate changes, indicating that their migratory movements between habitats may be cued by changes in regional water temperature (Pendleton *et al.,* 2022). These changes have the potential to lead to temporal misalignment between North Atlantic right whale seasonal arrival to this foraging habitat and the availability of the zooplankton prey (Ganley *et al.,* 2022).

North Atlantic right whale use of habitats such as in the Gulf of St. Lawrence and East Coast mid-Atlantic waters of the U.S. have also increased over time (Davis *et al.,* 2017; Davis and Brillant, 2019; Simard et al., 2019; Crowe *et al.,* 2021; Quintana-Rizzo *et al.,* 2021). Using passive acoustic data collected from 2010–2018 throughout the Gulf of St. Lawrence, a foraging habitat more recently exploited by a significant portion of the population, Simard *et al.* (2019) documented the presence of North Atlantic right whales for an unexpectedly extended period at four out of the eight recording stations, from the end of April through January, and found that occurrence peaked in the area from August through November each year. In 2015, the mean daily occurrence of North Atlantic right whales in the feeding grounds off Gaspé, located on the west side of the upper Gulf of St. Lawrence, quadrupled compared to 2011–2014 (Simard *et al.,* 2019). However, there is concern that prey biomass in the Gulf of St. Lawrence may be insufficient in most years to support successful reproduction of North Atlantic right whales (Gavrilchuk *et al.,* 2021), which could impel whales to seek out alternative foraging habitats. Based on high-resolution climate models, Ross *et al.,* (2021) projected that the redistribution of North Atlantic right whales throughout the western North Atlantic Ocean will continue at least through the year 2050 (Ross *et al.,* 2021).

Within the past decade in southern New England, increasing year-round observations of North Atlantic right whales have occurred and include documentation of social behaviors and foraging in all seasons, making it the only known winter foraging habitat (Kraus *et al.,* 2016; Leiter *et al.,* 2017; Stone *et al.,* 2017; Quintana-Rizzo *et al.,* 2021; O'Brien *et al.,* 2022; Van Parijs *et al.,* 2023; Davis *et al.,* 2023). Both visual and acoustic lines of evidence demonstrate the year-round presence of North Atlantic right whales in southern New England (Kraus *et al.,* 2016; Quintana-Rizzo *et al.* 2021; Estabrook *et al.,* 2022; O'Brian *et al.,* 2022; Davis *et al.,* 2023; van Parijs *et al.,* 2023). Right whales were sighted in winter and spring during aerial surveys conducted in the RI/MA and MA WEAs from 2011–2015 and 2017–2019 (Kraus *et al.,* 2016; Quintana-Rizzo *et al.,* 2021; O'Brien *et al.,* 2022). There was not significant variability in sighting rates among years, indicating consistent annual seasonal use of the area by North Atlantic right whales. Despite the lack of visual detection in most summer and fall months, right whales were acoustically detected in 30 out of the 36 recorded months (Kraus *et al.,* 2016). Since 2017, whales have been sighted in southern New England nearly every month with peak sighting rates between late winter and spring. Model outputs in Quintana-Rizzo *et al.* (2021) suggested that 23 percent of the right whale population is present from December through May, and the mean residence time tripled between 2011–2015 and 2017–2019 to an average of 13 days during these same months.

Based on analyses of PAM data collected at recording sites in the RI/MA and MA WEAs from 2011–2015, Estabrook *et al.* (2022) report that North Atlantic right whale upcall detections occurred throughout both WEAs in all seasons (during 34 of the 37 surveyed months) but predominantly in the late winter and spring, which aligns with visual observations (Kraus *et al.,* 2016; Quintana-Rizzo *et al.,* 2021). Among the recording locations in southern New England, detections were most frequent on acoustic recorders along the eastern side of the MA WEA (Estabrook *et al.,* 2022). December through April had higher presence while June through September had lower presence. Winter (December–April) had the highest presence (75 percent array-days, n = 193), and summer (June–Sep had the lowest presence (10 percent array-days, n = 27). Spring and autumn were similar, where approximately half of the array-days had upcall detections. The mean daily call rate for days upcalls were detected was highest in January, February, and March, accounting for 72 percent of all detected upcalls, and calling rates were significantly different among seasons (Estabrook *et al.,* 2022). Upcalls were detected on 41 percent of the 1,023 recording days in the MA WEA and on only 24 percent of the recording days in the RI–MA WEA. Similarly, both van Parijs *et al.* (2023) and. Davis *et al.* (2023) evaluated a 2020–2022 PAM dataset collected using seven acoustic recorders deployed in the RI/MA and MA WEAs, two deployed on Cox Ledge (*i.e.,* the northwest side of the RI/MA WEA), four along the eastern side of the MA WEA (along a transect approximately parallel to the 30-m isobath on the west side of Nantucket Shoals, the same bathymetric feature used to define the NARW EMA), and one positioned towards the center of Nantucket Shoals, and noted that North Atlantic right whales were acoustically detected at all seven sites from September through May, with sporadic presence in June through August. Upcalls were detected at each location nearly every week, annually, with detections steadily increasing through October, reaching consistently high levels from November through April, steadily declining in May, and remaining low throughout summer. Upcalls were detected nearly 7 days a week December through March at the two locations nearest the Lease Area along the eastern edge of the MA WEA (NS01 and NS02, see Figures 1 and 2 in Davis *et al.,* 2023). Comprehensively, acoustic and visual observations of North Atlantic right whales in southern New England indicate that whales occur year-round but more frequently in winter and spring and in eastern (versus western) southern New England.

While Nantucket Shoals is not designated as critical North Atlantic right whale habitat, its importance as a foraging habitat is well established (Leiter *et al.,* 2017; Quintana-Rizzo *et al.,* 2021; Estabrook *et al.,* 2022; O'Brien *et al.,* 2022). However, studies focusing on the link between right whale habitat use and zooplankton in the Nantucket Shoals region are limited (National Academy of Sciences, 2003). The supply of zooplankton to the Nantucket Shoals region is dependent on advection from sources outside the Shoals via regional circulation, but zooplankton aggregation is presumably dependent on local physical processes and zooplankton behavior (National Academy of Sciences, 2023). Nantucket Shoals' unique oceanographic and bathymetric features, including the persistent tidal front described in the Specified Geographical Area section, help sustain year-round elevated phytoplankton biomass and aggregate zooplankton prey for North Atlantic right whales (White *et* *al.,* 2020; Quintana-Rizzo *et al.,* 2021). O'Brien *et al.* (2022) hypothesize that North Atlantic right whale southern New England habitat use has increased in recent years (*i.e.,* over the last decade) as a result of either, or a combination of, a northward shift in prey distribution (thus increasing local prey availability) or a decline in prey in other abandoned feeding areas (*e.g.,* Gulf of Maine), both induced by climate change. Pendleton *et al.* (2022) characterize southern New England as a ''waiting room'' for North Atlantic right whales in the spring, providing sufficient, although sub-optimal, prey choices while North Atlantic right whales wait for *Calanus finmarchicus* supplies in Cape Cod Bay (and other primary foraging grounds like the Great South Channel) to optimize as seasonal primary and secondary production progresses. Throughout the year, southern New England provides opportunities for North Atlantic right whales to capitalize on *C.finmarchicus* blooms or alternative prey (*e.g., Pseudocalanus elongatus* and *Centropages spp.,* found in greater concentrations than *C.finmarchicus* in winter), although likely not to the extent provided seasonally in more well-understood feeding habitats like Cape Cod Bay in late spring or the Great South Channel (O'Brien *et al.,* 2022). Although extensive data gaps, highlighted in a recent report by the National Academy of Sciences (NAS, 2023), have prevented development of a thorough understanding of North Atlantic right whale foraging ecology in the Nantucket Shoals region, it is clear that the habitat was historically valuable to the species, given that the whaling industry capitalized on consistent right whale occurrence there and has again become increasingly so over the last decade.

Humpback Whale

Humpback whales were listed as endangered under the Endangered Species Conservation Act (ESCA) in June 1970. In 1973, the ESA replaced the ESCA, and humpbacks continued to be listed as endangered. On September 8, 2016, NMFS divided the once single species into 14 distinct population segments (DPS), removed the species-level listing, and, in its place, listed four DPSs as endangered and one DPS as threatened (81 FR 62259; September 8, 2016). The remaining nine DPSs were not listed. The West Indies DPS, which is not listed under the ESA, is the only DPS of humpback whales that is expected to occur in the project area. Bettridge *et al.* (2015) estimated the size of the West Indies DPS population at 12,312 (95 percent confidence interval (CI) 8,688–15,954) whales in 2004–2005, which is consistent with previous population estimates of approximately 10,000–11,000 whales (Stevick *et al.,* 2003; Smith *et al.,* 1999) and the increasing trend for the West Indies DPS (Bettridge *et al.,* 2015).

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

Kraus *et al.* (2016) visually observed humpback whales in the RI/MA and MA WEAs and surrounding areas during all seasons, but most frequently during spring and summer months, particularly from April to June. Concurrently collected acoustic data (from 2011 through 2015) indicated that this species may be present within the RI/MA WEA year-round, with the highest rates of acoustic detections in the winter and spring (Kraus *et al.,* 2016). Analyzing PAM data collected at six acoustic recording locations from January 2020 through November 2022, van Parijs *et al.* (2023) assessed daily, weekly, and monthly patterns in humpback whale acoustic occurrence within the RI/MA and MA WEAs, and found patterns similar to those described in Kraus *et al.* (2016). Humpback whale vocalizations were detected in all months, although most commonly from November through June, annually, at recording sites in eastern southern New England (near Nantucket Shoals) (van Parijs *et al.* 2023). Detections at recorder locations in western southern New England, near Cox Ledge, were even more frequent than at the eastern southern New England recorder locations, indicating humpback whales were present on a nearly daily basis in all months except September and October.

In New England waters, feeding is the principal activity of humpback whales, and their distribution in this region has been largely correlated to abundance of prey species, although behavior and bathymetry are factors influencing foraging strategy (Payne *et al.,* 1986; 1990). Humpback whales are frequently piscivorous when in New England waters, feeding on herring (*Clupea harengus*), sand lance (*Ammodytes spp.*), and other small fishes, as well as euphausiids in the northern Gulf of Maine (Paquet *et al.,* 1997). During winter, the majority of humpback whales from North Atlantic feeding areas (including the Gulf of Maine) mate and calve in the West Indies, where spatial and genetic mixing among feeding groups occurs, though significant numbers of animals are found in mid- and high-latitude regions at this time and some individuals have been sighted repeatedly within the same winter season, indicating that not all humpback whales migrate south every winter (Hayes *et al.,* 2018).

Since January 2016, elevated humpback whale mortalities have occurred along the Atlantic coast from Maine to Florida. This event was declared a UME in April 2017. Partial or full necropsy examinations have been conducted on approximately half of the 212 known cases (as of January 5, 2024). Of the whales examined (approximately 90), about 40 percent had evidence of human interaction either from vessel strike or entanglement. While a portion of the whales have shown evidence of pre-mortem vessel strike, this finding is not consistent across all whales examined and more research is needed. NOAA is consulting with researchers that are conducting studies on the humpback whale populations, and these efforts may provide information on changes in whale distribution and habitat use that could provide additional insight into how these vessel interactions occurred. More information is available at: *https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events.*

Since December 1, 2022, the number of humpback strandings along the mid-Atlantic coast has been elevated. In some cases, the cause of death is not yet known. In others, vessel strike has been deemed the cause of death. As the humpback whale population has grown, they are seen more often in the Mid-Atlantic. These whales may be following their prey (small fish) which were reportedly close to shore in the 2022–2033 winter. Changing distributions of prey impact larger marine species that depend on them and result in changing distribution of whales and other marine life. These prey also attract fish that are targeted by recreational and commercial fishermen, which increases the number of boats and amount of fishing gear in these areas. This nearshore movement increases the potential for anthropogenic interactions, particularly as the increased presence of whales in areas traveled by boats of all sizes increases the risk of vessel strikes.

Minke Whale

Minke whales are common and widely distributed throughout the U.S.

Atlantic Exclusive Economic Zone (EEZ) (Cetacean and Turtle Assessment Program (CETAP), 1982; Hayes *et al.,* 2022), although their distribution has a strong seasonal component. Individuals have often been detected acoustically in shelf waters from spring to fall and more often detected in deeper offshore waters from winter to spring (Risch *et al.,* 2013). Minke whales are abundant in New England waters from May through September (Pittman *et al.,* 2006; Waring *et al.,* 2014), yet largely absent from these areas during the winter, suggesting the possible existence of a migratory corridor (LaBrecque *et al.,* 2015). A migratory route for minke whales transiting between northern feeding grounds and southern breeding areas may exist to the east of the Lease Area, as minke whales may track warmer waters along the continental shelf while migrating (Risch *et al.,* 2014). Risch *et al.* (2014) suggests the presence of a minke whale breeding ground offshore of the southeastern U.S. during the winter.

There are two minke whale feeding BIAs from March through November, annually, identified in the southern and southwestern sections of the Gulf of Maine, including multiple habitats: Georges Bank, the Great South Channel, Cape Cod Bay and Massachusetts Bay, Stellwagen Bank, Cape Anne, and Jeffreys Ledge (LeBrecque *et al.,* 2015). However, these BIAs do not overlap the Lease Area or ECCs, as they are located further east and north.

Although minke whales are sighted in every season in southern New England (O'Brien *et al.,* 2022), minke whale use of the area is highest during the months of March through September (Kraus *et al.,* 2016; O'Brien *et al.,* 2023), and the species is largely absent in the winter (Risch *et al.,* 2013; Hayes *et al.,* 2023). Large feeding aggregations of humpback, fin, and minke whales have been observed during the summer (O'Brien *et al.,* 2023), suggesting southern New England may serve as a supplemental feeding grounds for these species. Aerial survey data indicate that minke whales are the most common baleen whale in the RI/MA & MA WEAs (Kraus et al., 2016; Quintana and Kraus, 2019; O'Brien *et al.,* 2021a, b). Surveys also reported a shift in the greatest seasonal abundance of minke whales from spring (2017–2018) (Quintana and Kraus, 2019) to summer (2018–2019 and 2020–2021) (O'Brien *et al.,* 2021a, b). Through analysis of PAM data collected in southern New England from January 2020 through November 2022, Van Parijs *et al.* (2023) detected minke whales at all seven passive acoustic recorder deployment sites, primarily from March through June and August through early December. Additional detections occurred in January on Cox Ledge and near the northeast portion of the Lease Area.

Elevated minke whale mortalities detected along the Atlantic coast from Maine through South Carolina resulted in the declaration of an on-going UME in 2017. As of May 20, 2024, a total of 169 minke whales have stranded during this UME. Full or partial necropsy examinations were conducted on more than 60 percent of the whales. Preliminary findings show evidence of human interactions or infectious disease, but these findings are not consistent across all of the minke whales examined, so more research is needed. More information is available at: *https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2022-minke-whale-unusual-mortality-event-along-atlantic-coast.*

Sei Whale

The Nova Scotia stock of sei whales can be found in deeper waters of the continental shelf edge of the eastern United States and northeastward to south of Newfoundland (Mitchell, 1975; Hain *et al.,* 1985; Hayes *et al.,* 2022). Sei whales have been detected acoustically along the Atlantic Continental Shelf and Slope from south of Cape Hatteras, North Carolina to the Davis Strait, and acoustic occurrence has been increasing in the mid-Atlantic region since 2010 (Davis *et al.,* 2020).

Sei whales are largely planktivorous, feeding primarily on euphausiids and copepods (Hayes *et al.,* 2023). Although their migratory movements are not well understood, sei whales are believed to migrate between feeding grounds in temperate and subpolar regions to wintering grounds in lower latitudes (Kenney and Vigness-Raposa, 2010; Hayes *et al.,* 2020). Through an analysis of PAM data collected from X to X, Davis *et al.* (2020) determined that peak call detections occurred in northern latitudes during summer, ranging from Southern New England through the Scotian Shelf. During spring and summer, the stock is mainly concentrated in these northern feeding areas, including the Scotian Shelf (Mitchell and Chapman, 1977), the Gulf of Maine, Georges Bank, the Northeast Channel, and south of Nantucket (CETAP, 1982; Kraus *et al.,* 2016; Roberts *et al.,* 2016; Palka *et al.,* 2017; Cholewiak *et al.,* 2018; Hayes *et al.,* 2022). While sei whales generally occur offshore, individuals may also move into shallower, more inshore waters to pursue prey (Payne *et al.,* 1990; Halpin *et al.,* 2009; Hayes *et al.,* 2023).

A sei whale feeding BIA occurs in New England waters from May through November (LaBrecque *et al.,* 2015). This BIA is located over 100 km to the east and north of the project area and is not expected to be impacted by the Project activities.

Persistent year-round detections in southern New England and the New York Bight indicate that sei whales may utilize these habitats to a greater extent than previously thought (Hayes *et al.,* 2023). The results of an analysis of acoustic data collected from January 2020 through November 2022 indicate that sei whale acoustic presence in southern New England peaks in late winter and early spring (February to May), and is otherwise sporadic throughout the rest of the year (van Parijs *et al.,* 2023). Fewer detections occurred at the two sites on Cox Ledge to the west compared to the sites located near the eastern edge of the MA WEA, potentially indicating sei whales prefer specific habitat within southern New England (Figure 1 in van Parijs *et al.,* 2023).

Fin Whale

Fin whales frequently occur in the waters of the U.S. Atlantic Exclusive EEZ, principally from Cape Hatteras, North Carolina northward and are distributed in both continental shelf and deep-water habitats (Hayes *et al.,* 2023). Although fin whales are present north of the 35-degree latitude region in every season and are broadly distributed throughout the western North Atlantic for most of the year, densities vary seasonally (Edwards *et al.,* 2015; Hayes *et al.,* 2023). Observations of fin whales indicate that they typically feed in the Gulf of Maine and the waters surrounding New England, but their mating and calving (and general wintering) areas are largely unknown (Hain *et al.,* 1992; Hayes *et al.,* 2021). Acoustic detections of fin whale singers augment and confirm these conclusions for males drawn from visual sightings. Recordings from Massachusetts Bay, New York Bight, and deep-ocean areas have detected some level of fin whale singing from September through June (Watkins *et al.,* 1987; Clark and Gagnon, 2002; Morano *et al.,* 2012). These acoustic observations from both coastal and deep-ocean regions support the conclusion that male fin whales are broadly distributed throughout the western North Atlantic for most of the year (Hayes *et al.,* 2019).

New England waters represent a major feeding ground for fin whales. A relatively small fin whale feeding BIA (2,933 km^2), active from March through October, is located approximately 34 km to the west of the Lease Area, offshore of Montauk Point, New York (Hain *et al.,* 1992; LaBrecque *et al.* 2015). A portion of the planned Brayton Point ECC route traces the northeast edge of the BIA. Although the Lease Area does not overlap this BIA, should SouthCoast decide to use vibratory pile driving to install foundations for Project 2, it's possible that the resulting Level B harassment zone may extend into the southeastern edge of the BIA during installation of the foundations on the northwest edge of the Lease Area. A separate larger year-round feeding BIA (18,015 km^2) located far to the northeast in the southern Gulf of Maine does not overlap with the project area and would, thus, not be impacted by project activities.

Kraus *et al.* (2016) suggest that, compared to other baleen whale species, fin whales have a high multi-seasonal relative abundance in the RI/MA & MA WEAs and surrounding areas. This species was observed primarily in the offshore (southern) regions of the RI/MA & MA WEAs during spring and was found closer to shore (northern areas) during the summer months (Kraus *et al.,* 2016). Although fin whales were largely absent from visual surveys in the RI/MA & MA WEAs in the fall and winter months (Kraus *et al.,* 2016), acoustic data indicate that this species is present in the RI/MA & MA WEAs during all months of the year, although to a much lesser extent in summer (Morano *et al.,* 2012; Muirhead *et al.,* 2018; Davis *et al.,* 2020). More recent surveys have documented fin whales throughout winter, spring, and summer (O'Brien *et al.,* 2020; 2021; 2022; 2023) with the greatest abundance occurring during the summer and clustered in the western portion of the WEAs (O'Brien *et al.,* 2023). Most recently, from January 2020 through November 2022, van Parijs *et al.* (2023) fin whales were acoustically detected at all seven recording sites in southern New England, which included two locations on Cox Ledge (western southern New England) and five locations along the east side of the MA WEA (along the western side of Nantucket Shoals). Similar to observations of humpback whale acoustic occurrence, fin whales were detected more frequently near Cox Ledge than at locations closer to Nantucket Shoals (van Paris *et al.* (2023). Daily acoustic presence occurred for the majority of the year, most intensively in the fall, yet fin whales were essentially acoustically absent at all recorder locations from April through August (van Parijs *et al.,* 2023). Although fin whale distribution is not fully understood, we expect that this period lacking acoustic detections corresponds to fin whale northward movement in late spring towards higher-latitude foraging grounds.

Blue Whale

Much is unknown about the blue whale populations. The last minimum population abundance was estimated at 402, but insufficient data prevent determining population trends (Hayes *et al.,* 2023). The total level of human caused mortality and serious injury is unknown, but it is believed to be insignificant and approaching a zero mortality and serious injury rate (Hayes *et al.,* 2019). There are no blue whale BIAs or ESA-protected critical habitats identified in the project area or along the U.S. Eastern Seaboard. There is no UME for blue whales.

In the North Atlantic Ocean, blue whales range from the subtropics to the Greenland Sea. The North Atlantic Stock includes animals utilizing mid-latitude (North Carolina coastal and open ocean) to Arctic (Newfoundland and Labrador) waters. Blue whales do not regularly occur within the U.S. EEZ, preferring offshore habitat with water depths of 328 ft (100 m) or more (Waring *et al.,* 2011). The most frequent sightings occur at higher latitudes off eastern Canada in the Gulf of St. Lawrence, with the greatest concentration of this species in the St. Lawrence Estuary (Comtois *et al.,* 2010; Lesage *et al.,* 2007; Hayes *et al.,* 2019). They often are found near the continental shelf edge where upwelling produces concentrations of krill, their main prey species (Yochem and Leatherwood, 1985; Fiedler *et al.,* 1998; Gill *et al.,* 2011).

Blue whales are uncommon in New England coastal waters. Visual surveys conducted in 2018–2020, did not result in any sightings of blue whales in MA and RI/MA WEAs (O'Brien *et al.,* 2021a; O'Brien *et al.,* 2021b). However, Kraus *et al.* (2016) conducted aerial and acoustic surveys between 2011–2015 in the MA and RI/MA WEAs and surrounding areas and, although blue whales were not visually observed, they were infrequently acoustically detected during winter. A 2008 study detected blue whale calls in offshore areas of the New York Bight, south of southern New England, on 28 out of 258 days of recordings (11 percent of recording days), mostly during winter (Muirhead *et al.,* 2018). Van Paris *et al.* (2023) detected a small number of blue whale calls in southern New England in January and February, although the species was otherwise acoustically absent. Given the long-distance propagation characteristics of low-frequency blue whale vocalizations, it's possible blue whale calls detected in southern New England originated from distant whales. Together, these data suggest that blue whales are rarely present in the MA and RI/MA WEAs.

Sperm Whale

Sperm whales can be found throughout the world's oceans. They can be found near the edge of the ice pack in both hemispheres and are also common along the equator. The North Atlantic stock is distributed mainly along the continental shelf-edge, over the continental slope, and mid-ocean regions, where they prefer water depths of 600 m (1,969 ft) or more and are less common in waters <300 m (984 ft) deep (Waring *et al.,* 2015; Hayes *et al.,* 2020). In the winter, sperm whales are observed east and northeast of Cape Hatteras. In the spring, sperm whales are more widely distributed throughout the Mid-Atlantic Bight and southern portions of George's Bank (Hayes *et al.,* 2020). In the summer, sperm whale distribution is similar to the spring, but they are more widespread in Georges Bank and the Northeast Channel region and are also observed inshore of the 100-m (328-ft) isobath south of New England (Hayes *et al.,* 2020). Sperm whale occurrence on the continental shelf in areas south of New England is at its highest in the fall (Hayes *et al.,* 2020). Between April 2020 and December 2021, there was 1 sighting of 2 individual sperm whales recorded during HRG surveys conducted within the area surrounding the Lease Area and Falmouth ECC.

Kraus *et al.* (2016) observed sperm whales four times in the RI/MA and MA WEAs and surrounding areas in the summer and fall during the 2011–2015 NLPSC aerial survey. Sperm whales, traveling singly or in groups of three or four, were observed three times in August and September of 2012, and once in June of 2015. Effort-weighted average sighting rates could not be calculated. The frequency of sperm whale clicks exceeded the maximum frequency of PAM equipment used in the Kraus *et al.* (2016) study, so no acoustic data are available for this species from that study. Sperm whales were observed only once in the MA WEA and nearby waters during the 2010–2017 AMAPPS surveys (NEFSC and SEFSC 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018). This occurred during a summer shipboard survey in 2016.

Phocid Seals

Harbor and gray seals have experienced two UMEs since 2018, although one was recently closed (2022 Pinniped UME in Maine) and closure of the second, described here, is pending. Beginning in July 2018, elevated numbers of harbor seal and gray seal mortalities occurred across Maine, New Hampshire, and Massachusetts. Additionally, stranded seals have shown clinical signs as far south as Virginia, although not in elevated numbers, therefore the UME investigation encompassed all seal strandings from Maine to Virginia. A total of 3,152 reported strandings (of all species) occurred from July 1, 2018, through March 13, 2020. Full or partial necropsy examinations were conducted on some of the seals and samples were collected for testing. Based on tests conducted thus far, the main pathogen found in the seals is phocine distemper virus. NMFS is performing additional testing to identify any other factors that may be involved in this UME, which is pending closure. Information on this UME is available online at: *https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-life-distress/2018-2020-pinniped-unusual-mortality-event-along.*

Marine Mammal Hearing

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

TABLE 6—MARINE MAMMAL HEARING GROUPS (NMFS, 2018)

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

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

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä *et al.,* 2006; Kastelein *et al.,* 2009; Reichmuth and Holt, 2013). For more detail concerning these groups and associated frequency ranges, please see NMFS (2018) for a review of available information.

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

Acoustic Habitat

Acoustic habitat is defined as distinguishable soundscapes inhabited by individual animals or assemblages of species, inclusive of both the sounds they create and those they hear (NOAA, 2016). All of the sound present in a particular location and time, considered as a whole, comprises a ''soundscape'' (Pijanowski *et al.,* 2011). When examined from the perspective of the animals experiencing it, a soundscape may also be referred to as ''acoustic habitat'' (Clark *et al.,* 2009, Moore *et al.,* 2012, Merchant *et al.,* 2015). High value acoustic habitats, which vary spectrally, spatially, and temporally, support critical life functions (feeding, breeding, and survival) of their inhabitants. Thus, it is important to consider acute (*e.g.,* stress or missed feeding/breeding opportunities) and chronic effects (*e.g.,* masking) of noise on important acoustic habitats. Effects that accumulate over long periods can ultimately result in detrimental impacts on the individual, stability of a population, or ecosystems that they inhabit.

Potential Effects of the Specified Activities on Marine Mammals and Their Habitat

This section includes a summary and discussion of the ways that components of the specified activity may impact marine mammals and their habitat. The Estimated Take section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The Negligible Impact Analysis and Determination section considers the content of this section, the Estimated Take section, and the Proposed Mitigation section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks. General background information on marine mammal hearing was provided previously (see the Description of Marine Mammals in the Specified Geographical Area section). Here, the potential effects of sound on marine mammals are discussed.

SouthCoast has requested, and NMFS proposes to authorize, the take of marine mammals incidental to the construction activities associated with the SouthCoast project. In their application, SouthCoast presented their analyses of potential impacts to marine mammals from the specified activities. NMFS carefully reviewed the information provided by SouthCoast and also independently reviewed applicable scientific research and literature and other information to evaluate the potential effects of SouthCoast's specified activities on marine mammals.

The proposed activities would result in the construction and placement of up to 149 permanent foundations (up to 147 WTGs; up to 5 OSPs) in the marine environment. Up to 10 UXO/MEC detonations may occur during construction if any found UXO/MEC cannot be removed by other means. There are a variety of types and degrees of effects to marine mammals, prey species, and habitat that could occur as a result of SouthCoast's specified activities. Below, we provide a brief description of the types of sound sources that would be generated by the project, the general impacts from these types of activities, and an analysis of the anticipated impacts on marine mammals from SouthCoast's specified activities, with consideration of select proposed mitigation measures.

Description of Sound Sources

This section contains a brief technical background on sound, on the characteristics of certain sound types, and on metrics used in this proposal inasmuch as the information is relevant to the specified activity and to a discussion of the potential effects of the specified activity on marine mammals found later in this document. For general information on sound and its interaction with the marine environment, please see Au and Hastings (2008), Richardson *et al.* (1995), Urick (1983), as well as the Discovery of Sound in the Sea (DOSITS) website at *https://dosits.org/.*

Sound is a vibration that travels as an acoustic wave through a medium such as a gas, liquid or solid. Sound waves alternately compress and decompress the medium as the wave travels. These compressions and decompressions are detected as changes in pressure by aquatic life and man-made sound receptors such as hydrophones (underwater microphones). In water, sound waves radiate in a manner similar to ripples on the surface of a pond and may be either directed in a beam (narrow beam or directional sources) or sound beams may radiate in all directions (omnidirectional sources).

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

The basic components of a sound wave are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in Hz or cycles per second. Wavelength is the distance between two peaks or corresponding points of a sound wave (length of one cycle). Higher frequency sounds have shorter wavelengths than lower frequency sounds and typically attenuate (decrease) more rapidly except in certain cases in shallower water. The intensity (or amplitude) of sounds are measured in decibels (dB), which are a relative unit of measurement that is used to express the ratio of one value of a power or field to another. Decibels are measured on a logarithmic scale, so a small change in dB corresponds to large changes in sound pressure. For example, a 10–dB increase is a ten-fold increase in acoustic power. A 20–dB increase is then a 100-fold increase in power and a 30–dB increase is a 1,000-fold increase in power. However, a ten-fold increase in acoustic power does not mean that the sound is perceived as being ten times louder. Decibels are a relative unit comparing two pressures; therefore, a reference pressure must always be indicated. For underwater sound, this is 1 microPascal (μPa). For in-air sound, the reference pressure is 20 μPa. The amplitude of a sound can be presented in various ways; however, NMFS typically considers three metrics. In this proposed rule, all decibel levels referenced to 1μPa.

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

Sound is generally defined using common metrics. Root mean square (rms) is the quadratic mean sound pressure over the duration of an impulse. Root mean square is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick, 1983). Root mean square accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels (Hastings and Popper, 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units than by peak pressures. Peak sound pressure (also referred to as zero-to-peak sound pressure or 0–pk) is the maximum instantaneous sound pressure measurable in the water at a specified distance from the source, and is represented in the same units as the rms sound pressure. Along with SEL, this metric is used in evaluating the potential for PTS (permanent threshold shift) and TTS (temporary threshold shift). Peak pressure is also used to evaluate the potential for gastro-intestinal tract injury (Level A harassment) from explosives. For explosives, an impulse metric (Pa–s), which is the integral of a transient sound pressure over the duration of the pulse, is used to evaluate the potential for mortality (*i.e.,* severe lung injury) and slight lung injury. Thes impulse metric thresholds account for animal mass and depth.

Sounds can be either impulsive or non-impulsive. The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (*e.g.,* Ward, 1997 in Southall *et al.,* 2007). Please see NMFS *et al.* (2018) and Southall *et al.* (2007, 2019a) for an in-depth discussion of these concepts. Impulsive sound sources (*e.g.,* airguns, explosions, gunshots, sonic booms, impact pile driving) produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (American National Standards Institute (ANSI), 1986, 2005; Harris, 1998; National Institute for Occupational

Safety and Health (NIOSH), 1998; International Organization for Standardization (ISO, 2003)) and occur either as isolated events or repeated in some succession. Impulsive sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury as compared with sounds that lack these features. Impulsive sounds are typically intermittent in nature.

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

Sounds are also characterized by their temporal component. Continuous sounds are those whose sound pressure level remains above that of the ambient sound with negligibly small fluctuations in level (NIOSH, 1998; ANSI, 2005) while intermittent sounds are defined as sounds with interrupted levels of low or no sound (NIOSH, 1998). NMFS identifies Level B harassment thresholds based on if a sound is continuous or intermittent.

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

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

Potential Effects of Underwater Sound on Marine Mammals

Anthropogenic sounds cover a broad range of frequencies and sound levels and can have a range of highly variable impacts on marine life from none or minor to potentially severe responses depending on received levels, duration of exposure, behavioral context, and various other factors. Broadly, underwater sound from active acoustic sources, such as those that would be produced by SouthCoast's activities, can potentially result in one or more of the following: temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, stress, and masking (Richardson *et al.,* 1995; Gordon *et al.,* 2003; Nowacek *et al.,* 2007; Southall *et al.,* 2007; Götz *et al.,* 2009; Erbe *et al.,* 2016, 2019). Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to high level underwater sound or as a secondary effect of extreme behavioral reactions (*e.g.,* change in dive profile as a result of an avoidance reaction) caused by exposure to sound include neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox *et al.,* 2006; Southall *et al.,* 2007; Zimmer and Tyack, 2007; Tal *et al.,* 2015). Potential effects from explosive sound sources can range in severity from behavioral disturbance or tactile perception to physical discomfort, slight injury of the internal organs and the auditory system, or mortality (Yelverton *et al.,* 1973; Siebert *et al.,* 2022).

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

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

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

Hearing Threshold Shift

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

When PTS occurs, there can be physical damage to the sound receptors in the ear (*i.e.,* tissue damage) whereas TTS represents primarily tissue fatigue and is reversible (Henderson *et al.,* 2008). In addition, other investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury (*e.g.,* Ward, 1997; Southall *et al.,* 2019a). Therefore, NMFS does not consider TTS to constitute auditory injury.

Relationships between TTS and PTS thresholds have not been studied in marine mammals, and there is no PTS data for cetaceans. However, such relationships are assumed to be similar to those in humans and other terrestrial mammals. Noise exposure can result in either a permanent shift in hearing thresholds from baseline (PTS; a 40–dB threshold shift approximates a PTS onset; *e.g.,* Kryter *et al.,* 1966; Miller, 1974; Henderson *et al.,* 2008) or a temporary, recoverable shift in hearing that returns to baseline (a 6–dB threshold shift approximates a TTS onset; *e.g.,* Southall *et al.,* 2019a). Based on data from terrestrial mammals, a precautionary assumption is that the PTS thresholds, expressed in the unweighted peak sound pressure level metric (PK), for impulsive sounds (such as impact pile driving pulses) are at least 6 dB higher than the TTS thresholds and the weighted PTS cumulative sound exposure level thresholds are 15 (impulsive sound) to 20 (non-impulsive sounds) dB higher than TTS cumulative sound exposure level thresholds (Southall *et al.,* 2019a). Given the higher level of sound or longer exposure duration necessary to cause PTS as compared with TTS, PTS is less likely to occur as a result of these activities, but it is possible and a small amount has been proposed for authorization for several species.

TTS is the mildest form of hearing impairment that can occur during exposure to sound, with a TTS of 6 dB considered the minimum threshold shift clearly larger than any day-to-day or session-to-session variation in a subject's normal hearing ability (Schlundt *et al.,* 2000; Finneran *et al.,* 2000; Finneran *et a*l., 2002). While experiencing TTS, the hearing threshold rises, and a sound must be at a higher level in order to be heard. In terrestrial and marine mammals, TTS can last from minutes or hours to days (in cases of strong TTS). In many cases, hearing sensitivity recovers rapidly after exposure to the sound ends. There is data on sound levels and durations necessary to elicit mild TTS for marine mammals, but recovery is complicated to predict and dependent on multiple factors.

Marine mammal hearing plays a critical role in communication with conspecifics, and interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (*i.e.,* recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious depending on the degree of interference with marine mammals hearing. For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that occurs during a time where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during time when communication is critical (*e.g.,* for successful mother/calf interactions, consistent detection of prey) could have more serious impacts.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin, beluga whale (*Delphinapterus leucas*), harbor porpoise, and Yangtze finless porpoise (*Neophocoena asiaeorientalis*)) and six species of pinnipeds (northern elephant seal (*Mirounga angustirostris*), harbor seal, ring seal, spotted seal, bearded seal, and California sea lion (*Zalophus californianus*)) that were exposed to a limited number of sound sources (*i.e.,* mostly tones and octave-band noise with limited number of exposure to impulsive sources such as seismic airguns or impact pile driving) in laboratory settings (Southall *et al.,* 2019). There is currently no data available on noise-induced hearing loss for mysticetes. For summaries of data on TTS or PTS in marine mammals or for further discussion of TTS or PTS onset thresholds, please see Southall *et al.* (2019), and NMFS (2018).

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

Behavioral Effects

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

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

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

With respect to distance influencing disturbance, DeRuiter *et al.* (2013) examined behavioral responses of Cuvier's beaked whales to mid-frequency sonar and found that whales responded strongly at low received levels (89–127 dB *re 1μPa*)by ceasing normal fluking and echolocation, swimming rapidly away, and extending both dive duration and subsequent non-foraging intervals when the sound source was 3.4–9.5 km (2.1–5.9 mi) away. Importantly, this study also showed that whales exposed to a similar range of received levels (78–106 dB *re 1μPa*) from distant sonar exercises (118 km (73 mi) away) did not elicit such responses, suggesting that context may moderate reactions. Thus, distance from the source is an important variable in influencing the type and degree of behavioral response and this variable is independent of the effect of received levels (*e.g.,* DeRuiter *et al.,* 2013; Dunlop *et al.,* 2017a, 2017b; Falcone *et al.,* 2017; Dunlop *et al.,* 2018; Southall *et al.,* 2019b).

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

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

Friedlaender *et al.* (2016) provided the first integration of direct measures of prey distribution and density variables incorporated into across-individual analyses of behavior responses of blue whales to sonar, and demonstrated a five-fold increase in the ability to quantify variability in blue whale diving behavior. When the prey field was mapped and used as a covariate in examining how behavioral state of blue whales is influenced by mid-frequency sound, the response in blue whale deep-feeding behavior was even more apparent, reinforcing the need for contextual variables to be included when assessing behavioral responses (Friedlaender *et al.,* 2016). These results illustrate that responses evaluated without such measurements for foraging animals may be misleading, which again illustrates the context-dependent nature of the probability of response.

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

Avoidance and Displacement

Avoidance is the displacement of an individual from an area or migration path as a result of the presence of a sound or other stressors and is one of the most obvious manifestations of disturbance in marine mammals (Richardson *et al.,* 1995). For example, gray whales (*Eschrichtius robustus*) and humpback whales are known to change direction, deflecting from customary migratory paths, in order to avoid noise from airgun surveys (Malme *et al.,* 1984; Dunlop *et al.,* 2018). Avoidance is qualitatively different from the flight response but also differs in the magnitude of the response (*i.e.,* directed movement, rate of travel, *etc.*). Avoidance may be short-term with animals returning to the area once the noise has ceased (*e.g.,* Malme *et al.,* 1984; Bowles *et al.,* 1994; Goold, 1996; Stone *et al.,* 2000; Morton and Symonds, 2002; Gailey *et al.,* 2007; Dähne *et al.,* 2013; Russel *et al.,* 2016). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (*e.g.,* Blackwell *et al.,* 2004; Bejder *et al.,* 2006; Teilmann *et al.,* 2006; Forney *et al.,* 2017). Avoidance of marine mammals during the construction of offshore wind facilities (specifically, impact pile driving) has been documented in the literature with some significant variation in the temporal and spatial degree of avoidance and with most studies focused on harbor porpoises as one of the most common marine mammals in European waters (*e.g.,* Tougaard *et al.,* 2009; Dähne *et al.,* 2013; Thompson *et al.,* 2013; Russell *et al.,* 2016; Brandt *et al.,* 2018).

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

Brandt *et al.* (2016) summarized the effects of the construction of eight offshore wind projects within the German North Sea (*i.e.,* Alpha Ventus, BARD Offshore I, Borkum West II, DanTysk, Global Tech I, Meerwind Süd/Ost, Nordsee Ost, and Riffgat) between 2009 and 2013 on harbor porpoises, combining PAM data from 2010–2013 and aerial surveys from 2009–2013 with data on noise levels associated with pile driving. Results of the analysis revealed significant declines in porpoise detections during pile driving when compared to 25–48 hours before pile driving began, with the magnitude of decline during pile driving clearly decreasing with increasing distances to the construction site. During the majority of projects, significant declines in detections (by at least 20 percent) were found within at least 5–10 km (3.1–6.2 mi) of the pile driving site, with declines at up to 20–30 km (12.4–18.6 mi) of the pile driving site documented in some cases. Similar results demonstrating the long-distance displacement of harbor porpoises (18–25 km (11.2–15.5 mi)) and harbor seals (up to 40 km (25 mi)) during impact pile driving have also been observed during the construction at multiple other European wind farms (Tougaard *et al.,* 2009; Bailey *et al.,* 2010.; Dähne *et al.,* 2013; Lucke *et al.,* 2012; Haelters *et al.,* 2015).

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

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

Some avoidance behavior of other marine mammal species has been documented to be dependent on distance from the source. As described above, DeRuiter *et al.* (2013) noted that distance from a sound source may moderate marine mammal reactions in their study of Cuvier's beaked whales (an acoustically sensitive species), which showed the whales swimming rapidly and silently away when a sonar signal was 3.4–9.5 km (2.1–5.9 mi) away while showing no such reaction to the same signal when the signal was 118 km (73 mi) away even though the received levels were similar. Tyack *et al.* (1983) conducted playback studies of Surveillance Towed Array Sensor System (SURTASS) low-frequency active (LFA) sonar in a gray whale migratory corridor off California. Similar to North Atlantic right whales, gray whales migrate close to shore (approximately 2 km (1.2 mi) from shore) and are low-frequency hearing specialists. The LFA sonar source was placed within the gray whale migratory corridor (approximately 2 km (1.2 mi) offshore) and offshore of most, but not all, migrating whales (approximately 4 km (2.5 mi) offshore). These locations influenced received levels and distance to the source. For the inshore playbacks, not unexpectedly, the louder the source level of the playback (*i.e.,* the louder the received level), whale avoided the source at greater distances. Specifically, when the source level was 170 dB SPL_{rms} and 178 dB_{rms}, whales avoided the inshore source at ranges of several hundred meters, similar to avoidance responses reported by Malme *et al.* (1983; 1984). Whales exposed to source levels of 185 dB_{rm}s demonstrated avoidance levels at ranges of +1 km (+0.6 mi). While there was observed deflection from course, in no case did a whale abandon its migratory behavior.

The signal context of the noise exposure has been shown to play an important role in avoidance responses. In a 2007–2008 study in the Bahamas, playback sounds of a potential predator—a killer whale—resulted in a similar but more pronounced reaction in beaked whales (an acoustically sensitive species), which included longer inter-dive intervals and a sustained straight-line departure of more than 20 km (12.4 mi) from the area (Boyd *et al.,* 2008; Southall *et al.,* 2009; Tyack *et al.,* 2011). SouthCoast does not anticipate and NMFS is not proposing to authorize take of beaked whales and, moreover, the sounds produced by SouthCoast do not have signal characteristics similar to predators. Therefore, we would not expect such extreme reactions to occur for similar species.

One potential consequence of behavioral avoidance is the altered energetic expenditure of marine mammals because energy is required to move and avoid surface vessels or the sound field associated with active sonar (Frid and Dill, 2002). Most animals can avoid that energetic cost by swimming away at slow speeds or speeds that minimize the cost of transport (Miksis-Olds, 2006), as has been demonstrated in Florida manatees (Miksis-Olds, 2006). Those energetic costs increase, however, when animals shift from a resting state, which is designed to conserve an animal's energy, to an active state that consumes energy the animal would have conserved had it not been disturbed. Marine mammals that have been disturbed by anthropogenic noise and vessel approaches are commonly reported to shift from resting to active behavioral states, which would imply that they incur an energy cost.

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

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (*e.g.,* directed movement, rate of travel). Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus, 1996; Frid and Dill, 2002). The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, beaked whale strandings (Cox *et al.,* 2006; D'Amico *et al.,* 2009). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves, 2008), and whether individuals are solitary or in groups may influence the response. Flight responses of marine mammals have been documented in response to mobile high intensity active sonar (*e.g.,* Tyack *et al.,* 2011; DeRuiter *et al.,* 2013; Wensveen *et al.,* 2019), and more severe responses have been documented when sources are moving towards an animal or when they are surprised by unpredictable exposures (Watkins 1986; Falcone et al. 2017). Generally speaking, however, marine mammals would be expected to be less likely to respond with a flight response to either stationary pile driving (which they can sense is stationary and predictable) or significantly lower-level HRG surveys unless they are within the area ensonified above behavioral harassment thresholds at the moment the source is turned on (Watkins, 1986; Falcone *et al.,* 2017). A flight response may also be possible in response to UXO/MEC detonation. However, detonations would be restricted to one per day and a maximum of 10 over 5 years, thus, there would be limited opportunities for flight response to be elicited as a result of detonation noise. The proposed mitigation and monitoring would result in any animals being far from the detonation location (*i.e.,* the clearance zones vary by hearing group and charge weight, but all zones are sized to ensure that marine mammals are beyond the area where PTS could occur prior to detonation) and any flight response would be spatially and temporally limited.

Diving and Foraging

Changes in dive behavior in response to noise exposure can vary widely. They may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive (*e.g.,* Frankel and Clark, 2000; Costa *et al.,* 2003; Ng and Leung, 2003; Nowacek *et al.;* 2004; Goldbogen *et al.,* 2013a, Goldbogen *et al.* 2013b). Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g.,* foraging) or they may be of little biological significance. Variations in dive behavior may also expose an animal to potentially harmful conditions (*e.g.,* increasing the chance of ship-strike) or may serve as an avoidance response that enhances survivorship. The impact of a variation in diving resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure, the type and magnitude of the response, and the context within which the response occurs (*e.g.,* the surrounding environmental and anthropogenic circumstances).

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

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the cessation of secondary indicators of feeding (*e.g.,* bubble nets or sediment plumes), or changes in dive behavior. As for other types of behavioral response, the frequency, duration, and temporal pattern of signal presentation as well as differences in species sensitivity are likely contributing factors to differences in response in any given circumstance (*e.g.,* Croll *et al.,* 2001; Nowacek *et al.;* 2004; Madsen *et al.,* 2006; Yazvenko *et al.,* 2007; Southall *et al.,* 2019b). An understanding of the energetic requirements of the affected individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal can facilitate the assessment of whether foraging disruptions are likely to incur fitness consequences (Goldbogen *et al.,* 2013b; Farmer *et al.,* 2018; Pirotta *et al.,* 2018a; Southall *et al.,* 2019a; Pirotta *et al.,* 2021).

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

Visual tracking, passive acoustic monitoring, and movement recording tags were used to quantify sperm whale behavior prior to, during, and following exposure to airgun arrays at received levels in the range 140–160 dB at distances of 7–13 km (4.3–8.1 mi), following a phase-in of sound intensity and full array exposures at 1–13 km (0.6–8.1 mi) (Madsen *et al.,* 2006; Miller *et al.,* 2009). Sperm whales did not exhibit horizontal avoidance behavior at the surface. However, foraging behavior may have been affected. The sperm whales exhibited 19 percent less vocal (buzz) rate during full exposure relative to post exposure, and the whale that was approached most closely had an extended resting period and did not resume foraging until the airguns had ceased firing. The remaining whales continued to execute foraging dives throughout exposure; however, swimming movements during foraging dives were six percent lower during exposure than control periods (Miller *et al.,* 2009). Miller *et al.* (2009) noted that more data are required to understand whether the differences were due to exposure or natural variation in sperm whale behavior.

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

Southall *et al.* (2011) found that blue whales had a different response to sonar exposure depending on behavioral state, which was more pronounced when whales were in deep feeding/travel modes than when engaged in surface feeding. Southall *et al.* (2023) conducted a controlled exposure experiment (CEE) study similar to Southall *et al.* (2011), but focused on fin whale behavioral responses to different sound sources including mid-frequency active sonar (MFAS), and pseudorandom noise (PRN) signals lacking tonal patterns but having frequency, duration, and source levels similar to sonar. In general, fewer fin whales (33 percent) displayed observable behavioral responses to similar noise stimuli compared to blue whales (66 percent), and fin whale responses were less dependent on the behavioral state of the whale at the time of exposure and more closely associated with the received level (*i.e.,* loudness) of the signal. Similar to blue whales, some fin whales responded to the sound exposure by lunge feeding and deep diving, particularly at higher received levels, and returned to baseline behaviors (*i.e.,* as observed prior to sound exposure) relatively quickly following noise exposure. Southall *et al.* (2023) found no evidence that noise exposure compromised fin whale foraging success, in contrast with observations of noise-exposed foraging blue whales by Friedlander *et al.* (2016). The baseline acoustic environment appeared to influence the degree of fin whale behavioral responses. The five fin whales that did present observable behavioral responses did so to a greater extent when exposed to PRN than MFAS. Southall *et al.* (2023) conducted the CEE in fin whale habitat that overlaps with an area in southern California frequently used for military sonar training exercises, thus, whales may be more familiar with sonar signals than PRN, a novel stimulus. The observations by Southall *et al.* (2023) underscore the importance of considering an animal's exposure history when evaluating behavioral responses to particular noise stimuli.

