

integrated surveys. The 2022 AIES dress rehearsal and subsequent full-scale AIES collections are authorized by title 13 U.S.C. 131, 182, and 193. Response to the dress rehearsal and the AIES is mandatory per sections 224 and 225 of title 13 U.S.C. All information collected will be kept confidential, consistent with the provisions of title 13 U.S.C. 9.

The AIES covers all domestic, private, non-farm employer businesses headquartered in the U.S. as defined by the 2017 North American Industry Classification System (NAICS). Exclusions are most foreign operations of U.S. businesses and most government operations (including the U.S. Postal Service), agricultural production companies, and private households. The AIES sample is selected from a frame of approximately 5.4 million companies constructed from the Business Register (BR), which is the Census Bureau's master business list. The 2022 AIES dress rehearsal will sample approximately 8,500 employer businesses and the full-scale AIES will sample approximately 385,000 employer businesses. Of the 385,000 employer businesses, the Census Bureau will select approximately 36,500 companies with 100% probability, based on the complexity of their operations. The remaining companies in the frame will be stratified within sector by geographic category within 3-digit industry NAICS classification. This is an unequal probability sample, with company inclusion probabilities accounting for contribution(s) to both national and subnational estimates of annual payroll.

The AIES estimates will include data on employment; revenue including sales; shipments; receipts; revenue by class of customer; sources of revenue; taxes, contributions; gifts and grants; products; e-commerce activity; operating expenses including purchased services; payroll; benefits; rental payments; utilities; interest; resales; equipment; materials and supplies; research and development; other detailed operating expenses; and assets which includes capital expenditures; inventories; depreciable assets; and robotics.

The AIES will provide continuous and timely national and subnational statistical data on the economy. Government program officials, industry organization leaders, economic and social analysts, business entrepreneurs, and domestic and foreign researchers in academia, business, and government will use statistics from AIES. More details on expected uses of the statistics from the AIES are found in the 30-Day

Notice for the AIES (88 FR 19906; April 4, 2023).

**Public Comments:** The Census Bureau published a Notice of Consideration in the **Federal Register** on November 4, 2022 (87 FR 66643) giving notice that it was considering a proposal to conduct the AIES. No comments were received in response to that notice. The Census Bureau subsequently published a Notice in the **Federal Register** on April 4, 2023 (88 FR 19906), which invited comment on the information collection request associated with the AIES. Census received one comment on that latter notice. The commenter agreed that the AIES should reduce respondent burden, increase data quality, and allow greater operational efficiencies. In addition, the commenter supported situations where the AIES may include new questions each year on policy-relevant topics such as technological advances, management and business practices, exporting practices, and globalization. The commenter also requested that Census be required to carry out additional research to ensure a reduction in NAICS code misclassification among survey respondents.

**Census Bureau Response to the Public Comment:** The Census Bureau supports conducting additional research and identifying opportunities to reduce NAICS misclassification. However, this effort is outside the scope of this action, research should be conducted on a larger-scale and not confined to the AIES. NAICS classification for companies selected in the AIES is driven by the Economic Census and the Census Bureau's BR. The Census Bureau is participating in discussions that are underway regarding a Federal statistical agency "data synchronization" effort across multiple agencies. The Census Bureau agrees to provide a research plan to address NAICS misclassification issues within one year of ICR approval.

**OMB Terms of Clearance:** OMB approved the 2022 AIES dress rehearsal portion of the Annual Integrated Economic Survey (AIES), including all relevant testing aspects. Prior to conducting the full-scale AIES, the Census Bureau will consult with OMB to determine next steps for clearing the full-scale AIES. In addition, in light of the Census Bureau's finding in Supporting Statement Part B "that NAICS classifications can be unnatural or challenging for some businesses," the Census Bureau within 1 year of this clearance shall provide OMB a research plan (and relevant research updates) to address such NAICS classification issues. This research plan will include ways the Census Bureau plans to estimate the percentage of respondents

across collections that select an incorrect NAICS code; how the Census Bureau plans to estimate the extent and source of differences in NAICS code assignments by the Census Bureau and the Bureau of Labor Statistics for the same establishments; and possible approaches the Census Bureau could take to reduce NAICS misclassification.

#### **Paperwork Reduction Act**

Notwithstanding any other provision of law, no person is required to respond to, nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act (PRA) unless that collection of information displays a currently valid Office of Management and Budget (OMB) control number. In accordance with the PRA, 44 U.S.C., Chapter 45, OMB approved the AIES under the OMB control number 0607-1024.

Based upon the foregoing, I have directed that the Annual Integrated Economic Survey be conducted for the purpose of collecting these data.

Robert L. Santos, Director, Census Bureau, approved the publication of this Notice in the **Federal Register**.

Dated: August 3, 2023.

**Shannon Wink,**

*Program Analyst, Policy Coordination Office, U.S. Census Bureau.*

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**BILLING CODE 3510-07-P**

## **DEPARTMENT OF COMMERCE**

### **National Oceanic and Atmospheric Administration**

[RTID 0648-XC993]

#### **Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to a Marine Geophysical Survey in Coastal Waters Off of Texas**

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

**ACTION:** Notice; proposed incidental harassment authorization; request for comments on proposed authorization and possible renewal.

**SUMMARY:** NMFS has received a request from the University of Texas at Austin (UT) for authorization to take marine mammals incidental to a marine geophysical survey in coastal waters off of Texas. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal

to issue an incidental harassment authorization (IHA) to incidentally take marine mammals during the specified activities. NMFS is also requesting comments on a possible one-time, 1-year renewal that could be issued under certain circumstances and if all requirements are met, as described in Request for Public Comments at the end of this notice. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorization and agency responses will be summarized in the final notice of our decision.

**DATES:** Comments and information must be received no later than September 7, 2023.

**ADDRESSES:** Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, NMFS and should be submitted via email to [ITP.Wachtendonk@noaa.gov](mailto:ITP.Wachtendonk@noaa.gov). Electronic copies of the application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: [www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-research-and-other-activities](http://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-research-and-other-activities). In case of problems accessing these documents, please call the contact listed above.

*Instructions:* NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Comments, including all attachments, must not exceed a 25-megabyte file size. All comments received are a part of the public record and will generally be posted online at [www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-research-and-other-activities](http://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-research-and-other-activities) without change. All personal identifying information (*e.g.*, name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

**FOR FURTHER INFORMATION CONTACT:** Rachel Wachtendonk, Office of Protected Resources, NMFS, (301) 427-8401.

**SUPPLEMENTARY INFORMATION:**

**Background**

The MMPA prohibits the “take” of marine mammals, with certain exceptions. Section 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) directs the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of

marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are proposed or, if the taking is limited to harassment, a notice of a proposed IHA is provided to the public for review.

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

**National Environmental Policy Act**

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216-6A, NMFS must review our proposed action (*i.e.*, the issuance of an IHA) with respect to potential impacts on the human environment. This action is consistent with categories of activities identified in Categorical Exclusion B4 (IHAs with no anticipated serious injury or mortality) of the Companion Manual for NOAA Administrative Order 216-6A, which do not individually or cumulatively have the potential for significant impacts on the quality of the human environment and for