Foraging strategies may impact foraging efficiency, such as by reducing foraging effort and increasing success in prey detection and capture, in turn promoting fitness and allowing individuals to better compensate for foraging disruptions. Surface feeding blue whales did not show a change in behavior in response to mid-frequency simulated and real sonar sources with received levels between 90 and 179 dB re *1 μPa,* but deep feeding and non-feeding whales showed temporary reactions including cessation of feeding, reduced initiation of deep foraging dives, generalized avoidance responses, and changes to dive behavior (DeRuiter *et al.,* 2017; Goldbogen *et al.;* 2013b; Sivle *et al.,* 2015). Goldbogen *et al.* (2013b) indicate that disruption of feeding and displacement could impact individual fitness and health. However, for this to be true, we would have to assume that an individual whale could not compensate for this lost feeding opportunity by either immediately feeding at another location, by feeding shortly after cessation of acoustic exposure, or by feeding at a later time. Here, there is no indication that individual fitness and health would be impacted, particularly since unconsumed prey would likely still be available in the environment in most cases following the cessation of acoustic exposure. Seasonal restrictions on pile driving and UXO/MEC detonations would limit temporal and spatial co-occurrence of these activities and foraging North Atlantic right whales (and other marine mammal species) in southern New England, thereby minimizing disturbance during times of year when prey are most abundant.

Similarly, while the rates of foraging lunges decrease in humpback whales due to sonar exposure, there was variability in the response across individuals with one animal ceasing to forage completely and another animal starting to forage during the exposure (Sivle *et al.,* 2016). In addition, almost half of the animals that demonstrated avoidance were foraging before the exposure but the others were not; the animals that avoided while not feeding responded at a slightly lower received level and greater distance than those that were feeding (Wensveen *et al.,* 2017). These findings indicate the behavioral state of the animal and foraging strategies play a role in the type and severity of a behavioral response.

Vocalizations and Auditory Masking

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

For example, in the presence of potentially masking signals, humpback whales and killer whales have been observed to increase the length of their songs (Miller *et al.,* 2000; Fristrup *et al.,* 2003; Foote *et al.,* 2004) and blue whales increased song production (Di Iorio and Clark, 2009) while North Atlantic right whales have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.,* 2007). In some cases, animals may cease or reduce sound production during production of aversive signals (Bowles *et al.,* 1994; Thode *et al.,* 2020; Cerchio *et al.,* (2014); McDonald *et al.,* 1995. Blackwell *et al.* (2015) showed that whales increased calling rates as soon as airgun signals were detectable before ultimately decreasing calling rates at higher received levels.

Sound can disrupt behavior through masking or interfering with an animal's ability to detect, recognize, or discriminate between acoustic signals of interest (*e.g.,* those used for intraspecific communication and social interactions, prey detection, predator avoidance, or navigation) (Richardson *et al.,* 1995; Erbe and Farmer, 2000; Tyack, 2000; Erbe *et al.,* 2016). Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity and may occur whether the sound is natural (*e.g.,* snapping shrimp, wind, waves, precipitation) or anthropogenic (*e.g.,* shipping, sonar, seismic exploration) in origin. The ability of a noise source to mask biologically important sounds depends on the characteristics of both the noise source and the signal of interest (*e.g.,* signal-to-noise ratio, temporal variability, direction) in relation to each other and to an animal's hearing abilities (*e.g.,* sensitivity, frequency range, critical ratios, frequency discrimination, directional discrimination, age, or TTS hearing loss), and existing ambient noise and propagation conditions.

Masking these acoustic signals can disturb the behavior of individual animals, groups of animals, or entire populations. Masking can lead to behavioral changes, including vocal changes (*e.g.,* Lombard effect, increasing amplitude, or changing frequency), cessation of foraging or lost foraging opportunities, and leaving an area, to both signalers and receivers in an attempt to compensate for noise levels (Erbe *et al.,* 2016) or because sounds that would typically have triggered a behavior were not detected. In humans, significant masking of tonal signals occurs as a result of exposure to noise in a narrow band of similar frequencies. As the sound level increases, though, the detection of frequencies above those of the masking stimulus decreases also. This principle is expected to apply to marine mammals as well because of common biomechanical cochlear properties across taxa. Therefore, when the coincident (masking) sound is manmade, it may be considered harassment when disrupting behavioral patterns. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which only occurs during the sound exposure. Because masking (without resulting in threshold shift) is not associated with abnormal physiological function, it is not considered a physiological effect, but rather a potential behavioral effect.

The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. For example, low-frequency signals may have less effect on high-frequency echolocation sounds produced by odontocetes but are more likely to affect detection of mysticete communication calls and other potentially important natural sounds such as those produced by surf and some prey species. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (*e.g.,* Clark *et al.,* 2009; Matthews *et al.,* 2017) and may result in energetic or other costs as animals change their vocalization behavior (*e.g.,* Miller *et al.,* 2000; Foote *et al.,* 2004; Parks *et al.,* 2007; Di Iorio and Clark, 2009; Holt *et al.,* 2009). Masking can be reduced in situations where the signal and noise come from different directions (Richardson *et al.,* 1995), through amplitude modulation of the signal, or through other compensatory behaviors (Houser and Moore, 2014). Masking can be tested directly in captive species (*e.g.,* Erbe, 2008), but in wild populations it must be either modeled or inferred from evidence of masking compensation. There are few studies addressing real-world masking sounds likely to be experienced by marine mammals in the wild (*e.g.,* Branstetter *et al.,* 2013; Cholewiak *et al.,* 2018).

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

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

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

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

Masking affects both senders and receivers of acoustic signals and, at higher levels and longer duration, can potentially have long-term chronic effects on marine mammals at the population level as well as at the individual level. Low-frequency ambient sound levels have increased by as much as 20 dB (more than three times in terms of SPL) in the world's ocean from pre-industrial periods, with most of the increase from distant commercial shipping (Hildebrand, 2009; Cholewiak *et al.,* 2018). All anthropogenic sound sources, but especially chronic and lower-frequency signals (*e.g.,* from commercial vessel traffic), contribute to elevated ambient sound levels, thus intensifying masking.

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

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

Marine mammals are also known to make vocal changes in response to anthropogenic noise. In cetaceans, vocalization changes have been reported from exposure to anthropogenic noise sources such as sonar, vessel noise, and seismic surveying (see the following for examples: Gordon *et al.,* 2003; Di Iorio and Clark, 2009; Hatch *et al.,* 2012; Holt *et al.,* 2009; Holt *et al.,* 2011; Lesage *et al.,* 1999; McDonald *et al.,* 2009; Parks *et al.,* 2007; Risch *et al.,* 2012; Rolland *et al.,* 2012), as well as changes in the natural acoustic environment (Dunlop *et al.,* 2014). Vocal changes can be temporary or persistent. For example, model simulation suggests that the increase in starting frequency for the North Atlantic right whale upcall over the last 50 years resulted in increased detection ranges between right whales. The frequency shift, coupled with an increase in call intensity by 20 dB, led to a call detectability range of less than 3 km (1.9 mi) to over 9 km (5.6 mi) (Tennessen and Parks, 2016). Holt *et al.* (2009) measured killer whale call source levels and background noise levels in the 1 to 40 kHz band and reported that the whales increased their call source levels by 1 dB SPL for every one dB SPL increase in background noise level. Similarly, another study on St. Lawrence River belugas reported a similar rate of increase in vocalization activity in response to passing vessels (Scheifele *et al.,* 2005). Di Iorio and Clark (2009) showed that blue whale calling rates vary in association with seismic sparker survey activity, with whales calling more on days with surveys than on days without surveys. They suggested that the whales called more during seismic survey periods as a way to compensate for the elevated noise conditions.

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

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

Masking is more likely to occur in the presence of broadband, relatively continuous noise sources such as vessels. Several studies have shown decreases in marine mammal communication space and changes in behavior as a result of the presence of vessel noise. For example, right whales were observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.,* 2007) as well as increasing the amplitude (intensity) of their calls (Parks, 2009; Parks *et al.,* 2011). Clark *et al.* (2009) observed that right whales' communication space decreased by up to 84 percent in the presence of vessels. Cholewiak *et al.* (2018) also observed loss in communication space in Stellwagen National Marine Sanctuary for North Atlantic right whales, fin whales, and humpback whales with increased ambient noise and shipping noise. Although humpback whales off Australia did not change the frequency or duration of their vocalizations in the presence of vessel noise, source levels were lower than expected compared to observed source level changes with increased wind noise, potentially indicating some signal masking (Dunlop, 2016). Multiple delphinid species have also been shown to increase the minimum or maximum frequencies of their whistles in the presence of anthropogenic noise and reduced communication space (for examples see: Holt *et al.,* 2009; Holt *et al.,* 2011; Gervaise *et al.,* 2012; Williams *et al.,* 2013; Hermannsen *et al.,* 2014; Papale *et al.,* 2015; Liu *et al.,* 2017). While masking impacts are not a concern from lower intensity, higher frequency HRG surveys, some degree of masking would be expected in the vicinity of turbine pile driving (*e.g.,* during vibratory pile driving, a continuous acoustic source) and concentrated support vessel operation. However, pile driving is an intermittent sound and would not be continuous throughout the day.

Habituation and Sensitization

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al.,* 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. It is important to note that habituation is appropriately considered as a ''progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial,'' rather than as, more generally, moderation in response to human disturbance having a neutral or positive outcome (Bejder *et al.,* 2009). The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. Both habituation and sensitization require an ongoing learning process. As noted, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson *et al.,* 1995; U.S. National Research Council (NRC), 2003; Wartzok *et al.,* 2003; Southall *et al.,* 2019b). Controlled experiments with captive marine mammals have shown pronounced behavioral reactions, including avoidance of loud sound sources (*e.g.,* Ridgway *et al.,* 1997; Finneran *et al.,* 2003; Houser *et al.* (2013a); Houser *et al.,* 2013b; Kastelein *et al.,* 2018). Observed responses of wild marine mammals to loud impulsive sound sources (typically airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds, 2002; see also Richardson *et al.,* 1995; Nowacek *et al.,* 2007; Tougaard *et al.,* 2009; Brandt *et al.,* 2011, Brandt *et al.,* 2012, Dähne *et al.,* 2013; Brandt *et al.,* 2014; Russell *et al.,* 2016; Brandt *et al.,* 2018).

Stone (2015) reported data from at-sea observations during 1,196 airgun surveys from 1994 to 2010. When large arrays of airguns (considered to be 500 in 3 or more) were firing, lateral displacement, more localized avoidance, or other changes in behavior were evident for most odontocetes. However, significant responses to large arrays were found only for the minke whale and fin whale. Behavioral responses observed included changes in swimming or surfacing behavior with indications that cetaceans remained near the water surface at these times. Behavioral observations of gray whales during an airgun survey monitored whale movements and respirations pre-, during-, and post-seismic survey (Gailey *et al.,* 2016). Behavioral state and water depth were the best 'natural' predictors of whale movements and respiration and after considering natural variation, none of the response variables were significantly associated with survey or vessel sounds. Many delphinids approach low-frequency airgun source vessels with no apparent discomfort or obvious behavioral change (*e.g.,* Barkaszi *et al.,* 2012), indicating the importance of frequency output in relation to the species' hearing sensitivity.

Physiological Responses

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

Neuroendocrine stress responses often involve the hypothalamus-pituitary-adrenal system. Virtually all neuroendocrine functions that are affected by stress—including immune competence, reproduction, metabolism, and behavior—are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction, altered metabolism, reduced immune competence, and behavioral disturbance (*e.g.,* Moberg, 1987; Blecha, 2000). Increases in the circulation of glucocorticoids are also equated with stress (Romano *et al.,* 2004).

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and "distress" is the cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose serious fitness consequences. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other functions. This state of distress will last until the animal replenishes its energetic reserves sufficiently to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well studied through controlled experiments and for both laboratory and free-ranging animals (*e.g.,* Holberton *et al.,* 1996; Hood *et al.,* 1998; Jessop *et al.,* 2003; Krausman *et al.,* 2004; Lankford *et al.,* 2005). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker, 2000; Romano *et al.,* 2002b) and, more rarely, studied in wild populations (*e.g.,* Lusseau and Bejder, 2007; Romano *et al.,* 2002a; Rolland *et al.,* 2012). For example, Rolland *et al.* (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales.

These and other studies lead to a reasonable expectation that some marine mammals will experience physiological stress responses upon exposure to acoustic stressors and that it is possible that some of these would be classified as "distress." In addition, any animal experiencing TTS would likely also experience stress responses (NRC, 2003, 2017). Respiration naturally varies with different behaviors and variations in respiration rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Mean exhalation rates of gray whales at rest and while diving were found to be unaffected by seismic surveys conducted adjacent to the whale feeding grounds (Gailey *et al.,* 2007). Studies with captive harbor porpoises show increased respiration rates upon introduction of acoustic alarms (Kastelein *et al.,* 2001; Kastelein *et al.,* 2006a) and emissions for underwater data transmission (Kastelein *et al.,* 2005). However, exposure of the same acoustic alarm to a striped dolphin under the same conditions did not elicit a response (Kastelein *et al.,* 2006a), again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure.

Stranding

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

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

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

The construction activities proposed by SouthCoast (*e.g.,* pile driving) do not inherently have the potential to result in marine mammal strandings. While vessel strikes could kill or injure a marine mammal (which may eventually strand), the required mitigation measures would reduce the potential for take from these activities to *de minimus* levels (see Proposed Mitigation section for more details). As described above, no mortality or serious injury is anticipated or proposed for authorization from any specified activities.

Of the strandings documented to date worldwide, NMFS is not aware of any being attributed to pile driving or the types of HRG equipment proposed for use during SouthCoast's surveys. Recently, there has been heightened interest in HRG surveys relative to recent marine mammals strandings along the U.S. East Coast. HRG surveys involve the use of certain sources to image the ocean bottom, which are very different from seismic airguns used in oil and gas surveys or tactical military sonar, in that they produce much smaller impact zones. Marine mammals may respond to exposure to these sources by, for example, avoiding the immediate area, which is why offshore wind developers have authorization to allow for Level B (behavioral) harassment, including SouthCoast. However, because of the combination of lower source levels, higher frequency, narrower beam-width (for some sources), and other factors, the area within which a marine mammal might be expected to be behaviorally disturbed by HRG sources is much smaller (by orders of magnitude) than the impact areas for seismic airguns or the military sonar with which a small number of marine mammal have been causally associated. Specifically, estimated harassment zones for HRG surveys are typically less than 200 m (656.2 ft) (such as those associated with the project), while zones for military mid-frequency active sonar or seismic airgun surveys typically extend for several kilometers ranging up to 10s of kilometers. Further, because of this much smaller ensonified area, any marine mammal exposure to HRG sources is reasonably expected to be at significantly lower levels and shorter duration (associated with less severe responses), and there is no evidence suggesting, or reason to speculate, that marine mammals exposed to HRG survey noise are likely to be injured, much less strand, as a result. Last, all but one of the small number of marine mammal stranding events that have been causally associated with exposure to loud sound sources have been deep-diving toothed whale species (not mysticetes), which are known to respond differently to loud sounds. NMFS has performed a thorough review of a report submitted by Rand (2023) that includes measurements of the Geo-Marine Geo-Source 400 sparker and suggests that NMFS is assuming lower source and received levels than is appropriate in its assessments of HRG impacts. NMFS has determined that the values in this proposed rule are appropriate, based on the model methodology (*i.e.,* the assumed source level propagated using spherical spreading) here predicting a peak level 3 dB louder than the maximum measured peak level at the closest measurement range in Rand (2023).

Also of note, in an assessment of monitoring reports for HRG surveys received from 2021 through 2023, as compared to the takes of marine mammals authorized, an average of fewer than 15 percent have been detected within harassment zones, with no more than 27 percent for any species (common dolphins) and 20 percent or less for all other species. The most common behavioral change observed while the HRG sound source was active was ''change direction'' (*i.e.* a potential behavioral reaction) though detections of ''no behavioral change'' occurred at least twice as many times as ''change direction.''

Potential Effects of Disturbance on Marine Mammal Fitness

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Potential Effects From Explosive Sources

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

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

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

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

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

Potential Effects From Vessel Strike

Vessel collisions with marine mammals, also referred to as vessel strikes or ship strikes, can result in death or serious injury of the animal. The most vulnerable marine mammals are those that spend extended periods of time at the surface in order to restore oxygen levels within their tissues after deep dives (*e.g.,* the sperm whale). Some baleen whales seem generally unresponsive to vessel sound, making them more susceptible to vessel collisions (Nowacek *et al.,* 2004). Marine mammal responses to vessels may include avoidance and changes in dive pattern (NRC, 2003). Wounds resulting from vessel strike may include massive trauma, hemorrhaging, broken bones, or propeller lacerations (Knowlton and Kraus, 2001). An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or an animal just below the surface could be cut by a vessel's propeller. Superficial strikes may not kill or result in the death of the animal. Lethal interactions are typically associated with large whales, which are occasionally found draped across the bulbous bow of large commercial ships upon arrival in port. Although smaller cetaceans are more maneuverable in relation to large vessels than are large whales, they may also be susceptible to strike. The severity of injuries typically depends on the size and speed of the vessel (Knowlton and Kraus, 2001; Laist *et al.,* 2001; Vanderlaan and Taggart, 2007; Conn and Silber, 2013). Impact forces increase with speed as does the probability of a strike at a given distance (Silber *et al.,* 2010; Gende *et al.,* 2011).

An examination of all known vessel strikes from all shipping sources (civilian and military) indicates vessel speed is a principal factor in whether a vessel strike occurs and, if so, whether it results in injury, serious injury, or mortality (Knowlton and Kraus, 2001; Laist *et al.,* 2001; Jensen and Silber, 2003; Pace and Silber, 2005; Vanderlaan and Taggart, 2007; Conn and Silber, 2013). In assessing records in which vessel speed was known, Laist *et al.* (2001) found a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision. The authors concluded that most deaths occurred when a vessel was traveling in excess of 13 knots (15 mph).

Jensen and Silber (2003) detailed 292 records of known or probable vessel strikes of all large whale species from 1975 to 2002. Of these, vessel speed at the time of collision was reported for 58 cases. Of these 58 cases, 39 (or 67 percent) resulted in serious injury or death (19 of those resulted in serious injury as determined by blood in the water, propeller gashes or severed tailstock, and fractured skull, jaw, vertebrae, hemorrhaging, massive bruising or other injuries noted during necropsy and 20 resulted in death). Operating speeds of vessels that struck various species of large whales ranged from 2 to 51 knots (2.3 to 59 mph). The majority (79 percent) of these strikes occurred at speeds of 13 knots (15 mph) or greater. The average speed that resulted in serious injury or death was 18.6 knots (21.4 mph). Pace and Silber (2005) found that the probability of death or serious injury increased rapidly with increasing vessel speed. Specifically, the predicted probability of serious injury or death increased from 45 to 75 percent as vessel speed increased from 10 to 14 knots (11.5 to 16 mph), and exceeded 90 percent at 17 knots (20 mph). Higher speeds during collisions result in greater force of impact and also appear to increase the chance of severe injuries or death. While modeling studies have suggested that hydrodynamic forces pulling whales toward the vessel hull increase with increasing speed (Clyne, 1999; Knowlton *et al.,* 1995), this is inconsistent with Silber *et al.* (2010), which demonstrated that there is no such relationship (*i.e.,* hydrodynamic forces are independent of speed).

In a separate study, Vanderlaan and Taggart (2007) analyzed the probability of lethal mortality of large whales at a given speed, showing that the greatest rate of change in the probability of a lethal injury to a large whale as a function of vessel speed occurs between 8.6 and 15 knots (9.9 and 17 mph). The chances of a lethal injury decline from approximately 80 percent at 15 knots (17 mph) to approximately 20 percent at 8.6 knots (10 mph). At speeds below 11.8 knots (13.5 mph), the chances of lethal injury drop below 50 percent, while the probability asymptotically increases toward 100 percent above 15 knots (17 mph).

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

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

Potential Effects to Marine Mammal Habitat

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

Effects on Prey

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

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

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

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

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

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

Pile-driving noise during construction is of particular concern as the very high sound pressure levels could potentially prevent fish from reaching breeding or spawning sites, finding food, and acoustically locating mates. A playback study in West Scotland revealed that there was a significant movement response to the pile-driving stimulus in both species at relatively low received sound pressure levels (sole: 144–156 dB re 1μPa Peak; cod: 140–161 dB re 1 μPa Peak, particle motion between 51 × 10 and 62 × 104^4 m/s^2 peak) (Mueller-Blenkle *et al.,* 2010). The swimming speed of the sole increased significantly during the playback period compared to before and after playback of construction noise when compared to the playbacks of before and after construction. While not statistically significant, cod also displayed a similar reaction, yet results were not significant. Cod showed a behavioral response during before, during, and after construction playbacks. However, cod demonstrated a specific and significant freezing response at the onset and cessation of the playback recording. Both species displayed indications of directional movements away from the playback source. During wind farm construction in the Eastern Taiwan Strait, Type 1 soniferous fish chorusing showed a relatively lower intensity and longer duration, while Type 2 chorusing exhibited higher intensity and no changes in its duration. Deviation from regular fish vocalization patterns may affect fish reproductive success, cause migration, augmented predation, or physiological alterations.

Occasional behavioral reactions to activities that produce underwater noise sources are unlikely to cause long-term consequences for individual fish or populations. The most likely impact to fish from impact and vibratory pile driving activities at the project areas would be temporary behavioral avoidance of the area. Any behavioral avoidance by fish of the disturbed area would still leave significantly large areas of fish and marine mammal foraging habitat in the nearby vicinity. The duration of fish avoidance of an area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. In general, impacts to marine mammal prey species are expected to be minor and temporary due to the expected short daily duration of individual pile driving events and the relatively small areas being affected.

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

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

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

Fish not killed or driven from a location by an explosion might change their behavior, feeding pattern, or distribution. Changes in behavior of fish have been observed as a result of sound produced by explosives, with effect intensified in areas of hard substrate (Wright, 1982). Stunning from pressure waves could also temporarily immobilize fish, making them more susceptible to predation. The abundances of various fish (and invertebrates) near the detonation point for explosives could be altered for a few hours before animals from surrounding areas repopulate the area. However, these populations would likely be replenished as waters near the detonation point are mixed with adjacent waters.

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

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

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

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

With regard to potential impacts on zooplankton, McCauley *et al.* (2017) found that exposure to airgun noise resulted in significant depletion for more than half the taxa present and that there were two to three times more dead zooplankton after airgun exposure compared with controls for all taxa, within 1 km (0.6 mi) of the airguns. However, the authors also stated that in order to have significant impacts on *r*-selected species (*i.e.,* those with high growth rates and that produce many offspring) such as plankton, the spatial or temporal scale of impact must be large in comparison with the ecosystem concerned, and it is possible that the findings reflect avoidance by zooplankton rather than mortality (McCauley *et al.,* 2017). In addition, the results of this study are inconsistent with a large body of research that generally finds limited spatial and temporal impacts to zooplankton as a result of exposure to airgun noise (*e.g.,* Dalen and Knutsen, 1987; Payne, 2004; Stanley *et al.,* 2011). Most prior research on this topic, which has focused on relatively small spatial scales, has showed minimal effects (*e.g.,* Kostyuchenko, 1973; Booman *et al.,* 1996; Sætre and Ona, 1996; Pearson *et al.,* 1994; Bolle *et al.,* 2012).

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

Notably, a more recent study produced results inconsistent with those of McCauley *et al.* (2017). Researchers conducted a field and laboratory study to assess if exposure to airgun noise affects mortality, predator escape response, or gene expression of the copepod *Calanus finmarchicus* (Fields *et al.,* 2019). Immediate mortality of copepods was significantly higher, relative to controls, at distances of 5 m (16.4 ft) or less from the airguns. Mortality one week after the airgun blast was significantly higher in the copepods placed 10 m (32.8 ft) from the airgun but was not significantly different from the controls at a distance of 20 m (65.6 ft) from the airgun. The increase in mortality, relative to controls, did not exceed 30 percent at any distance from the airgun. Moreover, the authors caution that even this higher mortality in the immediate vicinity of the airguns may be more pronounced than what would be observed in free-swimming animals due to increased flow speed of fluid inside bags containing the experimental animals. There were no sublethal effects on the escape performance or the sensory threshold needed to initiate an escape response at any of the distances from the airgun that were tested. Whereas McCauley *et al.* (2017) reported an SEL of 156 dB at a range of 509–658 m (1,670–2,159 ft), with zooplankton mortality observed at that range, Fields *et al.* (2019) reported an SEL of 186 dB at a range of 25 m (82 ft), with no reported mortality at that distance.

The presence and operation of wind turbines (both the foundation and WTG) has been shown to impact meso- and sub-meso-scale water column circulation, which can affect the density, distribution, and energy content of zooplankton and thereby, their availability as marine mammal prey. Topside, atmospheric wakes result in wind speed reductions influencing upwelling and downwelling in the ocean, while underwater structures such as WTG and OSP foundations cause turbulent current wakes, which impact circulation, stratification, mixing, turbidity, and sediment resuspension (Daewel *et al.,* 2022). Impacts from the presence of structures and/or operation of wind turbine generators are generally likely to result in certain oceanographic effects, such as perturbation of zooplankton aggregation mechanisms through changes to the strength of tidal currents and associated fronts, stratification, the degree of mixing, and primary production in the water column, and these effects may alter the production, distribution, and/or availability of marine mammal zooplankton prey (Chen *et al.,* 2021; Chen *et al.,* 2024, Johnson *et al.,* 2021, Christiansen *et al.,* 2022, Dorrell *et al.,* 2022).

Assessing the ecosystem impacts of offshore wind development has a unique set of challenges, including minimizing uncertainties in the fundamental understanding of how existing physical and biological oceanography might be altered by the presence of a single offshore wind turbine, by an offshore wind farm, or by a region of adjacent offshore wind farms. Physical models can demonstrate, among many things, the extent to which and how a single or large number of operating offshore wind turbine(s) can alter atmospheric and hydrodynamic flow through interruptions of local winds that drive circulation processes and by creating turbulence in the water column surrounding the pile(s). For example, Chen et al., 2024 found that regardless of variations in wind intensity and direction, the downwind wake caused by WTGs, as modeled from a wind farm simulation in a lease area located to the west of the SouthCoast lease area, could consistently produce and enhance offshore water transport of zooplankton (in this case scallop larvae), particularly around the 40 to 50-m isobaths.

However, many physical and biological processes are influenced by cross-scale phenomena (*e.g.,* aggregation of dense zooplankton patches), necessitating construction of more complex models that tolerate varying degrees of uncertainty. Thus, determining the impacts of offshore wind operations on not only physical processes but trophic connections from phytoplankton to marine mammals and ultimately the ecosystem will require significant data collection, monitoring, modeling, and research effort. Given the limited state of understanding of the entire system in southern New England and the changing oceanography and ecology, identification of substantial impacts on zooplankton, and specifically on right whale prey, that may result from wind energy development in the Nantucket Shoals region is difficult to assess ((National Academy of Sciences (NAS), 2023.

SouthCoast intends to install up to 147 WTGs, up to 85 of which would be operational following completion of Project 1 and the remainder operational following installation of Project 2. SouthCoast may commission turbines in batches (*i.e.,* not all foundations and WTGs need to be installed per Project before becoming operational). Based on SouthCoast's current schedule (Table 1), commissioning could begin in early 2029, assuming foundations were installed the previous year, thus, it is possible that any influence of operating turbines on local physical and/or biological processes may be observable at that time, depending on latency of effects. Given the proposed sequencing, NMFS anticipates the turbines closest to Nantucket Shoals would be commissioned first. As described above, there is scientific uncertainty around the scale of oceanographic impacts (meters to kilometers) associated with the presence of foundation structures (*e.g.,* monopile, piled jacket) in the water, as well as operation of the WTGs. Generally speaking and depending on the extent, impacts on prey could influence the distribution of marine mammals in within and among foraging habitats, potentially necessitating additional energy expenditure to find and capture prey, which could lead to fitness consequences. Although studies assessing the impacts of offshore wind development on marine mammals are limited and the results vary, the repopulation of some wind energy areas by harbor porpoises (Brandt *et al.,* 2016; Lindeboom *et al.,* 2011) and harbor seals (Lindeboom *et al.,* 2011; Russell *et al.,* 2016) following the installation of wind turbines indicates that, in some cases, there is evidence that suitable habitat, including prey resources, exists within developed waters.

Reef Effects

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

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

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

The most likely impact to marine mammal habitat from the Project is expected to be from pile driving, which may affect marine mammal food sources such as forage fish and zooplankton.

Water Quality

Temporary and localized reduction in water quality will occur as a result of in-water construction activities. Most of this effect will occur during pile driving and installation of the cables, including auxiliary work such as dredging and scour placement. These activities will disturb bottom sediments and may cause a temporary increase in suspended sediment in the Lease Area and ECCs. Indirect effects of explosives and unexploded ordnance to marine mammals via sediment disturbance is possible in the immediate vicinity of the ordnance but through the implementation of the mitigation, is it not anticipated marine mammals would be in the direct area of the explosive source. Currents should quickly dissipate any raised total suspended sediment (TSS) levels, and levels should return to background levels once the Project activities in that area cease.

No direct impacts on marine mammals are anticipated due to increased TSS and turbidity; however, turbidity within the water column has the potential to reduce the level of oxygen in the water and irritate the gills of prey fish species in the Lease Area and ECCs.

Further, contamination of water is not anticipated. Degradation products of Royal Demolition Explosive are not toxic to marine organisms at realistic exposure levels (Rosen and Lotufo, 2010). Relatively low solubility of most explosives and their degradation products means that concentrations of these contaminants in the marine environment are relatively low and readily diluted. Furthermore, while explosives and their degradation products were detectable in marine sediment approximately 6–12 in (0.15–0.3 m) away from degrading ordnance, the concentrations of these compounds were not statistically distinguishable from background beyond 3–6 ft (1–2 m) from the degrading ordnance.

Turbidity plumes associated with the Project would be temporary and localized, and fish in the proposed project area would be able to move away from and avoid the areas where plumes may occur. Therefore, it is expected that the impacts on prey fish species from turbidity, and therefore on marine mammals, would be minimal and temporary.

Equipment used by SouthCoast for the project, including ships and other marine vessels, aircrafts, and other implements, are also potential sources of by-products (*e.g.,* hydrocarbons, particulate matter, heavy metals). SouthCoast would be required to properly maintain all equipment in accordance with applicable legal requirements such that operating equipment meets Federal water quality standards, where applicable. Given these requirements, impacts to water quality are expected to be minimal.

Acoustic Habitat

Acoustic habitat is the holistic soundscape, encompassing all of the biotic and abiotic sound in a particular location and time, as perceived by an individual. Animals produce sound for and listen for sounds produced by conspecifics (communication during feeding, mating, and other social activities), other animals (finding prey or avoiding predators), and the physical environment (finding suitable habitats, navigating). Together, sounds made by animals and the geophysical environment (*e.g.,* produced by earthquakes, lightning, wind, rain, waves) comprise the natural contributions to the total soundscape. These acoustic conditions, termed acoustic habitat, are one attribute of an animal's total habitat.

Anthropogenic sound is another facet of the soundscape that influences the overall acoustic habitat. This may include incidental contributions from sources such as vessels or sounds intentionally introduced to the marine environment for data acquisition purposes (*e.g.,* use of high-resolution geophysical surveys), detonations for munitions disposal or coastal constructions, sonar for Navy training and testing purposes, or pile driving/hammering for construction.projects. Anthropogenic noise varies widely in its frequency, content, duration, and loudness, and these characteristics greatly influence the potential habitat-mediated effects to marine mammals (please also see the previous discussion on Masking), which may range from local effects for brief periods of time to chronic effects over large areas and for long durations. Depending on the extent of effects to their acoustic habitat, animals may alter their communications signals (thereby potentially expending additional energy) or miss acoustic cues (either conspecific or adventitious). Problems arising from a failure to detect cues are more likely to occur when noise stimuli are chronic and overlap with biologically relevant cues used for communication, orientation, and predator/prey detection (Francis and Barber, 2013). For more detail on these concepts see, *e.g.,* Barber *et al.,* 2009; Pijanowski *et al.,* 2011; Francis and Barber, 2013; Lillis *et al.,* 2014.

Communication space describes the area over which an animal's acoustic signal travels and is audible to the intended receiver (Brenowitz, 1982; Janik, 2000; Clark *et al.,* 2009; Havlick et al., 2022). The extent of this area depends on the temporal and spectral structure of the signal, the characteristics of the environment, and the receiver's ability to detect (the detection threshold) and discriminate the signal from background noise (Wiley and Richards, 1978; Clark *et al.,* 2009; Havlick et al., 2022). Large communication spaces are created by acoustic signals that propagate over long distances relative to the distribution of conspecifics, as exemplified by low-frequency baleen whale vocalizations (McGregor and Krebs, 1984; Morton, 1986; Janik, 2000). Conversely, both natural and anthropogenic noise may reduce communication space by increasing background noise, leading to a generalized contraction of the range over which animals would be able to detect signals of biological importance, including eavesdropping on predators and prey (Barber *et al.,* 2009). Any reduction in the communication space, due to increased background noise resulting in masking, may therefore have detrimental effects on the ability of animals to obtain important social and environmental information. Such metrics do not, in and of themselves, document fitness consequences for the marine animals that live in chronically noisy environments. Long-term population-level consequences of acoustic signal interference mediated through changes in the ultimate survival and reproductive success of individuals are difficult to study, and particularly in the marine environment. However, it is increasingly well documented that aquatic species rely on qualities of natural acoustic habitats. For example, researchers have quantified reduced detection of important ecological cues (*e.g.,* Francis and Barber, 2013; Slabbekoorn *et al.,* 2010) as well as survivorship consequences in several species (*e.g.,* damselfish; Simpson *et al.,* 2016; larval Atlantic cod, Nedelec *et al.,* 2015a; embryonic sea hare, Nedelec *et al.,* 2015a) following noise exposure.

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

In both newer, quieter, direct-drive systems and older generation, geared turbine designs, recent scientific studies indicate that operational noise from turbines is on the order of 110 to 125 dB re 1 μPa root-mean-square sound pressure level (SPL_{rms}) at an approximate distance of 50 m (164 ft) (Tougaard *et al.,* 2020). Recent measurements of operational sound generated from wind turbines (direct drive, 6 MW, jacket foundations) at Block Island wind farm (BIWF) indicate average broadband levels of 119 dB at 50 m (164 ft) from the turbine, with levels varying with wind speed (HDR, Inc., 2019). Interestingly, measurements from BIWF turbines showed operational sound had less tonal components compared to European measurements of turbines with gear boxes.

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

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

Recently, Holme *et al.* (2023) cautioned that Tougaard *et al.* (2020) and Stöber and Thomsen (2021) extrapolated levels for larger turbines should be interpreted with caution since both studies relied on data from smaller turbines (0.45 to 6.15 MW) collected over a variety of environmental conditions. They demonstrated that the model presented in Tougaard *et al.* (2020) tends to potentially overestimate levels (up to approximately 8 dB) measured to those in the field, especially with measurements closer to the turbine for larger turbines. Holme *et al.* (2023) measured operational noise from larger turbines (6.3 and 8.3 MW) associated with three wind farms in Europe and found no relationship between turbine activity (power production, which is proportional to the blade's revolutions per minute) and noise level, though it was noted that this missing relationship may have been masked by the area's relatively high ambient noise sound levels. Sound levels (RMS) of a 6.3 MW direct-drive turbine were measured to be 117.3 dB at a distance of 70 m (229.7 ft). However, measurements from 8.3 MW turbines were inconclusive as turbine noise was deemed to have been largely masked by ambient noise.

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

Overall, noise from operating turbines would raise ambient noise levels in the immediate vicinity of the turbines; however, the spatial extent of increased noise levels would be limited. NMFS proposes to require SouthCoast to measure operational noise levels.

Estimated Take

This section provides an estimate of the number of incidental takes that may be authorized through the proposed regulations, which will inform both NMFS' consideration of ''small numbers'' and the negligible impact determination. Harassment is the only type of take expected to result from these activities.

Authorized takes would be primarily by Level B harassment, as use of the acoustic sources (*i.e.,* impact and vibratory pile driving, site characterization surveys, and UXO/MEC detonations) has the potential to result in disruption of marine mammal behavioral patterns due to exposure to elevated noise levels. Impacts such as masking and TTS can contribute to behavioral disturbances. There is also some potential for auditory injury (Level A harassment) to occur in select marine mammal species incidental to the specified activities (*i.e.,* impact pile driving and UXO/MEC detonations). The required mitigation and monitoring measures, the majority of which are not considered in the estimated take analysis, are expected to reduce the extent of the taking to the lowest level practicable.

While, in general, mortality and serious injury of marine mammals could occur from vessel strikes or UXO/MEC detonation if an animal is close enough to the source, the mitigation and monitoring measures in this proposed rule, when implemented, are expected to minimize the potential for take by mortality or serious injury such that the probability for take is discountable. No other activities have the potential to result in mortality or serious injury, and no serious injury is anticipated or proposed for authorization through this rulemaking.

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

Below, we describe NMFS' acoustic and non-auditory injury thresholds, acoustic and exposure modeling methodologies, marine mammal density calculation methodology, occurrence information, and the modeling and methodologies applied to estimate incidental take for each specified activity likely to result in take by harassment.

Marine Mammal Acoustic Thresholds

NMFS recommends the use of acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals are likely to be behaviorally harassed (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment). Thresholds have also been developed to identify the levels above which animals may incur different types of tissue damage (non-acoustic Level A harassment or mortality) from exposure to pressure waves from explosive detonation. A summary of all NMFS' thresholds can be found at (*https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance*).

Level B Harassment

Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source or exposure context (*e.g.,* frequency, predictability, duty cycle, duration of the exposure, signal-to-noise ratio, distance to the source, ambient noise, and the receiving animals (animal's hearing, motivation, experience, demography, behavior at time of exposure, life stage, depth)) and can be difficult to predict (*e.g.,* Southall *et al.,* 2007, 2021; Ellison *et al.,* 2012). Based on the best scientific information available and the practical need to use a threshold based on a metric that is both predictable and measurable for most activities, NMFS typically uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. NMFS generally predicts that marine mammals are likely to be behaviorally harassed in a manner considered to be Level B harassment when exposed to underwater anthropogenic noise above the received sound pressure levels (SPL_{rms}) of 120 dB for continuous sources (*e.g.,* vibratory pile-driving, drilling) and above the received SPL_{rms}160 dB for non-explosive impulsive or intermittent sources (*e.g.,* impact pile driving, scientific sonar). Generally speaking, Level B harassment take estimates based on these behavioral harassment thresholds are expected to include any likely takes by TTS as, in most cases, the likelihood of TTS occurs at distances from the source less than those at which behavioral harassment is likely. TTS of a sufficient degree can manifest as behavioral harassment, as reduced hearing sensitivity and the potential reduced opportunities to detect important signals (conspecific communication, predators, prey) may result in changes in behavior patterns that would not otherwise occur.

Level A Harassment

NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) (NMFS, 2018) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). As dual metrics, NMFS considers onset of PTS (Level A harassment) to have occurred when either one of the two metrics is exceeded (*i.e.,* metric resulting in the largest isopleth). As described above, SouthCoast's proposed activities include the use of both impulsive and non-impulsive sources.

NMFS' thresholds identifying the onset of PTS are provided in table 7. The references, analysis, and methodology used in the development of the thresholds are described in NMFS' 2018 Technical Guidance, which may be accessed at: *www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance.*

TABLE 7—ONSET OF PERMANENT THRESHOLD SHIFT (PTS)

[NMFS, 2018]

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

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

Note: Peak sound pressure level ($L_{p,0\text{-}pk}$) has a reference value of 1 μPa, and weighted cumulative sound exposure level ($L_{E,p}$) has a reference value of 1μPa²s. In this 6able, thresholds are abbreviated to be more reflective of International Organization for Standardization standards (ISO, 2017). The subscript "flat" is being included to indicate peak sound pressure are flat weighted or unweighted within the generalized hearing range of marine mammals (*i.e.,* 7 Hz to 160 kHz). The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW pinnipeds) and that the recommended accumulation period is 24 hours. The weighted cumulative sound exposure level thresholds could be exceeded in a multitude of ways (*i.e.,* varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these thresholds will be exceeded.

Explosive Source

Based on the best scientific information available, NMFS uses the acoustic and pressure thresholds indicated in tables 8 and 9 to predict the onset of behavioral harassment, TTS, PTS, non-auditory injury, and mortality incidental to explosive detonations. Given SouthCoast would be limited to detonating one UXO/MEC per day, the TTS threshold is used to estimate the potential for Level B (behavioral) harassment (*i.e.,* individuals exposed above the TTS threshold may also be harassed by behavioral disruption, but we do not anticipate any impacts from exposure to UXO/MEC detonation below the TTS threshold would constitute behavioral harassment).

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

[NMFS, 2018]

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

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

Note: Peak sound pressure (L_{pk}) has a reference value of 1 μPa, and cumulative sound exposure level (L_E) has a reference value of 1μPa²s. In this table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI, 2013). However, ANSI defines peak sound pressure as incorporating frequency weighting, which is not the intent for this Technical Guidance. Hence, the subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the overall marine mammal generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (*i.e.,* varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.

Additional thresholds for non-auditory injury to lung and gastrointestinal (GI) tracts from the blast shock wave and/or onset of high peak pressures are also relevant (at relatively close ranges) (table 9). These criteria have been developed by the U.S. Navy (DoN (U.S. Department of the Navy) 2017a) and are based on the mass of the animal and the depth at which it is present in the water column. Equations predicting the onset of the associated potential effects are included below (table 9).

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

[DoN, 2017]

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

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

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

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

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

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

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

D animal depth (meters).

Modeling and Take Estimation

SouthCoast estimated density-based exposures in two separate ways, depending on the activity. To assess the potential for Level A harassment and Level B harassment resulting from exposure to the underwater sound fields produced during impact and vibratory pile driving, sophisticated sound and animal movement modeling was conducted to account for movement and behavior of marine mammals. For HRG surveys and UXO/MEC detonations, SouthCoast estimated the number of takes by Level B harassment using a simplified "static" method wherein the take estimates are the product of density, area of water ensonified above the NMFS defined threshold (*e.g.,* unweighted 160 dB SPL_{rms}) levels, and number of activity days (assuming a maximum of one UXO/MEC detonation per day). For some species, observational data from PSOs aboard HRG survey vessels or group size indicated that the density-based take estimates may be insufficient to account for the number of individuals of a species that may be encountered during the planned activities; thus, adjustments were made to the density-based estimates.

The assumptions and methodologies used to estimate take, in consideration of acoustic thresholds and appropriate marine mammal density and occurrence information, are described in activity-specific subsections below (*i.e.,*WTG and OSP foundation installation, HRG surveys, and UXO/MEC detonation). Resulting distances to threshold isopleths, densities used, activity-specific exposure estimates (as relevant to the analysis), and take estimates can be found in each activity subsection below. At the end of this section, we present the total annual and 5-year take estimates that NMFS proposes to authorize.

Marine Mammal Density and Occurrence

In this section, we provide information about marine mammal presence, density, or group dynamics that will inform the take calculations for all activities. Depending on the stock and as described in the take estimation section for each activity, take estimates may be based on the Roberts *et al.* (2023) density estimates, marine mammal monitoring results from HRG surveys, or average group sizes. The density and occurrence information resulting in the highest take estimate was considered in subsequent analyses, and the explanation and results for each activity are described in the specific activity sub-sections.

Habitat-based density models produced by the Duke University Marine Geospatial Ecology Laboratory and the Marine-life Data and Analysis Team, based on the best available marine mammal data obtained in a collaboration between Duke University, the Northeast Regional Planning Body, the University of North Carolina Wilmington, the Virginia Aquarium and Marine Science Center, and NOAA (Roberts *et al.,* 2016a, 2016b, 2017, 2018, 2020, 2021a, 2021b, 2023), represent the best available scientific information regarding marine mammal densities in and surrounding the Lease Area and along ECCs. Density data are subdivided into five separate raster data layers for each species, including: Abundance (density), 95 percent Confidence Interval of Abundance, 5 percent Confidence Interval of Abundance, Standard Error of Abundance, and Coefficient of Variation of Abundance.

Modifications to the densities used were necessary for some species. The estimated monthly density of seals provided in Roberts *et al.* (2016; 2023) includes all seal species present in the region as a single guild. To split the resulting ''seal'' density estimate by species, SouthCoast multiplied the estimate by the proportion of each species observed by PSOs during SouthCoast's 2020–2021 site characterization surveys (Milne, 2021; 2022). The proportions used were 231/246 (0.939) for gray seals and 15/246 (0.061) for harbor seals. The ''seal'' density provided by Roberts *et al.* (2016; 2023) was then multiplied by these proportions to get the species specific densities. While the Roberts *et al.* (2016; 2023) seals guild includes all phocid seals, as described in the Descriptions of Marine Mammals in the Specified Geographical Region section, harp seal occurrence is considered rare and unexpected in SNE. Given this, harp seals were not included when splitting the seal guild density and SouthCoast did not request take for this species. Monthly densities were unavailable for pilot whales, so SouthCoast applied the annual mean density to estimate take. As described in the Marine Mammal section, species' distributions indicate that the only species of pilot whale expected to occur in SNE is the long-finned pilot whale; therefore, the densities provided in Roberts *et al.* (2016, 2023) are attributed to this species (and not short-finned pilot whales). Similarly, distribution data for bottlenose dolphins stocks indicate that the only stock likely to occur in SNE is the Western North Atlantic offshore stock, thus all Robert *et al.* (2016, 2023) densities are attributed to this stock. Below, we describe observational data from monitoring reports and average group size information, both of which are appropriate to inform take estimates for certain activities or species in lieu of density estimates.

For some species and activities, observational data from Protected Species Observers (PSOs) aboard HRG and geotechnical (GT) survey vessels indicate that the density-based exposure estimates may be insufficient to account for the number of individuals of a species that may be encountered during the planned activities. PSO data from geophysical and geotechnical surveys conducted in the area surrounding the Lease Area and ECCs from April 2020 through December 2021 (RPS, 2021) were analyzed to determine the average number of individuals of each species observed per vessel day. For each species, the total number of individuals observed (including the''proportion of unidentified individuals'') was divided by the number of vessel days during which observations were conducted in 2020–2021 HRG surveys (555 survey days) to calculate the number of individuals observed per vessel day, as shown in the final columns of Table 7 in the SouthCoast ITA application.

For other less-common species, the predicted densities from Roberts *et al.* (2016; 2023) are very low and the resulting density-based exposure estimate is less than a single animal or a typical group size for the species. In such cases, the mean group size was considered as an alternative to the density-based or PSO data-based take estimates to account for potential impacts on a group during an activity. Mean group sizes for each species were calculated from recent aerial and/or vessel-based surveys, as shown in table 10. Additional detail regarding the density and occurrence as well as the methodology used to estimate take for specific activities is included in the activity-specific subsections below.

TABLE 10—MEAN GROUP SIZES OF SPECIES THAT MAY OCCUR IN THE PROJECT AREA

Species	Individuals	Sightings	Mean group size	Information source
North Atlantic right whale *	145	60	2.4	Kraus *et al.* (2016).
Blue whale *	3	3	1.0	Palka *et al.* (2017).
Fin whale *	155	86	1.8	Kraus *et al.* (2016).
Humpback whale	160	82	2.0	Kraus *et al.* (2016).
Minke whale	103	83	1.2	Kraus *et al.* (2016).
Sei whale *	41	25	1.6	Kraus *et al.* (2016).
Sperm whale *	208	138	1.5	Palka *et al.* (2017).
Atlantic spotted dolphin	1,335	46	29.0	Palka *et al.* (2017).
Atlantic white-sided dolphin	223	8	27.9	Kraus *et al.* (2016).
Bottlenose dolphin	259	33	7.8	Kraus *et al.* (2016).
Common dolphin	2,896	83	34.9	Kraus *et al.* (2016).
Pilot whales	117	14	8.4	Kraus *et al.* (2016).
Risso's dolphin	1,215	224	5.4	Palka *et al.* (2017).
Harbor porpoise	121	45	2.7	Kraus *et al.* (2016).
Seals (harbor and gray)	201	144	1.4	Palka *et al.* (2017).

* Denotes species listed under the Endangered Species Act.

The estimated exposure and take tables for each activity present the density-based exposure estimates, PSO-date derived take estimate, and mean group size for each species. The number of species-specific takes by Level B harassment that is proposed for authorization is based on the largest of these three values. Although animal exposure modeling resulted in Level A harassment exposure estimates for other species, NMFS is not proposing to authorize Level A harassment take for any species other than fin whales, harbor porpoises, and harbor and gray seals. The numbers of takes by Level A harassment proposed for authorization for these species are based strictly on density-based exposure modeling results (*i.e.,* not on PSO-data derived estimates or group size).

WTG and OSP Foundation Installation

Here, for WTG and OSP monopile and pin-piled jacket foundation installation, we provide summary descriptions of the modeling methodology used to predict sound levels generated from the Project with respect to harassment thresholds and potential exposures using animal movement, the density and/or occurrence information used to support the take estimates for this activity, and the resulting acoustic and exposure ranges, exposures, and authorized takes.

The predominant underwater noise associated with the construction of offshore components of the SouthCoast Project would result from impact and vibratory pile driving of the monopile and jacket foundations. SouthCoast employed JASCO Applied Sciences (USA) Inc. (JASCO) to conduct acoustic modeling to better understand sound fields produced during these activities (Limpert *et al.,* 2024). The basic modeling approach is to characterize the sounds produced by the source, and determine how the sounds propagate within the surrounding water column. For both impact and vibratory pile driving, JASCO conducted sophisticated source and propagation modeling (as described below). JASCO also conducted animal movement modeling to estimate the potential for marine mammal harassment incidental to pile driving. JASCO estimated species-specific exposure probabilities by considering the range- and depth-dependent sound fields in relation to animal movement in simulated representative construction scenarios. More details on these acoustic source modeling, propagation modeling and exposure modeling methods are described below and can be found in Limpert *et al.* (2024).

Pile Driving Acoustic Source Modeling

To model the sound emissions from the piles, the force of the pile driving hammers had to be modeled first. JASCO used the GRL, Inc. Wave Equation Analysis of Pile Driving wave equation model (GRLWEAP) (Pile Dynamics, 2010) in conjunction with JASCO's Pile Driving Source Model (PDSM), a physical model of pile vibration and near-field sound radiation (MacGillivray, 2014), to predict source levels associated with impact and vibratory pile driving activities. Forcing functions, representing the force of the impact or vibratory hammer at the top of each 9/16-m monopile and 4.5-m jacket foundation pile, were computed using the GRLWEAP 2010 wave equation model (GRLWEAP) (Pile Dynamics, 2010), which includes a large database of simulated impact and vibratory hammers. The GRLWEAP model assumed direct contact between the representative impact and vibratory hammers, helmets, and piles (*i.e.,* no cushioning material, which provides a more conservative estimate). For monopile and jacket foundations, the piles were assumed to be vertical and driven to a penetration depth of 35 m (115 ft) and 60 m (197 ft), respectively. Modeling assumed jacket foundation piles were either pre- and post-piled. As indicated in the *Description of Specified Activities* section, pre-piling means that the jacket structure will be set on pre-installed piles, as would be the case for SouthCoast's WTG foundations (if jacket foundations are used for WTGs). OSP foundations would be post-piled (using only impact pile driving), meaning that the jacket structure is placed on the seafloor and piles would be subsequently driven through guides at the base of each leg. These jacket foundations (which are separate from the pin piles on which they sit) will also radiate sound as the piles are driven. To account for the additional sound (beyond impact hammering of the OSP pin piles) radiating from the jacket structure, a 2–dB increase in received levels was included in the propagation calculations for OSP post-piling installations, based on a recommendation from Bellman *et al.* (2020).

Modeling the forcing function for vibratory pile driving required slightly different considerations than for impact pile driving given differences in the way each hammer type interacts with a pile, although the models used are the same for installation methods. Piles deform when driven with impact hammers, creating a bulge that travels down the pile and radiates sound into the surrounding air, water, and seabed. During the vibratory pile driving stage, piles are driven into the substrate due to longitudinal vibration motion at the hammer's operational frequency and corresponding amplitude, which causes the soil to liquefy, allowing the pile to penetrate into the seabed. Using GRLWEAP, one-second long vibratory forcing functions were computed for the 9/16-m monopile and 4.5-m jacket foundations, assuming the use of 32 clamps with total weight of 2102.4 kN for the monopile and 4 clamps with total weight of 213.56 kN for the jacket piles, connecting the hammer to the piles. Non-linearities were introduced to the vibratory forcing functions based on the decay rate observed in data measured during vibratory pile driving of smaller diameter piles (Quijano *et al.,* 2017). Key modeling assumptions can be found in Table B–1 in Appendix B of Limpert *et al.* (2024). Please see Figures 12 and 13 in Section 4.1.1 of Limpert *et al.* (2024), for impact pile driving forcing functions, and Figures 18 and 19 in section 4.1.2 for vibratory pile driving forcing functions.

Both the impact and vibratory pile driving forcing functions computed using the GRLWEAP model were used then as inputs to the PDSM model to compute the resulting pile vibrations. These models account for several parameters that describe the operation—pile type, material, size, and length—the pile driving equipment, and approximate pile penetration depth. The PDSM physical model computes the underwater vibration and sound radiation of a pile by solving the theoretical equations of motion for axial and radial vibrations of a cylindrical shell. Piles were modeled assuming vertical installation using a finite-difference structural model of pile vibration based on thin-shell theory. The sound radiating from the pile itself was simulated using a vertical array of discrete point sources. This model is used to estimate the energy distribution per frequency (source spectrum) at a close distance from the source (10 m (32.8 ft)). Please see Appendix E in Limpert *et al.* (2024), for a more detailed description.

The amount of sound generated during pile driving varies with the energy required to drive piles to a desired depth, and depends on the sediment resistance encountered. Sediment types with greater resistance require hammers that deliver higher energy strikes and/or an increased number of strikes relative to installations in softer sediment. Maximum sound levels usually occur during the last stage of impact pile driving (*i.e.,* when the pile is approaching full installation depth) where the greatest resistance is encountered (Betke, 2008). Rather than modeling increasing hammer energy with increasing penetration depth, SouthCoast assumed that maximum hammer energy would be used throughout the entire installation of monopiles and pin piles (tables 11 and 12). This is a conservative assumption, given the project area includes a predominantly sandy bottom habitat, which is a softer sediment (see *Specified Geographical Are*a section) that would require less than the maximum hammer energy to penetrate.

Representative hammering schedules for impact installation are shown in table 11 and for installations requiring vibratory followed by impact installation in table 12. For impact installation of 9/16-m WTG monopiles, 7,000 total hammer strikes were assumed, using the maximum hammer energy (6,600 kJ). The smaller 4.5-m pin piles for the WTG and OSP jacket foundations were assumed to require 4,000 total strikes using the maximum hammer energy (3,500 kJ). Modeling vibratory and subsequent impact installation of 9/16-m monopiles assumed 20 minutes of vibratory piling followed by 5,000 strikes of impact hammering. Installation of 4.5-m WTG piles using both vibratory and impact hammering methods assumed 90 minutes of vibratory pile driving followed by 2,667 impact hammer strikes.

TABLE 11—HAMMER ENERGY SCHEDULES FOR MONOPILE AND JACKET FOUNDATIONS INSTALLED WITH IMPACT HAMMER ONLY

WTG monopile foundations (9/16-m diameter)			WTG and OSP jacket foundations (4.5-m diameter)		
Hammer: NNN 6600			Hammer: MHU 3500S		
Energy level (kilojoule, kJ) [1]	Strike count	Pile penetration depth (m)	Energy level (kilojoule, kJ)	Strike count	Pile penetration depth
6,600 [a]	2,000	0–10	3,500 [a]	1,333	0–20
6,600 [b]	2,000	11–21	3,500 [b]	1,333	21–41
6,600 [c]	3,000	22–35	3,500 [c]	1,334	41–60
Total:	7,000	35	Total:	4,000	60

a, b, c—Modeling assumed application of the maximum hammer energy throughout the entire monopile installation. For ease of reference, JASCO used this notation to differentiate progressive stages of installation at the same hammer energy but at different penetration depths and number of hammer strikes.

TABLE 12—HAMMER ENERGY SCHEDULES FOR MONOPILE AND JACKET FOUNDATIONS INSTALLED WITH BOTH VIBRATORY AND IMPACT HAMMERS

WTG monopile foundations (9/16-m diameter)					WTG jacket foundations (4.5-m diameter)				
Hammers					Hammers				
Vibratory HXCV640 and Impact NNN6600					Vibratory SCV640 and Impact MHU 3500S				
Hammer type	Energy level (kilojoule, kJ)	Strike count	Duration (minutes)	Pile penetration depth (m)	Hammer type	Energy level (kilojoule, kJ)	Strike count	Duration (minutes)	Pile penetration depth (m)
Vibratory	3,500	....	20	0–10	Vibratory	3,500	....	90	0–20
Impact	6,600	2,000	....	11–21	Impact	6,000	1,333	....	21–41
		3,000	....	22–35			1,334	....	42–60
Total:	....	5,000	20	35	....	....	2,667	90	60

a, b, c—Modeling assumed application of the maximum hammer energy throughout the entire monopile installation. For ease of reference, JASCO used this notation to differentiate progressive stages of installation at the same hammer energy but at different penetration depths and number of hammer strikes.

TABLE 13—BROADBAND SEL (dB re 1 μPa²·S) PER MODELED ENERGY LEVEL AT 10 m FROM A 9/16-m MONOPILE AND 4.5-m PIN PILE INSTALLED USING A IMPACT HAMMER AT TWO REPRESENTATIVE LOCATIONS IN THE LEASE AREA [a]

Pile type	Impact hammer	Energy Level (kilojoule, kJ) [a]	SEL	
			L01 [1]	L02 [1]
9/16-m Monopile	NNN6600	6,600 [a]	207.5	208.1
		6,600 [b]	206.2	206.9
		6,600 [c]	206.9	207.1
4.5-m Pin Pile	MHU 3500S	3,500	197.4	198.1
		3,500	198.5	198.7
		3,500	195.7	190.5

1—L01 and L02 are located in the southwest and northeast sections of the Lease Area, respectively. See Figure 2 in Limpert et al. (2023) for a map of these locations.

a, b, c—Modeling assumed application of the maximum hammer energy throughout the entire monopile installation. For ease of reference, JASCO used this notation to differentiate progressive stages of installation at the same hammer energy but at different penetration depths and number of hammer strikes.

TABLE 14—BROADBAND SEL (dB re 1 µPa²·s) PER DURATION OF VIBRATORY PILING AT 10 m FROM A 9/16-m MONOPILE AND 4.5-m PIN PILE INSTALLED USING IMPACT HAMMERING AT TWO REPRESENTATIVE LOCATIONS IN THE LEASE AREA [a]

Pile type	Vibratory hammer	Vibratory pile driving duration (min)	SEL (dB re 1 µPa²·s	
			L01	L02
9/16-m Monopile	TA–CV320	20	214.8	213.5
4.5-m Pin Pile	HX–CV640	90	193.3	190.3

a—L01 and L02 are located in the southwest and northeast sections of the Lease Area, respectively. See Figure 2 in Limpert *et al.* (2023) for a map of these locations.

a, b, c—Modeling assumed application of the maximum hammer energy throughout the entire monopile installation. For ease of reference, JASCO used this notation to differentiate progressive stages of installation at the same hammer energy but at different penetration depths and number of hammer strikes.

Beyond understanding pile driving source levels (estimated using forcing functions), there are additional factors to consider when determining the degree to which noise would be transmitted through the water column. Noise abatement systems (NAS) are often used to decrease the sound levels in the water near a source by inserting a local impedance change that acts as a barrier to sound transmission. Attenuation by impedance change can be achieved through a variety of technologies, including bubble curtains, evacuated sleeve systems (*e.g.,* IHC-Noise Mitigation System (NMS)), encapsulated bubble systems (*e.g.,* HydroSound Dampers (HSD)), or Helmholtz resonators (AdBm NMS). The effectiveness of each system is frequency dependent and may be influenced by local environmental conditions such as current and depth. SouthCoast would employ systems to attenuate noise during all pile driving of monopile and jacket foundations, including, at minimum, a double big bubble curtain (DBBC). Several recent studies summarizing the effectiveness of NAS have shown that broadband sound levels are likely to be reduced by anywhere from 7 to 17 dB, depending on the environment, pile size, and the size, configuration and number of systems used (Buehler *et al.,* 2015; Bellmann *et al.,* 2020). Hence, hypothetical broadband attenuation levels of 0 dB, 6 dB, 10 dB, 15 dB, and 20 dB were incorporated into acoustic modeling to gauge effects on the ranges to thresholds given these levels of attenuation. Although five attenuation levels were evaluated, SouthCoast and NMFS anticipate that the noise attenuation system ultimately chosen will be capable of reliably reducing source levels by 10 dB; therefore, modeling results assuming 10-dB attenuation are carried forward in this analysis for pile driving. See the Proposed Mitigation section for more information regarding the justification for the 10-dB attenuation assumption.

Acoustic Propagation Modeling

To estimate sound propagation during foundation installation, JASCO's used the Full Waveform Range-dependent Acoustic Model (FWRAM) to combine the outputs of the source model with spatial and temporal environmental factors (*e.g.,* location, oceanographic conditions, and seabed type) to get time-domain representations of the sound signals in the environment and estimate sound field levels ((Limpert *et al.* (2024), Section F.1 in Appendix F of SouthCoast's ITA application)). Because the foundation pile is represented as a linear array and FWRAM employs the array starter method to accurately model sound propagation from a spatially distributed source (MacGillivray and Chapman, 2012), using FWRAM ensures accurate characterization of vertical directivity effects in the near-field zone. Due to seasonal changes in the temperature and salinity of the water column, sound propagation is likely to vary among different times of the year. To capture this variability, acoustic modeling was conducted using an average sound speed profile for a ''summer'' period including the months of May through November, and a ''winter'' period including December through April. FWRAM computes pressure waveforms via Fourier synthesis of the modeled acoustic transfer function in closely spaced frequency bands. This model is used to estimate the energy distribution per frequency (source spectrum) at a close distance from the source (10 m (32.8 ft)). Examples of decidecade spectral levels for each foundation pile type, hammer energy, and modeled location, using average summer sound speed profile are provided in Limpert *et al.* (2024).

Sounds produced by sequential installation of the 9/16-m WTG monopiles and 4.5-m pin piles were modeled at two locations. Water depths within the Lease Area range from 37 m to 64 m (121 ft to 210 ft). Sound fields produced during both impact and vibratory installation of 9/16-m WTG monopiles and 4.5-m WTG and OSP pin piles were modeled at two locations: L01 in the southwest section of the lease area in 38 m water depth and L02 in the northeast section of the lease area in 53 m (173.9 ft) depth (Figure 2 in Appendix A in Limpert *et al.,* 2024). Propagation modeling did not include water depths between 54 m and 64 m (deepest location) given the majority of foundation locations (*i.e.,* 101 out of 149) occur in depths less than 54 m (177 ft). The locations were selected to represent the acoustic propagation environment within the Lease Area and may not be actual foundation locations. JASCO selected alternative locations to model the ensonified zones produced during concurrent pile driving because the foundation installation locations would be closer together (*i.e.,* separated by approximately 2 nm) than those selected for sequential foundation installations.

For impulsive sounds from impact pile driving as well as non-impulsive sounds from vibratory piling, time-domain representations of the pressure waves generated in the water are required for calculating SPL_{rms} and SPL_{peak} at various distances from the pile, metrics that are important for characterizing potential impacts of pile driving noise on marine mammals. Furthermore, the pile must be represented as a distributed source to accurately characterize vertical directivity effects in the near-field zone. JASCO used FWRAM to compute synthetic pressure waveforms as a function of range and depth via Fourier synthesis of transfer functions in closely spaced frequency bands, in range-varying marine acoustic environments. Additional modeling details are described in Limpert *et al.* (2024). Impact and vibratory pile driving source and propagation modeling provides estimates of the distances from the pile location to NMFS' Level A harassment and Level B harassment threshold isopleths.

JASCO calculated acoustic ranges, which represent the distance to a harassment threshold based on sound propagation through the environment, independent of movement of a receiver. The use of acoustic ranges ($R_{95\%}$) to the Level A harassment SEL_{cum} metric thresholds to assess the potential for PTS is considered an overly conservative method, as it does not account for animal movement and behavior and, therefore, assumes that animals are essentially stationary at that distance for the entire duration of the pile installation, a scenario that does not reflect realistic animal behavior. However, because NMFS' Level A harassment (SPL_{peak}) and Level B harassment (SPL_{rms}) thresholds refer to instantaneous exposures, acoustic ranges are a better representation of distances to these NMFS' instantaneous harassment thresholds. These distances were not applied to exposure estimation but were used to define the Level B harassment zones for all species (see Proposed Mitigation and Monitoring) for WTG and OSP foundation installation in summer and winter, and the minimum visibility zone for installation of foundations in the NARW EMA (see Proposed Mitigation and Monitoring). The following tables present the largest acoustic ranges ($R_{95\%}$) among modeling sites (Figure 2 in Limpert *et al.,* 2024) resulting from JASCO's source and propagation models, for both ''summer'' and ''winter.'' Table 15 presents the $R_{95\%}$ distances to the Level A harassment (SPL_{peak}) isopleths. Table 16 provides $R_{95\%}$ distances to the Level A harassment (SEL_{cum}) thresholds for impact-only and combined method (*i.e.,* vibratory and impact pile driving) installations, respectively. Finally, table 17 presents $R_{95\%}$ distances for Level B harassment thresholds, for impact (160 dB) and vibratory (120 dB) pile driving.

TABLE 15—ACOUSTIC RANGES ($R_{95\%}$), IN KILOMETERS (km), TO MARINE MAMMAL LEVEL A HARASSMENT THRESHOLDS (SPL_{peak}) DURING IMPACT PILE DRIVING OF 9/16-m MONOPILES, 4.5-m PRE-PILED WTG JACKETS, AND 4.5-m POST-PILED OSP JACKETS, ASSUMING 10 dB ATTENUATION IN BOTH SUMMER AND WINTER

Hearing group	Distances to level A (SPL_{peak}) harassment thresholds (km)					
	WTG 9/16-m monopile		WTG 4.5-m pre-piled pin		OSP 4.5-m post-piled pin	
	Summer	Winter	Summer	Winter	Summer	Winter
LFC						
MFC						
HFC	0.27	0.26	0.12	0.13	0.14	0.13
PW						

TABLE 16—ACOUSTIC RANGES ($R_{95\%}$), IN KILOMETERS (km), TO MARINE MAMMAL LEVEL A HARASSMENT THRESHOLDS (SEL_{cum}) DURING PILE DRIVING OF 9/16-m MONOPILES, 4.5-m PRE-PILED WTG JACKETS, AND 4.5-m POST-PILED OSP JACKETS, ASSUMING 10 dB ATTENUATION IN BOTH SUMMER AND WINTER

Hearing group	Impact (I) or vibratory [1] and impact (V/I) installation	Distances to level A (SPL_{cum}) harassment thresholds (km)					
		WTG 9/16-m monopile		WTG 4.5-m pre-piled pin		OSP 4.5-m post-piled pin	
		Summer	Winter	Summer	Winter	Summer	Winter
LFC	I	6.09	6.68	4.94	5.16	5.83	6.21
	V/I	6.19	6.8	2.11	2.15		
MFC	I						
	V/I						
HFC	I	0.26	0.3	0.09	0.09	0.11	0.12
	V/I	0.2	0.2	0.02	0.02		
PW	I	0.79	0.79	0.48	0.49	0.68	0.71
	V/I	0.81	0.85	0.11	0.11		

[1] Vibratory pile driving applies to Project 2 only.

TABLE 17—ACOUSTIC RANGES ($R_{95\%}$), IN KILOMETERS (km), TO THE MARINE MAMMAL LEVEL B HARASSMENT THRESHOLDS DURING IMPACT (160 dB) AND VIBRATORY [1] (120 dB) PILE DRIVING OF 9/16-m MONOPILES, 4.5-m PRE-PILED WTG JACKETS, AND 4.5-m POST-PILED OSP JACKETS, ASSUMING 10 dB ATTENUATION, IN SUMMER AND WINTER

Installation approach	Distances to level B (SPL_{rms}) harassment thresholds (km)					
	WTG 9/16-m monopile		WTG 4.5-m pre-piled pin		OSP 4.5-m post-piled pin	
	Summer	Winter	Summer	Winter	Summer	Winter
Impact	7.44	8.63	4.18	4.41	4.88	5.24
Vibratory	42.02	84.63	15.83	21.92		

[1] Vibratory pile driving applies to Project 2 only.

To assess the extent to which marine mammal harassment might occur as a result of movement within this acoustic environment, JASCO next conducted animal movement and exposure modeling.

Animal Movement Modeling

To estimate the probability of exposure of animals to sound above NMFS' harassment thresholds to during foundation installation, JASCO's Animal Simulation Model Including Noise Exposure (JASMINE) was used to integrate the sound fields generated from the source and propagation models described above with species-typical behavioral parameters (*e.g.,* swim speeds dive patterns). The parameters used for forecasting realistic behaviors (*e.g.,* diving, foraging, and surface times) were determined and interpreted from marine species studies (*e.g.,* tagging studies) where available, or reasonably extrapolated from related species (Limpert *et al.,* 2024).

Applying animal movement and behavior within the modeled noise fields allows for a more realistic indication of the distances at which PTS acoustic thresholds are reached that considers the accumulation of sound over different durations. Sound exposure models such as JASMINE use simulated animals (animats) to sample the predicted 3–D sound fields with movement derived from animal observations (see Limpert *et al.,* 2024). Animats that exceed NMFS' acoustic thresholds are identified and the range (distance from the noise source) for the exceedances determined. The output of the simulation is the exposure history for each animat accumulated within the simulation. An individual animat's sound exposure levels are summed over a specific duration, (24 hours), to determine its total received acoustic energy (SEL) and maximum received SPL_{PK} and SPL_{rms}. These received levels are then compared to the harassment threshold criteria. The combined history of all animats gives a probability density function of exposure above threshold levels. The number of animals expected to exceed the regulatory thresholds is determined by scaling the number of predicted animat exposures by the species-specific density of animals in the area. By programming animats to behave like the 16 marine mammal species that may be exposed to pile driving noise, the sound fields are sampled in a manner similar to that expected for real animals.

Vibratory setting of piles followed by impact pile driving is being considered for Project 2 (Scenarios 2 and 3). Given the qualities of vibratory pile driving noise (*e.g.,* continuous, lower hammer energy), Level A harassment (PTS) is not an anticipated impact on marine mammals incidental to SouthCoast's use of this method. Although the potential to induce hearing loss is low during vibratory driving, it does introduce some SEL exposure that must be considered in the 24-hour SEL_{cum} estimates. For this reason, JASCO computed acoustic ranges from the combined sound energy from vibratory and impact pile driving. These results are presented in Appendix G in Limpert *et al.* (2024). The PTS-onset SEL thresholds are lower for impact piling than for vibratory piling (table 7) so, to be conservative, when estimating acoustic ranges and the number of animats exposed to potentially injurious sound levels from both impact and vibratory pile driving (for those piles that may require both methods), the lower (impulsive) SEL criteria were applied to determine if thresholds were exceeded.

Estimating the number of animats that may be exposed to sound above a behavioral SPL response threshold is simpler because it does not require integrating sound pressure over long time periods. This calculation was done separately for vibratory and impact pile driving because these two sound sources use different thresholds, and they are temporally separated activities (*i.e.,* impact follows vibratory pile driving). The numbers of animats exposed above the 120 dB (vibratory) and 160 dB (impact) Level B harassment thresholds are calculated individually and then the resulting numbers are combined to get total behavioral exposures from a single pile installed at each representative location when both hammer types are expected to be used on a pile. Individual animats that are exposed above behavioral thresholds for both vibratory and impact pile driving are only counted once to avoid over-estimation.

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

As described in the Detailed Description of Specific Activity section, SouthCoast proposed construction schedules that include both sequential and concurrent foundation installations. For sequential installations (both vibratory and/or impact) of two monopiles foundations or four jacket pin piles per day, two sites were used for modeling (see Figures 7 and 8, Section 2.51 of Appendix A in Limpert *et al.,* 2024), both considered representative locations of the Lease Area (one location for each foundation). Animats were exposed to only one sound field at a time. Received levels were accumulated over each animat's track over a 24-hour time window to derive sound exposure levels (SEL). Instantaneous single-exposure metrics (*e.g.,* SPL_{rms} and SPL_{peak}) were recorded at each simulation time step, and the maximum received level was reported.

Concurrent operations were handled slightly differently to capture the effects of installing piles spatially close to each other (*i.e.,* 2 nm (2.3 mi; 3.7 km)). The sites chosen for exposure modeling for concurrent operations are shown in Figure 9, Section 2.51 in Limpert *et al.* (2024). When simulating concurrent operations in JASMINE, sound fields from separate piles may be overlapping in time and space. For cumulative metrics (SEL_{cum}), received energy from each sound field the animat encounters is summed over a 24-hour time window. For SPL, received levels were summed within each simulation time step and the resultant maximum SPL over all time steps was carried forward. For both sequential and concurrent operations, the resulting cumulative or maximum received levels were then compared to the NMFS' thresholds criteria within each analysis period.

Additional assumptions used in modeling for each year of construction are summarized in table 18. As discussed previously, modeling assumed SouthCoast would install Project 1 WTG foundations using only impact pile driving and Project 2 WTG foundations using vibratory and/or impact pile driving. All pin piles supporting OSP jacket foundations would be impact driven. In addition, modeling assumed a seasonal restriction on pile driving from January 1 through April 30. However, as previously described, to provide additional North Atlantic right whale protection, SouthCoast would not install foundation in the NARW EMA from October 16 through May 31 or throughout the rest of the Lease Area from January 1 to May 15.

TABLE 18—ASSUMPTIONS USED IN WTG AND OSP FOUNDATION INSTALLATION EXPOSURE MODELING

Parameter	Project 1			Project 2			
	WTG monopiles scenario 1	WTG jackets scenario 2	OSP jackets	WTG monopiles scenario 1	WTG monopiles scenario 2	WTG jackets scenario 3	OSP jackets
Number of foundations	71	85	1	68	73	62	1
Pile diameter (m)	9/16	4.5	4.5	9/16	9/16	4.5	4.5
Piles per foundation	1	4	12–16	1	1	4	12–16
Penetration depth (m)	35	60	60	35	35	60	60
Max hammer energy (kJ)	6600	3500	3500	6600	6600	3500	3500
Impact or Vibratory	Impact	Impact	Impact	Impact	Both	Both	Impact
Number of impact strikes [1]	7000	4000	4000	7000	7000/5000	4000/2667	4000
Piles/day	1–2	4	4	1–2	1–2	4	4
Piling days	59	85	0.75	53	49	62	0.75

[1] The second value is the number of strikes required when vibratory preceded impact pile driving.

All proposed construction scenarios, including foundation type, installation method, number of monopiles or pin piles installed per day, and the rate of installation were presented in table 2 in the *Detailed Description of Specific Activities* section.

Tables 19–23 summarize the monthly construction schedules for each scenario assumed for modeling, including installation sequence and method, and the number of pile driving days per month. However, construction schedules cannot be fully predicted due to uncontrollable environmental factors (*e.g.,* weather) and installation schedules include variability (*e.g.,* due to drivability). The total number of construction days per month would be dependent on a number of factors, including environmental conditions, planning, construction, and installation logistics. As described previously, SouthCoast assumed that for sequential WTG foundation installations (using a single vessel), a maximum of 2 WTG monopiles or 4 OSP piled jacket pin piles may be driven in 24 hours. For concurrent installation (using two vessels), a maximum of 2 WTG monopiles and 4 OSP piled jacket pin piles or 4 WTG and 4 OSP pin piles may be driven in 24 hours. It is unlikely that these maximum installation rates would be consistently attainable throughout the construction phase, but this schedule was considered to have the greatest potential for Level A harassment (PTS) and was, therefore, carried forward into take estimation.

TABLE 19—SOUTHCOAST'S POTENTIAL FOUNDATION INSTALLATION SCHEDULE FOR PROJECT 1 SCENARIO 1 (P1S1)

Month	Vibratory & impact		Concurrent impact	Impact		Totals	
	WTG monopile		WTG monopile & OSP jacket pin piles	WTG monopile			
	2/day	1/day	1/day & 4/day	2/day	1/day	Total piles	Total days
May	0	0	0	0	2	2	2
June	0	0	0	1	8	10	9
July	0	0	0	3	10	16	13
Aug	0	0	0	4	10	18	14
Sept	0	0	0	3	9	15	12
Oct	0	0	3	1	3	20	7
Nov	0	0	0	0	1	1	1
Dec	0	0	0	0	1	1	1
Total	0	0	3	12	44	83	59

TABLE 20—SOUTHCOAST'S POTENTIAL FOUNDATION INSTALLATION SCHEDULE FOR PROJECT 1 SCENARIO 2 (P1S2)

Month	Vibratory & impact	Concurrent impact	Impact	Totals	
	WTG jacket	WTG monopile & OSP jacket pin piles	WTG jacket		
	4/day	1/day & 4/day	4/day	Total piles	Total days
May	0	0	8	32	8
June	0	0	10	40	10

TABLE 20—SOUTHCOAST'S POTENTIAL FOUNDATION INSTALLATION SCHEDULE FOR PROJECT 1 SCENARIO 2 (P1S2)—Continued

Month	Vibratory & impact	Concurrent impact	Impact	Totals	
	WTG jacket	WTG monopile & OSP jacket pin piles	WTG jacket		
	4/day	1/day & 4/day	4/day	Total piles	Total days
July	0	0	12	48	12
Aug	0	0	14	56	14
Sept	0	0	12	48	12
Oct	0	4	12	80	16
Nov	0	0	10	40	10
Dec	0	0	3	12	3
Total	0	0	81	356	85

TABLE 21—SOUTHCOAST'S POTENTIAL FOUNDATION INSTALLATION SCHEDULE FOR PROJECT 2 SCENARIO 1 (P2S1)

Month	Vibratory & impact		Concurrent impact	Impact		Totals	
	WTG monopile		WTG monopile & OSP jacket pin piles	WTG monopile			
	2/day	1/day	1/day & 4/day	2/day	1/day	Total piles	Total days
May	0	0	0	0	2	2	2
June	0	0	0	3	6	12	9
July	0	0	0	3	6	12	9
Aug	0	0	0	3	6	12	9
Sept	0	0	0	3	6	12	9
Oct	0	0	3	3	6	27	12
Nov	0	0	0	0	2	2	2
Dec	0	0	0	0	1	1	1
Total	0	0	0	15	35	80	53

TABLE 22—SOUTHCOAST'S POTENTIAL FOUNDATION INSTALLATION SCHEDULE FOR PROJECT 2 SCENARIO 2 (P2S2)

Month	Vibratory & impact		Concurrent impact	Impact		Totals	
	WTG monopile		WTG monopile & OSP jacket pin piles	WTG monopile			
	2/day	1/day	1/day & 4/day	2/day	1/day	Total piles	Total days
May	0	0	0	0	2	2	2
June	2	4	0	0	0	8	6
July	6	4	0	0	0	16	10
Aug	7	4	0	0	0	18	11
Sept	6	4	0	0	0	16	10
Oct	3	2	3	0	0	23	8
Nov	0	1	0	0	0	1	1
Dec	0	0	0	0	1	1	1
Total	24	19	0	0	3	85	49

TABLE 23—SOUTHCOAST'S POTENTIAL FOUNDATION INSTALLATION SCHEDULE FOR PROJECT 2 SCENARIO 3 (P2S3)

Month	Vibratory & impact	Concurrent impact	Impact	Totals	
	WTG jacket	WTG monopile & OSP jacket pin piles	WTG jacket		
	4/day	1/day & 4/day	4/day	Total piles	Total days
May	0	0	5	20	5
June	9	0	0	36	9
July	9	0	0	36	9
Aug	9	0	0	36	9
Sept	9	0	0	36	9
Oct	6	4	0	56	10
Nov	6	0	0	24	6
Dec	0	0	5	20	5
Total	48	4	10	264	62

By incorporating animal movement into the calculation of ranges to time-dependent thresholds (SEL metrics), $ER_{95\%}$ values provide a more realistic assessment of the distances within which acoustic thresholds may be exceeded. This also means that different species within the same hearing group can have different exposure ranges as a result of species-specific movement patterns. Substantial differences (greater than 500 m (1,640 ft)) between species within the same hearing group occurred for low frequency-cetaceans, so Level A harassment (PTS) $ER_{95\%}$ values are shown separately for those species (tables 24–29). For mid-frequency cetaceans and pinnipeds, the largest value from any single species was selected.

Projects 1 and 2 would include sequential WTG foundation installations using impact pile driving only and both vibratory and impact pile driving (Project 2 only), and concurrent WTG and OSP installations using only impact pile driving, each of which generates different $ER_{95\%}$ distances. The Level A harassment (PTS) $ER_{95\%}$ distances for sequential installation of WTG foundations using only impact pile driving are shown in table 24 for both summer and winter. SouthCoast does not anticipate conducting vibratory or concurrent pile driving in December, thus the Level A harassment (PTS) $ER_{95\%}$ distances for sequential installation of WTG foundations (both monopile and pin-piled jacket) using both vibratory and impact pile driving are shown in table 25 for summer only. Lastly, Level A harassment (PTS) $ER_{95\%}$ distances for potential concurrent installation of WTG and OSP foundations using impact pile driving (also limited to ''summer'' for modeling) are shown in table 26.

Comparison of the results in table 24 and table 26 show that the case assuming sequential installation of two WTG monopiles per day and concurrent installation of two WTG monopiles and 4 OSP piles per day yield very similar results. This may seem counterintuitive, given the assumed number of piles installed per day for concurrent installations is larger than that assumed for sequential installations, thus it might be expected that Level A harassment (PTS) $ER_{95\%}$ distances would be larger for concurrent installations. However, for that result to occur, animal movement modeling would have to show that animals would routinely occur close enough to one pile driving location (*e.g.,* WTG monopile) to accumulate enough sound energy without exceeding the Level A harassment SEL_{cum} threshold, and then also occur at the second pile driving location (*e.g.,* OSP jacket) at a distance close enough to accumulate the remaining sound energy needed to cross the SEL_{cum} threshold. The animal movement modeling showed this sequence of events did not happen often enough during concurrent installations of WTG monopile and OSP jacket foundations to cause a consistent increase in the Level A harassment (PTS) $ER_{95\%}$ distances across all species. This sequence of events did occur more often during concurrent installation of WTG jacket and OSP jacket foundation installations, thus the Level A harassment (PTS) $ER_{95\%}$ distances for concurrent installations were consistently larger than for installation of a single WTG jacket foundation on a given day (table 26). This was likely a result of the overall longer duration of pile driving per day required for installing 4 pin piles for each jacket foundation.

TABLE 24—EXPOSURE RANGES ($ER_{95\%}$) [1] TO THE MARINE MAMMAL PTS (LEVEL A) CUMULATIVE SOUND EXPOSURE LEVEL (SEL_{cum}) THRESHOLDS FOR SEQUENTIAL IMPACT PILE DRIVING INSTALLATION OF ONE OR TWO 9/16-m WTG MONOPILES, FOUR 4.5-m WTG JACKET PIN PILES, OR FOUR 4.5-m OSP JACKET PIN PILES IN ONE DAY, ASSUMING 10 dB OF BROADBAND NOISE ATTENUATION IN SUMMER (S) AND WINTER (W) [2]

Hearing group	SEL_{cum} threshold (dB re 1 μPa2·s)	Range (km)							
		9/16-m WTG monopiles (1 piles/day)		9/16-m WTG monopiles (2 piles/day)		4.5-m WTG jacket pin piles (4 piles/day)		4.5-m OSP jacket pin piles (4 piles/day)	
		S	W	S	W[3]	S	W	S	W
Blue whale *	183								
Fin whale *		3.99	4.49	4.15		2.37	2.55	3.18	3.50
Humpback whale		3.13	3.66	3.46		1.88	1.96	2.36	2.54
Minke whale		2.41	3	2.42		1.24	1.28	1.58	1.79
N.Atl. right whale *		2.83	3.23	2.95		1.73	1.85	2.01	2.13
Sei whale *		3.06	3.38	3.19		1.96	2.22	2.59	2.72

TABLE 24—EXPOSURE RANGES ($ER_{95\%}$) [1] TO THE MARINE MAMMAL PTS (LEVEL A) CUMULATIVE SOUND EXPOSURE LEVEL (SEL_{cum}) THRESHOLDS FOR SEQUENTIAL IMPACT PILE DRIVING INSTALLATION OF ONE OR TWO 9/16-m WTG MONOPILES, FOUR 4.5-m WTG JACKET PIN PILES, OR FOUR 4.5-m OSP JACKET PIN PILES IN ONE DAY, ASSUMING 10 dB OF BROADBAND NOISE ATTENUATION IN SUMMER (S) AND WINTER (W) [2]—Continued

Hearing group	SEL_{cum} threshold (dB re 1 µPa2·s)	Range (km)							
		9/16-m WTG monopiles (1 piles/day)		9/16-m WTG monopiles (2 piles/day)		4.5-m WTG jacket pin piles (4 piles/day)		4.5-m OSP jacket pin piles (4 piles/day)	
		S	W	S	W[3]	S	W	S	W
Mid-frequency	185	0	0	0	....	0	0	0	0
High-frequency	155	0	0	0	....	0	0	0	0
Phocids	185	0.4	0.34	0.12	....	0	0.32	0.41	0.41

* Denotes species listed under the Endangered Species Act.
[1] These are the maximum $ER_{95\%}$ values among modeling locations (L01 and L02 in Limpert et al., 2024).
[2] For acoustic propagation modeling, two average sound speed profiles were used, one for the "summer" season (May–November) and a second for the "winter" season (December).
[3] Given the small number of foundation installations planned for December (see tables 19–23), modeling assumed installation of only a single monopile per day for "winter."

TABLE 25—EXPOSURE RANGES ($ER_{95\%}$) [1] TO THE MARINE MAMMAL LEVEL A CUMULATIVE SOUND EXPOSURE LEVEL (SEL_{cum}) THRESHOLDS DURING SEQUENTIAL VIBRATORY [2] AND IMPACT PILE DRIVING INSTALLATION OF ONE OR TWO 9/16-m WTG MONOPILES OR FOUR 4.5-m WTG JACKET PIN PILES ASSUMING 10 dB OF ATTENUATION IN SUMMER [3]

Hearing group	SEL_{cum} threshold (dB re 1 µPa²·s)	Range (km)					
		WTG monopile (1 pile/day)		WTG monopile (2 piles/day)		WTG jacket pin piles (4 piles/day)	
		Impact	Vibratory	Impact	Vibratory	Impact	Vibratory
Blue whale *	183	....	....	....	....	....	....
Fin whale *		3.98	0	4.11	0.08	2.25	0
Humpback whale		3.10	0	3.49	0.18	1.84	0
Minke whale		2.41	0	2.37	0	1.13	0
N.Atl. right whale *		2.81	0	3.07	0.13	1.57	0
Sei whale *		3.11	0	3.13	0	1.84	0
Mid-frequency	185	0	0	0	0	0	0
High-frequency	155	0	0	0	0	0	0
Phocids	185	0.01	0	0.11	0	0	0

* Denotes species listed under the Endangered Species Act.
[1] These are the maximum $ER_{95\%}$ values among modeling locations (L01 and L02 in Limpert et al., 2024).
[2] SouthCoast proposed vibratory pile driving for Project 2 (Scenarios 2 and 3) but not for Project 1.
[3] For acoustic propagation modeling, two average sound speed profiles were used, one for the "summer" season (May–November) and a second for the "winter" season (December). Modeling assumed vibratory pile driving would only occur in "summer," thus, table 25 does not present "winter" values.

TABLE 26—EXPOSURE RANGES ($ER_{95\%}$) [1] TO THE MARINE MAMMAL LEVEL A CUMULATIVE SOUND EXPOSURE LEVEL (SEL_{cum}) THRESHOLDS DURING CONCURRENT [2] IMPACT PILE DRIVING INSTALLATION OF TWO 9/16-m WTG MONOPILES AND FOUR 4.5-m OSP JACKET PIN PILES, OR FOUR 4.5-m WTG JACKET PIN PILES [2] AND FOUR 4.5-m OSP JACKET PIN PILE IN ONE DAY ASSUMING 10 dB OF BROADBAND NOISE ATTENUATION IN SUMMER [3]

Hearing group	SEL_{cum} threshold (dB re 1 µPa²·s)	Range (km)	
		16-m WTG monopiles (2 piles/day) and 4.5-m OSP jacket pin piles (4 piles/day)	4.5-m WTG jacket pin piles (4 piles/day) and 4.5-m OSP jacket pin piles (4 piles/day)
Low-frequency	183		
Blue whale	....	....	....
Fin whale *	....	4.53	3.58
Humpback whale	....	3.71	2.57
Minke whale	....	2.31	1.56
N.Atl. right whale *	....	3.07	1.92
Sei whale *	....	3.44	2.31
Mid-frequency	185	0	0
High-frequency	155	0	0
Phocids	185	0.3	0.17

* Denotes species listed under the Endangered Act.
[1] These are the maximum $ER_{95\%}$ values among modeling locations (L01 and L02 in Limpert *et al.,* 2024).
[2] SouthCoast proposed concurrent impact pile driving of WTG and OSP foundations for Projects 1 and 2.
[3] For acoustic propagation modeling, two average sound speed profiles were used, one for the "summer" season (May–November) and a second for the "winter" season (December).

In addition to $ER_{95\%}$ distances to Level A harassment (PTS) thresholds, exposure modeling produced $ER_{95\%}$ distances to the Level B harassment 160 dB SPL_{rms} (impact pile driving) and 120 dB SPL_{rms} (vibratory pile driving) thresholds. The following tables provide the Level B harassment $ER_{95\%}$ distances for 1) sequential installation of WTG foundations using only impact pile driving for summer and winter (table 27); 2) summer-only sequential installation of WTG foundations (both monopile and pin-piled jacket) using both vibratory and impact pile driving (table 28); and 3) concurrent installation of WTG monopile and OSP pin-piled jacket foundations (table 29, also limited to ''summer''). These ranges were used to define the outer perimeter around the Lease Area from which Roberts *et al.* (2016, 2023) model data density grid cells were selected for exposure estimation.

TABLE 27—EXPOSURE RANGES ($ER_{95\%}$) [1] TO THE MARINE MAMMAL 160 dB LEVEL B HARASSMENT (SPL_{rms}) THRESHOLD FOR SEQUENTIAL IMPACT PILE DRIVING INSTALLATION OF ONE OR TWO 9/16-m WTG MONOPILES, FOUR 4.5-m WTG JACKET PIN PILES, OR FOUR 4.5-m OSP JACKET PIN PILES IN ONE DAY, ASSUMING 10 dB OF BROADBAND NOISE ATTENUATION IN SUMMER (S) AND WINTER (W) [2]

Species	Range (km)							
	9/16-m WTG monopiles (1 piles/day)		9/16-m WTG monopiles (2 piles/day)		4.5-m WTG jacket pin piles (4 piles/day)		4.5-m OSP jacket pin piles (4 piles/day)	
	S	W	S	W [3]	S	W	S	W
North Atlantic Right whale *	6.82	7.66	6.71		3.73	3.85	4.28	4.54
Blue Whale *								
Fin Whale *	7.08	8.33	7.03		3.92	4.27	4.55	4.94
Sei Whale *	7.04	8.17	6.86		3.85	3.90	4.42	4.88
Minke Whale	6.61	7.64	6.68		3.47	3.67	4.34	4.60
Humpback Whale	6.97	8.03	6.79		3.77	4.01	4.45	4.82
Sperm Whale *	6.93	7.93	6.75		3.73	3.92	4.34	4.72
Atlantic Spotted Dolphin	6.94	8.17	6.64		3.80	3.87	4.40	4.73
Atlantic White-Sided Dolphin	6.57	7.53	6.54		3.55	3.61	4.14	4.38
Bottlenose Dolphin, Offshore	5.51	6.55	5.46		3.08	3.22	3.72	3.86
Common Dolphin	6.67	7.61	6.44		3.63	3.80	4.38	4.60
Pilot Whale	6.80	7.65	6.60		3.66	3.76	4.31	4.64
Risso's Dolphin	7.02	7.89	6.87		3.68	4.08	4.42	4.71
Harbor Porpoise	6.67	7.54	6.67		3.47	3.75	4.31	4.58
Gray Seal	7.48	8.58	7.29		4.04	4.29	4.68	5.18
Harbor Seal	6.91	7.87	6.84		3.61	4.00	4.40	4.75

* Denotes species listed under the Endangered Species Act.
[1] These are the maximum $ER_{95\%}$ values among modeling locations (L01 and L02 in Limpert *et al.,* 2024).
[2] For acoustic propagation modeling, two average sound speed profiles were used, one for the ''summer'' season (May–November) and a second for the ''winter'' season (December).
[3] Given the small number of foundation installations planned for December (see tables 19–23), modeling assumed installation of only a single monopile per day for ''winter.''

TABLE 28—EXPOSURE RANGES ($ER_{95\%}$) [1] TO THE MARINE MAMMAL 160 dB AND 120 dB LEVEL B HARASSMENT (SPL_{rms}) THRESHOLDS DURING SEQUENTIAL VIBRATORY [2] AND IMPACT PILE DRIVING INSTALLATION OF ONE OR TWO 9/16-m WTG MONOPILES [3] OR FOUR 4.5-m WTG JACKET PIN PILES [4] ASSUMING 10 dB OF BROADBAND NOISE ATTENUATION IN SUMMER [5]

Species	Range (km)					
	WTG monopile (1 pile/day)		WTG monopile (2 piles/day)		WTG jacket pin piles (4 piles/day)	
	Impact	Vibratory	Impact	Vibratory	Impact	Vibratory
North Atlantic right whale	6.77	39.14	6.72	38.20	5.12	15.21
Blue Whale *						
Fin Whale	7.06	41.83	7.00	41.69	5.48	15.75
Sei Whale	7.01	41.15	6.87	40.46	5.35	15.43
Minke Whale	6.65	38.77	6.69	38.49	5.06	14.99
Humpback Whale	6.96	39.71	6.84	39.06	5.23	15.47
Sperm Whale	6.83	40.64	6.81	40.27	5.32	15.27
Atlantic Spotted Dolphin	6.90	40.92	6.65	39.53	5.35	15.72
Atlantic White-Sided Dolphin	6.64	38.50	6.58	37.57	5.03	14.67
Bottlenose Dolphin, Offshore	5.46	34.63	5.42	33.05	4.32	13.22
Common Dolphin	6.74	40.99	6.43	39.94	5.17	15.11
Pilot Whale	6.70	40.42	6.56	39.17	5.12	15.22
Risso's Dolphin	6.97	41.86	6.86	41.27	5.26	15.45
Harbor Porpoise	6.68	37.31	6.59	36.86	5.16	14.85
Gray Seal	7.49	40.66	7.30	40.38	5.54	15.68
Harbor Seal	6.81	39.66	6.84	39.28	5.11	14.91

* Denotes species listed under the Endangered Species Act.
[1] These are the maximum $ER_{95\%}$ values among modeling locations (L01 and L02 in Limpert et al., 2024).
[2] SouthCoast proposed vibratory pile driving for Project 2, Scenarios 2 and 3, but not for Project 1.

[3] Monopiles installed by 20 minutes of vibratory pile driving using HX–CV640 hammer followed by 5,000 strikes using NNN 6600 impact hammer.

[4] Pin piles installed by 90 minutes of vibratory pile driving using S–CV640 hammer followed by 2,667 strikes using MHU 3500S impact hammer.

[5] For acoustic propagation modeling, two average sound speed profiles were used, one for the "summer" season (May–November) and a second for the "winter" season (December). Modeling assumed vibratory pile driving would only occur in "summer," thus, table 28 does not present "winter" values.

TABLE 29—EXPOSURE RANGES ($ER_{95\%}$) TO THE MARINE MAMMAL 160 dB LEVEL B HARASSMENT (SPL_{rms}) THRESHOLD DURING CONCURRENT IMPACT PILE DRIVING INSTALLATION OF TWO 9/16-m WTG MONOPILES AND FOUR 4.5-m OSP JACKET PIN PILES, OR FOUR 4.5-m WTG JACKET PIN PILES AND FOUR 4.5-m OSP JACKET PIN PILE IN ONE DAY ASSUMING 10 dB OF BROADBAND NOISE ATTENUATION IN THE SUMMER [1]

Species	Range (km)	
	16-m WTG monopiles (2 piles/day) and 4.5-m OSP jacket pin piles (4 piles/day)	4.5-m WTG jacket pin piles (4 piles/day) and 4.5-m OSP jacket pin piles (4 piles/day)
Fin whale *	4.53	3.58
Humpback whale	3.71	2.57
Minke whale	2.31	1.56
N.Atl. right whale *	3.07	1.92
Sei whale *	3.44	2.31
Mid-frequency	0	0
High-frequency	0	0
Phocids	0.3	0.17

* Denotes species listed under the Endangered Act.

[1] For acoustic propagation modeling, two average sound speed profiles were used, one for the "summer" season (May–November) and a second for the "winter" season (December). Modeling assumed concurrent installations would only occur in October, thus table 29 present values for summer only.

SouthCoast modeled potential Level A harassment and Level B harassment density-based exposure estimates for all five foundation installation schedules (P1S1–P2S3), all of which include sequential pile driving and concurrent pile driving. In creating the installation schedules used for exposure modeling, the total number of installations was spread across all potential months in which they might occur (May-December) in order to incorporate the month-to-month variability in species densities. SouthCoast assumed that the OSP jacket foundations would be installed in October for each Project.

For both WTG and OSP foundation installations, mean monthly densities were calculated by first selecting density data from 5 × 5 km (3.1 × 3.1 mi) grid cells (Roberts *et al.,* 2016; 2023) both within the Lease Area and beyond its boundaries to predetermined perimeter distances. The widths of the perimeter (referred to as a ''buffer'' in SouthCoast's application) around the activity area used to select density data were determined using the $ER_{95\%}$, distances to the isopleths corresponding to Level A harassment (tables 24–26) and Level B harassment (table 27–29) thresholds, assuming 10-dB attenuation, which vary according to sound source (impact/vibratory piling) and season. For each species, foundation type and number, installation method, and season, the most appropriate density perimeter was selected from the predetermined distances (*i.e.,* 1 km (0.6 mi), 5 km (3.1 mi), 10 km (6.2 mi), 15 km (9.3 mi), 20 km (12.4 mi), 30 km (18.6 mi), 40 km (25 mi), and 50 km (31.1 mi)) by rounding the $ER_{95\%}$ up to the nearest predetermined perimeter size. For example, if the Level A harassment (PTS) $ER_{95\%}$ was 7.1 km (4.4 mi) for a given species and activity, a 10-km (6.2-mi) perimeter was created around the Lease Area and used to calculate mean monthly densities that were used in foundation installation Level A harassment (PTS) exposure estimates (*e.g.,* table 30). Similarly, if the 160 dB Level B harassment $ER_{95\%}$ was 20.1 km (12.5 mi) for a given species or activity, a 30-km (18.6-mi) perimeter around the Lease Area was created and used to calculate mean monthly densities for exposure estimation. In cases where the $ER_{95\%}$ was larger than 50 km (31.1 mi), the 50-km (31.1-mi) perimeter was used. The 50-km (31.1-mi) limit is derived from studies of mysticetes that demonstrate received levels, distance from the source, and behavioral context are known to influence the probability of behavioral response (Dunlop *et al.,* 2017). Please see Figure 10 in SouthCoast's ITA Application for an example of a density map showing the Roberts *et al.* (2016; 2023) density grid cells overlaid on a map of the Lease Area. Given the extensive number of density tables used for exposure modeling, we do not present them here beyond the example provided in table 30. Please see tables in Section H.2.1.1 of Appendix H in Limpert *et al.* (2024) for densities within the areas defined by additional perimeter sizes (*i.e.,* 1 km (0.6 mi), 5 km (3.1 mi), 10 km (6.2 mi), 15 km (9.3 mi), 20 km (12.4 mi), 30 km (18.6 mi), 40 km (25 mi), and 50 km (31.1 mi)).

TABLE 30—MEAN MONTHLY MARINE MAMMAL DENSITY ESTIMATES (ANIMALS km[1]) WITHIN 10-km (6.2 mi) OF THE LEASE AREA PERIMETER

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
North Atlantic right whale *	0.0054	0.0060	0.0054	0.0050	0.0037	0.0008	0.0004	0.0003	0.0004	0.0006	0.0011	0.0033
Blue Whale *	0.0000	0.000	0.000	0.000	0.000	0.000	0.0000	0.000	0.000	0.000	0.000	0.000
Fin Whale *	0.0022	0.0018	0.0015	0.0015	0.0030	0.0029	0.0047	0.0036	0.0027	0.0009	0.0005	0.0004
Sei Whale *	0.0004	0.0003	0.0005	0.0012	0.0019	0.0007	0.0002	0.0001	0.0002	0.0004	0.0009	0.0007
Minke Whale	0.0011	0.0013	0.0014	0.0075	0.0151	0.0175	0.0080	0.048	0.0054	0.0050	0.0005	0.0007
Humpback Whale	0.0003	0.0003	0.0005	0.0018	0.0031	0.0035	0.0021	0.0012	0.0017	0.0025	0.0020	0.0003
Sperm Whale *	0.0005	0.0002	0.0002	0.0000	0.0002	0.0003	0.0005	0.0017	0.0009	0.0006	0.0004	0.0003
Atlantic Spotted Dolphin	0.0000	0.0000	0.0000	0.0001	0.0004	0.0006	0.0005	0.0008	0.0043	0.0068	0.0017	0.0002
Atlantic White-Sided Dolphin	0.0263	0.0158	0.0111	0.0169	0.0369	0.0380	0.0204	0.0087	0.0193	0.0298	0.0225	0.0321
Bottlenose Dolphin, Offshore	0.0051	0.0012	0.0008	0.0022	0.0097	0.0163	0.0177	0.0200	0.0198	0.0181	0.0160	0.0129
Common Dolphin	0.0933	0.0362	0.0320	0.0474	0.0799	0.1721	0.01549	0.2008	0.3334	0.3331	0.1732	0.1467
Pilot Whales	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029
Risso's Dolphin	0.0005	0.0001	0.0000	0.0003	0.0014	0.0010	0.0013	0.0028	0.0035	0.0017	0.0015	0.0020
Harbor Porpoise	0.1050	0.1135	0.1081	0.0936	0.0720	0.0174	0.0174	0.0156	0.0165	0.0203	0.0219	0.0675
Gray Seal	0.0594	0.0585	0.0419	0.0379	0.0499	0.0075	0.0019	0.0016	0.0028	0.0064	0.0246	0.0499
Harbor Seal	0.1335	0.1314	0.0941	0.0850	0.1120	0.0167	0.0043	0.0037	0.0063	0.0145	0.0552	0.1120

* Listed as Endangered under the ESA.
[1] Densities were calculated using the 2022 Duke Habitat-Based Marine Mammal Density Models (Roberts *et al.,* 2016; 2023).

As previously discussed, SouthCoast's ITA application includes installation of up to 147 WTG foundations and up to 5 OSP foundations in 149 positions within the Lease Area. However, for the purposes of exposure modeling, SouthCoast assumed installation of two OSPs (one per Project), each supported by a piled jacket foundation secured by 12 to 16 pin piles.

TABLE 31—FOUNDATION INSTALLATION SCENARIOS

Scenario	Method: impact or vibratory	WTG foundation type	WTG foundation number	OSP pin pile number	Piling days
Project 1					
Scenario 1	Impact	Monopile	71	12	59
Scenario 2	Impact	Jacket	85	16	85
Project 2					
Scenario 1	Impact	Monopile	68	12	53
Scenario 2	Both	Monopile	73	12	49
Scenario 3	Both	Jacket	62	16	62

SouthCoast calculated take estimates for all five foundation installation scenarios presented in their application, based on modeled exposures and other relevant data (*e.g.,* PSO date, mean group sizes). Tables 32–36 provide the results of marine mammal exposure modeling, which assumes 10-dB attenuation and seasonal restrictions, for each scenario. The Level A harassment exposure estimates represent animats that exceeded the PTS SEL_{cum} thresholds as this metric was exceeded prior to exceeding PTS SPL_{peak} thresholds The Level B harassment exposure estimates shown for Project 1 Scenarios 1 and 2, and Project 2 Scenario 1 represent animats exceeding the unweighted 160 dB SPL_{rms} criterion because impact pile driving would be the only installation method in these scenarios. The Level B harassment exposure estimates shown for Project 2 Scenarios 2 and 3 (tables 32–36) represent animats exceeding the unweighted 120 dB SPL_{rms} and/or 160 dB SPL_{rms} criteria because these scenarios require both vibratory and impact pile driving. Columns 4 and 5 in tables 32–36 show what the take estimates would be if the PSO data or average group size, respectively, were used to inform the number of proposed takes by Level B harassment in lieu of the density and exposure modeling. The last column represents the total Level B harassment take estimate for each species, based on the highest of the three estimates (density-based exposures, PSO data, or average group size).

Below we present the exposure estimates and the take estimates for these scenarios (Tables 32–36). For Project 1, no single scenario results in a greater amount of take for all species; therefore, the maximum annual and 5-year total amount of take proposed for authorization is a combination of both scenarios depending on species (*i.e.,* the scenario which resulted in the greatest amount of take was carried forward for each species). For Project 2, Scenario 2 results in the greatest amount of take for all species and is carried forward in the maximum annual and 5-year total amount of take proposed for authorization.

TABLE 32—PROJECT 1 SCENARIO 1 (P1S1): ESTIMATED LEVEL A HARASSMENT [1] AND LEVEL B HARASSMENT [2] TAKE FROM INSTALLATION OF 71 WTG MONOPILE FOUNDATIONS AND 12 OSP JACKET PIN PILES, ASSUMING 10 dB OF NOISE ATTENUATION

Species	Level A harassment exposure modeling take estimate P1S1	Level B harassment exposure modeling take estimate P1S1	PSO data take estimate	Mean group size	Estimated level A harassment take P1S1	Estimated level B harassment take P1S1
Blue whale *	N/A	N/A		1.0	0	1
Fin whale *	13.2	38.8	3.4	1.8	14	39
Humpback whale	9.3	28.4	32.4	2.0	10	33
Minke whale	45.7	168.6	6.4	1.4	46	169
North Atlantic right whale *	2.1	8.8		2.4	3	9
Sei whale *	1.3	4.7	0.9	1.6	2	5
Atlantic spotted dolphin	0.0	22.71		29.0	0	29
Atlantic white-sided dolphin	0.0	520.8		27.9	0	521
Bottlenose dolphin	0.0	267.4	84.2	12.3	0	268
Common dolphin	0.0	6,975.3	735.6	34.9	0	6.976
Harbor porpoise	0.0	312.2	0.1	2.7	0	313
Pilot whales	0.0	60.7	3.7	10.3	0	61
Risso's dolphin	0.0	36.5		5.4	0	37
Sperm whale *	0.0	12.4	0.3	2.0	0	13
Gray seal	0.1	209.6	2.0	1.4	1	210
Harbor seal	0.0	15.1	30.5	1.4	1	31

* Denotes species listed under the Endangered Species Act.

[1] Level A harassment take estimates assumes no implementation of monitoring and mitigation measures beyond 10-dB attenuation using a Noise Mitigation System, and seasonal restrictions.

[2] Level B harassment take estimates are based on distances to the unweighted 120 dB threshold for vibratory pile driving and 160 dB threshold for impact pile driving.

TABLE 33—PROJECT 1 SCENARIO 2 (P1S2): ESTIMATED LEVEL A HARASSMENT [1] AND LEVEL B HARASSMENT [2] TAKE FROM INSTALLATION OF 85 PILED JACKET WTG FOUNDATIONS AND 16 OSP JACKET PIN PILES ASSUMING 10 dB OF NOISE ATTENUATION

Species	Level A harassment exposure modeling take estimate P1S2	Level B harassment exposure modeling take estimate P1S2	PSO data take estimate	Mean group size	Estimated level A harassment take P1S2	Estimated level B harassment take P1S2
Blue whale *	N/A	N/A		1.0	0	1
Fin whale *	10.3	22.4	3.8	1.8	11	23
Humpback whale	11.7	28.4	37.0	2.0	12	37
Minke whale	45.6	196.1	7.3	1.4	46	197
North Atlantic right whale *	3.9	12.0		2.4	4	12
Sei whale *	2.3	6.1	1.0	1.6	3	7
Atlantic spotted dolphin	0.0	24,4		29.0	0	29
Atlantic white-sided dolphin	0.0	727.1		27.9	0	728
Bottlenose dolphin	0.0	303.5	96.0	12.3	0	304
Common dolphin	0.0	8.552.1	839.2	34.9	0	8,553
Harbor porpoise	0.0	377.3	0.2	2.7	0	378
Pilot whales	0.0	39.8	4.2	10.3	0	40
Risso's dolphin	0.0	29.1		5.4	0	30
Sperm whale *	0.0	10.0	0.3	2.0	0	10
Gray seal	0.2	224.9	2.3	1.4	1	225
Harbor seal	0.0	25.8	34.8	1.4	0	35

* Denotes species listed under the Endangered Species Act.

[1] Level A harassment take estimates assumes no implementation of monitoring and mitigation measures beyond 10-dB attenuation using a Noise Mitigation System, and seasonal restrictions.

[2] Level B harassment take estimates are based on distances to the unweighted 120 dB threshold for vibratory pile driving and 160 dB threshold for impact pile driving.

TABLE 34—PROJECT 2 SCENARIO 1 (P2S1): ESTIMATED LEVEL A HARASSMENT [1] AND LEVEL B HARASSMENT [2] TAKE FROM INSTALLATION OF 68 MONOPILE WTG FOUNDATIONS AND 12 OSP JACKET PIN PILES ASSUMING 10 dB OF NOISE ATTENUATION

Species	Level A harassment exposure modeling take estimate P2S1	Level B harassment exposure modeling take estimate P2S1	PSO data take estimate	Mean group size	Estimated level A harassment take P2S1	Estimated level B harassment take P2S1
Blue whale *	N/A	N/A		1.0	0	1
Fin whale *	11.0	31.9	3.2	1.8	11	32
Humpback whale	9.7	28.8	31.1	2.0	10	32
Minke whale	45.0	163.9	6.2	1.4	46	164
North Atlantic right whale *	2.2	9.1		2.4	3	10
Sei whale *	1.5	5.2	0.8	1.6	2	6
Atlantic spotted dolphin	0.0	26.05		29.0	0	29
Atlantic white-sided dolphin	0.0	550.1		27.9	0	551
Bottlenose dolphin	0.0	249.7	80.6	12.3	0	250
Common dolphin	0.0	6,912.3	704.5	34.9	0	6,913
Harbor porpoise	0.0	304.3	0.1	2.7	0	305
Pilot whales	0.0	57.5	3.5	10.3	0	58
Risso's dolphin	0.0	31.9		5.4	0	32
Sperm whale *	0.0	10.4	0.3	2.0	0	11
Gray seal	0.1	234.1	1.9	1.4	1	235
Harbor seal	0.0	16.9	29.2	1.4	1	30

* Denotes species listed under the Endangered Species Act.
[1] Level A harassment take estimates assumes no implementation of monitoring and mitigation measures beyond 10-dB attenuation using a Noise Mitigation System, and seasonal restrictions.
[2] Level B harassment take estimates are based on distances to the unweighted 120 dB threshold for vibratory pile driving and 160 dB threshold for impact pile driving.

TABLE 35—PROJECT 2 SCENARIO 2 (P2S2): ESTIMATED LEVEL A HARASSMENT [1] AND LEVEL B HARASSMENT [2] TAKE FROM INSTALLATION OF 73 MONOPILE WTG FOUNDATIONS AND 12 OSP JACKET PIN PILES ASSUMING 10 dB OF NOISE ATTENUATION

Species	Level A harassment exposure modeling take estimate P2S2	Level B harassment exposure modeling take estimate P2S2	PSO data take estimate	Mean group size	Estimated level A harassment take P2S2	Estimated level B harassment take P2S2
Blue whale *	N/A	N/A		1.0	0	1
Fin whale *	14.3	482.0	7.2	1.8	15	481
Humpback whale	10.7	282.0	69.9	2.0	11	282
Minke whale	49.6	868.2	13.9	1.4	50	869
North Atlantic right whale *	2.3	100.0		2.4	3	100
Sei whale *	1.4	41.9	1.9	1.6	2	42
Atlantic spotted dolphin	0.0	319.59		29.0	0	320
Atlantic white-sided dolphin	0.0	3,045.0		27.9	0	3,045
Bottlenose dolphin	0.0	2,341.1	181.4	12.3	0	2,342
Common dolphin	0.0	41,092.2	1,585.1	34.9	0	41,093
Harbor porpoise	0.0	2,381.3	0.3	2.7	0	2,382
Pilot whales	0.0	634.0	8.0	10.3	0	635
Risso's dolphin	0.0	1,759.8		5.4	0	1,760
Sperm whale *	0.0	121.4	0.6	2.0	0	122
Gray seal	0.2	8,330.8	4.3	1.4	1	8,331
Harbor seal	0.0	432.0	65.8	1.4	1	432

* Denotes species listed under the Endangered Species Act.
[1] Level A harassment take estimates assumes no implementation of monitoring and mitigation measures beyond 10-dB attenuation using a Noise Mitigation System, and seasonal restrictions.
[2] Level B harassment take estimates are based on distances to the unweighted 120 dB threshold for vibratory pile driving and 160 dB threshold for impact pile driving.

TABLE 36—PROJECT 2 SCENARIO 3 (P2S3): ESTIMATED LEVEL A HARASSMENT [1] AND LEVEL B HARASSMENT [2] TAKE FROM INSTALLATION OF 62 PILED JACKET WTG FOUNDATIONS AND 16 OSP JACKET PIN PILES ASSUMING 10 dB OF NOISE ATTENUATION

Species	Level A harassment exposure modeling take estimate P2S3	Level B harassment exposure modeling take estimate P2S3	PSO data take estimate	Mean group size	Estimated level A harassment take P2S3	Estimated level B harassment take P2S3
Blue whale *	N/A	N/A		1.0	0	1
Fin whale *	8.1	113.0	3.4	1.8	9	113
Humpback whale	8.7	97.7	32.4	2.0	9	98
Minke whale	34.9	491.1	6.4	1.4	35	492
North Atlantic right whale *	3.1	40.0		2.4	4	40
Sei whale *	1.7	18.0	0.9	1.6	2	19
Atlantic spotted dolphin	0.0	74.62		29.0	0	75
Atlantic white-sided dolphin	0.0	1,647.5		27.9	0	1,648
Bottlenose dolphin	0.0	829.5	84.2	12.3	0	830
Common dolphin	0.0	20,176.9	735.6	34.9	0	20,177
Harbor porpoise	0.0	1,001.1	0.1	2.7	0	1,002
Long-finned pilot whale	0.0	195.0	3.7	10.3	0	195
Risso's dolphin	0.0	135.7		5.4	0	136
Sperm whale *	0.0	35.1	0.3	2.0	0	36
Gray seal	0.3	992.8	2.0	1.4	1	993
Harbor seal	0.0	70.2	30.5	1.4	0	71

* Denotes species listed under the Endangered Species Act.
[1] Level A harassment take estimates assumes no implementation of monitoring and mitigation measures beyond 10-dB attenuation using a Noise Mitigation System, and seasonal restrictions.
[2] Level B harassment take estimates are based on distances to the unweighted 120 dB threshold for vibratory pile driving and 160 dB threshold for impact pile driving.

The model-based Level A harassment (PTS) exposure estimates are conservative in that they assume no mitigation measures other than 10 dB of sound attenuation and seasonal restrictions. Although the enhanced mitigation and monitoring measures SouthCoast proposed (see Proposed Mitigation and Proposed Monitoring and Reporting sections below) are specifically focused on reducing pile-driving impacts on North Atlantic right whales, other marine mammal species would experience conservation benefits as well (*e.g.,* extended seasonal restrictions, increased monitoring effort and larger minimum visibility zone improving detectability and mitigation efficacy, extended pile-driving delays (24–48 hrs) if a North Atlantic right whale is detected). When implemented, the additional mitigation measures described in the Proposed Mitigation section, including soft-start and clearance/shutdown processes, would reduce the already very low probability of Level A harassment. Additionally, modeling does not include any avoidance behavior by the animals, yet we know many marine mammals avoid areas of loud sounds. Thus, it is unlikely that an animal would remain within the Level A harassment SEL_{cum} zone long enough to incur PTS and could potentially redirect their movements away from the pile installation location in response to the soft-start procedure. For these reasons, SouthCoast is not requesting Level A harassment (PTS) take incidental to foundation installation for most marine mammal species, even though animal movement modeling estimated that a small number of PTS exposures could occur for multiple species (as shown in tables 32–36). In the case of North Atlantic right whales, the potential for Level A harassment (PTS) has been determined to be reduced to a de minimis likelihood due to the enhanced mitigation and monitoring measures, which include even larger clearance and shutdown zones (see Proposed Mitigation and Proposed Monitoring and Reporting sections). SouthCoast did not request, and NMFS is not proposing to authorize, take by Level A harassment of North Atlantic right whales.

However, as a precautionary measure, because the WTG and OSP foundation installation Level A harassment $ER_{95\%}$ distances for fin whales are, in some cases, substantially larger than for other mysticete whales, Level A harassment take is being requested for this species. The second largest mysticete Level A harassment $ER_{95\%}$ distance was selected as the clearance/shutdown zone size for baleen whales to avoid Level A harassment take of other mysticete species. SouthCoast assumed that the large clearance/shutdown zone size along with the soft-start procedure and potential for animal aversion to loud sounds would prevent Level A harassment take of other species. In most installation scenarios, 15–20 percent of the fin whale Level A harassment $ER_{95\%}$ zone extends beyond the planned clearance/shutdown distance for non-NARW baleen whales, therefore, the requested Level A take for fin whales incidental to foundation installation is 20 percent of the fin whale Level A exposure estimates produced by the exposure modeling (Project 1 = 14; Project 2 = 15). This results in a request for 3 Level A harassment takes for fin whales for both Project 1 and Project 2 (total of 6 across Projects). Table 37 shows the requested take incidental to foundation installation that is included in the total take NMFS proposes to authorize.

For Project 1, no single scenario resulted in a greater amount of take for all species; therefore, the annual Level B harassment take numbers carried forward in table 37 reflect the maximum take estimate for each species between the two possible foundation installation scenarios (P1S1 and P1S2). Similarly for Project 2, the number of species-specific Level B harassment takes in table 37 reflects the maximum take estimate among the three analyzed scenarios (P2S1, P2S2, P2S3) which, in all cases, resulted from installations of P2S2. However, the 5-year total take incidental to foundation installation proposed for authorization for a given species (shown in the last two columns in table 37) is less than the direct sum across Projects 1 and 2 values in the columns to the left. This is because the total number of takes must be based on a realistic construction scenario sequence that does not include take estimates resulting from modeling of installation of more than 149 foundations. For example, the number of estimated sei whale Level B harassment takes in column 3 of table 37 resulted from modeling installation of Project 1 Scenario 2 (85 WTG foundations) and the number in column 5 resulted from modeling installation of Project 2 Scenario 2 (73 WTG foundations), representing take incidental to installation of a number of WTG foundations (158) larger than the maximum in SouthCoast's PDE (147). As described previously, some combinations of Project 1 and 2 scenarios are not possible because they would exceed the number of foundation positions available. However, SouthCoast indicates that the scenario chosen for Project 2 is dependent on the scenario installed for Project 1, which is uncertain at this time. Given this uncertainty, SouthCoast considers each of the five installation scenarios (Project 1, Scenarios 1 or 2; Project 2, Scenarios 1–3) described in table 2 possible. To ensure the total take proposed for authorization is based on a realistic number of foundations, the 5-year total is based on installation of Project 1 Scenario 1 and Project 2 Scenario 2 (146 total foundations). This ensures that the take proposed for authorization for Project 2 represents the maximum possible yearly take among the three scenarios considered for Project 2 as it is estimated using the largest potential ensonified zone (resulting from vibratory pile driving) and that sufficient take is requested for the full buildout. SouthCoast also considers the combination of Project 1 Scenario 2 and Project 2 Scenario 3 (147 total foundations) a realistic construction plan. However, the 5-year take request is based on Project 1 Scenario 1 combined with Project 2 Scenario 2 because it reflects a realistic construction plan that results in the greatest number of estimated takes.

TABLE 37—LEVEL A HARASSMENT (PTS) AND LEVEL B HARASSMENT TAKE INCIDENTAL TO WTG AND OSP FOUNDATION INSTALLATION PROPOSED TO BE AUTHORIZED

Species	SouthCoast requested and NMFS proposed take					
	Project 1—maximum between scenarios 1–2 (P1S1 and P1S2)		Project 2—maximum among scenarios 1–3 (P2S1, P2S2, and P1S2)		Total based on realistic combination of project 1 scenario 1 and project 2 scenario 2	
	Level A harassment	Level B harassment	Level A harassment	Level B harassment	Level A harassment	Level B harassment
Blue whale *		1		1		2
Fin whale *	3	39	3	481	6	520
Humpback whale		37		282		315
Minke whale		197		869		1,038
North Atlantic right whale *		12		100		109
Sei whale *		7		42		47
Atlantic spotted dolphin		29		320		349
Atlantic white-sided dolphin		728		3,045		3,566
Bottlenose dolphin		304		2,342		2,610
Common dolphin		8,553		41,093		48,069
Harbor porpoise		378		2,382		2,695
Pilot whales		61		635		696
Risso's dolphin		37		1,760		1,797
Sperm whale *		13		122		135
Gray seal		225		8,331		8,451
Harbor seal		35		432		463

* Denotes species listed under the Endangered Species Act.

UXO/MEC Detonation

SouthCoast may detonate up to 5 UXO/MECs within the Lease Area and 5 within the ECCs (10 UXOs/MECs total) over the 5-year effective period of the proposed rule. Charge weights of 2.3 kgs (2.2 lbs), 9.1 kgs (20.1 lbs), 45.5 kgs (100 lbs), 227 kgs (500 lbs), and 454 kgs (1,001 lbs), were modeled to determine acoustic ranges to mortality, gastrointestinal injury, lung injury, PTS, and TTS thresholds. To do this, the source pressure function used for estimating peak pressure level and impulse metrics was calculated with an empirical model that approximates the rapid conversion of solid explosive to gaseous form in a small bubble under high pressure, followed by exponential pressure decay as that bubble expands (Hannay and Zykov, 2022). This initial empirical model is only valid close to the source (within tens of meters), so alternative formulas were used beyond those distances to a point where the sound pressure decay with range transitions to the spherical spreading model. The SEL thresholds occur at distances of many water depths in the relatively shallow waters of the Project (Hannay and Zykov, 2022). As a result, the sound field becomes increasingly influenced by the contributions of sound energy reflected from the sea surface and sea bottom multiples times. To account for this, propagation modeling was carried out in decidecade frequency bands using JASCO's MONM. This model applies a parabolic equation approach for frequencies below 4 kHz and a Gaussian beam ray trace model at higher frequencies (Hannay and Zykov, 2022). In SouthCoast project's location, sound speed profiles generally change little with depth, so these environments do not have strong seasonal dependence (see Figure 2 in the SouthCoast Underwater Acoustic Modeling of UXO/MEC report). The propagation modeling for UXO/MEC detonations was performed using an average sound speed profile for ''September'', which is slightly downward refracting. Please see the supplementary report for SouthCoast's ITA application titled ''Underwater Acoustic Modeling of Detonations of Unexploded Ordnance (UXO/MEC removal) for Mayflower Wind Farm Construction,'' found on NMFS' website (*https://www.fisheries.noaa.gov/action/incidental-take-authorization-SouthCoast-wind-llc-construction-and-operation-SouthCoast-wind*) for more technical details about the modeling methods, assumptions and environmental parameters used as inputs (Hannay and Zykov, 2022).

The exact type and net explosive weight of UXO/MECs that may be detonated are not known at this time; however, they are likely to fall into one of the bins identified in table 38. To capture a range of UXO/MECs, five categories or ''bins'' of net explosive weight, established by the U.S. Navy (2017a), were selected for acoustic modeling (table 38).

TABLE 38—NAVY ''BINS'' AND CORRESPONDING MAXIMUM CHARGE WEIGHTS (EQUIVALENT TNT) MODELED

Navy bin designation	Maximum equivalent (kg)	Weight (TNT) (lbs)
E4	2.3	5
E6	9.1	20
E8	45.5	100
E10	227	500
E12	454	1,000

These charge weights were modeled at five different locations and associated depths located within the Lease Area and ECCs. Two sites are located in the Lease Area, S1 (60 m (196.9 ft)) and S2 (45 m (147.6 ft)). Three sites are located within the ECCs, one along the western ECC (S3, 30 m) and two along the eastern ECC (S4, 20m (65.6 ft); S5, 10 m (32.8 ft))). Sites 1 and 2 were deemed to be representative of the Lease Area and Sites 3–5 were deemed representative of the ECCs where detonations could occur (see Figure 1 in Hannay and Zykov, 2022). Exact locations for the modeling sites are shown in Figure 1 of Hannay and Zykov (2022).

All distances to isopleths modeled can be found in Hannay and Zykov (2022). It is not currently known how easily SouthCoast would be able to identify the size and charge weights of UXOs/MECs in the field. Therefore, NMFS has proposed to require SouthCoast to implement mitigation measures assuming the largest E12 charge weight as a conservative approach. As such, distances to PTS (tables 39 and 40) and TTS thresholds (tables 41 and 42) for only the 454 kg (1,001 lbs) UXO/MEC are presented, as this size UXO/MEC has the greatest potential for these impacts and is what is used to estimate take. NMFS notes that it is extremely unlikely that all 10 of the UXO/MECs found and requiring detonation for the SouthCoast Project would consist of this 454 kg (1,001 lbs) charge weight. If SouthCoast is able to reliably demonstrate that they can easily and accurately identify charge weights in the field, NMFS will consider mitigation and monitoring zones based on UXO/MEC charge weight for the final rulemaking rather than assuming the largest charge weight in every situation.

To further reduce impacts to marine mammals, SouthCoast would deploy a NAS (a DBBC, at minimum) during every detonation event, similar to that described for foundation installation, with the expectation that their selected system would be able to achieve 10-dB attenuation. This expectation is based on an assessment of UXO/MEC clearance activities in European waters as summarized by Bellman and Betke (2021). NMFS would require SouthCoast to deploy NAS(s) (a dBBC, at minimum) during all denotations, thus it was deemed appropriate to apply attenuation R95% distances to determine the size of the ensonified zone for take estimation.

Given the impact zone sizes and the required mitigation and monitoring measures, neither mortality nor non-auditory injury are considered likely to result from the activity. NMFS does not expect or propose to authorize any non-auditory injury, serious injury, or mortality of marine mammals from UXO/MEC detonation. The modeled distances, assuming 10 dB of sound attenuation, to the mortality threshold for all UXO/MECs sizes for all animal masses for the ECCs and Lease Area are small (*i.e.,* 28–368 m (91.9 ft–1,207.4 ft); see Tables 40–44 in SouthCoast's supplemental UXO/MEC modeling report; Hannay and Zykov, 2022), as compared to the distance/area that can be effectively monitored. The modeled distances to non-auditory injury thresholds range from 67–694 m (219.8–2,276.9 ft), assuming 10 dB of sound attenuation (see Tables 35–39 in SouthCoast's supplemental UXO/MEC modeling report; Hannay and Zykov, 2022). SouthCoast would be required to conduct extensive monitoring using both PSOs and PAM operators and clear an area of marine mammals prior to any detonation of UXOs/MECs. Given that SouthCoast would be employing multiple platforms to visually monitor marine mammals as well as passive acoustic monitoring, it is reasonable to assume that marine mammals would be reliably detected within approximately 700 m (2,296.59 ft) of the UXO/MEC being detonated, the potential for mortality or non-auditory injury is *de minimis.* SouthCoast did not request, and NMFS is not proposing to authorize, take by mortality or non-auditory injury. For this reason, we are not presenting all modeling results here; however, they can be found in SouthCoast's UXO/MEC acoustic modeling report (Hannay and Zykov, 2022).

To estimate the maximum ensonified zones that could result from UXO/MEC detonations, the largest acoustic ranges ($R_{95\%}$; assuming 10-dB attenuation) to PTS and TTS thresholds for the E12 UXO/MEC charge weight were used as radii to calculate the area of a circle (pi × r^2; where r is the range to the threshold level) for each marine mammal hearing group. The largest range for the Lease Area from Sites 1 and 2 (S1 and S2) is shown in tables 39 and 41 and for the ECCs the largest range from Sites 3–5 (S3, S4, and S5) is shown in tables 40 and 42. These results represent the largest area potentially ensonified above the PTS and TTS threshold levels from a single detonation within the SouthCoast ECCs (tables 40 and 42) and Lease Area (tables 39 and 41).

TABLE 39—LARGEST SEL-BASED $R_{95\%}$ PTS-ONSET RANGES (IN METERS) SITES S1–S2 (LEASE AREA) MODELED DURING UXO/MEC DETONATION, ASSUMING 10-dB SOUND REDUCTION

Marine mammal hearing group	Representative site used for modeling	Distance (m) to PTS threshold during E12 (454 kg) detonation		Maximum ensonified zone (km²)
		R_{max}	$R_{95\%}$	
Low-Frequency Cetaceans	Site S1	4,490	4,300	58.1
Mid-Frequency Cetaceans	Site S2	349	322	0.3
High-frequency cetaceans	Site S1	9,280	8,610	233
Phocid pinnipeds (in water)	Site S1	1,680	1,560	7.6

[1] For each hearing group, a given range ($R_{95\%}$ or R_{max}) reflects the modeling result for S1 or S2, whichever value was largest.

TABLE 40—LARGEST SEL-BASED $R_{95\%}$ PTS-ONSET RANGES (IN METERS) SITES S3–S5 (ECCS) MODELED DURING UXO/MEC DETONATION, ASSUMING 10-dB SOUND REDUCTION

Marine mammal hearing group	Representative site used for modeling	Distance (m) to PTS threshold during E12 (454 kg) detonation		Maximum ensonified zone (km²)
		R_{max}	$R_{95\%}$	
Low-frequency cetaceans	Site S5	5,830	4,840	73.6
Mid-frequency cetaceans	Site S5	659	597	1.1
High-frequency cetaceans	Site S3	8,190	7,390	172
Phocid pinnipeds (in water)	Site S5	2,990	2,600	21.2

[1] For each hearing group, a given range ($R_{95\%}$ or R_{max}) reflects the modeling result for S3, S4, or S5, whichever value was largest.

TABLE 41—LARGEST SEL-BASED $R_{95\%}$ TTS-ONSET RANGES (IN METERS) FROM SITES S1–S2 (LEASE AREA) MODELED DURING UXO/MEC DETONATION, ASSUMING 10-dB SOUND REDUCTION

Marine mammal hearing group	Representative site used for modeling	Distance (m) to TTS threshold during E12 (454 kg) detonation		Maximum ensonified zone (km²)
		R_{max}	$R_{95\%}$	
Low-frequency cetaceans	Site S2	13,200	11,900	445
Mid-frequency cetaceans	Site S1	2,820	2,550	20.4
High-frequency cetaceans	Site S1	15,400	14,100	625
Phocid pinnipeds (in water)	Site S2	7,610	6,990	154

[1] For each hearing group, a given range ($R_{95\%}$ or R_{max}) reflects the modeling result for S1 or S2, whichever value was largest.

TABLE 42—LARGEST SEL-BASED $R_{95\%}$ TTS-ONSET RANGES (IN METERS) FROM SITES S3–S5 (ECCS) MODELED DURING UXO/MEC DETONATION, ASSUMING 10-dB SOUND REDUCTION

Marine mammal hearing group	Representative site used for modeling	Distance (m) to TTS threshold during E12 (454 kg) detonation		Maximum ensonified zone (km²)
		R_{max}	$R_{95\%}$	
Low-frequency cetaceans	Sites S4 and S5	13,500	11,800	437
Mid-frequency cetaceans	Site S3	2,820	2,480	19.3
High-frequency cetaceans	Site S4 and S5	15,600	13,700	589
Phocid pinnipeds (in water)	Sites S4 and S5	7,820	7,020	155

[1] For each hearing group, a given range ($R_{95\%}$ or R_{max}) reflects the modeling result for S3, S4, or S5, whichever value was largest.

To avoid any *in situ* detonations of UXO/MECs during periods when North Atlantic right whale densities are highest in and near the ECCs and Lease Area, this activity would be restricted from December 1 through April 30, annually. Accordingly, for each species, they selected the highest average monthly density between May and November and assumed all 10 UXO/MECs would be detonated in that month to conservatively estimate exposures from UXO/MEC detonation for a given species in any given year. Given UXO/MECs detonations have the potential to occur anywhere within the Lease Area and ECCs, a 15-km (9.3-mi) perimeter was applied around the Lease and, separately, the ECCs to define the area over which densities would be evaluated. As described above, in the case of blue whales and pilot whales, monthly densities were unavailable; therefore, annual densities were used instead.

Table 43 provides those densities and the associated months in which the species-specific densities are highest for the Lease Area and ECCs.

TABLE 43—MAXIMUM AVERAGE MONTHLY MARINE MAMMAL DENSITIES (INDIVIDUALS/km²) WITHIN 15 km OF THE SOUTHCOAST PROJECT ECCS AND LEASE AREA FROM MAY THROUGH NOVEMBER, AND THE MONTH IN WHICH THE MAXIMUM DENSITY OCCURS

Species	ECCs		Lease area	
	Maximum average monthly density (individual/km²)	Maximum density month	Maximum density	Maximum average monthly density (individual/km²)
Blue whale *	0.0000	Annual	0.0000	Annual
Fin whale *	0.0013	May	0.0047	July
Humpback whale	0.0012	May	0.0035	June
Minke whale	0.0107	May	0.0175	June
North Atlantic right whale *	0.0022	May	0.0037	May
Sei whale *	0.0007	May	0.0019	May
Atlantic spotted dolphin	0.0002	September	0.0068	October
Atlantic white-sided dolphin	0.0102	May	0.0380	June
Bottlenose dolphin	0.0042	August	0.0200	August
Common dolphin	0.0335	November	0.3334	September
Harbor porpoise	0.0284	May	0.0720	May
Pilot whales	0.0002	Annual	0.0029	Annual
Risso's dolphin	0.0004	November	0.0035	September
Sperm whale *	0.0003	August	0.0017	August
Grey seal	0.1051	May	0.0499	May
Harbor seal	0.2362	May	0.1120	May

* Denotes species listed under the Endangered Species Act.

Based on the available information, up to five UXO/MEC detonations may be necessary in the ECCs and up to five in the Lease Area (10 UXO/MEC detonations total). To estimate take incidental to UXO/MEC detonations in the SouthCoast ECCs, the maximum ensonified areas based on the largest $R_{95\neq}$ to Level A harassment (PTS) and Level B harassment (TTS) thresholds (assuming 10-dB attenuation) from a single detonation (assuming the largest UXO/MEC charge weight) in the ECC, as shown in tables 40 and 42, were multiplied by three (the maximum number of UXOs/MECs that are expected to be detonated in the SouthCoast ECC in Year 1 of construction) and two (the maximum number of UXOs/MECs that are expected to be detonated in the SouthCoast ECC in Year 2 of construction). The results were then multiplied by the marine mammal densities shown in table 43, resulting in the exposures estimates in table 44. The division of five total detonations within the ECCs across the two years was based on the relative number of foundations to be installed in each year. The same method was applied using the maximum single detonation areas shown in table 39 and table 41 to calculate the potential take from UXO/MEC detonations in the Lease area. The resulting density-based take estimates for all 10 UXO/MEC detonations are summarized in table 44. Table 52 in SouthCoast's application provides annual take estimates separately for each of the two years during which UXO/MEC detonations may occur.

As shown below in table 44, the likelihood of marine mammal exposures above the PTS threshold is low, especially considering the instantaneous nature of the acoustic signal and the fact that there will be no more than 10 UXO/MECs detonated throughout the effective period of the authorization. Further, NMFS is proposing mitigation and monitoring measures intended to minimize the potential for PTS for most marine mammal species, and the extent and severity of behavioral harassment (TTS), including: (1) time of year/seasonal restrictions; (2) time of day restrictions; (3) use of PSOs to visually observe for North Atlantic right whales; (4) use of PAM to acoustically detect North Atlantic right whales; (5) implementation of clearance zones; (6) use of noise mitigation technology; and, (7) post-detonation monitoring visual and acoustic monitoring by PSOs and PAM operators (see Proposed Mitigation and Proposed Monitoring and Reporting sections below). However, given the relatively large distances to the high-frequency cetacean Level A harassment (PTS, SEL_{cum}) isopleth applicable to harbor porpoises and the difficulty detecting this species at sea, NMFS is proposing to authorize 109 Level A harassment takes of harbor porpoise from UXO/MEC detonations. Similarly, seals are difficult to detect at longer ranges, and although the distances to the phocid hearing group SEL PTS threshold are not as large as those for high-frequency cetaceans, it may not be possible to detect all seals within the PTS threshold distances even with the proposed monitoring measures. Therefore, NMFS is proposing to authorize 40 Level A harassment takes of gray seals and 4 Level A harassment takes of harbor seals incidental to UXO/MEC detonation. Although exposure modeling resulted in small numbers of estimated Level A harassment (PTS) exposures for large whales (*i.e.,* fin, humpback, minke, North Atlantic, and sei whales), NMFS anticipates that implementation of the mitigation and monitoring measures described above will reduce the potential for Level A harassment to discountable amounts.

TABLE 44—LEVEL A HARASSMENT (PTS) AND LEVEL B HARASSMENT (TTS, BEHAVIOR) ESTIMATED TAKE INCIDENTAL TO UXO/MEC DETONATIONS [1] ASSUMING 10-dB NOISE ATTENUATION

Marine mammal species	Total level A density based exposure estimate project 1	Total level B density based exposure estimate project 1	Total level A density based exposure estimate project 2	Total level B density based exposure estimate project 2	PSO data take estimate	Mean group size	Requested level A take project 1 [2]	Requested level B take project 1	Requested level A take project 2 [2]	Requested level B take project 2
Blue whale *	0.0	0.0	0.0	0.0		1.0	0	1	0	1
Fin whale *	1.1	12.5	0.7	8.3	0.5	1.8	0	13	0	9
Humpback whale	0.9	9.2	0.6	6.1	4.6	2.0	0	10	0	7
Minke whale	5.5	46.4	3.6	30.9	0.9	1.2	0	47	0	31
North Atlantic right whale *	1.1	9.9	0.7	6.6		2.4	0	10	0	7
Sei whale *	0.5	5.1	0.3	3.4		1.6	0	6	0	4
Atlantic spotted dolphin	0.0	0.8	0.0	0.6		29.0	0	29	0	29
Atlantic white-sided dolphin	0.0	4.5	0.0	3.1		27.9	0	28	0	28
Bottlenose dolphin	0.0	2.4	0.0	1.6	11.9	7.8	0	13	0	13
Common dolphin	0.4	39.7	0.3	26.5	103.6	34.9	0	104	0	104
Harbor porpoise	64.9	262.3	43.2	174.8	0.0	2.7	65	263	44	175
Pilot whales	0.0	0.4	0.0	0.2	0.5	8.4	0	11	0	11
Risso's dolphin	0.0	0.4	0.0	0.2		5.4	0	6	0	6
Sperm whale *	0.0	0.2	0.0	0.2	0.0	1.5	0	2	0	2
Gray seal	23.9	140.6	15.9	93.8	0.1	1.4	24	141	16	94
Harbor seal	1.5	9.1	1.1	6.1	0.2	1.4	2	10	2	7

* Denotes species listed under the Endangered Species Act.

[1] SouthCoast expects up to 10 UXO/MECs will necessitate high-order removal (detonation), and anticipates that 5 of these would be found in the Lease Area, and 5 would be found in the export cable corridors.

[2] Although UXO/MEC exposure modeling estimated potential Level A harassment (PTS) exposures for mysticete whales, SouthCoast did not request Level A harassment for these species given the assumption that their proposed monitoring and mitigation measures would prevent this form of take incidental to UXO/MEC detonations.

HRG Surveys

SouthCoast's proposed HRG survey activity includes the use of impulsive (*i.e.,* boomers and sparkers) and non-impulsive (*e.g.,* CHIRP SBPs) sources (table 45).

TABLE 45—REPRESENTATIVE HRG SURVEY EQUIPMENT AND OPERATING FREQUENCIES

Equipment type	Representative equipment model	Operating frequency (kHz)
Sub-bottom Profiler	Teledyne Benthos Chirp III—TTV 170	2–7
Sparker	Applied Acoustics Dura-Spark UHD (400 tips, 800 J)	0.01–1.9
Boomer	Applied Acoustics triple plate S-Boom (700 J)	0.1–5

Authorized takes would be by Level B harassment only in the form of disruption of behavioral patterns for individual marine mammals resulting from exposure to noise from certain HRG acoustic sources. Based primarily on the characteristics of the signals produced by the acoustic sources planned for use, Level A harassment is neither anticipated, even absent mitigation, nor proposed for authorization. Therefore, the potential for Level A harassment is not evaluated further. Please see SouthCoast's application for details of a quantitative exposure analysis (*i.e.,* calculated distances to Level A harassment isopleths and Level A harassment exposures). No serious injury or mortality is anticipated to result from HRG survey activities.

In order to better account for the narrower and directional beams of the sources, NMFS has developed a tool, specific to HRG surveys, for determining the sound pressure level (SPL_{rms}) at the 160-dB isopleth for the purposes of estimating the extent of Level B harassment isopleths associated with HRG survey equipment (NMFS, 2020). This methodology incorporates frequency-dependent absorption and some directionality to refine estimated ensonified zones. SouthCoast used NMFS' methodology with additional modifications to incorporate a seawater absorption formula and account for energy emitted outside of the primary beam of the source. For sources that operate with different beamwidths, the maximum beam width was used, and the lowest frequency of the source was used when calculating the frequency-dependent absorption coefficient.

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

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

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

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

The Teledyne Benthos Chirp III has the highest source level, so it was also selected as a representative sub-bottom profiling system in table 45. Crocker and Fratantonio (2016) measured source levels of a device similar to the Teledyne Benthos Chirp III TTV 170 towfish, the Knudsen 3202 Chirp sub-bottom profiler, at several different power settings. The highest power settings measured for the Knudsen 3202 were determined to be applicable to a hull-mounted Teledyne Benthos Chirp III system, while the lowest power settings were determined to be applicable to the towfish version of the Teledyne Benthos Chirp III that may be used by SouthCoast. The EdgeTech Chirp 512i measurements and specifications provided by Crocker and Fratantonio (2016) were used as a proxy for both the Edgetech 3100 with SB–216 towfish and EdgeTech DW–106, given its similar operations settings. The EdgeTech Chirp 424 source levels were used as a proxy for the Knudsen Pinger sub-bottom profiler. The sparker systems that may be used during the HRG surveys, the Applied Acoustics Dura-Spark and the Geomarine Geo-Spark, were measured by Crocker and Fratantonio (2016) but not with an energy setting near 800 Joules (J). A similar alternative system, the SIG ELC 820 sparker,measured with an input voltage of 750 J, was used as a proxy for both the Applied Acoustics Dura-Spark UHD (400 tips, 800 J) and Geomarine Geo-Spark (400 tips, 800 J), and was conservatively assumed to be an omnidirectional source.

Table 46 identifies all the representative survey equipment that operates below 180 kHz (*i.e.,* at frequencies that are audible and have the potential to disturb marine mammals) that may be used in support of planned survey activities and are likely to be detected by marine mammals given the source level, frequency, and beamwidth of the equipment. This table also provides all operating parameters used to calculate the distances to threshold for marine mammals.

TABLE 46—SUMMARY OF REPRESENTATIVE HRG SURVEY EQUIPMENT AND OPERATING PARAMETERS

Equipment type	Representative model	Operating frequency (kHz)	Source level SPL_{rms} (dB)	Source $level_{0-pk}$ (dB)	Pulse duration (ms)	Repetition rate (Hz)	Beamwidth (degrees)	Information source
Sub-bottom Profiler	EdgeTech 3100 with SB–216[1] towfish	2–16	179	184	10	9.1	51	CF
	EdgeTech DW–106[1]	1–6	176	183	14.4	10	66	CF
	Knudson Pinger[2]	15	180	187	4	2	71	CF
	Teledyne Benthos CHIRP III—TTV 170[3]	2–7	199	204	10	14.4	82	CF
Sparker[4]	Applied Acoustics Dura-Spark UHD (400 tips, 800 J)	0.01–1.9	203	213	3.4	2	Omni	CF
	Geomarine Geo-Spark (400 tips, 800 J)	0.01–1.9	203	213	3.4	2	Omni	CF
Boomer	Applied Acoustics triple plate S-Boom (700 J)	0.1–5	205	211	0.9	3	61	CF

Note: J = joule; kHz = kilohertz; dB = decibels; SL = source level; UHD = ultra-high definition; rms = root-mean square; µPa = microPascals; re = referenced to; SPL = sound pressure level; PK = zero-to-peak pressure level; Omni = omnidirectional source; CF = Crocker and Fratantonio (2016).

[1] The EdgeTech Chirp 512i measurements and specifications provided by Crocker and Fratantonio (2016) were used as a proxy for the Edgetech 3100 with SB–216 towfish and EdgeTech DW–106.

[2] The EdgeTech Chirp 424 measurements and specifications provided by Crocker and Fratantonio (2016) were used as a proxy for the Knudsen Pinger SBP.

[3] The Knudsen 3202 Echosounder measurements and specifications provided by Crocker and Fratantonio (2016) were used as a proxy for the Teledyne Benthos Chirp III TTV 170.

[4] The SIG ELC 820 Sparker, 5 m source depth, 750 J setting was used as a proxy for both the Applied Acoustics Dura-Spark UHD (400 tips, 800 J) and Geomarine Geo-Spark (400 tips, 800 J).

Results of modeling using the methodology described above indicated that, of the HRG equipment planned for use by SouthCoast that has the potential to result in Level B harassment of marine mammals, sound produced by the Geomarine Geo-Spark and Applied Acoustics Dura-Spark would propagate furthest to the Level B harassment isopleth (141 m (462.6 ft); table 47). For the purposes of take estimation, it was conservatively assumed that sparkers would be the dominant acoustic source for all survey days (although, again, this may not always be the case). Thus, the range to the isopleth corresponding to the threshold for Level B harassment for and the boomer and sparkers (141 m (462.6 ft)) was used as the basis of take calculations for all marine mammals. This is a conservative approach as the actual sources used on individual survey days or during a portion of a survey day may produce smaller distances to the Level B harassment isopleth.

TABLE 47—DISTANCES TO THE LEVEL B HARASSMENT THRESHOLDS FOR REPRESENTATIVE HRG SOUND SOURCE OR COMPARABLE SOUND SOURCE CATEGORY FOR EACH MARINE MAMMAL HEARING GROUP

Equipment type	Representative model	Level B harassment threshold (m) All (SPL_{rms})
Sub-bottom Profiler	Edgetech 3100 with SB–216 towfish	4
	EdgeTech DW–106[1]	3
	Knudson Pinger[2]	6
	Teledyn Benthos CHIRP III—TTV 170[3]	66

TABLE 47—DISTANCES TO THE LEVEL B HARASSMENT THRESHOLDS FOR REPRESENTATIVE HRG SOUND SOURCE OR COMPARABLE SOUND SOURCE CATEGORY FOR EACH MARINE MAMMAL HEARING GROUP—Continued

Equipment type	Representative model	Level B harassment threshold (m)
		All (SPL_{rms})
Sparker	Applied Acoustics Dura-Spark UHD 400 tips (800 J)	141
	Geomarine Geo-Spark (400 tips, 800 J)	141
Boomer	Applied Acoustics triple plate S-Boom (700–1,000 J)	90

To estimate species densities for the HRG surveys occurring both within the Lease Area and within the ECCs based on Roberts *et al.* (2016; 2023), a 5-km (3.11 mi) perimeter was applied around each area (see Figures 14 and 15 of SouthCoast's application) using GIS (ESRI, 2017). Given that HRG surveys could occur at any point year-round and is likely to be spread out throughout the year, the annual average density for each species was calculated using average monthly densities from January through December (table 48).

TABLE 48—ANNUAL AVERAGE MARINE MAMMAL DENSITIES ALONG THE EXPORT CABLE CORRIDORS AND SOUTHCOAST LEASE AREA [1]

Marine mammal species	ECCs annual average density (individual per km^2)	Lease Area Annual Average density (individual per km^2)
Blue whale *	0.0000	0.0000
Fin whale *	0.0008	0.0022
Humpback whale	0.0007	0.0016
Minke whale	0.0029	0.0057
North Atlantic right whale *	0.0023	0.0027
Sei whale *	0.0003	0.0006
Atlantic spotted dolphin	0.0000	0.0013
Atlantic white-sided dolphin	0.0050	0.0231
Bottlenose dolphin	0.0023	0.0116
Common dolphin	0.0218	0.1503
Harbor porpoise	0.0267	0.0557
Pilot whales	0.0002	0.0029
Risso's dolphin	0.0002	0.0013
Sperm whale *	0.0001	0.0005
Harbor seal	0.1345	0.0641
Gray seal	0.0599	0.0285

* Denotes species listed under the Endangered Species Act.

The maximum range (141 m (462.6 ft)) to the Level B harassment threshold and the estimated trackline distance traveled per day by a given survey vessel (*i.e.,* 80 km (50 mi)) were then used to calculate the daily ensonified area or zone of influence (ZOI) around the survey vessel.

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

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

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

The largest daily ZOI (22.6 km^2 (8.7 mi^2)), associated with the proposed use of sparkers, was applied to all planned survey days.

During construction, SouthCoast estimated approximately a length of 4,000 km (2,485.5 mi) of surveys would occur within the Lease Area and 5,000 km (3,106.8 mi) would occur within the ECCs. Potential Level B density-based harassment exposures were estimated by multiplying the average annual density of each species within the survey area by the daily ZOI. That product was then multiplied by the number of planned survey days in each sector during the approximately 2-year construction timeframe (62.5 days in the ECCs and 50 days in the Lease Area), and the product was rounded to the nearest whole number. This assumed a total ensonified area of 1,130 km^2 (702.1 mi^2) in the Lease Area and 1,412.5 km^2 (877.7 mi^2) along the ECCs. The density-based modeled Level B harassment take for HRG surveys during the construction period assumes approximately 60 percent (5,400 km) and 40 percent (3,600 km) of track lines would be surveyed during Year 1 (associated with Project 1) and Year 2 (associated with Project 2), respectively. SouthCoast estimated a conservative number of annual takes by Level B harassment based on the highest predicted value among the density-based, PSO data-derived, or average group size estimates. These results can be found in table 49.

TABLE 49—ESTIMATED LEVEL B HARASSMENT TAKE INCIDENTAL TO HRG SURVEYS DURING THE 2-YEAR CONSTRUCTION PERIOD

Marine mammal species	Project 1 estimated take		Project 2 estimated take		Total density-based take estimate	PSO data take estimate	Mean group size	Highest annual Level B harass-ment take Project 1	Highest Annual Level B harassment take Project 2
	Lease area	ECCs	Lease area	ECCs					
Blue whale *	0.0	0.0	0.0	0.0	0.0	–	1.0	1	1
Fin whale *	1.2	0.6	1.3	0.6	3.6	5.3	1.8	6	6
Humpback whale	0.9	0.5	0.9	0.5	2.8	51.4	2.0	52	52
Minke whale	3.2	2.0	3.3	1.7	10.5	10.2	1.4	11	11
North Atlantic right whale *.	1.5	1.6	1.5	1.7	6.3	–	2.4	4	4
Sei whale *	0.3	0.2	0.4	0.2	1.1	1.4	1.6	2	2
Atlantic spotted dolphin	0.7	0.0	0.7	0.0	1.5	–	29.0	29	29
Atlantic white-sided dolphin.	12.9	3.5	13.3	3.6	33.2	–	27.9	28	28
Bottlenose dolphin	6.5	1.6	6.7	1.7	16.4	133.4	12.3	134	134
Common dolphin	83.8	15.2	86.1	15.6	200.8	1165.5	34.9	1,166	1,166
Harbor porpoise	31.1	18.6	31.9	19.1	100.8	0.2	2.7	50	52
Pilot whales	1.6	0.1	1.7	0.1	3.6	5.9	8.4	11	11
Risso's dolphin	0.7	0.1	0.8	0.1	1	–	5.4	6	6
Sperm whale *	0.3	0.1	0.3	0.1	0.7	0.4	1.5	2	2
Gray seal	48.5	127.2	49.8	130.8	355.6	3.1	1.4	176	181
Harbor seal	3.1	8.3	3.2	8.5	23.1	48.3	1.4	49	49

* Denotes species listed under the Endangered Species Act.
Note:–not applicable.

As mentioned previously, HRG surveys would also routinely be carried out during the period following completion of foundation installations which, for the purposes of exposure modeling, SouthCoast assumed to be three years. Generally, SouthCoast followed the same approach as described above for HRG surveys occurring during the two years of construction activities, modified to account for reduced survey effort following foundation installation. During the three years when construction is not occurring, SouthCoast estimates that HRG surveys would cover 2,800 km (1,739.8 mi) within the Lease Area and 3,200 km (1,988.4 mi) along the ECCs annually. Maintaining that 80 km (50 mi) are surveyed per day, this amounts to 35 days of survey activity in the Lease Area and 40 days of survey activity along the ECCs each year or 225 days total for the three-year timeframe following the two years of construction activities. Similar to the approach outlined above, density-based take was estimated by multiplying the daily ZOI by the annual average densities and the number of survey days planned for the ECCs and SouthCoast Lease Area. Using the same approach described above, SouthCoast estimated a conservative number of annual takes by Level B harassment based on the highest exposures predicted by the density-based, PSO based, or average group size-based estimates. The highest predicted take estimate was multiplied by three to yield the number of takes that is proposed for authorization, as shown in table 50 below.

TABLE 50—ESTIMATE TAKE, BY LEVEL B HARASSMENT, INCIDENTAL TO HRG SURVEYS DURING THE 3 YEARS WHEN CONSTRUCTION WOULD NOT OCCUR

Marine mammal species	Annual operations phase take by survey area		Annual total density-based take estimate	Annual PSO data take estimate	Mean group size	Highest annual Level B take	Total Level B harassment take over 3 years of HRG surveys
	Lease area	ECCs					
Blue whale *	0.0	0.0	0.0	–	1.0	1	3
Fin whale *	1.8	0.7	2.5	3.6	1.8	4	12
Humpback whale	1.3	0.6	1.9	34.3	2.0	35	105
Minke whale	4.5	2.6	7.1	6.8	1.4	8	24
North Atlantic right whale *	2.1	2.1	4.2	–	2.4	5	15
Sei whale *	0.5	0.3	0.7	0.9	1.6	2	6
Atlantic spotted dolphin	1.0	0.0	1.1	–	29.0	29	87
Atlantic white-sided dolphin	18.3	4.5	22.8	–	27.9	28	84
Bottlenose dolphin	9.2	2.1	11.3	88.9	12.3	89	267
Common dolphin	119.0	19.7	138.7	777.0	34.9	778	2,334
Harbor porpoise	44.1	24.2	68.3	0.1	2.7	69	207
Pilot whales	2.3	0.1	2.5	3.9	10.3	11	33
Risso's dolphin	1.1	0.1	1.2	–	5.4	6	18
Sperm whale *	0.4	0.1	0.5	0.3	2.0	2	6
Gray seal	68.8	165.1	234.0	2.1	1.4	234	702
Harbor seal	4.5	10.7	15.2	32.2	1.4	33	99

** Denotes species listed under the Endangered Species Act.
Note:–not applicable.

Total Proposed Take Across All Activities

The species-specific numbers of annual take by Level A harassment and Level B harassment NMFS proposes to authorize incidental to all specified activities combined are provided in table 51. Take estimation assumed pile-driving noise will be attenuated by 10 dB and, where applicable, implementation of seasonal restrictions and clearance and shutdown processes to discount the potential for Level A harassment of most species for which it was estimated. NMFS also presents the 5-year total number of takes proposed for authorization for each species in table 52.

Table 51 presents the annual take proposed for authorization, based on the assumption that specific activities would occur in particular years. SouthCoast currently plans to install all permanent structures (*i.e.,* WTG and OSP foundations) within two of the five years of the proposed effective period, which includes a single year for Project 1 and a single year for Project 2. However, foundation installations may not begin in the first year of the effective period of the rule or occur in sequential years, and NMFS acknowledges that construction schedules may shift. The proposed rule allows for this flexibility; however, the number of takes for each species in any given year must not exceed the maximum annual numbers provided in table 53.

In table 51, years 1 and 2 represent the assumed years (for take estimation) in which SouthCoast would install WTG and OSP foundations. For each species, the Year 1 proposed take includes the highest take estimate between P1S1 and P1S2 for foundation installation, one year of HRG surveys, and five high-order detonations of the heaviest charge weight (E12) UXO/MECs (at a rate of one per day for up to five days). The proposed Level B harassment take for Year 2 is based on P2S2 for foundation installation, given it resulted in the highest Level B harassment take estimates among P2S1, P2S2, and P2S3 for all species because it includes vibratory (in addition to impact) pile driving of monopiles, one year of HRG surveys, and up to five high-order detonations of the heaviest charge weight (E12) UXO/MECs (also at a rate of one per day for up to five days). In table 51, take for years 3–5 is incidental to HRG surveys. All activities with the potential to result in incidental take of marine mammals are expected to be completed by early 2031.

In making the negligible impact determination, NMFS assesses both the maximum annual total number of takes (Level A harassment and Level B harassment) of each marine mammal species or stocks allowable in any one year, which in the case of this proposed rule is in Year 2, and the total taking of each marine mammal species or stock allowable during the 5-year effective period of the rule.

NMFS has carefully considered all information and analysis presented by SouthCoast as well as all other applicable information and, based on the best scientific information available, concurs that the SouthCoast's estimates of the types and number of take for each species and stock are reasonable and, thus, NMFS is proposing to authorize the number requested.

TABLE 51—LEVEL A HARASSMENT AND LEVEL B HARASSMENT TAKES OF MARINE MAMMALS PROPOSED TO BE AUTHORIZED INCIDENTAL TO ALL ACTIVITIES DURING CONSTRUCTION AND DEVELOPMENT OF THE SOUTHCOAST OFFSHORE WIND ENERGY PROJECT

Marine mammal species	NMFS stock abundance	Year 1		Year 2 [1]		Year 3		Year 4		Year 5	
		Level A harassment (max annual)	Level B harassment	Level A harassment	Level B harassment (max annual)	Level A harassment	Level B harassment	Level A harassment	Level B harassment	Level A harassment	Level B harassment
Blue whale*	[2] 402	0	3	0	3	0	1	0	1	0	1
Fin whale*	6,802	3	58	3	496	0	4	0	4	0	4
Humpback whale	1,396	0	99	0	341	0	35	0	35	0	35
Minke whale	21,968	0	255	0	911	0	8	0	8	0	8
North Atlantic right whale*	338	0	26	0	111	0	5	0	5	0	5
Sei whale*	6,292	0	15	0	48	0	2	0	2	0	2
Atlantic spotted dolphin	39,921	0	87	0	378	0	29	0	29	0	29
Atlantic white-sided dolphin	93,221	0	784	0	3,101	0	28	0	28	0	28
Bottlenose dolphin [3]	62,851	0	451	0	2,489	0	89	0	89	0	89
Common dolphin	172,974	0	9,823	0	42,363	0	778	0	778	0	778
Harbor porpoise	95,543	*65	691	44	2,609	0	69	0	69	0	69
Long-finned pilot whales [3]	39,215	0	83	0	657	0	11	0	11	0	11
Risso's dolphin	35,215	0	49	0	1,772	0	6	0	6	0	6
Sperm whale*	4,349	0	17	0	126	0	2	0	2	0	2
Gray seal	27,300	*24	542	16	8,606	0	234	0	234	0	234
Harbor seal	61,336	2	94	2	488	0	33	0	33	0	33

* Denotes species listed under the Endangered Species Act.

TABLE 52—5-YEAR TOTAL LEVEL A HARASSMENT AND LEVEL B HARASSMENT TAKES OF MARINE MAMMALS PROPOSED TO BE AUTHORIZED INCIDENTAL TO ALL ACTIVITIES DURING CONSTRUCTION AND DEVELOPMENT OF THE SOUTHCOAST OFFSHORE WIND ENERGY PROJECT

Marine mammal species	NMFS stock abundance	5-Year totals	
		Proposed Level A harassment take	Proposed Level B harassment
Blue whale*	[1] 402	0	9
Fin whale*	6,802	6	566
Humpback whale	1,396	0	541
Minke whale	21,968	0	1,162

TABLE 52—5-YEAR TOTAL LEVEL A HARASSMENT AND LEVEL B HARASSMENT TAKES OF MARINE MAMMALS PROPOSED TO BE AUTHORIZED INCIDENTAL TO ALL ACTIVITIES DURING CONSTRUCTION AND DEVELOPMENT OF THE SOUTHCOAST OFFSHORE WIND ENERGY PROJECT—Continued

Marine mammal species	NMFS stock abundance	5-Year totals	
		Proposed Level A harassment take	Proposed Level B harassment
North Atlantic right whale *	338	0	149
Sei whale *	6,292	0	67
Atlantic spotted dolphin	39,921	0	552
Atlantic white-sided dolphin	93,233	0	3,762
Bottlenose dolphin	62,851	0	3,171
Common dolphin	172,974	0	52,943
Harbor porpoise	95,543	109	3,442
Long-finned pilot whales	39,215	0	773
Risso's dolphin	35,215	0	1,839
Sperm whale *	4,349	0	149
Gray seal	27,300	40	9,835
Harbor seal	61,336	4	677

* Denotes species listed under the Endangered Species Act.

To inform both the negligible impact analysis and the small numbers determination, NMFS assesses the maximum number of takes of marine mammals that could occur within any given year. In this calculation, the maximum number of Level A harassment takes in any one year is summed with the maximum number of Level B harassment takes in any one year for each species to yield the highest number of estimated take that could occur in any year (table 53). Table 53 also depicts the number of takes relative to the abundance of each stock. The takes enumerated here represent daily instances of take, not necessarily individual marine mammals taken. One take represents a day (24-hour period) in which an animal was exposed to noise above the associated harassment threshold at least once. Some takes represent a brief exposure above a threshold, while in some cases takes could represent a longer, or repeated, exposure of one individual animal above a threshold within a 24-hour period. Whether or not every take assigned to a species represents a different individual depends on the daily and seasonal movement patterns of the species in the area. For example, activity areas with continuous activities (all or nearly every day) overlapping known feeding areas (where animals are known to remain for days or weeks on end) or areas where species with small home ranges live (*e.g.,* some pinnipeds) are more likely to result in repeated takes to some individuals. Alternatively, activities far out in the deep ocean or takes to nomadic species where individuals move over the population's range without spatial or temporal consistency represent circumstances where repeat takes of the same individuals are less likely. In other words, for example, 100 takes could represent 100 individuals each taken on 1 day within the year, or it could represent 5 individuals each taken on 20 days within the year, or some other combination depending on the activity, whether there are biologically important areas in the project area, and the daily and seasonal movement patterns of the species of marine mammals exposed. Wherever there is information to better contextualize the enumerated takes for a given species is available, it is discussed in the Preliminary Negligible Impact Analysis and Determination and/or Small Numbers sections, as appropriate. We recognize that certain activities could shift within the 5-year effective period of the rule; however, the rule allows for that flexibility and the takes are not expected to exceed those shown in table 53 in any one year.

Of note, there is significant uncertainty regarding the impacts of turbine foundation presence and operation on the oceanographic conditions that serve to aggregate prey species for North Atlantic right whales and—given SouthCoast's proximity to Nantucket Shoals—it is possible that the expanded analysis of turbine presence and/or operation over the life of the project developed for the ESA biological opinion for the proposed SouthCoast project or additional information received during the public comment period will necessitate modifications to this analysis. For example, it is possible that additional information or analysis could result in a determination that changes in the oceanographic conditions that serve to aggregate North Atlantic right whale prey may result in impacts that would qualify as a take under the MMPA for North Atlantic right whales.

TABLE 53—MAXIMUM NUMBER OF PROPOSED TAKES (LEVEL A HARASSMENT AND LEVEL B HARASSMENT) THAT COULD OCCUR IN ANY ONE YEAR OF THE PROJECT RELATIVE TO STOCK POPULATION SIZE (ASSUMING EACH TAKE IS OF A DIFFERENT INDIVIDUAL), AND TOTAL TAKE FOR 5-YEAR PERIOD

Marine mammal species	NMFS stock abundance	Maximum annual [1] take proposed to be authorized			
		Maximum Level A harassment	Maximum Level B harassment	Maximum annual take [4]	Total percent stock taken based on maximum annual take
Blue whale * [2]	[1] 402	0	3	3	0.75

TABLE 53—MAXIMUM NUMBER OF PROPOSED TAKES (LEVEL A HARASSMENT AND LEVEL B HARASSMENT) THAT COULD OCCUR IN ANY ONE YEAR OF THE PROJECT RELATIVE TO STOCK POPULATION SIZE (ASSUMING EACH TAKE IS OF A DIFFERENT INDIVIDUAL), AND TOTAL TAKE FOR 5-YEAR PERIOD—Continued

Marine mammal species	NMFS stock abundance	Maximum annual [1] take proposed to be authorized			
		Maximum Level A harassment	Maximum Level B harassment	Maximum annual take [4]	Total percent stock taken based on maximum annual take
Fin whale *	6,802	3	496	499	7.34
Humpback whale	1,396	0	341	341	24.4
Minke whale	21,968	0	911	911	4.15
North Atlantic right whale *	[3] 338	0	111	111	32.8
Sei whale *	6,292	0	48	48	0.76
Atlantic spotted dolphin	39,921	0	378	378	0.95
Atlantic white-sided dolphin	93,221	0	3,101	3,101	3.33
Bottlenose dolphin,	62,851	0	2,489	2,489	3.96
Common dolphin	172,974	0	42,363	42,363	24.5
Harbor porpoise	95,543	65	2,609	2,674	2.80
Long-finned pilot whales	68,139	0	657	657	0.96
Risso's dolphin	35,215	0	1,772	1,772	5.03
Sperm whale *	4,349	0	126	126	2.90
Gray seal	27,300	24	8,606	8,630	31.6
Harbor seal	61,336	2	488	490	0.80

* Denotes species listed under the Endangered Species Act.

[1] The percent of stock impacted is the sum of the maximum number of Level A harassment takes in any year plus the maximum and Level B harassment divided by the stock abundance estimate then multiplied by 100. The best available stock abundance estimates are derived from the NMFS Stock Assessment Reports (Hayes *et al.,* 2024). Year 2 has the maximum expected annual take authorized.

[2] The minimum blue whale population is estimated at 402 (Hayes *et al.,* 2024), although the exact value is not known. NMFS is utilizing this value for our small numbers determination.

[3] NMFS notes that the 2022 North Atlantic Right Whale Annual Report Card (Pettis *et al.,* 2023; n=340) is the same as the draft 2023 SAR (Hayes *et al.,* 2024). While NMFS acknowledges the estimate found on the North Atlantic Right Whale Consortium's website (*https://www.narwc.org/report-cards.html*) matches, we have used the value presented in the draft 2023 SARs as the best available science for this final action (88 FR 5495, January 29, 2024, *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports;* nmin=340).

Proposed Mitigation

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

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

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

(2) The practicability of the measures for applicant implementation, which may consider factors, such as: cost, impact on operations, and, in the case of military readiness activities, personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

The mitigation strategies described below are consistent with those required and successfully implemented under previous incidental take authorizations issued in association with in-water construction activities (*e.g.,* soft-start, establishing shutdown zones). Additional measures have also been incorporated to account for the fact that the construction activities would occur offshore in an area that includes important marine mammal habitat. Modeling was performed to estimate Level A harassment and Level B harassment zone sizes, which were used to inform mitigation measures for the project's activities to minimize Level A harassment and Level B harassment to the extent practicable. Generally speaking, the proposed mitigation measures considered and required here fall into three categories: temporal (*i.e.,* seasonal and daily) work restrictions, real-time measures (*e.g.,* clearance, shutdown, and vessel strike avoidance), and noise attenuation/reduction measures. Temporal work restrictions are designed to avoid operations when marine mammals are concentrated or engaged in behaviors that make them more susceptible or make impacts more likely to occur. When temporal restrictions are in place, both the number and severity of potential takes, as well as both chronic (longer-term) and acute effects are expected to be reduced. Real-time measures, such as clearing an area of marine mammals prior to beginning activities or shutting down an activity if it is occuring, as well as vessel strike avoidance measures, are intended to reduce the probability and severity of harassment by taking steps in real time once a higher-risk scenario is identified (*e.g.,* once animals are detected within a harassment zone). Noise attenuation measures, such as bubble curtains, are intended to reduce the noise at the source, which reduces both acute impacts as well as the contribution to aggregate and cumulative noise that may result in long-term chronic impacts. Soft-starts are another type of noise reduction measure in that animals are warned of the introduction of sound into their environment at lower levels before higher noise levels are produced. As a conservative measure applicable to all project activities and vessels, if a whale is observed or acoustically detected but cannot be confirmed as a species other than a North Atlantic right whale, SouthCoast must assume that it is a North Atlantic right whale and take the appropriate mitigation measures.

Below, NMFS briefly describes the required training, coordination, and vessel strike avoidance measures that apply to all specified activities, and in the following subsections, we describe the measures that apply specifically to foundation installation, UXO/MEC detonations, and HRG surveys. Throughout, we also present enhanced mitigation measures specifically focused on reducing potential impacts of project activities on North Atlantic right whales given their population status and baseline conditions, as described in the Description of Marine Mammals in the Specified Geographic Area section. Details on specific mitigation requirements can be found in section 217.334 of the proposed regulatory text below in Part 217—Regulations Governing The Taking And Importing Of Marine Mammals.

Training and Coordination

NMFS requires all project employees and contractors conducting activities on the water, including but not limited to, all vessel captains and crew, to be trained in various marine mammal and regulatory requirements. All relevant personnel, including the marine mammal monitoring team(s), are required to participate in joint, onboarding training prior to the beginning of project activities. New relevant personnel (*e.g.,* new PSOs, construction contractors, relevant crew) who join the project after work commences must also complete training before they begin work. The training must include review of, at minimum, marine mammal detection and identification methods, communication requirements and protocols, all required mitigation measures for each activity, including vessel strike avoidance measures, to minimize impacts on marine mammals and the authority of the marine mammal monitoring team(s). The training must support SouthCoast's compliance with these regulations and associated LOA if promulgated and issued. In addition, training would include information and resources available regarding applicable Federal laws and regulations for protected species. SouthCoast would provide documentation of training to NMFS prior to the start of in-water activities, and any time new personnel receive training.

Vessel Strike Avoidance Measures

Implementation of the numerous vessel strike avoidance measures included in this rule is expected to reduce the risk of vessel strike to the degree that vessel strike would be avoided. While the likelihood of a vessel strike is generally low without these measures, vessel interaction is one of the most common ways that marine mammals are seriously injured or killed by human activities. Therefore, enhanced mitigation and monitoring measures are required to avoid vessel strikes to the extent practicable. While many of these measures are proactive, intending to avoid the heavy use of vessels during times when marine mammals of particular concern may be in the area, several are reactive and occur when Project personnel sight a marine mammal. The vessel strike avoidance mitigation requirements are described generally here and in detail in the proposed regulatory text in proposed section 217.334(b)). SouthCoast Wind must comply with all vessel strike avoidance measures while in the specific geographic region unless a deviation is necessary to maintain safe maneuvering speed and justified because the vessel is in an area where oceanographic, hydrographic, and/or meteorological conditions severely restrict the maneuverability of the vessel; an emergency situation (as defined in the proposed regulatory text) presents a threat to the health, safety, life of a person; or when a vessel is actively engaged in emergency rescue or response duties, including vessel-in distress or environmental crisis response.

While underway, SouthCoast Wind would be required to monitor for marine mammals and operate vessels in a manner that reduces the potential for vessel strike. SouthCoast must employ at least one dedicated visual observer (*i.e.,* PSO or trained crew member) on each transiting vessel, regardless of speed or size. The dedicated visual observer(s) must maintain a vigilant watch for all marine mammals during transit and be equipped with suitable monitoring technology (*e.g.,* binoculars, night vision devices) located at an appropriate vantage point. Any marine mammal detection by the observer (or anyone else on the vessel) must immediately be communicated to the vessel captain and any required mitigative action (*e.g.,* reduce speed) must be taken.

All of the project-related vessels would be required to comply with existing NMFS vessel speed restrictions for North Atlantic right whales and additional speed restriction measures within this rule. Reducing vessel speed is one of the most effective, feasible options available to reduce the likelihood of and effects from a vessel strike. Numerous studies have indicated that slowing the speed of vessels reduces the risk of lethal vessel collisions, particularly in areas where right whales are abundant and vessel traffic is common and otherwise traveling at high speeds (Vanderlaan and Taggart, 2007; Conn and Silber, 2013; Van der Hoop *et al.,* 2014; Martin *et al.,* 2015; Crum *et al.,* 2019). In summary, all vessels must operate at 10 knots (18.5 km/hr) or less when traveling from November 1 through April 30; in a SMA, DMA, Slow Zone; or when a North Atlantic right whale is observed or acoustically detected. Additionally, in the event that any project-related vessel, regardless of size, observes any large whale (other than a North Atlantic right whale) within 500 m of an underway vessel or acoustically detected via the PAM system in the transit corridor, the vessel is required to immediately reduce speeds to 10 knots (18.5 km/hr) or less and turn away from the animal until the whale can be confirmed visually beyond 500 m (1,640 ft) of the vessel.

When vessel speed restrictions are not in effect and a vessel is traveling at greater than 10 knots 10 knots (18.5 km/hr) in addition to the required dedicated visual observer, SouthCoast would be required to monitor the vessel transit corridor(s) (the path(s) crew transfer vessels take from port to any work area) in real-time with PAM prior to and during transits. Should SouthCoast determine it may travel over 10 knots (18.5 km/hr), it must submit a North Atlantic Right Whale Vessel Strike Avoidance Plan at least 180 days prior to transiting over 10 knots (18.5 km/hr) which fully identifies the communication protocols and PAM system proposed for use. NMFS must approve the plan before SouthCoast Wind can operate vessels over 10 knots (18.5 km/hr).

To monitor SouthCoast Wind's requirements with vessel speed restrictions, all vessels must be equipped with an AIS and SouthCoast Wind must report all Maritime Mobile Service Identify (MMSI) numbers to NMFS Office of Protected Resources prior to initiating in-water activities.

In addition to speed restrictions, all project vessels, regardless of size, must maintain the following minimum separation distances between vessels and marine mammals: 500 m (1,640 ft) from North Atlantic right whale; 100 m (328 ft) from sperm whales and non-North Atlantic right whale baleen whales; and 50 m (164 ft) from all delphinid cetaceans and pinnipeds (an exception is made for those species that approach the vessel such as bow-riding dolphins) (table 56). All reasonable steps must be taken to not violate minimum separation distances. If any of these species are sighted within their respective minimum separation zone, the underway vessel must turn away from the animal and shift its engine to neutral (if safe to do so) and the engines must not be engaged until the animal(s) have been observed to be outside of the vessel's path and beyond the respective minimum separation zone.

Seasonal and Daily Restrictions and Foundation Installation Sequencing

Temporal restrictions in places where marine mammals are concentrated, engaged in biologically important behaviors, and/or present in sensitive life stages are effective measures for reducing the magnitude and severity of human impacts. NMFS is requiring temporal work restrictions to minimize the risk of noise exposure to North Atlantic right whales incidental to certain specified activities to the extent practicable. These temporal work restrictions are expected to greatly reduce the number of takes of North Atlantic right whales that would have otherwise occurred should all activities be conducted during these months. The measures proposed by SouthCoast Wind and those included in this rule are built around North Atlantic right whale protection; however, they also afford protection to other marine mammals that are known to use the project area with greater frequency during months when the restrictions would be in place, including other baleen whales.

As described in the Description of Marine Mammals in the Specified Geographic Area section above, North Atlantic right whales may be present in the specified geographical region throughout the year. As it is not practicable to restrict activities year-round, NMFS evaluated the best scientific information available to identify temporal restrictions on foundation pile driving and UXO/MEC detonation that would ensure that the mitigation measures effect the least practicable adverse impact on marine mammals. First, NMFS evaluated density data (Roberts *et al.,* 2023) which demonstrate that from June through October, the densities of North Atlantic right whales are expected to be an order of magnitude lower than those in November through May (see table 30 as an example). In addition, the number of DMAs, which are triggered by a sighting of three or more whales (and suggest foraging behavior may be taking place (Pace and Clapham, 2001)) also increase November through May. Additionally, the best available, recently published science indicates North Atlantic right whale presence is persistent beginning in late October through May (*e.g.,* Davis *et al.,* 2023; van Parijs *et al.,* 2023) (see Description of Marine Mammals in the Specified Geographic Area). NMFS and SouthCoast worked together to evaluate these multiple data sources in consideration of the modeling analysis and proximity to known high density areas of critical foraging importance in and around Nantucket Shoals to identify practicable temporal restrictions that affect the least practicable adverse impact on marine mammals. As described previously, no foundation pile driving would occur October 16–May 31 inside the NARW EMA or January 1–May 15 throughout the rest of the Lease Area. Further, pile driving in December outside of the NARW EMA must not be planned (*i.e.,* may only occur due to unforeseen circumstances, following approval by NMFS). Should NMFS approve December pile driving outside the NARW EMA, SouthCoast would be required to implement enhanced mitigation and monitoring measures to further reduce potential impacts to North Atlantic right whales as well as other marine mammal species.

As described previously, the area in and around Nantucket Shoals is important foraging habitat for many marine mammal species. Therefore, SouthCoast Wind, in coordination with NMFS, has also proposed (and NMFS is proposing to require) that SouthCoast Wind sequence the installation of piles strategically. In the NARW EMA, SouthCoast would install foundations beginning June 1 in the northernmost positions, and sequence subsequent installations to the south/southwest such that foundation installation in positions closest to Nantucket Shoals would be completed during the period of lowest North Atlantic right whale occurrence in that area. NMFS would require SouthCoast to install the foundations as quickly as possible.

With respect to diel restrictions, SouthCoast Wind has requested to initiate pile driving during night time. For nighttime pile driving to be approved, SouthCoast would be required to submit a Nighttime Monitoring Plan for NMFS' approval that reliably demonstrates the efficacy of their nighttime monitoring methods and systems and provides evidence that their systems are capable of detecting marine mammals, particularly large whales, at distances necessary to ensure that the required mitigation measures are effective. Should a plan not be approved, SouthCoast Wind would be restricted to initiating foundation pile driving during daylight hours, no earlier than 1 hour after civil sunrise and no later than 1.5 hours before civil sunset. Pile driving would be allowed to continue after dark when the installation of the same pile began during daylight (1.5 hours before civil sunset), when clearance zones were fully visible for at least 30 minutes or must proceed for human safety or installation feasibility reasons.

There is no schedule for UXO/MEC detonations, as they would be considered on a case-by-case basis and only after all other means of removal have been exhausted. However, SouthCoast proposed a seasonal restriction on UXO/MEC detonations from December 1 through April 30 in both the Lease Area and ECCs to reduce impacts to North Atlantic right whales during peak occurrence periods. SouthCoast proposes to detonate no more than one UXO/MEC per 24-hr period. Moreover, detonations may only occur during daylight hours.

Given the very small harassment zones resulting from HRG surveys and that the best available science indicates that any harassment from HRG surveys, should a marine mammal be exposed to sounds produced by the survey equipment (*e.g.,* boomer), would most likely manifest as minor behavioral harassment only (*e.g.,* potentially some avoidance of the HRG source), SouthCoast did not propose and NMFS is not proposing to require any seasonal and daily restrictions for HRG surveys.

More information on activity-specific seasonal and daily restrictions can be found in the proposed regulatory text in proposed sections 217.334(c)(1) and 217.334(c)(2).

Noise Abatement Systems

SouthCoast Wind would be required to employ noise abatement systems (NAS), also known as noise attenuation systems, during all foundation installations (*i.e.,* during both vibratory and impact pile driving) and UXO/MEC detonations to reduce the sound pressure levels that are transmitted through the water in an effort to reduce ranges to acoustic thresholds and minimize any acoustic impacts, to the extent practicable, resulting from these activities.

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

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

The literature presents a wide array of observed attenuation results for bubble curtains. The variability in attenuation levels is the result of variation in design as well as differences in site conditions and difficulty in properly installing and operating in-water attenuation devices. Dähne *et al.* (2017) found that single bubble curtains that reduce sound levels by 7 to 10 dB reduced the overall sound level by approximately 12 dB when combined as a double bubble curtain for 6-m steel monopiles in the North Sea. During installation of monopiles (consisting of approximately 8-m in diameter) for more than 150 WTGs in comparable water depths (≤25 m) and conditions in Europe indicate that attenuation of 10 dB is readily achieved (Bellmann, 2019; Bellmann *et al.,* 2020) using single BBCs for noise attenuation. While there are many assumptions that influence results of acoustic modeling (*e.g.,* hammer energy, propagation), sound field verification measurements taken during construction of the South Fork Wind Farm and Vineyard Wind 1 wind farm indicate that it is reasonable to expect dual attenuation systems to achieve at least 10 dB sound attenuation.

SouthCoast Wind would be required to use multiple NASs (*e.g.,* double big bubble curtain (DBBC)) to ensure that measured sound levels do not exceed the levels modeled assuming a 10-dB sound level reduction for foundation installation and high-order UXO/MEC detonations, as well as implement adjustments to operational protocols (*e.g.,* reduce hammer energy) to minimize noise levels. A single bubble curtain, alone or in combination with another NAS device, may not be used for either pile driving or UXO/MEC detonation as previously received sound field verification (SFV) data has revealed that this approach is unlikely to attenuate sounds to the degree that measured distances to harassment thresholds are equal to or smaller than those modeled assuming 10 dB of attenuation. Pursuant to the adaptive management provisions included in the proposed rule, should the research and development phase of newer attenuation systems demonstrate effectiveness, SouthCoast Wind may submit data on the efficacy of these systems and request approval from NMFS to use them during foundation installation and UXO/MEC detonation activities.

Together, these systems must reduce noise levels to those not exceeding modeled ranges to Level A harassment and Level B harassment isopleths corresponding to those modeled assuming 10-dB sound attenuation, pending results of SFV; see the *Sound Field Verification* section below and Part 217—Regulations Governing The Taking And Importing Of Marine Mammals).

When a double big bubble curtain is used (noting a single bubble curtain is not allowed), SouthCoast Wind would be required to maintain numerous operational performance standards. These standards are defined in the proposed regulatory text in proposed sections 217.334(c)(7) and 217.334(d)(5) and include, but are not limited to, the requirements that construction contractors must train personnel in the proper balancing of airflow to the bubble ring and SouthCoast Wind must submit a performance test and maintenance report to NMFS within 72 hours following the performance test. Corrections to the attenuation device to meet regulatory requirements must occur prior to use during foundation installation activities and UXO/MEC detonation. In addition, a full maintenance check (*e.g.,* manually clearing holes) must occur prior to each pile installation and UXO/MEC detonation. Should SouthCoast Wind identify that the NAS systems are not optimized, they would be required to make corrections to the NASs. The SFV monitoring and reporting requirements (see Proposed Monitoring and Reporting section) would be the means by which NMFS would determine if modifications to the NASs would be required. Noise abatement systems are not required during HRG surveys. A NAS cannot practicably be employed around a moving survey ship, but SouthCoast Wind would be required to make efforts to minimize source levels by using the lowest energy settings on equipment that has the potential to result in harassment of marine mammals (*e.g.,* sparkers, CHIRPs, boomers) and turning off equipment when not actively surveying. Overall, minimizing the amount and duration of noise in the ocean from any of the project's activities through use of all means necessary and practicable will affect the least practicable adverse impact on marine mammals.

Clearance and Shutdown Zones

NMFS requires the establishment of both clearance and, where technically feasible, shutdown zones during project activities that have the potential to result in harassment of marine mammals. The purpose of ''clearance'' of a particular zone is to minimize potential instances of auditory injury and more severe behavioral disturbances by delaying the commencement of an activity if marine mammals are near the activity. The purpose of a shutdown is to prevent a specific acute impact, such as auditory injury or severe behavioral disturbance of sensitive species, by halting the activity.

In addition to the zones described above, SouthCoast Wind would be required to establish a minimum visibility zone during pile driving to ensure that sighting conditions are sufficient for PSOs to visually detect marine mammals in the areas of highest potential impact. No minimum visibility zone would be required for UXO/MEC detonation as the entire visual clearance zone must be clearly visible, given the potential for lung and GI injury. Within the NARW EMA from August 1–October 15 and outside the NARW EMA from May 16–31 and December 1–31, the minimum visibility zone sizes would be set equal to the largest Level B harassment zone (unweighted acoustic ranges to 160 dB re 1 µPa sound pressure level) modeled for each pile type, assuming 10 dB of noise attenuation, rounded up to the nearest 0.1 km (0.06 mi) (7.5 km (4.7 mi) monopiles; 4.9 km (3.0 mi) pin piles). For installations outside the NARW EMA from June 1–November 30, the minimum visibility zone would extend 3.7 km (2.3 mi) from the pile driving location (table 54). This distance equals the second largest modeled $ER_{95\%}$ distance to the Level A harassment isopleth (assuming 10 dB attenuation) among all marine mammals, rounded up to the closest 0.1 km (0.06 mi). The entire minimum visibility zone must be visible (*i.e.,* not obscured by dark, rain, fog, *etc.*) for a full 60 minutes immediately prior to commencing foundation pile driving. At no time would foundation pile driving be initiated when the minimum visibility zones cannot be fully visually monitored (using appropriate technology), as determined by the Lead PSO on duty.

All relevant clearance and shutdown zones during project activities would be monitored by NMFS-approved PSOs and PAM operators (where required). Marine mammals may be detected visually or, in the case of pile driving and UXO/MEC detonation, acoustically. SouthCoast must design PAM systems to acoustically detect North Atlantic right whales to the identified PAM Clearance and Shutdown Zones (table 54). The PAM system must also be able to detect marine mammal vocalizations, maximize baleen whale detections, and be capable of detecting North Atlantic right whales to 10 km (6.2 km) and 15 km (9.3 mi), around pin piles and monopiles, respectively. NMFS recognizes that detectability of each species' vocalizations will vary based on vocalization characteristics (*e.g.,* frequency content, source level), acoustic propagation conditions, and competing noise sources), such that other marine mammal species (*e.g.,* harbor porpoise) may not be detected at 10 km (6.2 mi) or 15 km (9.3 mi). and that, during pile driving, detecting marine mammals very close to the pile may be difficult due to masking from pile driving noise. Acoustic detections of any species would trigger mitigative action (delays or shutdown), when appropriate.

Before the start of the specified activities (*i.e.,* foundation installation, UXO/MEC detonation, and HRG surveys), SouthCoast Wind would be required to ensure designated areas (*i.e.,* clearance zones as provided in tables 54–56) are clear of marine mammals to minimize the potential for and degree of harassment once the noise-producing activity begins. Immediately prior to foundation installation and UXO/MEC detonations, PSOs and PAM operators would be required to begin visually and acoustically monitor clearance zones for marine mammals for a minimum of 60 minutes. For HRG surveys, PSOs would be required to monitor these zones for the 30 minutes directly before commencing use of boomers, sparkers, or CHIRPS. Clearance zones for all activities (*i.e.,* foundation installation, UXO/MEC detonation, HRG surveys) must be confirmed to be free of marine mammals for 30-minutes immediately prior to commencing these activities, else, commencement of the activity must be delayed until the animal(s) has been observed exiting its respective zone or until an additional time period has elapsed with no further sightings. A North Atlantic right whale sighting at any distance by PSOs monitoring pile driving or UXO/MEC activities or acoustically detected within the PAM clearance zone (for pile driving or UXO/MEC detonations) would trigger a pile driving or detonation delay.

In some cases, NMFS would require SouthCoast to implement extended pile driving delays to further reduce potential impacts to North Atlantic right whales utilizing habitat in the project area. As described previously, North Atlantic right whale occurrence in the project area remains low in June and July and begins to steadily increase from August through the fall, reaching maximum occurrence in winter, particularly in the portion of the lease area closest to Nantucket Shoals. For foundation installations in the NARW EMA from August 1–October 15 and throughout the remainder of the lease area May 16–31 and December 1–31, annually, if a delay or shutdown is triggered by a sighting of less than three (*i.e.,* one or two) North Atlantic right whales or an acoustic detection within the PAM clearance zone (10 km (6.2 mi), pin piles; 15 km (9.3 mi), monopiles), SouthCoast would be required to delay commencement or resumption of pile driving 24 hours rather than after 60 minutes pass without additional sightings of the whale(s). While NMFS is requiring seasonal restrictions, there is potential for North Atlantic right whales to congregate in the project area when foundation pile driving activities are occuring. Data demonstrates these foraging aggregations are sporadic and dependent upon availability of prey, which is highly variable. For example, in August and October 2022, a total of 9 and 10 North Atlantic right whales, respectively, were sighted south of Nantucket (southeast of SouthCoast's Lease Area) over multiple days. In May 2023, 58 North Atlantic right whales were sighted southeast of Nantucket, although further to the east of the Lease Area than the 2022 sightings. The best available science demonstrates that when three or more North Atlantic right whales are observed, more often than not, they are both foraging and persisting in an area (Pace and Clapham, 2001). Therefore, for all foundation installations in the NARW EMA and those outside the NARW EMA from May 16–31 and December 1–31, annually, should PSOs sight three or more North Atlantic right whales in the same areas/times, SouthCoast would be required to delay pile driving for 48 hours. In both cases (*i.e.,* 24- or 48-hour delay), NMFS would require that SouthCoast complete a vessel-based survey of the area around the pile driving location (10-km (6.2-mi) radius, pin piles; 15-km (9.3-mi) radius, monopiles) to ensure North Atlantic right whales are no longer in the project area before they could commence pile driving activities for the day.

Once an activity begins, an observation of any marine mammal entering or within its respective shutdown zone (tables 54–56) would trigger cessation of the activity. In the case of pile driving, the shutdown requirement may be waived if is not practicable due to imminent risk of injury or loss of life to an individual, risk of damage to a vessel that creates risk of injury or loss of life for individuals, or where the lead engineer determines there is pile refusal or pile instability. Because UXO/MEC detonations are instantaneous, no shutdown is possible; therefore, there are clearance, but no shutdown, zones for UXO/MEC detonations (table 55). In situations when shutdown is called for during foundation pile driving but SouthCoast Wind determines shutdown is not practicable due to any of the aforementioned emergency reasons, reduced hammer energy must be implemented when the lead engineer determines it is practicable. Specifically, pile refusal or pile instability could result in not being able to shut down pile driving immediately. Pile refusal occurs when a foundation pile encounters significant resistance or difficulty during the installation process. Pile instability occurs when the pile is unstable and unable to stay standing if the piling vessel were to ''let go.'' During these periods of instability, the lead engineer may determine a shutdown is not feasible because the shutdown combined with impending weather conditions may require the piling vessel to ''let go'' SouthCoast Wind would be required to document and report to NMFS all cases where the emergency exemption is taken.

After shutdown, foundation installation may be reinitiated once all clearance zones are clear of marine mammals for the minimum species-specific periods, or, if required to maintain pile stability, at which time the lowest hammer energy must be used to maintain stability. As described previously, for shutdowns triggered by observations of North Atlantic right whales, SouthCoast would not be able to resume pile driving until a survey of the 10-km (6.2-mi; for 4.5-m pin piles) or 15-km (9.3-mi; for 9/16-m monopiles) zone surrounding the installation location is completed wherein no additional sightings occur. Upon re-starting pile driving, soft-start protocols must be followed if pile driving has ceased for 30 minutes or longer.

SouthCoast proposed equally-sized clearance and shutdown zones for pile driving, which are generally based on Level A harassment (PTS) $ER_{95\%}$ distances, rounded up to the nearest 0.1 km (0.06 mi) for PSO clarity. For impact pile driving, the visual clearance and shutdown zones for large whales, other than North Atlantic right whales, correspond to the second largest modeled Level A harassment (PTS) exposure range ($ER_{95\%}$) distance, assuming 10 dB attenuation.

Clearance and shutdown zone sizes vary by activity and species groups. All distances to the perimeter of these zones are the radii from the center of the pile (table 54), UXO/MEC detonation location (table 55), or HRG acoustic source (table 56). Pursuant to the proposed adaptive management provisions, SouthCoast may request modification to these zone sizes (except for those that apply to North Atlantic right whales) as well as the minimum visibility zone, pending results of sound field verification (see Proposed Monitoring and Reporting section). Any changes to zone size would require NMFS' approval.

TABLE 54—CLEARANCE, SHUTDOWN, AND MINIMUM VISIBILITY ZONES, IN METERS (m), DURING SEQUENTIAL AND CONCURRENT INSTALLATION OF 9/16-m MONOPILES AND 4.5-m PIN PILES IN SUMMER (AND WINTER)

Installation order	Sequential						Concurrent	
Pile type	9/16-m Monopile	4.5-m Pin pile	9/16-m Monopile		4.5-m Pin pile		1 WTG Monopile + 4 OSP pin piles	4 WTG pin +4 OSP pin piles
Method	Impact only		Impact	Vibe	Impact	Vibe	Impact	
North Atlantic right whale Visual Clearance/Shutdown Zone	Sighting at any distance from PSOs on pile-driving or dedicated PSO vessels.							
North Atlantic right whale PAM [1] Clearance/Shutdown Zone [1]	10,000 m (pin), 15,000 m (monopile).							
Other baleen whales Clearance/Shutdown Zone [1]	3,500 (3,700)	2,000 (2,300)	3,500	200	1,900	[2] NAS	3,500	2,600
Sperm whales & delphinids Clearance/Shutdown Zone [1]	NAS	NAS	NAS	NAS	NAS	NAS	NAS	NAS
Harbor porpoise Clearance/Shutdown Zone [1]	NAS	NAS	NAS	NAS	NAS	NAS	NAS	NAS
Seals Clearance/Shutdown Zone [1]	200 (400)	NAS	200	NAS	NAS	NAS	300	200
Minimum Visibility Zone [3]	Within NARW EMA Enhanced: 4,800 m (pin) 7,400 m (mono); Outside NARW EMA: equal to 'other baleen whales' impact pile driving clearance zones.							

[1] The PAM system used during clearance and shutdown must be designed to detect marine mammal vocalizations, maximize baleen whale detections, and must be capable of detecting North Atlantic right whales at 10 km (6.2 mi) and 15 km (9.3 mi) for pin piles and monopile installations, respectively. NMFS recognizes that detectability of each species' vocalizations will vary based on vocalization characteristics (*e.g.,* frequency content, source level), acoustic propagation conditions, and competing noise sources), such that other marine mammal species (*e.g.,* harbor porpoise) may not be detected at 10 km (6.2 mi) or 15 km (9.3 mi).

[2] NAS = noise attenuation system (*e.g.,* double bubble curtain (DBBC)). This zone size designation indicates that the clearance and shutdown zones, based on modeled distances to the Level A harassment thresholds, would not extend beyond the DBBC deployment radius around the pile.

[3] PSOs must be able to visually monitor minimum visibility zones. To provide enhanced protection of North Atlantic right whales during foundation installations in the NARW EMA, SouthCoast proposed monitoring of minimum visibility zones equal to the Level B harassment zones when installing pin piles (4.8 km (3.0 mi)) and monopiles (7.4 km (4.6 mi)). Outside the NARW EMA, the minimum visibility zone would be equal to SouthCoast's clearance/shutdown zones for 'other baleen whales.'

SouthCoast proposed the following clearance zone sizes for UXO/MEC detonation, which are dependent on the size (*i.e.,* charge weight) of a UXO/MEC. SouthCoast has indicated that they will be able to determine the UXO/MEC charge weight prior to detonation. If the charge weight is determined to be unknown or uncertain, SouthCoast would implement the largest clearance zone (E12, 454 kg (1,001 lbs)) prior to detonation.

TABLE 55—LEVEL B HARASSMENT AND CLEARANCE ZONES (IN METERS (m)) DURING UXO/MEC DETONATIONS IN THE EXPORT CABLE CORRIDOR (ECC) AND LEASE AREA (LA), BY CHARGE WEIGHT AND ASSUMING 10 dB OF SOUND ATTENUATION

UXO/MEC charge weights	Low-frequency cetaceans		Mid-frequency cetaceans		High-frequency cetaceans		Phocid pinnipeds	
	ECC	LA	ECC	LA	ECC	LA	ECC	LA
PAM Clearance Zone [1]	15 km							
E4 (2.3 kg):								
Level B harassment (m)	2,800	2,900	500	500	6,200	6,200	1,300	1,500
Clearance Zone (m)	800	400	100	50	2,500	2,200	300	100
E6 (9.1 kg):								
Level B harassment (m)	4,500	4,700	800	800	7,900	8,000	2,200	2,400
Clearance Zone (m)	1,500	800	200	50	3,500	3,200	500	200
E8 (45.5 kg):								
Level B harassment (m)	7,300	7,500	1,300	1,300	10,100	10,300	3,900	3,900
Clearance Zone (m)	2,900	1,800	300	100	4,900	4,900	1,000	600
E10 (227 kg):								
Level B harassment (m)	10,300	10,500	2,100	2,200	12,600	12,900	6,000	6,000
Clearance Zone (m)	4,200	3,400	500	300	6,600	7,200	1,900	1,200
E12 (454 kg):								
Level B harassment (m)	11,800	11,900	2,500	2,600	13,700	14,100	7,100	7,000
Clearance Zone (m)	4,900	4,300	600	400	7,400	8,700	2,600	1,600

[1] The PAM system used during clearance must be designed to detect marine mammal vocalizations, maximize baleen whale detections, and must be capable of detecting North Atlantic right whales at 15 km (9.3 mi). NMFS recognizes that detectability of each species' vocalizations will vary based on vocalization characteristics (*e.g.,* frequency content, source level), acoustic propagation conditions, and competing noise sources), such that other marine mammal species (*e.g.,* harbor porpoise) may not be detected at 10 km (6.2 mi) or 15 km (9.3 mi).

For an HRG survey clearance process that had begun in conditions with good visibility, including via the use of night vision equipment (*i.e.,* IR/thermal camera), and during which the Lead PSO has determined that the clearance zones (table 56) are clear of marine mammals, survey operations would be allowed to commence (*i.e.,* no delay is required) despite periods of inclement weather and/or loss of daylight.

TABLE 56—LEVEL B HARASSMENT THRESHOLD RANGES AND MITIGATION ZONES DURING HRG SURVEYS

Species	Level B harassment zone boomer/sparker (m)	Level B harassment zone CHIRPs (m)	Clearance zone (m)	Shutdown zone (m)
North Atlantic right whale	141	48	500	500
Other baleen whales [1]			100	100
Mid-frequency cetaceans [2]	141	48	100	[1] 100
High-frequency cetaceans	141	48	100	100
Phocid Pinnipeds	141	48	100	100

[1] Baleen whales other the North Atlantic right whale.
[2] An exception is noted for bow-riding delphinids of the following genera: *Delphinus, Stenella, Lagenorhynchus,* and *Tursiops.*

For any other in-water construction heavy machinery activities (*e.g.,* trenching, cable laying, *etc.*), if a marine mammal is on a path towards or comes within 10 m (32.8 ft) of equipment, SouthCoast Wind would be required to delay or cease operations until the marine mammal has moved more than 10 m (32.8 ft) on a path away from the activity to avoid direct interaction with equipment.

Soft-Start and Ramp-Up

The use of a soft-start for impact pile driving or ramp-up for HRG surveys procedures are employed to provide additional protection to marine mammals by warning them or providing them with a chance to leave the area prior to the impact hammer or HRG equipment operating at full capacity. Soft-start typically involves initiating hammer operation at a reduced energy level, relative to the full operating capacity, followed by a waiting period. It is difficult to specify a reduction in energy for any given hammer because of variation across drivers and installation conditions. Typically, NMFS requires a soft-start procedure of the applicant performing four to six strikes per minute at 10 to 20 percent of the maximum hammer energy, for a minimum of 20 minutes. To allow maximum flexibility given Project-specific conditions and any number of safety issues, particularly if pile driving stops before target pile penetration depth is reached, which may result in pile refusal, general soft-start requirements are incorporated into the proposed regulatory text at proposed section 217.334(c)(6) but specific soft-start protocols considering final construction design details, including site-specific soil properties and other considerations, would be identified in their Pile Driving Monitoring Plan, which SouthCoast would submit to NMFS for approval prior to begin foundation installation.

HRG survey operators are required to ramp-up sources when the acoustic sources are used unless the equipment operates on a binary on/off switch. The ramp-up would involve starting from the smallest setting to the operating level over a period of approximately 30 minutes.

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

Fishery Monitoring Surveys

While the likelihood of SouthCoast Wind's fishery monitoring surveys impacting marine mammals is minimal, NMFS is proposing to require SouthCoast Wind to adhere to gear and vessel mitigation measures to reduce the risk of gear interaction to *de minimis* levels. In addition, all crew undertaking the fishery monitoring survey activities would be required to receive protected species identification training prior to activities occurring and attend the aforementioned onboarding training. The specific requirements that NMFS is proposing for the fishery monitoring surveys can be found in the proposed regulatory text in proposed section 217.334(f).

Based on our evaluation of the mitigation measures, as well as other measures considered by NMFS, NMFS has preliminarily determined that these measures will provide the means of affecting the least practicable adverse impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Proposed Monitoring and Reporting

In order to promulgate a rulemaking for an activity, section 101(a)(5)(A) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the 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 (*i.e.,* 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 (*i.e.,* behavioral or physiological) to acoustic stressors (*i.e.,* acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors;
- How anticipated responses to stressors impact either: (1) long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks;
- Effects on marine mammal habitat (*e.g.,* marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat); and/or
- Mitigation and monitoring effectiveness.

Separately, monitoring is also regularly used to support mitigation implementation (*i.e.,* mitigation monitoring) and monitoring plans typically include measures that both support mitigation implementation and increase our understanding of the impacts of the activity on marine mammals.

North Atlantic Right Whale Awareness Monitoring

SouthCoast Wind must use available sources of information on North Atlantic right whale presence, including, but not limited to, daily monitoring of the Right Whale Sightings Advisory System, Whale Alert, and monitoring of U.S. Coast Guard very high frequency (VHF) Channel 16 throughout each day to receive notifications of any sightings and information associated with any regulatory management actions (*e.g.,* establishment of a zone identifying the need to reduce vessel speeds). Maintaining frequent daily awareness of North Atlantic right whale presence in the area through SouthCoast's ongoing visual and passive acoustic monitoring efforts and opportunistic data sources (outside of SouthCoast Wind's efforts) and subsequent coordination for disseminating that information across Project personnel affords increased protection of North Atlantic right whales by alerting project personnel and the marine mammal monitoring team to a higher likelihood of encountering a North Atlantic right whale, potentially increasing the efficacy of mitigation and vessel strike avoidance efforts. Finally, at least one PAM operator must review available passive acoustic data collected in the project area within at least the 24 hours, the duration recommended by Davis *et al.* (2023), prior to foundation installation or any UXO/MEC detonations to identify detections of North Atlantic right whales and convey that information to project personnel (*e.g.,* vessel operators and crew, PSOs).

In addition to utilizing available sources of information on marine mammal presence as described above, SouthCoast would be required to employ and utilize a marine mammal visual monitoring team to monitor throughout (*i.e.,* before, during, and after) all specified activities (*i.e.,* foundation installation, UXO/MEC detonation, and HRG surveys) consisting of NMFS-approved vessel-based PSOs and trained lookouts on all vessels, and PAM operator(s) to monitor throughout foundation installation and UXO/MEC detonation. Visual observations and acoustic detections would be used to support the activity-specific mitigation measures (*e.g.,* clearance zones). To increase understanding of the impacts of the activity on marine mammals, PSOs must record all incidents of marine mammal occurrence at any distance from the piling locations, near the HRG acoustic sources, and during UXO/MEC detonations. PSOs would document all behaviors and behavioral changes, in concert with distance from an acoustic source. Further, SFV during foundation installation and UXO/MEC detonation is required to ensure compliance and that the potential impacts are within the bounds of that analyzed. The required monitoring, including PSO and PAM Operator qualifications, is described below, beginning with PSO measures that are applicable to all the aforementioned activities and PAM (for specific activities).

Protected Species Observer and PAM Operator Requirements

SouthCoast Wind would be required to employ NMFS-approved PSOs and PAM operators for certain activities. PSOs are trained professionals who are tasked with visually monitoring for marine mammals during pile driving, UXO/MEC detonations, and HRG surveys. The primary purpose of a PSO is to carry out the monitoring, collect data, and, when appropriate, call for the implementation of mitigation measures. In addition to visual observations, NMFS would require SouthCoast Wind to conduct real-time acoustic monitoring by PAM operators during foundation pile driving, UXO/MEC detonation, and vessel transit over 10 knots (18.5 km/hr).

The inclusion of PAM, which would be conducted by NMFS-approved PAM operators utilizing standardized measurement, processing, reporting, and metadata methods and metrics for offshore wind, combined with visual data collection, is a valuable way to provide the most accurate record of species presence as possible and, together, these two monitoring methods are well understood to provide best results when combined together (*e.g.,* Barlow and Taylor, 2005; Clark *et al.,* 2010; Gerrodette *et al.,* 2011; Van Parijs *et al.,* 2021). Acoustic monitoring (in addition to visual monitoring) increases the likelihood of detecting marine mammals, if they are vocalizing, within the shutdown and clearance zones of project activities, which when applied in combination of required shutdowns helps to further reduce the risk of marine mammals being exposed to sound levels that could otherwise result in acoustic injury or more intense behavioral harassment. The exact configuration and number of PAM systems depends on the size of the zone(s) being monitored, the amount of noise expected in the area, and the characteristics of the signals being monitored.

The exact configuration and number of PAM systems depends on the size of the zone(s) being monitored, the amount of noise expected in the area, and the characteristics of the signals being monitored. More closely-spaced hydrophones would allow for more directionality and range to the vocalizing marine mammals. Larger baleen cetacean species (*i.e.,* mysticetes), which produce loud and lower-frequency vocalizations, may be able to be heard with fewer hydrophones spaced at greater distances. However, detection of smaller cetaceans (*e.g.,* mid-frequency delphinids; odontocetes) may necessitate more hydrophones and to be spaced closer together given the shorter range of the shorter, mid-frequency acoustic signals (*e.g.,* whistles and echolocation clicks). As there are no ''perfect fit'' single-optimal-array configurations, these set-ups would need to be considered on a case-by-case basis.

NMFS does not formally administer any PSO or PAM operator training programs or endorse specific providers but would approve PSOs and PAM operators that have successfully completed courses that meet the curriculum and training requirements referenced below and/or demonstrate experience. PSOs would be allowed to act as PAM operators or PSOs (but not simultaneously) as long as they demonstrate that their training and experience are sufficient to perform each task.

NMFS would provide PSO and PAM operator approval, if the candidate is qualified, to ensure that PSOs and PAM operators have the necessary training and/or experience to carry out their duties competently. NMFS may approve PSOs and PAM operators as conditional or unconditional. A conditionally-approved PSO may be one who has completed training in the last 5 years but has not yet attained the requisite field experience. An unconditionally approved PSO is one who has completed training within the last 5 years (or completed training earlier but has demonstrated recent experience acting as a PSO) and attained the necessary experience (*i.e.,* demonstrate experience with monitoring for marine mammals at clearance and shutdown zone sizes similar to those produced during the respective activity). The specific requirements for conditional and unconditional approval can be found in the proposed regulatory text in proposed section 217.335(a)(7). PSOs and PAM operators for pile driving and UXO/MEC detonation must be unconditionally approved. PSOs for HRG surveys may be conditionally or unconditionally approved; however, conditionally-approved PSOs must be paired with an unconditional-approved PSO to ensure that the quality of marine mammal observations and data recording is kept consistent.

At least one PSO and PAM operator per platform must be designated as a Lead. To qualify as a Lead PSO or PAM operator, the person must be unconditionally approved and demonstrate that they have a minimum of 90 days of at-sea experience monitoring marine mammals in the specific role, with the conclusion of the most recent relevant experience not more than 18 months previous to deployment. The person must also have experience specifically monitoring baleen whale species;

SouthCoast Wind must submit a list of previously approved PSOs and PAM operators to NMFS Office of Protected Resources for review and confirmation of their approval for specific roles at least 30 days prior to commencement of the activities requiring PSOs and PAM operators or 15 days prior to when new, previously approved PSOs and PAM operators are required after activities have commenced. For prospective PSOs and PAM operators not previously approved or for PSOs and PAM operators whose approval is not current, SouthCoast Wind must submit resumes for approval to NMFS at least 60 days prior to PSO and PAM operator use. Resumes must include information related to roles for which approval is being sought, relevant education, experience, and training, including dates, duration, location, and description of prior PSO or PAM operator experience. Resumes must be accompanied by relevant documentation of successful completion of necessary training.

The number of PSOs and PAM operators that would be required to actively observe for the presence of marine mammals are specific to each activity, as are the types of equipment required (*e.g.,* big eyes on the pile driving vessel; acoustic buoys) to increase marine mammal detection capabilities. A minimum of three on-duty PSOs per platform (*e.g.,* pile driving vessel, dedicated PSO vessel) would conduct monitoring before, during, and after foundation installations and UXO/MEC detonations. A minimum number of PAM operators would be required to actively monitor for marine mammal acoustic detections for these activities; this number would be based on the PAM systems and specified in the PAM Plan SouthCoast would submit for NMFS approval prior to the start of in-water activities. At least one PSO must be on-duty during HRG surveys conducted during daylight hours; and at least two PSOs must be on-duty during HRG surveys conducted during nighttime. NMFS would not require PAM or PAM operators during HRG surveys.

The number of platforms from which the required number of PSOs would conduct monitoring depends on the activity and timeframe. Within the NARW EMA from June 1–August 15 and outside the NARW EMA June 1–November 30, SouthCoast would conduct monitoring before, during, and after foundation installation from three dedicated PSO monitoring vessels, in addition to the pile driving platform. Within the NARW EMA from August 16–October 15 and outside the NARW EMA May 16–May 31 and December 1–31 (if NMFS approved SouthCoast's request for allowance to install foundations in December), PSOs would monitor from four dedicated PSO vessels and the pile driving vessel (*i.e.,* five platforms total). The number of monitoring platforms required for UXO/MEC detonations depends on the charge weight. For detonation of lower charge weight (E4–E8) UXO/MECs, SouthCoast would conduct monitoring from the main activity platform and a dedicated PSO monitoring platform. If, after attempting all methods of UXO/MEC disposal, SouthCoast must detonate a heavier charge weight UXO/MEC (*i.e.,* E10 or E12) that is predicted to result in a larger ensonified zone (*i.e.,* >5 km), additional monitoring platforms (*i.e.,* vessel, plane) would be required. During HRG surveys, PSOs would conduct monitoring from the survey vessels. In addition to monitoring duties, PSOs and PAM operators are responsible for data collection. The data collected by PSO and PAM operators and subsequent analysis provide the necessary information to inform an estimate of the number of take that occurred during the project, better understand the impacts of the project on marine mammals, address the effectiveness of monitoring and mitigation measures, and to adaptively manage activities and mitigation in the future. Data reported includes information on marine mammal sightings, activity occurring at time of sighting, monitoring conditions, and if mitigative actions were taken. Specific data collection requirements are contained within the regulations at the end of this rulemaking.

SouthCoast Wind would be required to submit Pile Driving and UXO/MEC Detonation Marine Mammal Monitoring Plans and a PAM Plan to NMFS 180 days in advance of foundation installation and UXO/MEC detonation. The Plans must include details regarding PSO and PAM monitoring protocols and equipment proposed for use, as described in the draft LOA available at *https://www.fisheries.noaa.gov/action/incidental-take-authorization-southcoast-wind-llc-construction-southcoast-wind-offshore-wind.* More specifically, the PAM Plan must, among other things, include a description of all proposed PAM equipment, address how the proposed passive acoustic monitoring must follow standardized measurement, processing methods, reporting metrics, and metadata standards for offshore wind as described in *NOAA and BOEM Minimum Recommendations for Use of Passive Acoustic Listening Systems in Offshore Wind Energy Development Monitoring and Mitigation Programs* (Van Parijs *et al.,* 2021). NMFS must approve the Plans prior to foundation installation activities or UXO/MEC detonation commencing.

Sound Field Verification (SFV)

SouthCoast would be required to conduct SFV measurements during all foundation installations and all UXO/MEC detonations. At minimum, the first three monopile foundations and four pin piles must be monitored with Thorough SFV (T–SFV), which requires, at minimum, measurements at four locations along one transect from the pile with each recorder equipped with two hydrophones as well as an additional recorder at a 90 degrees from the transect (total of 10 hydrophones). For example, SouthCoast would deploy acoustic recorders at positions 750 m (2,460.6 ft), 1500 m (4,921.3 ft)), 3000 m (9,842.5 ft), and 10,000 m (32,808.4 ft) in a single linear array due south and another acoustic recorder due east of the foundation installation location. SFV protocols for impact pile driving, can be found in ISO 18406 *Underwater acoustics—Measurement of radiated underwater sound from percussive pile driving* (2017). T–SFV measurements must continue until at least three consecutive piles demonstrate distances to thresholds are at or below those modeled assuming 10 dB of attenuation. Subsequent T–SFV measurements are also required should larger piles be installed or additional piles be driven that are anticipated to produce longer distances to harassment isopleths than those previously measured (*e.g.,* higher hammer energy, greater number of strikes, *etc.*). The required reporting metrics associated with T–SFV can be found in the draft LOA. The requirements are extensive to ensure monitoring is conducted appropriately and the reporting (*i.e.,* communicating monitoring results to NMFS) is frequent to ensure SouthCoast is making any necessary adjustments quickly (*e.g.,* ensure bubble curtain hose maintenance, check bubble curtain air pressure supply, add additional sound attenuation) to ensure impacts to marine mammals are not above those considered in this analysis. SouthCoast would be required to conduct abbreviated SFV (A–SFV) on all piles for which T–SFV is not conducted; the reporting requirements and frequency of reporting can be found in the proposed regulatory text at proposed section 217.334(c)(20). SouthCoastWind must also conduct SFV during operations to better understand the sound fields and potential impacts on marine mammals associated with turbine operations.

Reporting

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

NMFS would require standardized and frequent reporting from SouthCoast Wind during the life of the regulations and LOA. All data collected relating to the Project would be recorded using industry-standard software (*e.g.,* Mysticetus or a similar software) installed on field laptops and/or tablets. SouthCoast Wind is required to submit weekly, monthly, annual, and situational, and final reports. The specifics of what we require to be reported can be found in the proposed regulatory text at proposed section 217.335(c).

Weekly Report—During foundation installation activities, SouthCoast would be required to compile and submit weekly marine mammal monitoring reports for foundation installation pile driving to NMFS Office of Protected Resources that document the daily start and stop of all pile-driving activities, the start and stop of associated observation periods by PSOs, details on the deployment of PSOs, a record of all detections of marine mammals (acoustic and visual), any mitigation actions (or if mitigation actions could not be taken, provide reasons why), and details on the noise abatement system(s) (*e.g.,* system type, distance deployed from the pile, bubble rate, *etc.*), and A–SFV results. Weekly reports will be due on Wednesday for the previous week (Sunday to Saturday). The weekly reports are also required to identify which turbines become operational and when (a map must be provided). Once all foundation pile installation is complete, weekly reports would no longer be required.

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

Annual Reporting—SouthCoast is required to submit an annual marine mammal monitoring (including visual and acoustic observations of marine mammals) report to NMFS Office of Protected Resources by March 31st, annually, describing in detail all of the information required in the monitoring section above for the previous calendar year. A final annual report must be prepared and submitted within 30 calendar days following receipt of any NMFS comments on the draft report.

Final Reporting—SouthCoast must submit its draft 5-year report(s) to NMFS Office of Protected Resources. The report must contain, but is not limited to, a description of activities conducted (including GIS files where relevant), and all visual and acoustic monitoring, including all SFV and monitoring effectiveness, conducted under the LOA within 90 calendar days of the completion of activities occurring under the LOA. A final 5-year report must be prepared and submitted within 60 calendar days following receipt of any NMFS comments on the draft report.

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

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

In the event of a vessel strike of a marine mammal by any vessel associated with the Project, SouthCoast Wind must immediately report the strike incident. If the strike occurs in the Greater Atlantic Region (Maine to Virginia), SouthCoast must call the NMFS Greater Atlantic Stranding Hotline. Separately, SouthCoast must also and immediately report the incident to NMFS Office of Protected Resources and GARFO. SouthCoast must immediately cease all on-water activities until NMFS Office of Protected Resources is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate to ensure compliance with the terms of the LOA. NMFS Office of Protected Resources may impose additional measures to minimize the likelihood of further prohibited take and ensure MMPA compliance. SouthCoast Wind may not resume their activities until notified by NMFS.

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

The specifics of what NMFS Office of Protected Resources proposes to require to be reported are included in the draft LOA.

Sound Field Verification—SouthCoast is required to submit interim T–SFV reports after each foundation installation and UXO/MEC detonation as soon as possible but no later than 48 hours after monitoring of each activity is complete. Reports for A–SFV must be included in the weekly monitoring reports. The final SFV report (including both A–SFV and T–SFV results) for all foundation installations and UXO/MEC detonations would be required within 90 days following completion of sound field verification monitoring.

Adaptive Management

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

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

The following are some of the possible sources of new information to be considered through the adaptive management process: (1) results from monitoring reports, including the weekly, monthly, situational, and annual reports required; (2) results from research on marine mammals, noise impacts, or other related topics; and (3) any information that reveals that marine mammals may have been taken in a manner, extent, or number not authorized by these regulations or subsequent LOA. Adaptive management decisions may be made at any time, as new information warrants it. NMFS may consult with SouthCoast Wind regarding the practicability of the modifications.

Preliminary Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.,* population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be ''taken'' by mortality, serious injury, Level A harassment and Level B harassment, we consider other factors, such as the likely nature of any behavioral responses (*e.g.,* intensity, duration), the context of any such responses (*e.g.,* critical reproductive time or location, migration) as well as effects on habitat and the likely effectiveness of mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS' implementing regulations (54 FR 40338, September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.,* as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

In the Estimated Take section, we estimated the maximum number of takes, by Level A harassment and Level B harassment, of marine mammal species and stocks that could occur incidental to SouthCoast's specified activities. The impact on the affected species and stock that any given take may have is dependent on many case-specific factors that need to be considered in the negligible impact analysis (*e.g.,* the context of behavioral exposures such as duration or intensity of a disturbance, the health of impacted animals, the status of a species that incurs fitness-level impacts to individuals, *etc.*). In this proposed rule, we evaluate the likely impacts of the enumerated harassment takes that are proposed for authorization, in consideration of the context in which the predicted takes would occur. We also collectively evaluate this information as well as other more taxa-specific information and mitigation measure effectiveness in group-specific discussions that support our preliminary negligible impact determinations for each stock. No serious injury or mortality is expected or proposed for authorization for any species or stock.

The Description of the Specified Activities section describes SouthCoast's specified activities that may result in the take of marine mammals and an estimated schedule for conducting those activities. SouthCoast has provided a realistic construction schedule, although we recognize schedules may shift for a variety of reasons (*e.g.,* weather or supply delays). For each species, the maximum number of annual takes proposed for authorization is based on the pile driving scenario for each year (table X) that resulted in the highest number of Level B harassment takes for a given species. The 5-year total number of takes proposed for authorization is based on installation of Project 1 Scenario 1 in a single year and Project 2 Scenario 2 in a single year. The total number of authorized takes would not exceed the maximum annual totals in any given year or the 5-year total take specified in tables 53 and 52, respectively.

We base our analysis and preliminary negligible impact determination on the maximum number of takes that are proposed for authorization in any given year and the total takes proposed for authorization across the 5-year effective period of these regulations, if issued, as well as extensive qualitative consideration of other contextual factors that influence the severity and nature of impacts on affected individuals and the number and context of the individuals affected. As stated before, the number of takes, both maximum annual and 5-year totals, alone are only a part of the analysis.

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

Last, we provide a preliminary negligible impact determination for each species or stock, providing information relevant to our analysis, where appropriate. Organizing our analysis by grouping species or stocks that share common traits or that would respond similarly to effects of SouthCoast's activities and then providing species- or stock-specific information allows us to avoid duplication while ensuring that we have analyzed the effects of the specified activities on each affected species or stock. It is important to note that for all species or stocks, the majority of the impacts are associated with WTG and OSP foundation installation, which would occur over 2 years per SouthCoast's schedule (tables 19–23). The maximum annual take for each species or stock would occur during construction of Project 2. The number of takes proposed for authorization by NMFS in other years would be notably less.

As described previously, no serious injury or mortality is anticipated or proposed for authorization. Non-auditory injury (*e.g.,* lung injury or gastrointestinal injury from UXO/MEC detonation) is also not anticipated due to the proposed mitigation measures and would not be authorized in any LOA issued under this rule. Any Level A harassment authorized would be in the form of auditory injury (*i.e.,* PTS).

Behavioral Disturbance

In general, NMFS anticipates that impacts on an individual that has been harassed are likely to be more intense when exposed to higher received levels and for a longer duration (though this is not a strictly linear relationship for behavioral effects across species, individuals, or circumstances) and less severe impacts result when exposed to lower received levels and for a brief duration. However, there is also growing evidence of the importance of contextual factors, such as distance from a source in predicting marine mammal behavioral response to sound—*i.e.,* sounds of a similar level emanating from a more distant source have been shown to be less likely to evoke a response of equal magnitude (*e.g.,* DeRuiter and Doukara, 2012; Falcone *et al.,* 2017). As described in the Potential Effects to Marine Mammals and their Habitat section, the intensity and duration of any impact resulting from exposure to SouthCoast's activities is dependent upon a number of contextual factors including, but not limited to, sound source frequencies, whether the sound source is stationary or moving towards the animal, hearing ranges of marine mammals, behavioral state at time of exposure, status of individual exposed (*e.g.,* reproductive status, age class, health) and an individual's experience with similar sound sources. Southall *et al.* (2021), Ellison *et al.* (2012), and Moore and Barlow (2013), among others, emphasize the importance of context (*e.g.,* behavioral state of the animals, distance from the sound source) in evaluating behavioral responses of marine mammals to acoustic sources. Harassment of marine mammals may result in behavioral modifications (*e.g.,* avoidance, temporary cessation of foraging or communicating, changes in respiration or group dynamics, masking) or may result in auditory impacts such as hearing loss. In addition, some of the lower level physiological stress responses (*e.g.,* change in respiration, change in heart rate) discussed previously would likely co-occur with the behavioral modifications, although these physiological responses are more difficult to detect and fewer data exist relating these responses to specific received levels of sound. Level B harassment takes, then, may have a stress-related physiological component as well; however, we would not expect SouthCoast's activities to produce conditions of long-term and continuous exposure to noise leading to long-term physiological stress responses in marine mammals that could affect reproduction or survival.

In the range of exposure intensities that might result in Level B harassment (which by nature of the way it is modeled/counted, occurs within one day), the less severe end might include exposure to comparatively lower levels of a sound, at a greater distance from the animal, for a few or several minutes. A less severe exposure of this nature could result in a behavioral response such as avoiding a small area that an animal would otherwise have chosen to move through or feed in for some number of time, or breaking off one or a few feeding bouts. More severe effects could occur if an animal receives comparatively higher levels at very close distances, is exposed continuously to one source for a longer time, or is exposed intermittently throughout a day. Such exposure might result in an animal having a more severe avoidance response and leaving a larger area for an extended duration, potentially, for example, losing feeding opportunities for a day or more. Given the extensive mitigation and monitoring measures included in this rule, we anticipate severe behavioral effects to be minimized to the extent practicable.

Many species perform vital functions, such as feeding, resting, traveling, and socializing on a diel cycle (24-hour cycle). Behavioral reactions to noise exposure, when taking place in a biologically important context, such as disruption of critical life functions, displacement, or avoidance of important habitat, are more likely to be significant if they last more than one day or recur on subsequent days (Southall *et al.,* 2007) due to diel and lunar patterns in diving and foraging behaviors observed in many cetaceans (Baird *et al.,* 2008; Barlow *et al.,* 2020; Henderson *et al.,* 2016, Schorr *et al.,* 2014). It is important to note the water depth in the Lease Area and ECCs is shallow ranging from 0–41.5 in the ECCs and 37.1–63.4 in the Lease Area) and deep-diving species, such as sperm whales, are not expected to be engaging in deep foraging dives when exposed to noise above NMFS harassment thresholds during the specified activities. Therefore, we do not anticipate foraging behavior in deep water to be impacted by the specified activities.

It is important to identify that the estimated number of takes for each stock does not necessarily equate to the number of individual marine mammals expected to be harassed (which may be lower, depending on the circumstances), but rather to the instances of take that may occur. These instances may represent either brief exposures of seconds for UXO/MEC detonations, seconds to minutes for HRG surveys, or, in some cases, longer durations of exposure within (but not exceeding) a day (*e.g.,* pile driving). Some members of a species or stock may experience one exposure (*i.e.,* be taken on one day) as they move through an area, while other individuals may experience recurring instances of take over multiple days throughout the year, in which case the number of individuals taken is smaller than the number of takes proposed for authorization for that species or stock. For species that are more likely to be migrating through the area and/or for which only a comparatively smaller number of takes are predicted (*e.g.,* some of the mysticetes), it is more likely that each take represents a different individual. However, for non-migrating species or stocks with larger numbers of predicted take, we expect that the total anticipated takes represent exposures of a smaller number of individuals of which some would be taken across multiple days.

For the SouthCoast Project, impact pile driving of foundation piles is most likely to result in a higher magnitude and severity of behavioral disturbance than other activities (*i.e.,* vibratory pile driving, UXO/MEC detonations, and HRG surveys). Impact pile driving has higher source levels than vibratory pile driving and HRG surveys, and produces much lower frequencies than most HRG survey equipment, resulting in significantly greater sound propagation because lower frequencies typically propagate further than higher frequencies. While UXO/MEC detonations may have higher source levels than other activities, the number of UXO/MEC detonations is limited (10 over 5 years) and each produces blast noise and pressure for an extremely short period (on the order of a fraction of a second near the source and seconds further from the source) as compared to multiple hours of pile driving or HRG surveys in a given day.

While foundation installation impact pile driving is anticipated to result in the most takes due to high source levels, pile driving would not occur all day, every day. Table 2 describes the number of piles, by pile type and scenario, that may be driven each day. As described in the Description of Specified Activities section, impact driving could occur for up to 4 hours per monopile and 2 hours per pin pile. For those piles also including vibratory driving in Project 2, the duration of impact driving would be reduced. If vibratory pile driving is used to set the pile (Project 2 only), this would be limited to 20 minutes per monopile and 90 minutes per pin pile. No more than 2 monopiles or 4 pin piles would be installed each day for the majority of installations. As described in the construction schedule scenarios (Table 2), on 3 or 4 days for each Project, two installation vessels would work concurrently to install WTG foundations and OSP foundations, further reducing the overall amount of time during which impact pile driving noise is transmitted into marine mammal habitat. Impacts would be minimized through implementation of mitigation measures, including use of a sound attenuation system, soft-starts, and the implementation of clearance and shutdown zones that either delay or suspend, respectively, pile driving when marine mammals are detected at specified distances. Further, given sufficient notice through the use of soft-start, marine mammals are expected to move away from a pile driving sound source prior to becoming exposed to very loud noise levels. The requirement to couple visual monitoring (using multiple PSOs) and PAM before and during all foundation installation and UXO/MEC detonations will increase the overall capability to detect marine mammals and effectively implement realtime mitigation measures, as compared to one method alone. Measures such as the requirement to apply noise attenuation systems and implementation of clearance zones also apply to UXO/MEC detonation(s), which also have the potential to elicit TTS and more severe behavioral reactions; hence, severity of TTS and behavioral responses, are expected to be lower than would be the case without noise mitigation.

Occasional, milder behavioral reactions are unlikely to cause long-term consequences for individual animals or populations. Even if some smaller subset of the takes are in the form of a longer (several hours or a day) and more severe response, if they are not expected to be repeated over numerous or sequential days, impacts to individual fitness are not anticipated. Nearly all studies and experts agree that infrequent exposures of a single day or less are unlikely to impact an individual's overall energy budget (Farmer *et al.,* 2018; Harris *et al.,* 2017; King *et al.,* 2015; National Academy of Science, 2017; New *et al.,* 2014; Southall *et al.,* 2007; Villegas-Amtmann *et al.,* 2015). Further, the effect of disturbance is strongly influenced by whether it overlaps with biologically important habitats when individuals are present—avoiding biologically important habitats (which occur in both space and time) will provide opportunities to compensate for reduced or lost foraging (Keen *et al.,* 2021). Importantly, the seasonal restrictions on pile driving and UXO/MEC detonation limit take to those times when species of particular concern are less likely to be present in biologically important habitats and, if present, less likely to be engaged in critical behaviors such as foraging.

Temporary Threshold Shift (TTS)

Temporary Threshold Shift (TTS)

TTS is one form of Level B harassment that marine mammals may incur through exposure to SouthCoast's activities and, as described earlier, the proposed takes by Level B harassment may represent takes in the form of behavioral disturbance, TTS, or both. As discussed in the Potential Effects to Marine Mammals and their Habitat section, in general, TTS can last from a few minutes to days, be of varying degree, and occur across different frequency bandwidths, all of which determine the severity of the impacts on the affected individual, which can range from minor to more severe. Impact and vibratory pile driving and UXO/MEC detonations are broadband noise sources (*i.e.,* produce sound over a wide range of frequencies) but most of the energy is concentrated below 1–2 kHz, with a small amount of energy ranging up to 20 kHz. Low-frequency cetaceans are most susceptible to noise-induced hearing loss at lower frequencies, given this is a frequency band in which they produce vocalizations to communicate with conspecifics, we would anticipate the potential for TTS incidental to pile driving and detonations to be greater in this hearing group (*i.e.,* mysticetes) compared to others (*e.g.,* mid-frequency). However, we would not expect the TTS to span the entire communication or hearing range of any species given that the frequencies produced by these activities do not span entire hearing ranges for any particular species. Additionally, though the frequency range of TTS that marine mammals might sustain would overlap with some of the frequency ranges of their vocalizations and other auditory cues for the time periods when they are in the vicinity of the sources, the frequency range of TTS from SouthCoast's pile driving and UXO/MEC detonation activities would not be expected to span the entire frequency range of one vocalization type, much less span all types of vocalizations or of all other critical auditory cues for any given species, much less for long continuous durations. The proposed mitigation measures further reduce the potential for TTS in mysticetes.

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

Permanent Threshold Shift (PTS)

NMFS proposes to authorize a very small number of take by PTS to some marine mammals. The numbers of proposed annual takes by Level A harassment are relatively low for all marine mammal stocks and species (table 51). The only activities incidental to which we anticipate PTS may occur is from exposure to impact pile driving and UXO/MEC detonations, which produce sounds that are both impulsive and primarily concentrated in the lower frequency ranges (below 1 kHz) (David, 2006; Krumpel *et al.,* 2021). PTS would consist of minor degradation of hearing capabilities occurring predominantly at frequencies one-half to one octave above the frequency of the energy produced by pile driving or instantaneous UXO/MEC detonation (*i.e.,* the low-frequency region below 2 kHz) (Cody and Johnstone, 1981; McFadden, 1986; Finneran, 2015), not severe hearing impairment. If hearing impairment occurs from either impact pile driving or UXO/MEC detonation, it is most likely that the affected animal would lose a few decibels in its hearing sensitivity, which in most cases is not likely to meaningfully affect its ability to forage and communicate with conspecifics.

SouthCoast estimates 10 UXO/MECs may be detonated and the exposure analysis conservatively assumes that all of the UXO/MECs found would consist of the largest charge weight of UXO/MEC (E12; 454 kg (1,001 lbs)). However, it is highly unlikely that all charges would be the maximum size; thus, the number of takes by Level A harassment that may occur incidental to the detonation of the UXO/MECs is likely less than what is estimated.

There are no PTS data on cetaceans and only one instance of PTS being induced in older harbor seals (Reichmuth *et al.,* 2019). However, available TTS data (of mid-frequency hearing specialists exposed to mid- or high-frequency sounds (Southall *et al.,* 2007; NMFS, 2018; Southall *et al.,* 2019)) suggest that most threshold shifts occur in the frequency range of the source up to one octave higher than the source. We would anticipate a similar result for PTS. Further, no more than a small degree of PTS is expected to be associated with any of the incurred Level A harassment given it is unlikely that animals would stay in the close vicinity of impact pile driving for a duration long enough to produce more than a small degree of PTS and given sufficient notice through use of soft-start prior to implementation of full hammer energy during impact pile driving, marine mammals are expected to move away from a sound source that is disturbing prior to it resulting in severe PTS. Given UXO/MEC detonations are instantaneous, the potential for PTS is not a function of duration. NMFS recognizes the distances to PTS thresholds may be large for certain species (*e.g.,* over 8.6 km (28,215 ft) based on the largest charge weights; see tables 39–42); however, SouthCoast would utilize multiple vessels equipped with at minimum 3 PSOs each as well as PAM to observe and acoustically detect marine mammals. A marine mammal within the PTS zone would trigger a delay to detonation until the clearance zones are declared clear of marine mammals, thereby minimizing potential for PTS for all marine mammal species and ensuring that any PTS that does occur is of a relatively low degree.

Auditory Masking or Communication Impairment

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

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

Impacts on Habitat and Prey

Pile driving associated with foundation installation or UXO/MEC detonation may result in impacts to prey, the extent to which based, in part, on the specific prey type. While fish and invertebrate mortality or injury may occur, it is anticipated that these types of impacts would be limited to a very small subset of available prey very close to the source, and that the implementation of mitigation measures (*e.g.,* use of a noise attenuation system during pile driving and UXO/MEC detonation, soft-starts for pile driving) would limit the severity and extent of impacts (again, noting UXO/MEC detonation would be limited to 10 events). Pile driving noise, both impact and vibratory, UXO.MEC detonations, and HRG surveys may cause mobile prey species, primarily fish, to temporarily leave the area of disturbance, resulting in temporary displacement from habitat near the pile driving or detonation site. For those HRG acoustic sources used by SouthCoast that operate at frequencies that are likely outside the hearing range of marine mammal prey species, no effects are anticipated.

Any behavioral avoidance of the disturbed area by the subset of affected fish is expected to be localized (*i.e.,* fish would not travel far from the site of disturbance) and temporary, thus piscivorous species (including marine mammals and some larger fish species), would still have access to significantly large areas of prey in foraging habitat in the nearby vicinity. Repeated exposure of individual fish to sound and energy from pile driving or underwater explosions is not likely, given fish movement patterns, especially schooling prey species. The duration of fish avoidance of an area after pile driving stops or a UXO/MEC is detonated is unknown, but it is anticipated that there would be a rapid return to normal recruitment, distribution and behavior following cessation of the disturbance. Long-term consequences for fish populations, including key prey species within the project area, would not be expected.

Impacts to prey species with limited self-mobility (*e.g.,* zooplankton) would also depend on proximity to the specified activities, without the potential for avoidance of the activity site on the same spatial scale as fishes and other mobile species. However, impacts to zooplankton, in the context of availability as marine mammal prey, from these activities are expected to be minimal, based on both experimental data and theoretical modeling of zooplankton population responses to airgun noise exposure (see Effects on Prey section). In general, the rapid reproductive rate of zooplankton, coupled with advection of zooplankton from sources outside of the Lease Area and ECCs would help support maintenance of the population in these areas, should pile driving or detonation activities result in changes in physiology impacting limiting reproduction (*e.g.,* growth suppression) or mortality of zooplankton. Long-term impacts to zooplankton populations and their habitat from pile driving and detonation activities in the project area are not anticipated, thereby limiting potential impacts to zooplanktivorous species, including North Atlantic right whales.

In general, impacts to marine mammal prey species from construction activities are expected to be minor and temporary due to the expected limited daily duration of individual pile driving events and few instances (10) of UXO/MEC detonations. Behavioral changes in prey in response to construction activities could temporarily impact marine mammals' foraging opportunities in a limited portion of the foraging range but, because of the relatively small area of the habitat that may be affected at any given time (*e.g.,* around a pile being driven) and the temporary nature of the disturbance on prey species, the impacts to marine mammal habitat from construction activities (*i.e.,* foundation installation, UXO/MEC detonation, and HRG surveys) are not expected to cause significant or long-term negative consequences.

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

The physical presence of WTG foundations and associated scour protection within the Lease Area would remain within marine mammal habitat for approximately 30 years. The submerged parts of these structures act as artificial reefs, providing new habitats and restructuring local ecology, likely affecting some prey resources that could benefit many species, including some marine mammals. Wind turbine presence and/or operations is, in general, likely to result in oceanographic effects in the marine environment, and may alter aggregations and distribution of marine mammal zooplankton prey and other species through changing the strength of tidal currents and associated fronts, changes in stratification, primary production, the degree of mixing, and stratification in the water column (Schultze *et al.,* 2020; Chen *et al.,* 2021; Johnson *et al.,* 2021; Christiansen *et al.,* 2022; Dorrell *et al.,* 2022). However, there is significant uncertainty regarding the extent to and rate at which changes may occur, how potential changes might impact various marine mammal prey species (*e.g.,* fish, copepods), and how or if impacts to prey species might result in impacts to marine mammal foraging that may result in fitness consequences.

The project would consist of no more than 149 foundations supporting 147 WTGs and 2 OSPs in the Lease Area, which will gradually become operational (*i.e.,* commissioned) throughout construction of Project 1 and Project 2. SouthCoast's construction schedule indicates that it is possible that WTGs would not become operational until the latter part of the 5-year effective period of the rule, if issued.

Mitigation To Reduce Impacts on All Species

This proposed rulemaking includes a variety of mitigation measures designed to minimize impacts on all marine mammals, with enhanced measures focused on North Atlantic right whales (the latter is described in more detail below). For impact pile driving of foundation piles and UXO/MEC detonations, ten overarching mitigation and monitoring measures are proposed, which are intended to reduce both the number and intensity of marine mammal takes: (1) seasonal and time of day work restrictions; (2) use of multiple PSOs to visually observe for marine mammals (with any detection within specifically designated zones that would trigger a delay or shutdown); (3) use of PAM to acoustically detect marine mammals, with a focus on detecting baleen whales (with any detection within designated zones triggering delay or shutdown); (4) implementation of clearance zones; (5) implementation of shutdown zones; (6) use of soft-start; (7) use of noise attenuation technology; (8) maintaining situational awareness of marine mammal presence through the requirement that any marine mammal sighting(s) by SouthCoast's personnel must be reported to PSOs; (9) sound field verification monitoring; and (10) vessel strike avoidance measures to reduce the risk of a collision with a marine mammal and vessel. For HRG surveys, we are requiring six measures: (1) measures specifically for vessel strike avoidance; (2) specific requirements during daytime and nighttime HRG surveys; (3) implementation of clearance zones; (4) implementation of shutdown zones; (5) use of ramp-up of acoustic sources; and (6) maintaining situational awareness of marine mammal presence through the requirement that any marine mammal sighting(s) by SouthCoast's personnel must be reported to PSOs.

NMFS has proposed mitigation to reduce the impacts of the specified activities on the species and stocks to the extent practicable. The Proposed Mitigation section discusses the manner in which the required mitigation measures reduce the magnitude and/or severity of the take of marine mammals. For pile driving and UXO/MEC detonations, SouthCoast would be required to reduce noise levels to the lowest levels practicable and implement additional NAS should SFV identify that measured distances have exceeded modeled distances to harassment threshold isopleths, assuming a 10-dB attenuation. Use of a soft-start during impact pile driving will allow animals to move away from the sound source prior to applying higher hammer energy levels needed to install the pile (this anticipated behavior is accounted for in the take estimates given they represent installation of the entire pile at various hammer energy levels, including very low energy levels). SouthCoast would not use a hammer energy greater than necessary to install piles, thereby minimizing exposures to higher sound levels. Similarly, ramp-up during HRG surveys would allow animals to move away and avoid the acoustic sources before they reach their maximum energy level. For pile driving and HRG surveys, clearance zone and shutdown zone implementation, which are required when marine mammals are within given distances associated with certain impact thresholds for all activities, would reduce the magnitude and severity of marine mammal take by delaying or shutting down the activity if marine mammals are detected within these relevant zones, thus reducing the potential for exposure to more disturbing levels of noise. Additionally, the use of multiple PSOs (WTG and OSP foundation installation, HRG surveys, and UXO/MEC detonations), PAM operators (for impact foundation installation and UXO/MEC detonation), and maintaining awareness of marine mammal sightings reported in the region (for WTG and OSP foundation installation, HRG surveys, and UXO/MEC detonations) would aid in detecting marine mammals that would trigger the implementation of the mitigation measures. The reporting requirements, including SFV reporting (for foundation installation, foundation operation, and UXO/MEC detonations), will assist NMFS in identifying if impacts beyond those analyzed in this proposed rule are occurring, potentially leading to the need to enact adaptive management measures in addition to or in place of the proposed mitigation measures. Overall, the proposed mitigation measures affect the least practicable adverse impact on marine mammals from the specified activities.

Mysticetes

Six mysticete species (comprising six stocks) of cetaceans (North Atlantic right whale, humpback whale, blue whale, fin whale, sei whale, and minke whale) may be taken by harassment. These species, to varying extents, utilize the specified geographicalregion, including the Lease Area and ECCs, for the purposes of migration, foraging, and socializing. The extent to which any given individual animal engages in these behaviors in the area is species-specific, varies seasonally, and, in part, is dependent upon the availability of prey (with animals generally foraging if the amount of prey necessary to forage is available). For example, mysticetes may be migrating through the project area towards or from primary feeding habitats (*e.g.,* Cape Cod Bay, Stellwagen Bank, Great South Channel, and Gulf of St. Lawrence) and calving grounds in the southeast, and thereby spending a very limited amount of time in the presence of the specified activities. Alternatively, as discussed in the Effects section and in the species-specific sections below, mysticetes may be engaged in foraging behavior over several days. Overall, the mitigation measures, including the enhanced seasonal restrictions on pile driving and UXO/MEC detonation, are specifically designed to limit, to the maximum extent practical, take to those times when species of concern, namely the North Atlantic right whale, are most likely to not be engaged in critical behaviors such as concentrated foraging.

As described previously, Nantucket Shoals provides important foraging habitat for multiple species. For Projects 1 and 2, the ensonified zone extending to the NMFS harassment threshold isopleths produced during impact installation of foundations would extend out to a distance of 7.4 km (4.6 mi) from each pile as it is installed, including from foundations located closest to Nantucket Shoals. While vibratory pile driving for Project 2 would result in a larger ensonified zone (42 km (26.1 mi)), foundations for that project would be located in the southwestern part of the Lease Area, a minimum of 20 km (12.4 mi) from the 30-m (98.4-ft) isobath on the western edge of Nantucket Shoals and vibratory driving would be limited in duration for each foundation using this method (up to 90 minutes for each pin pile and up to 20 minutes for each monopile). As described in the Effects section, distance from a source can be influential on the intensity of impact (*i.e.,* the farther a marine mammal receiver is from a source, the less intense the expected behavioral reaction). In addition, any displacement of whales or interruption of foraging bouts would be expected to be relatively temporary in nature. Seasonal restrictions on pile driving and UXO/MEC detonations would ensure that these activities do not occur during prime foraging periods for particular mysticete species, including the North Atlantic right whale. Thus, for both projects, the area of potential marine mammal disturbance during pile driving does not fully spatially and temporally encompass the entirety of any specific mysticete foraging habitat.

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

The potential for repeated exposures is dependent upon the residency time of whales, with migratory animals unlikely to be exposed on repeated occasions and animals remaining in the area to be more likely exposed repeatedly. For mysticetes, where relatively low numbers of species-specific take by Level B harassment are predicted (compared to the abundance of the mysticete species or stock, such as is indicated in table 53) and movement patterns for most species suggest that individuals would not necessarily linger around the project area for multiple days, each predicted take likely represents an exposure of a different individual, with perhaps, for a few species, a subset of takes potentially representing a small number of repeated takes of a limited number of individuals across multiple days. In other words, the behavioral disturbance to any individual mysticete would, therefore, likely occur within a single day within a year, or potentially across a few days.

In general, the duration of exposures would not be continuous throughout any given day (with an estimated maximum of 8 hours of intermittent impact pile driving per day in Project 1, regardless of foundation type; up to 8 hours of intermittent impact driving if 2 monopiles are installed per day using only an impact hammer in Project 2; up to 5.6 hours of intermittent impact and 40 minutes of of vibratory pile driving in Project 2 if installing 2 monopiles requiring both installation methods; or up to 6 hours of intermittent impact and 6 hours of vibratory pile driving if installing 4 pin piles requiring both methods). In addition, pile driving would not occur on all consecutive days within a given year, due to weather delays or any number of logistical constraints SouthCoast has identified. Species-specific analysis regarding potential for repeated exposures and impacts is provided below.

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

North Atlantic Right Whale

North Atlantic right whales are listed as endangered under the ESA and as both depleted and strategic stocks under the MMPA. As described in the Potential Effects to Marine Mammals and Their Habitat section, North Atlantic right whales are threatened by a low population abundance, high mortality rates, and low reproductive rates. Recent studies have reported individuals showing high stress levels (*e.g.,* Corkeron *et al.,* 2017) and poor health, which has further implications on reproductive success and calf survival (Christiansen *et al.,* 2020; Stewart *et al.,* 2021; Stewart *et al.,* 2022; Pirotta *et al.,* 2024). As described below, a UME has been designated for North Atlantic right whales. Given this, the status of the North Atlantic right whale population is of heightened concern and, therefore, merits additional analysis and consideration. No Level A harassment, serious injury, or mortality is anticipated or proposed for authorization for this species.

For North Atlantic right whales, this proposed rule would allow for the authorization of up to 149 takes, by Level B harassment, over the 5-year period, with no more than 111 takes by Level B harassment allowed in any single year. The majority of these takes (n=111) would likely occur in the year in which SouthCoast proposes to construct Project 2 Scenario 2 (73 monopiles), with two-thirds (n=100) occurring incidental to impact and vibratory pile driving in the southern portion of the Lease Area (farthest from important feeding habitat near Nantucket Shoals). Installation using a combination of pile driving methods would begin with vibratory pile driving, which is expected to occur for 20 minutes per 9/16-m monopile and 90 minutes per 4.5-m pin pile, and require fewer impact hammer strikes during the impact hammering phase because the pile would already be partially installed using vibratory pile driving, thus minimizing use of the installation method (*i.e.,* impact pile driving) expected to elicit stronger behavioral responses. Although the Level B harassment zone resulting from vibratory pile driving is larger (42 km (26.1 mi)) than that produced by impact hammering (7.4 km (4.6 mi)), it would extend from Project 2 foundation only, thus reducing overlap of the ensonified zone with North Atlantic right whale feeding habitat nearer Nantucket Shoals. As described in the Potential Effects of the Specified Activities on Marine Mammals and Their Habitat section, the best available science indicates that distance from a source is an important variable when considering both the potential for and the anticipated severity of behavioral disturbance from an exposure in that it can have an effect on behavioral response that is independent of the effect of received level (*e.g.,* DeRuiter *et al.,* 2013; Dunlop *et al.,* 2017a; Dunlop *et al.,* 2017b; Falcone *et al.,* 2017; Dunlop *et al.,* 2018; Southall *et al.,* 2019a). The maximum number of North Atlantic right whale takes that may occur in a given year are primarily driven by Project 2, Scenario 2 in which impact and vibratory driving are anticipated to result in 100 takes (table 35). The majority of these takes are due to extension of the ensonified zone, given the 120-dB behavioral threshold for vibratory driving, towards areas with higher densities of North Atlantic right whales on Nantucket Shoals. Animals exposed to vibratory driving sounds on the Shoals would be tens of kilometers from the source; therefore, while NMFS anticipates takes may occur, the intensity of take is expected to be minimal and not result in behavioral changes that would meaningfully result in impacts that could affect the population through annual rates of recruitment or survival.

The maximum number of annual takes (111 total, incidental to all activities) equates to approximately 32.8 percent of the stock abundance, if each take were considered to be of a different individual. However, this is a highly unlikely scenario given the reasons described below. Further, far lower numbers of take are expected in the years when SouthCoast is not installing foundations (*e.g.,* years when only HRG surveys would be occurring). For Project 1, only 12 takes (approximately 8 percent of all 149 takes) would be incidental to installation of foundations using impact pile driving as the only installation method, the activity NMFS anticipates would result in the most intense behavioral responses. A small number of Level B harassment takes (23) would occur incidental to HRG surveys over 5 years, an activity for which the maximum size ensonified zone is very small (141 m (462.6 ft)) and the severity of any behavioral harassment is expected to be very low. The remaining takes (17) would occur incidentally to 10 instantaneous UXO/MEC detonations, should they occur. SouthCoast would detonate UXO/MECs as a last resort, only after attempting every other option available, including avoidance (*i.e.,* working around the UXO/MEC location in the project area). SouthCoast's proposed seasonal restriction on this activity (December 1–April 30) would significantly reduce the potential that detonation events occur when North Atlantic right whales are expected to be most frequent in Southern New England region, and the required extensive clearance process prior to detonation would help ensure no right whales were within the portion of the Lease Area or ECC where the planned detonation would occur, minimizing the potential for more severe TTS (*e.g.,* longer lasting and of higher shift) or behavioral reaction. Detonations, if required, would be instantaneous, further limiting the probability of exposure to sound levels likely to result in TTS or more severe behavioral reactions. In consideration of the enhanced mitigation measures, including the extensive monitoring proposed to detect North Atlantic right whales to enact such mitigation, the Level B harassment takes proposed for authorization are expected to elicit only minor behavioral responses (*e.g.,* avoidance, temporary cessation of foraging) and not result in impacts to reproduction and survival.

As previously described, it is long-established that coastal waters in SNE are part of a known migratory corridor for North Atlantic right whales, but over the past decade or more, it has become increasingly clear that suitable foraging habitat exists in the area as well. In addition to increased occurrence (understood through visual and PAM detection data) in the area, the number of DMAs declared in the area has also increased in recent years. Foraging North Atlantic right whales, particularly those in groups of 3 or more, often remain in a feeding area for up to 2 weeks (this is the basis for defining DMAs), meaning individual whales may be using SNE habitat for extended periods. The region has been also been characterized as an important transition region (*i.e.,* a stopover site for migrating North Atlantic right whales moving to or from southeastern calving grounds and more northern feeding grounds, as well as a feeding location utilized at other times of the year by individuals (Quintana-Rizzo *et al.,* 2021; O'Brien *et al.,* 2022). Additional qualitative observations in southern New England include animals socializing (Quintana-Rizzo *et al.,* 2021). As described in the Potential Effects of the Specified Activities on Marine Mammals and Their Habitat section, North Atlantic right whales range outside of the project area for their main feeding, breeding, and calving activities; however, the importance of Southern New England, particularly the Nantucket Shoals area, for critical behaviors such as foraging, warranted the enhanced mitigation measures described in this proposed rule to minimize the potential impacts on North Atlantic right whales.

Quintana-Rizzo *et al.* (2021) noted different degrees of residency (*i.e.,* the minimum number of days an individual remained in southern New England) for right whales, with individual sighting frequency ranging from 1 to 10 days, annually. Resightings (*i.e.,* observation of the same individual on separate occasions) occurred most frequently from December through May. Model outputs suggested that, during these months, 23 percent of the species' population was present in this region, and that the mean residence time tripled between their study periods (*i.e.,* December through May, 2011–2015 compared to 2017–2019) to an average of 13 days during these months. The seasonal restriction on pile driving for both Projects 1 and 2 includes this period, thus reducing the potential for repeated exposures of individual right whales during either project because whales are not expected to persist in the project area to the same extent during the months pile driving would occur. The more extensive seasonal restriction within the NARW EMA (October 16–May 31 would further reduce this possibility, although the increased likelihood of foraging activity closer to Nantucket Shoals might create the potential for repeated exposures, should whales linger there to forage despite the occurrence of construction activities in the vicinity. Across all years, if an individual were exposed during a subsequent year, the impact of that exposure is likely independent of the previous exposure given the expectation that impacts to marine mammals from project activities would generally be temporary (*i.e.,* minutes to hours) and of low severity, coupled with the extensive duration between exposures. However, the extensive mitigation and monitoring measures SouthCoast would be required to implement, including delaying or ceasing pile driving for 24 to 48 hours (depending on the number of animals sighted and time of year) if SouthCoast observes a North Atlantic right whale at any distance or acoustically detects a right whale within the 10-km (6.2-mi) (pin pile) or 15-km (9.3-mi) (monopile) PAM clearance/shutdown zone, are expected to reduce impacts should take occur.

Quintana-Rizzo *et al.* (2021) noted that North Atlantic right whale sightings during the 2017–2019 study period were primarily concentrated in the southeastern sections of the MA WEA, throughout the northeast section of the Lease Area and areas south of Nantucket, during winter (December–February), shifted northwest towards Martha's Vineyard and the RI/MA WEA in spring (March–May), and to the east higher up on Nantucket Shoals in the summer (June–August) (Quintano-Rizzo *et al.,* 2021). Summer and fall sightings did not occur in 2011–2015, and only a small number of right whales were sighted south of Nantucket (Quintana-Rizzo *et al.,* 2021). In PAM data collected in southern New England from 2020 through 2022, acoustic detections of North Atlantic right whales occurred most frequently from November through April, and less frequently from May through mid-October, particularly in recordings collected on the eastern edge of the WEAs, within the NARW EMA, compared to recordings collected in western southern New England (van Parijs *et al.,* 2023; Davis *et al.,* 2023). Placing a moratorium on pile driving in the NARW EMA from Oct 16–May 31 would minimize exposures of right whales to pile driving noise, and any potential associated foraging disruptions, by avoiding foundation installation when right whales are most prevalent and most likely to be engaged in foraging in that part of the project area, as well as minimizing the potential for multiple exposures per individual given pile driving would not occur when residency times are expected to be extended based on resighting frequency and acoustic persistence data (Quintano-Rizzo *et al.,* 2021; Davis *et al.,* 2023). Similarly, seasonally restricting pile driving from January 1–May 15, annually, outside of the NARW EMA (applicable to a portion of Project 1 foundations and all of Project 2 foundations), would extend the area over which pile driving is limited during the period of peak right whale abundance in southern New England, thus limiting exposures and temporary foraging disturbances more broadly. Similarly, restricting UXO/MEC detonations from December 1–April 30 ensures that this activity would not occur when North Atlantic right whales utilize habitat in the project area most often. Although HRG surveys would not be subject to seasonal restrictions, impacts from Level B harassment would be minimal given the low numbers of take proposed for authorization and very small harassment zone.

In summary, North Atlantic right whales in the project area are expected to be predominately engaging in migratory behavior during the spring and fall, foraging behavior primarily in late winter and spring (and, to some degree, throughout the year), and social behavior during winter and spring (Quintana-Rizzo *et al.,* 2021). Within the project area, North Atlantic right whale occurrence and foraging are both expected to be most extensive near Nantucket Shoals, along the eastern edge of the MA WEA within the NARW EMA. Given the species' migratory behavior and occurrence patterns, we anticipate individual whales would typically utilize specific habitat in the project area (inside and outside the NARW EMA), primarily during months when foundation installation and UXO/MEC detonation would not occur (given the specific time/area restrictions on these activities specific to inside, and outside, the NARW EMA). It is important to note the activities that could occur from December through May (*i.e.,* are not seasonally restricted) that may impact North Atlantic right whales using the habitat for foraging would be primarily HRG surveys, with very small Level B harassment zones (less than 150 m) due to rapid transmission loss of the sounds produced neither of which would result in very high received levels. While UXO/MEC detonation may occur in November or May, the number of UXO/MECs are expected to be very minimal (if any) and would be instantaneous in nature; thereby, resulting in short term, minimal impacts with any TTS that may occur recovering quickly.

As described in the Description of Marine Mammals in the Specified Geographic Area section of this preamble, North Atlantic right whales are presently experiencing an ongoing UME (beginning in June 2017). Preliminary findings support human interactions, specifically vessel strikes and entanglements, as the cause of death for the majority of North Atlantic right whales. Given the current status of the North Atlantic right whale, the loss of even one individual could significantly impact the population. Any disturbance to North Atlantic right whales due to SouthCoast's activities is expected to result in temporary avoidance of the immediate area of construction. As no injury, serious injury, or mortality is expected or proposed for authorization and Level B harassment of North Atlantic right whales will be reduced to the lowest level practicable (both in magnitude and severity) through use of mitigation measures, the proposed number of takes of North Atlantic right whales would not exacerbate or compound the effects of the ongoing UME.

As described in the general *Mysticetes* section above, foundation installation is likely to result in the greatest number of annual takes and is of greatest concern given loud source levels. This activity would be most extensively limited to locations outside of the NARW EMA and during times when, based on the best available science, North Atlantic right whales are less frequently encountered in the NARW EMA and less likely to be engaged in critical foraging behavior (although NMFS recognizes North Atlantic right whales may forage year-round in the project area). Temporal limits on foundation installation outside of the NARW EMA are similarly defined by expectations, based on the best available science, that North Atlantic right whale occurrence would be lowest when pile driving would occur.

The potential types, severity, and magnitude of impacts are also anticipated to mirror that described in the general *Mysticetes* section above, including avoidance (the most likely outcome), changes in foraging or vocalization behavior, masking, and temporary physiological impacts (*e.g.,* change in respiration, change in heart rate). Although a small amount of TTS is possible, it is not likely. Importantly, given the enhanced mitigation measures specific to North Atlantic right whales, the effects of the activities are expected to be sufficiently low-level and localized to specific areas as to not meaningfully impact important migratory or foraging behaviors for North Atlantic right whales. These takes are expected to result in temporary behavioral disturbance, such as slight displacement (but not abandonment) of migratory habitat or temporary cessation of feeding.

In addition to the general mitigation measures discussed earlier in the Preliminary Negligible Impact Analysis section, to provide enhanced protection for right whales and minimize the number and/or severity of exposures, SouthCoast would be required to implement conditionally-triggered protocols in response to sightings or acoustic detections of North Atlantic right whales. If one or two North Atlantic right whales is/are sighted or if PAM operators detect a right whale vocalization, pile driving would be suspended until the next day, commencing only after SouthCoast conducts a vessel-based survey of the zone around the pile driving location (10-km (6.2-mi) zone for pin pile; 15-km (9.3-mi) zone for monopile) to ensure the zone is clear of North Atlantic right whales. Pile driving would be delayed for 482 days following a sighting of 3 or more whales (more likely indicative of a potential feeding aggregation), followed by the same survey requirement prior to commencing foundation installation. Further, given many of these exposures are generally expected to occur to different individual right whales migrating through (*i.e.,* many individuals would not be impacted on more than one day in a year), with some subset potentially being exposed on no more than a few days within the year, they are unlikely to result in energetic consequences that could affect reproduction or survival of any individuals.

Overall, NMFS expects that any behavioral harassment of North Atlantic right whales incidental to the specified activities would not result in changes to their migration patterns or foraging success, as only temporary avoidance of an area during construction is expected to occur. As described previously, North Atlantic right whales migrate, forage, and socialize in the Lease Area, but are not expected to remain in this habitat (*i.e.,* not expected to be engaged in extensive foraging behavior) for prolonged durations during the months SouthCoast would install foundations, considering the seasonal restrictions SouthCoast proposed and NMFS would require, relative to habitats to the north, such as Cape Cod Bay, the Great South

Channel, and the Gulf of St. Lawrence (Mayo, 2018; Quintana-Rizzo *et al.,* 2021; Meyer-Gutbrod *et al.,* 2022; Plourde *et al.,* 2024). Any temporarily displaced animals would be able to return to or continue to travel through the project area and subsequently utilize this habitat once activities have ceased.

Although acoustic masking may occur in the vicinity of the foundation installation activities, based on the acoustic characteristics of noise associated with impact pile driving (*e.g.,* frequency spectra, short duration of exposure) and construction surveys (*e.g.,* intermittent signals), NMFS expects masking effects to be minimal. Given that the majority of Project 1 foundations would be located within the NARW EMA, where North Atlantic right whales are most likely to occur throughout the year, SouthCoast decided to use the installation method that resulted in a smaller ensonified zone (*i.e.,* impact pile driving). Foundations would be installed farther from the NARW EMA in the southwestern half of the Lease Area for Project 2, thus, if vibratory pile driving occurs, the Level B harassment zone would not overlap this high-use area to the same extent. In addition, the most severe masking impacts would likely occur when a North Atlantic right whale is in relatively close proximity to the pile driving location, which would be minimized given the requirement that pile driving must be delayed or shutdown if a North Atlantic right whale is sighted at any distance or acoustically detected within the PAM clearance or shutdown zones (10-km (6.2-mi) or 15-km (9.3-mi)) during installation of 4.5-m pin piles or 9/16-m monopiles, respectively). In addition, both pile driving methods are expected to occur intermittently within a day and be confined to the months in which North Atlantic right whales occur at lower densities. Any masking effects would be minimized by anticipated mitigation effectiveness and likely avoidance behaviors.

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

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

As described in the Description of Marine Mammals in the Specified Geographic Area section of this preamble, SouthCoast Project would be constructed within the North Atlantic right whale migratory corridor BIA, which represents areas and months within which a substantial portion of a species is known to migrate. The Lease Area is relatively narrow compared to the width of the North Atlantic right whale migratory corridor BIA (approximately 47.5 km (29.5 mi) versus approximately 300 km (186 mi), respectively, at the furthest points near the Lease Area). Because of this, overall North Atlantic right whale migration is not expected to be impacted by the proposed activities. There are no known North Atlantic right whale mating or calving areas within the project area. Although the project area includes foraging habitat, extensive mitigation measures would minimize impacts by temporally and spatially reducing co-occurrence of project activities and feeding North Atlantic right whales. Prey species (*e.g.,* calanoid copepods) are more broadly distributed throughout southern New England during periods when pile driving and UXO/MEC detonation would occur (noting again that North Atlantic right whale prey is not particularly concentrated in the project area relative to nearby habitats). Therefore, any impacts to prey that may occur during the effective period of these regulations are also unlikely to impact marine mammals in a manner that would affect reproduction or survival of any individuals.

The most significant measure to minimize impacts to individual North Atlantic right whales is the seasonal moratorium on all foundation installation activities in the NARW EMA from October 16 through May 31, annually, and throughout the rest of the Lease Area from January 1 through May 15, as well as the limitation on these activities in December (*e.g.,* only work with approval from NMFS), when North Atlantic right whale abundance in the Lease Area is expected to be highest. NMFS also expects this measure to greatly reduce the potential for mother-calf pairs to be exposed to impact pile driving noise above the Level B harassment threshold during their annual spring migration through the project area from calving grounds to primary foraging grounds (*e.g.,* Cape Cod Bay). UXO/MEC detonations would also be restricted from December 1 through April 30, annually. NMFS also expects that the severity of any take of North Atlantic right whales would be reduced due to the additional proposed mitigation measures that would ensure that any exposures above the Level B harassment threshold would result in only short-term effects to individuals exposed.

Pile driving and UXO/MEC detonations may only begin in the absence of North Atlantic right whales (based on visual and passive acoustic monitoring). If pile driving has commenced, NMFS anticipates North Atlantic right whales would avoid the area, utilizing nearby waters to carry on pre-exposure behaviors. However, foundation installation activities must be shut down if a North Atlantic right whale is sighted at any distance or acoustically detected at any distance within the PAM shutdown zone, unless a shutdown is not feasible due to risk of injury or loss of life. If a sighting of a North Atlantic right whale within the Level B harassment zone triggers shutdown, both the duration and intensity of exposure would be reduced. NMFS anticipates that if North Atlantic right whales are exposed to foundation installation or UXO/MEC detonation noise, it is unlikely a North Atlantic right whale would approach the sound source locations to the degree that they would purposely expose themselves to very high noise levels. This is because observations of typical whale behavior demonstrate likely avoidance of harassing levels of sound where possible (Richardson *et al.,* 1985). These measures are designed to avoid PTS and also reduce the severity of Level B harassment, including the potential for TTS. While some TTS could occur, given the mitigation measures (*e.g.,* delay pile driving upon a sighting or acoustic detection and shutting down upon a sighting or acoustic detection), the potential for TTS to occur is low and, as described above for all mysticetes, any TTS would be expected to be of a relatively short duration and small degree.

The proposed clearance and shutdown measures are most effective when detection efficiency is maximized, as the measures are triggered by a sighting or acoustic detection. To maximize detection efficiency, SouthCoast proposed and NMFS is proposing to require the combination of PAM and visual observers. In addition, NMFS is proposing to require communication protocols with other project vessels and other heightened awareness efforts (*e.g.,* daily monitoring of North Atlantic right whale sighting databases) such that as a North Atlantic right whale approaches the source (and thereby could be exposed to higher noise energy levels), PSO detection efficacy would increase, the whale would be detected, and a delay to commencing pile driving or shutdown (if feasible) would occur. NMFS is proposing to require that, during three timeframes (NARW EMA: August 1–Oct 15; outside NARW EMA: May 16–May 31 and December 1–31), SouthCoast deploy four dedicated PSO vessels, each with three on-duty PSOs, to monitor before, during, and after pile driving for right whale sightings ''at any distance.'' For all other foundation installation timeframes (NARW EMA: June 1–July 31; outside NARW EMA: June 1–November 30) NMFS would require that this monitoring be conducted by a minimum 3 PSOs on each of three dedicated PSO vessels. By increasing the extent of monitoring platforms and observers, and thereby the detection efficacy, exposures would be minimized because North Atlantic right whales would be detected at greater distances, prompting delay or shutdown before the whale enters the Level B harassment zone.

Given that specific locations for the 10 possible UXOs/MECs are not presently known, SouthCoast has agreed to undertake specific mitigation measures to reduce impacts on any North Atlantic right whales, including delaying a UXO/MEC detonation if a North Atlantic right whale is visually observed or acoustically detected at any distance. The UXO/MEC detonations mitigation measures described above would further reduce the potential to be exposed to high received levels.

For HRG surveys, the maximum distance to the Level B harassment isopleth is 141 m (462.6 ft). Because of the short maximum distance to the Level B harassment isopleth, the requirement that vessels maintain a distance of 500 m (1,640.4 ft) from any North Atlantic right whale, the fact whales are unlikely to remain in close proximity to an HRG survey vessel for any length of time, and that the acoustic source would be shutdown if a North Atlantic right whale is observed within 500 m (1,640.4 ft) of the source, any exposure to noise levels above the Level B harassment threshold (if any) would be very brief. To further minimize exposures, ramp-up of boomers, sparkers, and CHIRPs must be delayed during the clearance period if PSOs detect a North Atlantic right whale within 500 m (1,640.4 ft) of the acoustic source. Due to the nature of the activity, and with implementation of the proposed mitigation requirements, take by Level A harassment is unlikely and, therefore, not proposed for authorization. Potential impacts associated with Level B harassment would include low-level, temporary behavioral modifications, most likely in the form of avoidance behavior. Given the high level of precautions taken to minimize both the amount and intensity of Level B harassment on North Atlantic right whales, it is unlikely that the anticipated low-level exposures would lead to reduced reproductive success or survival for any individual North Atlantic right whales.

Given the documented habitat use within the area within the timeframe foundation installations and UXO/MEC detonations may occur, a subset of these takes may represent multiple exposures of some number of individuals than is the case for other mysticetes, though some takes may also represent one-time exposures to an individual the majority of the individuals taken would be impacted on only one day in a year, with a small subset potentially impacted on no more than a few days a year and, further, low level impacts are generally expected from any North Atlantic right whale exposure. The magnitude and severity of harassment are not expected to result in impacts on the reproduction or survival of any individuals, let alone have impacts on annual rates of recruitment or survival of this stock.

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

Of note, there is significant uncertainty regarding the impacts of turbine foundation presence and operation on the oceanographic conditions that serve to aggregate prey species for North Atlantic right whales and—given SouthCoast's proximity to Nantucket Shoals—it is possible that the expanded analysis of turbine presence and/or operation over the life of the project developed for the ESA biological opinion for the proposed SouthCoast project or additional information received during the public comment period will necessitate modifications to the proposed analysis, mitigation and monitoring measures, and/or this finding. For example, it is possible that additional information or analysis could result in a determination that changes in the oceanographic conditions that serve to aggregate North Atlantic right whale prey may result in impacts that would qualify as a take under the MMPA for North Atlantic right whales.

Blue Whale

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

The rule allows up to nine takes of blue whales, by Level B harassment, over the 5-year period. The maximum annual allowable number of takes by Level B harassment is three, which equates to approximately 0.75 percent of the stock abundance if each take were considered to be of a different individual. Based on the migratory nature of blue whales and the fact that there are neither feeding nor reproductive areas documented in or near the project area, and in consideration of the very low number of predicted annual takes, it is unlikely that the predicted instances of takes would represent repeat takes of any individual—in other words, each take likely represents one whale exposed on 1 day within a year.

With respect to the severity of those individual takes by Level B harassment, we would anticipate impacts to be limited to low-level, temporary behavioral responses with avoidance and potential masking impacts in the vicinity of the foundation installation to be the most likely type of response. Any potential TTS would be concentrated at half or one octave above the frequency band of pile driving noise (most sound is below 2 kHz) which does not include the full predicted hearing range of blue whales. Any hearing ability temporarily impaired from TTS is anticipated to return to pre-exposure conditions within a relatively short time period after the exposures cease. Any avoidance of the project area due to the activities would be expected to be temporary.

Given the magnitude and severity of the impacts discussed above, and in consideration of the required mitigation and other information presented, SouthCoast's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take by Level B harassment anticipated and proposed to be authorized will have a negligible impact on the western North Atlantic stock of blue whales.

Fin Whale

The fin whale is listed as endangered under the ESA, and the western North Atlantic stock is considered both depleted and strategic under the MMPA. No UME has been designated for this species or stock.

The rule proposes to authorize up to 572 takes, by harassment only, over the 5-year effective period. The maximum annual allowable take by Level A harassment and Level B harassment, is 3 and 496, respectively (combined, this annual take (n=499) equates to approximately 7.34 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HRG surveys would be occurring). Given the months the project will occur and that southern New England is generally considered a feeding habitat, it is likely that some subset of the individual whales exposed could be taken several times annually.

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

Fin whales are present in the waters off of New England year-round and are one of the most frequently observed large whales and cetaceans in continental shelf waters, principally from Cape Hatteras, North Carolina in the Mid-Atlantic northward to Nova Scotia, Canada (Sergeant, 1977; Sutcliffe and Brodie, 1977; CETAP, 1982; Hain *et al.,* 1992; Geo-Marine, 2010; BOEM, 2012; Edwards *et al.,* 2015; Hayes *et al.,* 2022). In the project area, fin whales densities are highest in the winter and summer months (Roberts *et al.,* 2023) though detections do occur in spring and fall (Watkins *et al.,* 1987; Clark and Gagnon, 2002; Geo-Marine, 2010; Morano *et al.,* 2012). However, fin whales feed more extensively in waters in the Great South Channel north to the Gulf Maine into the Gulf of St. Lawrence, areas north and east of the project area (Hayes *et al.,* 2024).

As discussed previously, the majority of project area is located to the east of small fin whale feeding BIA (2,933 km^2 (724,760.1 acres)) east of Montauk Point, New York (Figure 2.3 in LaBrecque *et al.,* 2015) that is active from March to October. Except for a small section of the Brayton Point route, the Lease Area and the ECCs do not overlap the fin whale feeding BIA. However, if vibratory pile driving is used for Project 2, the ensonified zone resulting from installation of the closest foundations could extend into the southeastern side of the BIA. Foundation installations and UXO/MEC detonations have seasonal work restrictions (*i.e.,* spatial and temporal) such that the temporal overlap between these specified activities and the active BIA timeframe would exclude the months of March and April. A separate larger year-round feeding BIA (18,015 km^2 (4,451,603.4 acres)) located to the east in the southern Gulf of Maine does not overlap with the project area and would thus not be impacted by project activities. We anticipate that if foraging is occurring in the project area and foraging whales are exposed to noise levels of sufficient strength, they would avoid the project area and move into the remaining area of the feeding BIA that would be unaffected to continue foraging without substantial energy expenditure or, depending on the time of year, travel south towards New York Bight foraging habitat or northeast to the larger year-round feeding BIA.

Given the documented habitat use within the area, some of the individuals taken would likely be exposed on multiple days. However, low level impacts are generally expected from any fin whale exposure. Given the magnitude and severity of the impacts discussed above (including no more than 566 takes of the course of the 5-year rule, and a maximum annual allowable take by Level A harassment and Level B harassment, of 3 and 496, respectively), and in consideration of the required mitigation and other information presented, SouthCoast's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have determined that the take by harassment anticipated and proposed for authorization will have a negligible impact on the western North Atlantic stock of fin whales.

Sei Whale

Sei whales are listed as endangered under the ESA, and the Nova Scotia stock is considered both depleted and strategic under the MMPA. There are no known areas of specific biological importance in or adjacent to the project area, and no UME has been designated for this species or stock. No serious injury or mortality is anticipated or authorized for this species.

The rule authorizes up to 67 takes by harassment over the 5-year period. No Level A harassment is anticipated for proposed for authorization. The maximum annual allowable take by Level B harassment is 48, which equates to approximately 0.8 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HRG surveys would be occurring). As described in the Description of Marine Mammals in the Specified Geographic Area section of this preamble, most of the sei whale distribution is concentrated in Canadian waters and seasonally in northerly U.S. waters, although they are uncommonly observed as far south as the waters off of New York. Because sei whales are migratory and their known feeding areas are east and north of the project area (*e.g.,* there is a feeding BIA in the Gulf of Maine), they would be more likely to be moving through and, considering this and the very low number of total takes, it is unlikely that any individual would be exposed more than once within a given year.

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

Given the magnitude and severity of the impacts discussed above (including no more than 67 takes of the course of the 5-year rule, and a maximum annual allowable take of 0 by Level A harassment and 48 by Level B harassment), and in consideration of the required mitigation and other information presented, SouthCoast's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take by harassment anticipated and proposed to be authorized will have a negligible impact on the Nova Scotia stock of sei whales.

Minke Whale

Minke whales are not listed under the ESA, and the Canadian East Coast stock is neither considered depleted nor strategic under the MMPA. There are no known areas of specific biological importance in or adjacent to the project area. As described in the Description of Marine Mammals in the Specific Geographic Area section of this preamble, a UME has been designated for this species but is pending closure. No serious injury or mortality is anticipated or authorized for this species.

The rule authorizes up to 1,162 takes by Level B harassment over the 5-year period. No Level A harassment is anticipated or proposed for authorization. The maximum annual allowable take by Level B harassment is 911, which equates to approximately 4 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HRG surveys would be occurring). As described in the Description of Marine Mammals in the Specified Geographic Area section, minke whales inhabit coastal waters during much of the year and are common offshore the U.S. Eastern Seaboard with a strong seasonal component in the continental shelf and in deeper, off-shelf waters (CETAP, 1982; Hayes *et al.,* 2022; Hayes *et al.,* 2024). Spring through fall are times of relatively widespread and common acoustic occurrence on the continental shelf. From September through April, minke whales are frequently detected in deep-ocean waters throughout most of the western North Atlantic (Clark and Gagnon, 2002; Risch *et al.,* 2014; Hayes *et al.,* 2024). Minke whales were detected in southern New England primarily in the spring and fall, with few detections in the summer and winter. In eastern southern New England, near the project area, acoustic detections were most frequent from April through mid-June (van Parijs *et al.,* 2023). Because minke whales are migratory and their known feeding areas are north and east of the project area, including a feeding BIA in the southwestern Gulf of Maine and George's Bank, they would be more likely to be transiting through (with each take representing a separate individual), though it is possible that some subset of the individual whales exposed could be taken up to a few times annually.

As previously detailed in the Description of Marine Mammals in the Specified Geographic Area section, there is a UME for minke whales along the Atlantic coast, from Maine through South Carolina, with the highest number of deaths in Massachusetts, Maine, and New York. Preliminary findings in several of the whales have shown evidence of human interactions or infectious diseases. However, we note that the population abundance is approximately 22,000, and the take by Level B harassment authorized through this action is not expected to exacerbate the UME.

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

Given the magnitude and severity of the impacts discussed above (including no more than 1,162 takes of the course of the 5-year rule, and a maximum annual allowable take by Level A harassment and Level B harassment, of 0 and 911, respectively), and in consideration of the required mitigation and other information presented, SouthCoast's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take by harassment anticipated and proposed for authorized will have a negligible impact on the Canadian Eastern Coastal stock of minke whales.

Humpback Whale

The West Indies Distinct Population Segments (DPS) of humpback whales is not listed as threatened or endangered under the ESA but the Gulf of Maine stock, which includes individuals from the West Indies DPS, is considered strategic under the MMPA. However, as described in the Description of Marine Mammals in the Specified Geographic Area section of this preamble to the rule, humpback whales along the Atlantic Coast have been experiencing an active UME as elevated humpback whale mortalities have occurred along the Atlantic coast from Maine through Florida since January 2016. Of the cases examined, approximately 40 percent had evidence of human interaction (vessel strike or entanglement). Take from vessel strike and entanglement is not authorized. Despite the UME, the relevant population of humpback whales (the West Indies breeding population, or DPS of which the Gulf of Maine stock is a part) remains stable at approximately 12,000 individuals.

NMFS is proposing to authorize up to 541 takes, by Level B harassment, over the 5-year period. No Level A harassment take is proposed for authorization. The maximum annual allowable take by Level B harassment is 341, which equates to approximately 24 percent of the stock abundance, if each take were considered to be of a different individual), with far lower numbers than that expected in the years without foundation installation (*e.g.,* years when only HRG surveys would be occurring). Given that feeding is considered the principal activity of humpback whales in southern New England waters, it is likely that some subset of the individual whales exposed could be taken several times annually.

Among the activities analyzed, the combination of impact and vibratory pile driving has the potential to result in the highest amount of annual take of humpback whales (0 takes by Level A harassment and 341 takes by Level B harassment) and is of greatest concern, given the associated loud source levels associated with impact pile driving and large Level B harassment zone resulting from vibratory pile driving.

In the western North Atlantic, humpback whales feed during spring, summer, and fall over a geographic range encompassing the eastern coast of the U.S. Feeding is generally considered to be focused in areas north of the project area, including in a feeding BIA in the Gulf of Maine/Stellwagen Bank/Great South Channel, but has been documented off the coast of southern New England and as far south as Virginia (Swingle *et al.,* 1993). Foraging animals tend to remain in the area for extended durations to capitalize on the food sources.

Assuming humpback whales who are feeding in waters within or surrounding the project area behave similarly, we expect that the predicted instances of disturbance could consist of some individuals that may be exposed on multiple days if they are utilizing the area as foraging habitat. Also similar to other baleen whales, if migrating, such individuals would likely be exposed to noise levels from the project above the harassment thresholds only once during migration through the project area.

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

Given the magnitude and severity of the impacts discussed above (including no more than 541 takes over the course of the 5-year rule, and a maximum annual allowable take by Level A harassment and Level B harassment, of 0 and 341 respectively), and in consideration of the required mitigation measures and other information presented, SouthCoast's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined that the take by harassment anticipated and proposed for authorization will have a negligible impact on the Gulf of Maine stock of humpback whales.

Odontocetes

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

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

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

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

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

Sperm Whale

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

No mortality, serious injury or Level A harassment is anticipated or proposed for authorization for this species. Impacts would be limited to Level B harassment and would occur to only a small number of individuals (maximum of 126 in any given year (likely year 2) and 149 across all 5 years) incidental to pile driving, UXO/MEC detonation(s), and HRG surveys. Sperm whales are not common within the project area due to the shallow waters, and it is not expected that any noise levels would reach habitat in which sperm whales are common, including deep-water foraging habitat. If sperm whales do happen to be present in the project area during any activities related to the SouthCoast project, they would likely be only transient visitors and not engaging in any significant behaviors. This very low magnitude and severity of effects is not expected to result in impacts on the reproduction or survival of individuals, much less impact annual rates of recruitment or survival. For these reasons, we have preliminarily determined, in consideration of all of the effects of the SouthCoast's activities combined, that the take proposed for authorization would have a negligible impact on the North Atlantic stock of sperm whales.

Dolphins and Small Whales (Including Delphinids and Pilot Whales)

There are no specific issues with the status of odontocete stocks that cause particular concern (*e.g.,* no recent UMEs). No mortality or serious injury is expected or proposed for authorization for these stocks. No Level A harassment is anticipated or proposed for authorization for any dolphin or small whale.

The maximum number of take, by Level B harassment, proposed for authorization within any one year for all odontocetes cetacean stocks ranges from 522 to 52,943 instances, which is less than approximately 5 percent for 5 stocks and less that 25 percent for one stock, as compared to the population size for all stocks. The common dolphin, one of the most frequently occurring marine mammals in southern New England, is the species for which take estimation resulted in the maximum number of takes (n=52,943) and associated population percentage (24.5 percent) among small odontocetes. As described above for odontocetes broadly, we anticipate that a fair number of these instances of take in a day represent multiple exposures of a smaller number of individuals, meaning the actual number of individuals taken is lower. Although some amount of repeated exposure to some individuals is likely given the duration of activity proposed by SouthCoast, the intensity of any Level B harassment combined with the availability of alternate nearby foraging habitat suggests that the likely impacts would not impact the reproduction or survival of any individuals.

Overall, the populations of all dolphins and small whale species and stocks for which we propose to authorize take are stable (no declining population trends), not facing existing UMEs, and the small number, magnitude and severity of takes is not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival. For these reasons, we have preliminarily determined, in consideration of all of the effects of the SouthCoast's activities combined, that the take proposed for authorization would have a negligible impact on all dolphin and small whale species and stocks considered in this analysis.

Harbor Porpoises

The Gulf of Maine/Bay of Fundy stock of harbor porpoises is found predominantly in northern U.S. coastal waters (less than 150 m depth) and up into Canada's Bay of Fundy. Although the population trend is not known, there are no UMEs or other factors that cause particular concern for this stock. No mortality or non-auditory injury is anticipated or proposed for authorization for this stock. NMFS proposes to authorize 109 takes by Level A harassment (PTS; incidental to UXO/MEC detonations) and 3,442 takes by Level B harassment (incidental to multiple activities).

Regarding the severity of takes by behavioral Level B harassment, because harbor porpoises are particularly sensitive to noise, it is likely that a fair number of the responses could be of a moderate nature, particularly to pile driving. In response to pile driving, harbor porpoises are likely to avoid the area during construction, as previously demonstrated in Tougaard *et al.* (2009) in Denmark, in Dahne *et al.* (2013) in Germany, and in Vallejo *et al.* (2017) in the United Kingdom, although a study by Graham *et al.* (2019) may indicate that the avoidance distance could decrease over time. However, pile driving is scheduled to occur when harbor porpoise abundance is low off the coast of Massachusetts and, given alternative foraging areas, any avoidance of the area by individuals is not likely to impact the reproduction or survival of any individuals. Given only one UXO/MEC would be detonated on any given day and up to only 10 UXO/MEC would be detonated over the 5-year effective period of the LOA, any behavioral response would be brief and of a low severity.

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

In summary, the number of takes proposed for authorization across all 5 years is 109 by Level A harassment and 3,442 by Level B harassment. While harbor porpoises are likely to avoid the area during any construction activity discussed herein, as demonstrated during European wind farm construction, the time of year in which work would occur is when harbor porpoises are not in high abundance, and any work that does occur would not result in the species' abandonment of the waters off of Massachusetts. The low magnitude and severity of harassment effects is not expected to result in impacts on the reproduction or survival of any individuals, let alone have impacts on annual rates of recruitment or survival of this stock. No mortality or serious injury is anticipated or proposed for authorization. For these reasons, we have preliminarily determined, in consideration of all of the effects of the SouthCoast's activities combined, that the proposed authorized take would have a negligible impact on the Gulf of Maine/Bay of Fundy stock of harbor porpoises.

Phocids (Harbor Seals and Gray Seals)

Neither the harbor seal nor gray seal are listed under the ESA. SouthCoast requested, and NMFS proposes to authorize, that no more than 4 and 677 harbor seals and 40 and 9,835 gray seals may be taken by Level A harassment and Level B harassment, respectively, within any one year. These species occur in Massachusetts waters most often in winter, when impact pile driving and UXO/MEC detonations would not occur. Seals are also more likely to be close to shore such that exposure to impact pile driving would be expected to be at lower levels generally (but still above NMFS behavioral harassment threshold). The majority of takes of these species is from monopile installations, and HRG surveys. Research and observations show that pinnipeds in the water may be tolerant of anthropogenic noise and activity (a review of behavioral reactions by pinnipeds to impulsive and non-impulsive noise can be found in Richardson *et al.* (1995) and Southall *et al.* (2007)). Available data, though limited, suggest that exposures between approximately 90 and 140 dB SPL do not appear to induce strong behavioral responses in pinnipeds exposed to non-pulse sounds in water (Costa *et al.,* 2003; Jacobs and Terhune, 2002; Kastelein *et al.,* 2006c). Although there was no significant displacement during construction as a whole, Russell *et al.* (2016) found that displacement did occur during active pile driving at predicted received levels between 168 and 178 dB re 1μPa$_{(p-p)}$; however seal distribution returned to the pre-piling condition within two hours of cessation of pile driving. Pinnipeds may not react at all until the sound source is approaching (or they approach the sound source) within a few hundred meters and then may alert, ignore the stimulus, change their behaviors, or avoid the immediate area by swimming away or diving. Effects on pinnipeds that are taken by Level B harassment in the project area would likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring). Most likely, individuals would simply move away from the sound source and be temporarily displaced from those areas (see Lucke *et al.,* 2006; Edren *et al.,* 2010; Skeate *et al.,* 2012; Russell *et al.,* 2016). Given their documented tolerance of anthropogenic sound (Richardson *et al.,* 1995; Southall *et al.,* 2007), repeated exposures of individuals of either of these species to levels of sound that may cause Level B harassment are unlikely to significantly disrupt foraging behavior. Given the low anticipated magnitude of impacts from any given exposure, even repeated Level B harassment across a few days of some small subset of individuals, which could occur, is unlikely to result in impacts on the reproduction or survival of any individuals. Moreover, pinnipeds would benefit from the mitigation measures described in the Proposed Mitigation section.

SouthCoast requested, and NMFS is proposing to authorize, a limited number of takes by Level A harassment in the form of PTS (4 harbor seals and 40 gray seals) incidental to UXO/MEC detonations over the 5-year effective period of the rule. As described above, noise from UXO/MEC detonation is low frequency and while any PTS that does occur would fall within the lower end of pinniped hearing ranges (50 Hz to 86 kHz), PTS would not occur at frequencies where pinniped hearing is most sensitive. In summary, any PTS, would be of limited degree and not occur across the entire or even most sensitive hearing range. Hence, any impacts from PTS are likely to be of low severity and not interfere with behaviors critical to reproduction or survival.

Elevated numbers of harbor seal and gray seal mortalities were first observed in July 2018 and occurred across Maine, New Hampshire, and Massachusetts until 2020. Based on tests conducted so far, the main pathogen found in the seals belonging to that UME was phocine distemper virus, although additional testing to identify other factors that may be involved in this UME are underway. In 2022, a UME was declared in Maine with some harbor and gray seals testing positive for highly pathogenic avian influenza (HPAI) H5N1. Although elevated strandings continue. For harbor seals, the population abundance is over 75,000 and annual M/SI (350) is well below PBR (2,006) (Hayes *et al.,* 2020). The population abundance for gray seals in the United States is over 27,000, with an estimated overall abundance, including seals in Canada, of approximately 450,000. In addition, the abundance of gray seals is likely increasing in the U.S. Atlantic, as well as in Canada (Hayes *et al.,* 2020).

Overall, impacts from the Level B harassment take proposed for authorization incidental to SouthCoast's specified activities would be of relatively low magnitude and a low severity. Similarly, while some individuals may incur PTS overlapping some frequencies that are used for foraging and communication, given the low degree, the impacts would not be expected to impact reproduction or survival of any individuals. In consideration of all of the effects of SouthCoast's activities combined, we have preliminarily determined that the authorized take will have a negligible impact on harbor seals and gray seals.

Preliminary Negligible Impact Determination

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

Small Numbers

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

NMFS proposes to authorize incidental take (by Level A harassment and Level B harassment) of 16 species of marine mammal (with 16 managed stocks). The maximum number of takes possible within any one year and proposed for authorization relative to the best available population abundance is less than one-third for all species and stocks potentially impacted (*i.e.,* less than 1 percent for 5 stocks, less than 8 percent for 7 stocks, less than 25 percent for 2 stocks, and less than 33 percent for 2 stocks; see table 53).

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

Unmitigable Adverse Impact Analysis and Determination

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

Classification

Endangered Species Act (ESA)

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

NMFS is proposing to authorize the take of five marine mammal species which are listed under the ESA: the North Atlantic right, sei, fin, blue, and sperm whale. The Permit and Conservation Division requested initiation of Section 7 consultation on November 1, 2022 with GARFO for the promulgation of this proposed rulemaking. NMFS will conclude the Endangered Species Act consultation prior to reaching a determination regarding the proposed issuance of the authorization. The proposed regulations and any subsequent LOA(s) would be conditioned such that, in addition to measures included in those documents, SouthCoast would also be required to abide by the reasonable and prudent measures and terms and conditions of a Biological Opinion and Incidental Take Statement, issued by NMFS, pursuant to Section 7 of the Endangered Species Act.

Executive Order 12866

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

Regulatory Flexibility Act (RFA)

Pursuant to the RFA (5 U.S.C. 601 *et seq.*), the Chief Counsel for Regulation of the Department of Commerce has certified to the Chief Counsel for Advocacy of the Small Business Administration that this proposed rule, if adopted, would not have a significant economic impact on a substantial number of small entities. SouthCoast is the sole entity that would be subject to the requirements in these proposed regulations, and SouthCoast is not a small governmental jurisdiction, small organization, or small business, as defined by the RFA. Because of this certification, a regulatory flexibility analysis is not required and none has been prepared.

Paperwork Reduction Act (PRA)

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

Coastal Zone Management Act (CZMA)

We have preliminarily determined that this action is not within or would not affect a state's coastal zone, and thus do not require a consistency determination under 307(c)(3)(A) of the Coastal Zone Management Act (CZMA; 16 U.S.C. 1456 (c)(3)(A)). Since the proposed action is expected to authorize incidental take of marine mammals in coastal waters and on the outer continental shelf, and is an unlisted activity under 15 CFR 930.54, the only way in which this action would be subject to state consistency review is if the state timely submits an unlisted activity request to the Director of NOAA's Office for Coastal Management (along with copies concurrently submitted to the applicant and NMFS) within 30 days from the date of publication of the notice of proposed rulemaking in the **Federal Register** and the Director approves such request.

Proposed Promulgation

As a result of these preliminary determinations, NMFS proposes to promulgate regulations that allow for the authorization of take, by Level A harassment and Level B harassment, incidental to construction activities associated with the SouthCoast Wind Project offshore of Massachusetts for a 5-year period from April 1, 2027, through March 31, 2032, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Request for Additional Information and Public Comments

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

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

List of Subjects in 50 CFR Part 217

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

Dated: June 17, 2024.

Samuel D. Rauch III,

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

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

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

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

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

■ 2. Add subpart HH, consisting of §§ 217.330 through 217.339, to read as follows:

Subpart HH—Taking Marine Mammals Incidental to the SouthCoast Wind Offshore Wind Farm Project Offshore Massachusetts

Sec.

Subpart HH—Taking Marine Mammals Incidental to the SouthCoast Wind Project Offshore Massachusetts

§ 217.330 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to activities associated with the SouthCoast Wind Project conducted by SouthCoast Wind Energy, LLC (SouthCoast Wind) and those persons SouthCoast Wind authorizes or funds to conduct activities on its behalf in the area outlined in paragraph (b) of this section. Requirements imposed on SouthCoast Wind must be implemented by those persons it authorizes or funds to conduct activities on its behalf.

(b) The specified geographical region is the Mid-Atlantic Bight and vessel transit routes to marshaling ports in Charleston, South Carolina and Sheet Harbor, Canada. The Mid-Atlantic Bight extends between Cape Hatteras, North Carolina and Martha's Vineyard, Massachusetts, extending westward into the Atlantic to the 100-m isobath and includes, but is not limited to, the Bureau of Ocean Energy Management (BOEM) Lease Area Outer Continental Shelf (OCS)–A–0521 Commercial Lease of Submerged Lands for Renewable Energy Development, two export cable routes, and two sea-to-shore transition point at Brayton Point in Somerset, Massachusetts and Falmouth, Massachusetts.

(c) The specified activities are impact and vibratory pile driving to install wind turbine generator (WTG) and offshore substation platform (OSP) foundations; high-resolution geophysical (HRG) site characterization surveys; detonation of unexploded ordnances or munitions and explosives of concern (UXOs/MECs); fisheries and benthic monitoring surveys; placement of scour protection; sand leveling; dredging; trenching, laying, and burial activities associated with the installation of the export cable from the OSP to shore based converter stations and inter-array cables between WTG foundations; vessel transit within the specified geographical region to transport crew, supplies, and materials; and WTG operations.

§ 217.331 Effective dates.

The regulations in this subpart are effective from April 1, 2027 through March 31, 2032.

§ 217.332 Permissible methods of taking.

Under a LOA issued pursuant to §§ 216.106 and 217.336, SouthCoast Wind and those persons it authorizes or funds to conduct activities on its behalf, may incidentally, but not intentionally, take marine mammals within the specified geographicalregion in the following ways, provided SouthCoast Wind is in compliance with all terms, conditions, and requirements of the regulations in this subpart and the LOA.

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

(b) By Level A harassment associated with impact pile driving WTG and OSP foundations and UXO/MEC detonations.

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

TABLE 1 TO PARAGRAPH (c)

Marine mammal species	Scientific name	Stock
Blue whale	*Balaenoptera musculus*	Western North Atlantic.
Fin whale	*Balaenoptera physalus*	Western North Atlantic.
Sei whale	*Balaenoptera borealis*	Nova Scotia.
Minke whale	*Balaenoptera acutorostrata*	Canadian East Stock.
North Atlantic right whale	*Eubalaena glacialis*	Western North Atlantic.
Humpback whale	*Megaptera novaeangliae*	Gulf of Maine.
Sperm whale	*Physeter macrocephalus*	North Atlantic.
Atlantic spotted dolphin	*Stenella frontalis*	Western North Atlantic.
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Western North Atlantic.
Bottlenose dolphin	*Tursiops truncatus*	Western North Atlantic Offshore.
Common dolphin	*Delphinus delphis*	Western North Atlantic.
Harbor porpoise	*Phocoena phocoena*	Gulf of Maine/Bay of Fundy.
Long-finned pilot whale	*Globicephala melas*	Western North Atlantic.
Risso's dolphin	*Grampus griseus*	Western North Atlantic.
Gray seal	*Halichoerus grypus*	Western North Atlantic.
Harbor seal	*Phoca vitulina*	Western North Atlantic.

§ 217.333 Prohibitions.

Except for the takings described in § 217.332 and authorized by a LOA issued under §§ 217.336 or 217.337, it is unlawful for any person to do any of the following in connection with the activities described in this subpart.

(a) Violate or fail to comply with the terms, conditions, and requirements of this subpart or a LOA issued under §§ 217.336 or 217.337.

(b) Take any marine mammal not specified in § 217.332(c).

(c) Take any marine mammal specified in § 217.332(c) in any manner other than specified in § 217.332(a) and (b).

§ 217.334 Mitigation requirements.

When conducting the specified activities identified in §§ 217.330(c), SouthCoast Wind must implement the following mitigation measures contained in this section and any LOA issued under §§ 217.336 or 217.337 of this subpart. These mitigation measures include, but are not limited to:

(a) *General Conditions.* SouthCoast Wind must comply with the following general measures:

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

issued LOA; (2) SouthCoast Wind must conduct training for construction supervisors, construction crews, and the PSO and PAM team prior to the start of all construction activities and when new personnel join the work in order to explain responsibilities, communication procedures, marine mammal monitoring and reporting protocols, and operational procedures. A description of the training program must be provided to NMFS at least 60 days prior to the initial training before in-water activities begin. Confirmation of all required training must be documented on a training course log sheet and reported to NMFS Office of Protected Resources prior to initiating project activities;

(3) SouthCoast Wind is required to use available sources of information on North Atlantic right whale presence to aid in monitoring efforts. These include daily monitoring of the Right Whale Sighting Advisory System, consulting of the WhaleAlert app, and monitoring of the Coast Guard's VHF Channel 16 to receive notifications of marine mammal sightings and information associated with any Dynamic Management Areas (DMA) and Slow Zones;

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

(5) If an individual from a species for which authorization has not been granted or a species for which authorization has been granted but the authorized take number has been met is observed entering or within the relevant clearance zone prior to beginning a specified activity, the activity must be delayed. If an activity is ongoing and an individual from a species for which authorization has not been granted or a species for which authorization has been granted but the authorized take number has been met is observed entering or within the relevant shutdown zone, the activity must be shut down (*i.e.,* cease) immediately unless shutdown would result in imminent risk of injury or loss of life to an individual, pile refusal, or pile instability. The activity must not commence or resume until the animal(s) has been confirmed to have left the clearance or shutdown zones and is on a path away from the applicable zone or after 30 minutes for all baleen whale species and sperm whales, and 15 minutes for all other species;

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

(7) For in-water construction heavy machinery activities listed in section 1(a), if a marine mammal is detected within or about to enter 10 meters (m) (32.8 feet (ft)) of equipment, SouthCoast Wind must cease operations until the marine mammal has moved more than 10 m on a path away from the activity to avoid direct interaction with equipment;

(8) All vessels must be equipped with a properly installed, operational Automatic Identification System (AIS) device prior to vessel use and SouthCoast Wind must report all Maritime Mobile Service Identify (MMSI) numbers to NMFS Office of Protected Resources;

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

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

(b) *Vessel strike avoidance measures:* SouthCoast Wind must comply with the following vessel strike avoidance measures while in the specific geographic region unless a deviation is necessary to maintain safe maneuvering speed and justified because the vessel is in an area where oceanographic, hydrographic, and/or meteorological conditions severely restrict the maneuverability of the vessel; an emergency situation presents a threat to the health, safety, life of a person; or when a vessel is actively engaged in emergency rescue or response duties, including vessel-in distress or environmental crisis response. An emergency is defined as a serious event that occurs without warning and requires immediate action to avert, control, or remedy harm.

(1) Prior to the start of the Project's activities involving vessels, all vessel personnel must receive a protected species training that covers, at a minimum, identification of marine mammals that have the potential to occur in the specified geographical region; detection and observation methods in both good weather conditions (*i.e.,* clear visibility, low winds, low sea states) and bad weather conditions (*i.e.,* fog, high winds, high sea states, with glare); sighting communication protocols; all vessel strike avoidance mitigation requirements; and information and resources available to the project personnel regarding the applicability of Federal laws and regulations for protected species. This training must be repeated for any new vessel personnel who join the project. Confirmation of the vessel personnels' training and understanding of the LOA requirements must be documented on a training course log sheet and reported to NMFS within 30 days of completion of training, prior to personnel joining vessel operations;

(2) All vessel operators and dedicated visual observers must maintain a vigilant watch for all marine mammals and slow down, stop their vessel, or alter course to avoid striking any marine mammal;

(3) All transiting vessels, operating at any speed must have a dedicated visual observer on duty at all times to monitor for marine mammals within a 180 degrees (°) direction of the forward path of the vessel (90° port to 90° starboard) located at an appropriate vantage point for ensuring vessels are maintaining required separation distances. Dedicated visual observers may be PSOs or crew members, but crew members responsible for these duties must be provided sufficient training by SouthCoast Wind to distinguish marine mammals from other phenomena and must be able to identify a marine mammal as a North Atlantic right whale, other large whale (defined in this context as sperm whales or baleen whales other than North Atlantic right whales), or other marine mammals. Dedicated visual observers must be equipped with alternative monitoring technology (*e.g.,* night vision devices, infrared cameras) for periods of low visibility (*e.g.,* darkness, rain, fog, *etc.*). The dedicated visual observer must not have any other duties while observing and must receive prior training on protected species detection and identification, vessel strike avoidance procedures, how and when to communicate with the vessel captain, and reporting requirements in this subpart;

(4) All vessel operators and dedicated visual observers must continuously monitor US Coast Guard VHF Channel 16 at the onset of transiting through the

duration of transit. At the onset of transiting and at least once every 4 hours, vessel operators and/or trained crew member(s) must also monitor the project's Situational Awareness System, (if applicable), WhaleAlert, and relevant NOAA information systems such as the Right Whale Sighting Advisory System (RWSAS) for the presence of North Atlantic right whales;

(5) Prior to transit, vessel operators must check for information regarding the establishment of Seasonal and Dynamic Management Areas, Slow Zones, and any information regarding North Atlantic right whale sighting locations;

(6) All vessel operators must abide by vessel speed regulations (50 CFR 224.105). Nothing in this subpart exempts vessels from any other applicable marine mammal speed or approach regulations;

(7) All vessels, regardless of size, must immediately reduce speed to 10 knots (18.5 km/hr) or less for at least 24 hours when a North Atlantic right whale is sighted at any distance by any project related personnel or acoustically detected by any project-related PAM system. Each subsequent observation or acoustic detection in the Project area must trigger an additional 24-hour period. If a North Atlantic right whale is reported via any of the monitoring systems (described in paragraph (b)(4) of this section) within 10 km of a transiting vessel(s), that vessel must operate at 10 knots (18.5 km/hr) or less for 24 hours following the reported detection.

(8) In the event that a DMA or Slow Zone is established that overlaps with an area where a project-associated vessel is operating, that vessel, regardless of size, must transit that area at 10 knots (18.5 km/hr) or less;

(9) Between November 1st and April 30th, all vessels, regardless of size, must operate at 10 knots (18.5 km/hr) or less in the specified geographical region, except for vessels while transiting in Narragansett Bay or Long Island Sound;

(10) All vessels, regardless of size, must immediately reduce speed to 10 knots (18.5 km/hr) or less when any large whale, (other than a North Atlantic right whale), mother/calf pairs, or large assemblages of non-delphinid cetaceans are observed within 500 m (0.31 mi) of a transiting vessel;

(11) If a vessel is traveling at any speed greater than 10 knots (18.5 km/hr) (*i.e.,* no speed restrictions are enacted) in the transit corridor (defined as from a port to the Lease Area or return), in addition to the required dedicated visual observer, SouthCoast Wind must monitor the transit corridor in real-time with PAM prior to and during transits. If a North Atlantic right whale is detected via visual observation or PAM within or approaching the transit corridor, all vessels in the transit corridor must travel at 10 knots (18.5 km/hr) or less for 24 hours following the detection. Each subsequent detection shall trigger a 24-hour reset. A slowdown in the transit corridor expires when there has been no further North Atlantic right whale visual or acoustic detection in the transit corridor in the past 24 hours;

(12) All vessels must maintain a minimum separation distance of 500 m from North Atlantic right whales. If underway, all vessels must steer a course away from any sighted North Atlantic right whale at 10 knots (18.5 km/hr) or less such that the 500-m minimum separation distance requirement is not violated. If a North Atlantic right whale is sighted within 500 m of an underway vessel, that vessel must turn away from the whale(s), reduce speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 500 m;

(13) All vessels must maintain a minimum separation distance of 100 m (328 ft) from sperm whales and non-North Atlantic right whale baleen whales. If one of these species is sighted within 100 m (328 ft) of an underway vessel, the vessel must turn away from the whale(s), reduce speed, and shift the engine(s) to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 100 m (328 ft);

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

(15) All vessels underway must not divert or alter course to approach any marine mammal; and

(16) SouthCoast Wind must submit a Marine Mammal Vessel Strike Avoidance Plan 180 days prior to the planned start of vessel activity that provides details on all relevant mitigation and monitoring measures for marine mammals, vessel speeds and transit protocols from all planned ports, vessel-based observer protocols for transiting vessels, communication and reporting plans, and proposed alternative monitoring equipment in varying weather conditions, darkness, sea states, and in consideration of the use of artificial lighting. If SouthCoast Wind plans to implement PAM in any transit corridor to allow vessel transit above 10 knots (18.5 km/hr) the plan must describe how PAM, in combination with visual observations, will be conducted. If a plan is not submitted and approved by NMFS prior to vessel operations, all project vessels must travel at speeds of 10 knots (18.5 km/hr) or less. SouthCoast Wind must comply with any approved Marine Mammal Vessel Strike Avoidance Plan.

(c) *Wind turbine generator (WTG) and offshore substation platform (OSP) foundation installation.* The following requirements apply to vibratory and impact pile driving activities associated with the installation of WTG and OSP foundations: (1) Foundation pile driving activities must not occur January 1 through May 15 throughout the Lease Area. From October 16 through May 31, impact and vibratory pile driving must not occur at locations in SouthCoast's Lease Area within the North Atlantic right whale Enhanced Mitigation Area (NARW EMA; defined as the area within 20 km (12.4 mi) from the 30-m (98-ft) isobath on the west side of Nantucket Shoals);

(2) Outside of the NARW EMA, foundation pile driving must not be planned for December; however, it may occur only if necessary to complete pile driving within a given year and with prior approval by NMFS and implementation of enhanced mitigation and monitoring (see 217.334(c)(7), 217.334(c)(13)). SouthCoast Wind must notify NMFS in writing by September 1 of that year if circumstances are expected to necessitate pile driving in December;

(3) In the NARW EMA, SouthCoast must install foundations as quickly as possible and sequence them from the northeast corner of the Lease Area to the southwest corner such that foundation installation in positions closest to Nantucket Shoals are completed during the period of lowest North Atlantic right whale occurrence in that area;

(4) Monopiles must be no larger than a tapered 9/16-m diameter monopile design and pin piles must be no larger than 4.5-m diameter design. The minimum amount of hammer energy necessary to effectively and safely install and maintain the integrity of the piles must be used. Impact hammer energies must not exceed 6,600

kilojoules (kJ) for monopile installations and 3,500 kJ for pin pile installations;

(5) SouthCoast must not initiate pile driving earlier than 1 hour after civil sunrise or later than 1.5 hours prior to civil sunset unless SouthCoast submits and NMFS approves a Nighttime Pile Driving Monitoring Plan that demonstrates the efficacy of their low-visibility visual monitoring technology (*e.g.,* night vision devices, Infrared (IR) cameras) to effectively monitor the mitigation zones in low visibility conditions. SouthCoast must submit this plan or plans (if separate Daytime Reduced Visibility and Nighttime Monitoring Plans are prepared) at least 180 calendar days before foundation installation is planned to begin. SouthCoast must submit a separate Plan describing daytime reduced visibility monitoring if the information in the Nighttime Monitoring Plan does not sufficiently apply to all low-visibility monitoring;

(6) SouthCoast Wind must utilize a soft-start protocol at the beginning of foundation installation for each impact pile driving event and at any time following a cessation of impact pile driving for 30 minutes or longer;

(7) SouthCoast Wind must deploy, at minimum, a double bubble curtain during all foundation pile driving;

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

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

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

(iv) SouthCoast Wind must inspect and carry out maintenance on the noise attenuation systems prior to every pile driving event and prepare and submit a Noise Attenuation System (NAS) inspection/performance report. For piles for which Thorough SFV (T–SFV) (as required by 217.334(c)(19)) is carried out, this report must be submitted as soon as it is available, but no later than when the interim T–SFV report is submitted for the respective pile. Performance reports for all subsequent piles must be submitted with the weekly pile driving reports. All reports must be submitted by email to *pr.itp.monitoringreports@noaa.gov.*

(8) SouthCoast Wind must utilize PSOs. Each monitoring platform must have at least three on-duty PSOs. PSOs must be located on the pile driving vessel as well as on a minimum of three PSO-dedicated vessels inside the NARW EMA June 1 through July 31 and outside the NARW EMA June 1 through November 30, and a minimum of four PSO-dedicated vessels within the NARW EMA from August 1 through October 15 and throughout the Lease Area from May 16–31 and December 1–31 (if pile driving in December is deemed necessary and approved by NMFS);

(9) Concurrent with visual monitoring, SouthCoast Wind must utilize PAM operator(s), as described in a NMFS-approved PAM Plan, who must conduct acoustic monitoring of marine mammals for 60 minutes before, during, and 30 minutes after completion of impact and vibratory pile driving for each pile. PAM operators must immediately communicate all detections of marine mammals to the Lead PSO, including any determination regarding species identification, distance, and bearing and the degree of confidence in the determination;

(10) To increase situational awareness prior to pile driving, the PAM operator must review PAM data collected within the 24 hours prior to a pile installation;

(11) The PAM system must be able to detect marine mammal vocalizations, maximize baleen whale detections, and detect North Atlantic right whale vocalizations up to a distance of 10 km (6.2 mi) and 15 km (9.3mi) during pin pile and monopile installation, respectively. NMFS recognizes that detectability of each species' vocalizations will vary based on vocalization characteristics (*e.g.,* frequency content, source level), acoustic propagation conditions, and competing noise sources), such that other marine mammal species (*e.g.,* harbor porpoise) may not be detected at 10 km (6.2 mi) or 15 km (9.3 mi);

(12) SouthCoast Wind must submit a Passive Acoustic Monitoring Plan (PAM Plan) to NMFS Office of Protected Resources for review and approval at least 180 days prior to the planned start of foundation installation activities and abide by the Plan if approved;

(13) SouthCoast Wind must establish clearance and shutdown zones, which must be measured using the radial distance from the pile being driven. All clearance zones must be confirmed to be free of marine mammals for 30 minutes immediately prior to the beginning of soft-start procedures or vibratory pile driving. If a marine mammal (other than a North Atlantic right whale) is detected within or about to enter the applicable clearance zones during this 30-minute time period, vibratory and impact pile driving must be delayed until the animal has been visually observed exiting the clearance zone or until a specific time period has elapsed with no further sightings. The specific time periods are 30 minutes for all baleen whale species and sperm whales and 15 minutes for all other species;

(14) For North Atlantic right whales, any visual observation by a PSO at any distance, or acoustic detection within the 10-km (6.2-mi) (pin pile) and 15-km (9.32-mi) (monopile) PAM clearance and shutdown zones must trigger a delay to the commencement or shutdown (if already begun) of pile driving. For any acoustic detection within the North Atlantic right whale PAM clearance and shutdown zones or sighting of 1 or 2 North Atlantic right whales, SouthCoast Wind must delay commencement of or shutdown pile driving for 24 hours. For any sighting of 3 or more North Atlantic right whales, SouthCoast Wind must delay commencement of or shutdown pile driving for 48 hours. Prior to beginning clearance at the pile driving location after these periods, SouthCoast must conduct a vessel-based survey to visually clear the 10-km (6.2-mi) zone, if installing pin piles that day, or 15-km (9.32-mi) zone, if installing monopiles.

(15) If visibility decreases such that the entire clearance zone is not visible, at minimum, PSOs must be able to visually clear (*i.e.,* confirm no marine mammals are present) the minimum visibility zone. The entire minimum visibility zone must be visible (*i.e.,* not obscured by dark, rain, fog, *etc.*) for the full 60 minutes immediately prior to commencing impact and vibratory pile driving;

(16) If a marine mammal is detected (visually or acoustically) entering or within the respective shutdown zone after pile driving has begun, the PSO or PAM operator must call for a shutdown of pile driving and SouthCoast Wind must stop pile driving immediately, unless shutdown is not practicable due to imminent risk of injury or loss of life to an individual or risk of damage to a vessel that creates risk of injury or loss of life for individuals, or the lead engineer determines there is risk of pile refusal or pile instability. If pile driving is not shut down due to one of these situations, SouthCoast Wind must

reduce hammer energy to the lowest level practicable to maintain stability;

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

(18) SouthCoast Wind must submit a Pile Driving Marine Mammal Monitoring Plan to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of foundation pile driving and abide by the Plan if approved. SouthCoast Wind must obtain both NMFS Office of Protected Resources and NMFS Greater Atlantic Regional Fisheries Office Protected Resources Division's concurrence with this Plan prior to the start of any pile driving;

(19) SouthCoast Wind must perform T–SFV measurements during installation of, at minimum, the first three WTG monopile foundations, first four WTG pin piles, and all OSP jacket foundation pin piles;

(i) T–SFV measurements must continue until at least three consecutive monopiles or four consecutive pin piles demonstrate noise levels are at or below those modeled, assuming 10 decibels (dB) of attenuation. Subsequent T–SFV measurements are also required should larger piles be installed or if additional monopiles or pin piles are driven that may produce louder sound fields than those previously measured (*e.g.,* from higher hammer energy, greater number of strikes);

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

(iii) If any of the T–SFV results indicate that distances to harassment isopleths were exceeded, then SouthCoast Wind must implement additional measures for all subsequent foundation installations to ensure the measured distances to the Level A harassment and Level B harassment threshold isopleths do not exceed those modeled assuming 10 dB attenuation. SouthCoast Wind must also increase clearance, shutdown, and/or Level B harassment zone sizes to those identified by NMFS until T–SFV measurements on at least three additional monopiles or four pin piles demonstrate distances to harassment threshold isopleths meet or are less than those modeled assuming 10-dB of attenuation. For every 1,500 m (4,900 ft) that a marine mammal clearance or shutdown zone is expanded, additional PSOs must be deployed from additional platforms/vessels to ensure adequate and complete monitoring of the expanded clearance and/or shutdown zone(s), with each PSO responsible for scanning no more than 120 degrees (°) out to a radius no greater than 1,500 m (4,900 ft). SouthCoast Wind must optimize the sound attenuation systems (*e.g.,* ensure hose maintenance, pressure testing, *etc.*) to, at least, meet noise levels modeled, assuming 10-dB attenuation, within three monopiles or four pin piles, or else foundation installation activities must cease until NMFS and SouthCoast Wind can evaluate potential reasons for louder than anticipated noise levels. Alternatively, if SouthCoast determines T–SFV results demonstrate noise levels are within those modeled assuming 10 dB attenuation, SouthCoast may proceed to the next pile after submitting the interim report to NMFS;

(20) SouthCoast Wind also must conduct abbreviated SFV, using at least one acoustic recorder (consisting of a bottom and mid-water column hydrophone) for every foundation for which T–SFV monitoring is not conducted. All abbreviated SFV data must be included in weekly reports. Any indications that distances to the identified Level A harassment and Level B harassment thresholds for marine mammals may be exceeded based on this abbreviated monitoring must be addressed by SouthCoast Wind in the weekly report, including an explanation of factors that contributed to the exceedance and corrective actions that were taken to avoid exceedance on subsequent piles. SouthCoast Wind must meet with NMFS within two business days of SouthCoast Wind's submission of a report that includes an exceedance to discuss if any additional action is necessary;

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

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

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

(24) If any of the SFV measurements from any pile indicate that the distance to any isopleth of concern is greater than those modeled assuming 10-dB attenuation, before the next pile is installed, SouthCoast Wind must implement the following measures, as applicable: identify and propose for

review and concurrence; additional, modified, and/or alternative noise attenuation measures or operational changes that present a reasonable likelihood of reducing sound levels to the modeled distances; provide a written explanation to NMFS Office of Protected Resources supporting that determination, and request concurrence to proceed; and, following NMFS Office of Protected Resources' concurrence, deploy those additional measures on any subsequent piles that are installed (*e.g.,* if threshold distances are exceeded on pile 1, then additional measures must be deployed before installing pile 2);

(25) If SFV measurements indicate that ranges to isopleths corresponding to the Level A harassment and Level B harassment thresholds are less than the ranges predicted by modeling (assuming 10-dB attenuation) for 3 consecutive monopiles or 4 consecutive pin piles, SouthCoast Wind may submit a request to NMFS Office of Protected Resources for a modification of the mitigation zones for non-North Atlantic right whale species. Mitigation zones for North Atlantic right whales cannot be decreased;

(26) SouthCoast must measure background noise (*i.e.,* noise absent pile driving) for 30 minutes before and after each pile installation;

(27) SouthCoast must conduct SFV measurements upon commencement of turbine operations to estimate turbine operational source levels, in accordance with a NMFS-approved Foundation Installation Pile Driving SFV Plan. SFV must be conducted in the same manner as previously described in paragraph (13) of this section, with adjustments to measurement distances, number of hydrophones, and hydrophone sensitivities being made, as necessary; and

(28) SouthCoast Wind must submit a SFV Plan for thorough and abbreviated SFV for foundation installation and WTG operations to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of foundation installation activities and abide by the Plan if approved. Pile driving may not occur until NMFS provides SouthCoast concurrence that implementation of the SFV Plan meets the requirements in the LOA.

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

(1) Upon encountering a UXO/MEC, SouthCoast Wind can only resort to high-order removal (*i.e.,* detonation) if all other means of removal are impracticable (*i.e.,* As Low As Reasonably Practicable (ALARP) risk mitigation procedure)) and this determination must be documented and submitted to NMFS;

(2) UXO/MEC detonations must not occur from December 1 through April 30;

(3) UXO/MEC detonations must only occur during daylight hours (1 hour after civil sunrise through 1.5 hours prior to civil sunset);

(4) No more than one detonation can occur within a 24-hour period. No more than 10 detonations may occur throughout the effective period of these regulations;

(5) SouthCoast Wind must deploy, at minimum, a double bubble curtain during all UXO/MEC detonations and comply with the following requirements related to noise abatement:

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

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

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

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

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

(vi) SouthCoast Wind must inspect and carry out maintenance on the noise attenuation system prior to every UXO/MEC detonation and prepare and submit a Noise Attenuation System (NAS) inspection/performance report as soon as it is available and prior to the UXO/MEC detonation to NMFS Office of Protected Resources.

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

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

(ii) The SFV measurement systems must have a sensitivity for the expected sound levels from detonations received at the nominal ranges throughout the detonation. The dynamic range of the SFV measurement systems must be sufficient such that at each location, the signals avoid poor signal-to-noise ratios for low amplitude signals and the signals avoid clipping, nonlinearity, and saturation for high amplitude signals;

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

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

(v) SouthCoast Wind must submit SFV reports within 72 hours after each UXO/MEC detonation;

(vi) If acoustic field measurements collected during UXO/MEC detonation indicate ranges to the isopleths, corresponding to Level A harassment and Level B harassment thresholds, are greater than the ranges predicted by modeling (assuming 10 dB attenuation), SouthCoast Wind must implement additional noise mitigation measures prior to the next UXO/MEC detonation. SouthCoast Wind must provide written notification to NMFS Office of Protected Resources of the changes planned for the next detonation within 24 hours of implementation. Subsequent UXO/MEC detonation activities must not occur until NMFS and SouthCoast Wind can evaluate the situation and ensure future detonations will not exceed noise levels modeled assuming 10-dB attenuation; and

(vii) SouthCoast Wind must optimize the noise attenuation systems (*e.g.,* ensure hose maintenance, pressure testing) to, at least, meet noise levels modeled, assuming 10-dB attenuation.

(7) SouthCoast Wind must establish and implement clearance zones for UXO/MEC detonation using both visual and acoustic monitoring;

(8) At least three on-duty PSOs must be stationed on each monitoring platform and be monitoring for 60 minutes prior to, during, and 30 minutes after each UXO/MEC detonation. The number of platforms is contingent upon the size of the UXO/MEC detonation to be identified in SouthCoast's UXO/MEC Detonation Marine Mammal Monitoring Plan and must be sufficient such that PSOs are able to visually clear the entire clearance zone. Concurrently, at least one PAM operator must be actively monitoring for marine mammals with PAM 60 minutes before, during, and 30 minutes after detonation; and

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

(e) *HRG surveys.* The following requirements apply to HRG surveys operating sub-bottom profilers (SBPs) (*e.g.,* boomers, sparkers, and Compressed High Intensity Radiated Pulse (CHIRPS)) (hereinafter referred to as ''acoustic sources''):

(1) SouthCoast Wind must establish and implement clearance and shutdown zones for HRG surveys using visual monitoring. These zones must be measured using the radial distance(s) from the acoustic source(s) currently in use;

(2) SouthCoast must utilize PSO(s), as described in § 217.335(e). Visual monitoring must begin no less than 30 minutes prior to initiation of specified acoustic sources and must continue until 30 minutes after use of specified acoustic sources ceases. Any PSO on duty has the authority to delay the start of survey operations or shutdown operations if a marine mammal is detected within the applicable zones. When delay or shutdown is instructed by a PSO, the mitigative action must be taken and any dispute resolved only following deactivation;

(3) Prior to starting the survey and after receiving confirmation from the PSOs that the clearance zone is clear of any marine mammals, SouthCoast Wind is required to ramp-up acoustic sources to half power for 5 minutes prior to commencing full power, unless the equipment operates on a binary on/off switch (in which case ramp-up is not required). Any ramp-up of acoustic sources may only commence when visual clearance zones are fully visible (*e.g.,* not obscured by darkness, rain, fog, *etc.*) and clear of marine mammals, as determined by the Lead PSO, for at least 30 minutes immediately prior to the initiation of survey activities using a specified acoustic source. Ramp-ups must be scheduled so as to minimize the time spent with the source activated;

(4) Prior to a ramp-up procedure starting, the acoustic source operator must notify the Lead PSO of the planned start of ramp-up. The notification time must not be less than 60 minutes prior to the planned ramp-up or activation in order to allow the PSO(s) time to monitor the clearance zone(s) for 30 minutes prior to the initiation of ramp-up or activation (pre-start clearance). During this 30-minute clearance period, the entire applicable clearance zones must be visible;

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

(6) If a marine mammal is observed within a clearance zone during the 30 minute clearance period, ramp-up or acoustic surveys may not begin until the animal(s) has been observed voluntarily exiting its respective clearance zone or until a specific time period has elapsed with no further sighting. The specific time periods are 30 minutes for all baleen whale species and sperm whales and 15 minutes for all other species;

(7) In any case when the clearance process has begun in conditions with good visibility, including via the use of night vision/reduced visibility monitoring equipment (infrared (IR)/thermal camera), and the Lead PSO has determined that the clearance zones are clear of marine mammals, survey operations may commence (*i.e.,* no delay is required) despite periods of inclement weather and/or loss of daylight. Ramp-up may occur at times of poor visibility, including nighttime, if required visual monitoring has occurred with no detections of marine mammals in the 30 minutes prior to beginning ramp-up;

(8) Once the survey has commenced, SouthCoast Wind must shut down acoustic sources if a marine mammal enters a respective shutdown zone. In cases when the shutdown zones become obscured for brief periods (less than 30 minutes) due to inclement weather, survey operations would be allowed to continue (*i.e.,* no shutdown is required) so long as no marine mammals have been detected. The shutdown requirement does not apply to small delphinids of the following genera: *Delphinus, Stenella, Lagenorhynchus,* and *Tursiops.* If there is uncertainty regarding the identification of a marine mammal species (*i.e.,* whether the observed marine mammal belongs to one of the delphinid genera for which shutdown is waived), the PSOs must use their best professional judgment in making the decision to call for a shutdown. Shutdown is required if a delphinid that belongs to a genus other than those specified in this paragraph of this section is detected in the shutdown zone;

(9) If an acoustic source has been shut down due to the presence of a marine mammal, the use of an acoustic source may not commence or resume until the animal(s) has been confirmed to have left the Level B harassment zone or until a full 30 minutes for all baleen whale species and sperm whales and 15 minutes for all other species have elapsed with no further sighting. If an acoustic source is shut down for reasons other than mitigation (*e.g.,* mechanical

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

(10) If multiple HRG vessels are operating concurrently, any observations of marine mammals must be communicated to PSOs on all nearby survey vessels; and

(11) Should an autonomous survey vehicle (ASV) be used during HRG surveys, the ASV must remain with 800 m (2,635 ft) of the primary vessel while conducting survey operations; two PSOs must be stationed on the mother vessel at the best vantage points to monitor the clearance and shutdown zones around the ASV; at least one PSO must monitor the output of a thermal high-definition camera installed on the mother vessel to monitor the field-of-view around the ASV using a hand-held tablet, and during periods of reduced visibility (*e.g.,* darkness, rain, or fog), PSOs must use night-vision goggles with thermal clip-ons and a hand-held spotlight to monitor the clearance and shutdown zones around the ASV.

(f) *Fisheries Monitoring Surveys.* The following measures apply during fisheries monitoring surveys and must be implemented by SouthCoast Wind:

(1) Marine mammal monitoring must be conducted within 1 nmi (1.85 km) from the planned survey location by the trained captain and/or a member of the scientific crew for 15 minutes prior to deploying gear, throughout gear deployment and use, and for 15 minutes after haul back;

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

(3) Gear must not be deployed if there is a risk of interaction with marine mammals. Gear must not be deployed until a minimum of 15 consecutive minutes have elapsed during which no marine mammal sightings within 1 nmi (1,852 m) of the sampling station have occurred;

(4) If marine mammals are sighted within 1 nm of the planned location (*i.e.,* station) within the 15 minutes prior to gear deployment, then SouthCoast Wind must move the vessel away from the marine mammal to a different section of the sampling area. If, after moving on, marine mammals are still visible from the vessel, SouthCoast Wind must move again to an area visibly clear of marine mammals or skip the station;

(5) If a marine mammal is at risk of interacting with deployed gear or set, all gear must be immediately removed from the water. If marine mammals are sighted before the gear is fully removed from the water, the vessel must slow its speed and maneuver the vessel away from the animals to minimize potential interactions with the observed animal;

(6) Survey gear must be deployed as soon as possible once the vessel arrives on station and after fulfilling the requirements in (g)(1) and (g)(3);

(7) SouthCoast Wind must maintain visual marine mammal monitoring effort during the entire period of time that gear is in the water (*i.e.,* throughout gear deployment, fishing, and retrieval). If marine mammals are sighted before the gear is fully removed from the water, SouthCoast Wind will take the most appropriate action to avoid marine mammal interaction;

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

(9) SouthCoast Wind's fixed gear must comply with the Atlantic Large Whale Take Reduction Plan regulations at 50 CFR 229.32 during fisheries monitoring surveys;

(10) Trawl tows must be limited to a maximum of 20 minute trawl-time and trawl tows must not exceed at a speed of 3.0 knots (3.5 mph);

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

(12) During trawl surveys, vessel or scientific crew must open the cod end of the trawl net close to the deck in order to avoid injury to animals that may be caught in the gear;

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

(14) During any survey that uses vertical lines, buoy lines must be weighted and must not float at the surface of the water. All groundlines must be composed entirely of sinking lines. Buoy lines must utilize weak links. Weak links must break cleanly leaving behind the bitter end of the line. The bitter end of the line must be free of any knots when the weak link breaks. Splices are not considered to be knots. The attachment of buoys, toggles, or other floatation devices to groundlines is prohibited;

(15) All in-water survey gear, including buoys, must be properly labeled with the scientific permit number or identification as SouthCoast Wind's research gear. All labels and markings on the gear, buoys, and buoy lines must also be compliant with the applicable regulations, and all buoy markings must comply with instructions received by the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division;

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

(17) All reasonable efforts that do not compromise human safety must be undertaken to recover gear; and

(18) Any lost gear associated with the fishery surveys must be reported to the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division within 24 hours.

§ 217.335 Monitoring and Reporting Requirements.

SouthCoast Wind must implement the following monitoring and reporting requirements when conducting the specified activities (see § 217.330(c)):

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

(1) SouthCoast Wind must use NMFS-approved PSOs and PAM operators that are employed by a third-party observer provider. PSOs and PAM operators must have no tasks other than to conduct observational effort, collect data, and communicate with and instruct relevant personnel regarding the presence of marine mammals and mitigation requirements;

(2) All PSOs and PAM operators must have successfully attained a bachelor's degree from an accredited college or university with a major in one of the natural sciences. The educational requirements may be waived if the PSO or PAM operator has acquired the relevant experience and skills (see § 217.335(a)(3)) for visually and/or acoustically detecting marine mammals in a range of environmental conditions (*e.g.,* sea state, visibility) within zone sizes equivalent to the clearance and shutdown zones required by these regulations. Requests for such a waiver must be submitted to NMFS Office of Protected Resources prior to or when SouthCoast Wind requests PSO and PAM operator approvals and must include written justification describing alternative experience. Alternate experience that may be considered includes, but is not limited to,

conducting academic, commercial, or government-sponsored marine mammal visual and/or acoustic surveys or previous work experience as a PSO/PAM operator. All PSO's and PAM operators should demonstrate good standing and consistently good performance of all assigned duties;

(3) PSOs must have visual acuity in both eyes (with correction of vision being permissible) sufficient enough to discern moving targets on the water's surface with the ability to estimate the target size and distance (binocular use is allowable); ability to conduct field observations and collect data according to the assigned protocols, writing skills sufficient to document observations and the ability to communicate orally by radio or in-person with project personnel to provide real-time information on marine mammals observed in the area;

(4) All PSOs must be trained to identify northwestern Atlantic Ocean marine mammal species and behaviors and be able to conduct field observations and collect data according to assigned protocols. Additionally, PSOs must have the ability to work with all required and relevant software and equipment necessary during observations described in paragraphs (b)(2) and (b)(3) of this section;

(5) All PSOs and PAM operators must have successfully completed a PSO, PAM, or refresher training course within the last 5 years and obtained a certificate of course completion that must be submitted to NMFS. This requirement is waived for any PSOs and PAM operators that completed a relevant training course more than five years prior to seeking approval but have been working consistently as a PSO or PAM operator within the past five years;

(6) At least one on-duty PSO and PAM operator, where applicable, per platform must be designated as a Lead during each of the specified activities;

(7) PSOs and PAM operators are responsible for obtaining NMFS' approval. NMFS may approve PSOs as conditional or unconditional. An unconditionally approved PSO is one who has completed training within the last 5 years and attained the necessary experience (*i.e.,* demonstrate experience with monitoring for marine mammals at clearance and shutdown zone sizes similar to those produced during the respective activity) or for PSOs and PAM operators who completed training more than five years previously and have worked in the specified role consistently for at least the past 5 years. A conditionally-approved PSO may be one who has completed training in the last 5 years but has not yet attained the requisite field experience. To qualify as a Lead PSO or PAM operator, the person must be unconditionally approved and demonstrate that they have a minimum of 90 days of at-sea experience in the specific role, with the conclusion of the most recent relevant experience not more than 18 months previous to deployment, and must also have experience specifically monitoring baleen whale species;

(7) PSOs for HRG surveys may be unconditionally or conditionally approved. A conditionally approved PSO for HRG surveys must be paired with an unconditionally approved PSO;

(8) PSOs and PAM operators for foundation installation and UXO detonation must be unconditionally approved;

(9) SouthCoast Wind must submit NMFS-approved PSO and PAM operator resumes to NMFS Office of Protected Resources for review and confirmation of their approval for specific roles at least 90 days prior to commencement of the activities requiring PSOs/PAM operators or 30 days prior to when new PSOs/PAM operators are required after activities have commenced. Resumes must include information related to relevant education, experience, and training, including dates, duration (*i.e.,* number of days as a PSO or PAM operator per project), location, and description of each prior PSO or PAM operator experience (*i.e.,* zone sizes monitored, how monitoring supported mitigation; PAM system/software utilized);

(10) For prospective PSOs and PAM operators not previously approved by NMFS or for PSOs and PAM operators whose approval is not current (*i.e.,* approval date is more than 5 years prior to the start of monitoring duties), SouthCoast Wind must submit the list of pre-approved PSOs and PAM operators for qualification verification at least 60 days prior to PSO and PAM operator use. Resumes must include information detailed in 217.335(a)(9). Resumes must be accompanied by certificate of completion of a NMFS-approved PSO and/or PAM training/course;

(11) To be approved as a PAM operator, the person must meet the following qualifications: the PAM operator must have completed a PAM Operator training course, and demonstrate prior experience using PAM software, equipment, and real-time acoustic detection systems. They must demonstrate that they have prior experience independently analyzing archived and/or real-time PAM data to identify and classify baleen whale and other marine mammal vocalizations by species, including North Atlantic right whale and humpback whale vocalizations, and experience with deconfliction of multiple species' vocalizations that are similar and/or received concurrently. PAM operators must be independent observers (*i.e.,* not construction personnel), trained to use relevant project-specific PAM software and equipment, and must also be able to test software and hardware functionality prior to beginning real-time monitoring. The PAM operator must be able to identify and classify marine mammal acoustic detections by species in real-time (prioritizing North Atlantic right whales and noting other marine mammals vocalizations, when detected). At a minimum, for each acoustic detection, the PAM operator must be able to categorically determine whether a North Atlantic right whale is detected, possibly detected, or not detected, and notify the Lead PSO of any confirmed or possible detections, including baleen whale detections that cannot be identified to species. If the PAM software is capable of localization of sounds or deriving bearings and distance, the PAM operators must demonstrate experience using this technique;

(12) PSOs may work as PAM operators and vice versa if NMFS approves each individual for both roles; however, they may only perform one role at any one time and must not exceed work time restrictions, which must be tallied cumulatively; and

(13) All PSOs and PAM operators must complete a Permits and Environmental Compliance Plan training that must be held by the Project compliance representative(s) prior to the start of in-water project activities and whenever new PSOs and PAM operators join the marine mammal monitoring team. PSOs and PAM operators must also complete training and orientation with the construction operation to provide for personal safety;

(b) *General PSO and PAM operator requirements.* The following measures apply to PSOs and PAM operators and must be implemented by SouthCoast Wind: (1) All PSOs must be located at the best vantage point(s) on any platform, as determined by the Lead PSO, in order to collectively obtain 360-degree visual coverage of the entire clearance and shutdown zones around the activity area and as much of the Level B harassment zone as possible. PAM operators may be located on a vessel or remotely on-shore but must have a computer station equipped with a data collection software system and acoustic data analysis software available wherever they are stationed, and data or data products must be streamed in real-time or in near real-time to allow PAM operators to provide assistance to on-duty PSOs in determining if mitigation is required (*i.e.,* delay or shutdown);

(2) PSOs must use high magnification (25x) binoculars, standard handheld (7x) binoculars, and the naked eye to search continuously for marine mammals during visual monitoring. During foundation installation, at least three PSOs on each dedicated PSO vessel must be equipped with functional Big Eye binoculars (*e.g.,* 25 x 150; 2.7 view angle; individual ocular focus; height control). These must be pedestal mounted on the deck at the best vantage point that provides for optimal sea surface observation and PSO safety. PAM operators must use a NMFS-approved PAM system to conduct acoustic monitoring;

(3) During periods of low visibility (*e.g.,* darkness, rain, fog, poor weather conditions, *etc.*), PSOs must use alternative technology (*e.g.,* infrared or thermal cameras) to monitor the mitigation zones;

(4) PSOs and PAM operators must not exceed 4 consecutive watch hours on duty at any time, must have a 2-hour (minimum) break between watches, and must not exceed a combined watch schedule of more than 12 hours in a 24-hour period; and

(5) SouthCoast Wind must ensure that PSOs conduct, as rotation schedules allow, observations for comparison of sighting rates and behavior with and without use of the specified acoustic sources. Off-effort PSO monitoring must be reflected in the PSO monitoring reports.

(c) *Reporting.* SouthCoast Wind must comply with the following reporting measures:

(1) Prior to initiation of project activities, SouthCoast Wind must demonstrate in a report submitted to NMFS Office of Protected Resources (*pr.itp.monitoringreports@noaa.gov*) that all required training for SouthCoast Wind personnel, including the vessel crews, vessel captains, PSOs, and PAM operators has been completed;

(2) SouthCoast Wind must use a standardized reporting system. All data collected related to the Project must be recorded using industry-standard software that is installed on field laptops and/or tablets. Unless stated otherwise, all reports must be submitted to NMFS Office of Protected Resources (*PR.ITP.MonitoringReports@noaa.gov*), dates must be in MM/DD/YYYY format, and location information must be provided in Decimal Degrees and with the coordinate system information (*e.g.,* NAD83, WGS84);

(3) Full detection data, metadata, and location of recorders (or GPS tracks, if applicable) from all real-time hydrophones used for monitoring during foundation installation and UXO/MEC detonations must be submitted within 90 calendar days following completion of activities requiring PAM for mitigation via the International Organization for Standardization (ISO) standard metadata forms available on the NMFS Passive Acoustic Reporting System website (*https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reportingsystem-templates*). Submit the completed data templates to *nmfs.nec.pacmdata@noaa.gov.* The full acoustic recordings from real-time systems must also be sent to the National Centers for Environmental Information (NCEI) for archiving within 90 days following completion of activities requiring PAM for mitigation. Submission details can be found at: *https://www.ncei.noaa.gov/products/passive-acoustic-data;*

(4) SouthCoast Wind must compile and submit weekly reports during foundation installation containing, at minimum, the marine mammal monitoring and abbreviated SFV data to NMFS Office of Protected Resources (*pr.itp.monitoringreports@noaa.gov*). Weekly reports are due on Wednesday for the previous week (Sunday–Saturday);

(5) SouthCoast Wind must compile and submit monthly reports during foundation installation containing, at minimum, data as described in the weekly reports to NMFS Office of Protected Resources (*pr.itp.monitoringreports@noaa.gov*). Monthly reports are due on the 15th of the month for the previous month;

(6) SouthCoast Wind must submit a draft annual marine mammal monitoring report to NMFS (*PR.ITP.monitoringreports@noaa.gov*) no later than March 31, annually that contains data for all specified activities. The final annual marine mammal monitoring report must be prepared and submitted within 30 calendar days following the receipt of any comments from NMFS on the draft report;

(7) SouthCoast Wind must submit the T–SFV interim report no later than 48 hours after cessation of pile driving for a given foundation installation. In addition to the 48-hour interim reports, SouthCoast Wind must submit a draft annual SFV report to NMFS (*PR.ITP.monitoringreports@noaa.gov*) no later than 90 days after SFV is completed for the year. The final annual SFV report must be prepared and submitted within 30 calendar days (or longer upon approval by NMFS) following the receipt of any comments from NMFS on the draft report;

(8) SouthCoast Wind must submit its draft final 5-year report to NMFS (*PR.ITP.monitoringreports@noaa.gov*) on all visual and acoustic monitoring, including SFV monitoring, within 90 calendar days of the completion of the specified activities. A 5-year report must be prepared and submitted within 60 calendar days (or longer upon approval by NMFS) following receipt of any NMFS Office of Protected Resources comments on the draft report;

(9) SouthCoast Wind must submit SFV results from UXO/MEC detonation monitoring in a report prior to detonating a subsequent UXO/MEC or within the relevant weekly report, whichever comes first;

(10) SouthCoast must submit bubble curtain performance reports within 48 hours of each bubble curtain deployment;

(11) SouthCoast Wind must provide NMFS Office of Protected Resources with notification of planned UXO/MEC detonation as soon as possible but at least 48 hours prior to the planned detonation unless this 48-hour notification requirement would create delays to the detonation that would result in imminent risk of human life or safety. This notification must include the coordinates of the planned detonation, the estimated charge size, and any other information available on the characteristics of the UXO/MEC;

(13) SouthCoast Wind must submit a report to the NMFS Office of Protected Resources (insert ITP monitoring email) within 24 hours if an exemption to any of the requirements in the regulations and LOA is taken;

(14) SouthCoast Wind must submit reports on all North Atlantic right whale sightings and any dead or entangled marine mammal sightings to NMFS Office of Protected Resources (*PR.ITP.MonitoringReports@noaa.gov*); and

(15) SouthCoast Wind must report any lost gear associated with the fishery surveys to the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division (*nmfs.gar.incidentaltake@noaa.gov*) as soon as possible or within 24 hours of the documented time of missing or lost gear.

§ 217.336 Letter of Authorization.

(a) To incidentally take marine mammals pursuant to these regulations, SouthCoast Wind must apply for and obtain an LOA;

(b) An LOA, unless suspended or revoked, may be effective for a period of time not to exceed the effective period of this subpart;

(c) If an LOA expires prior to the expiration date of these regulations, SouthCoast Wind may apply for and obtain a renewal of the LOA;

(d) In the event of projected changes to the activity or to mitigation and monitoring measures required by an LOA, SouthCoast Wind must apply for and obtain a modification of the LOA as described in § 217.337; and

(e) The LOA must set forth:

(1) Permissible methods of incidental taking;

(2) Means of effecting the least practicable adverse impact (*i.e.,* mitigation) on the species, its habitat, and on the availability of the species for subsistence uses; and

(3) Requirements for monitoring and reporting.

(f) Issuance of the LOA must be based on a determination that the level of taking must be consistent with the findings made for the total taking allowable under this subpart; and

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

§ 217.337 Modifications of Letter of Authorization.

(a) A LOA issued under §§ 216.106 and 217.336 of this section for the activities identified in § 217.330(c) shall be modified upon request by SouthCoast Wind, provided that:

(1) The specified activity and mitigation, monitoring, and reporting measures, as well as the anticipated impacts, are the same as those described and analyzed for this subpart (excluding changes made pursuant to the adaptive management provision in paragraph (c)(1) of this section); and

(2) NMFS determines that the mitigation, monitoring, or reporting measures required by the previous LOA under this subpart were implemented.

(b) For a LOA modification request by the applicant that includes changes to the activity or the mitigation, monitoring, or reporting measures (excluding changes made pursuant to the adaptive management provision in paragraph (c)(1) of this section), the LOA shall be modified, provided that:

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

(2) NMFS may publish a notice of proposed modified LOA in the **Federal Register**, including the associated analysis of the change, and solicit public comment before issuing the LOA.

(c) A LOA issued under §§ 216.106 and 217.336 of this section for the activities identified in § 217.330(c) may be modified by NMFS under the following circumstances:

(1) Through adaptive management, NMFS may modify (including remove, revise, or add to) the existing mitigation, monitoring, or reporting measures after consulting with SouthCoast Wind regarding the practicability of the modifications, if doing so creates a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring measures set forth in this subpart.

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

(A) Results from SouthCoast Wind's monitoring;

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

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

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

(2) If NMFS determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in the LOA issued pursuant to §§ 216.106 and 217.336 of this section, a LOA may be modified without prior notice or opportunity for public comment. Notice would be published in the **Federal Register** within 30 days of the action.

§§ 217.338–217.339 [Reserved]

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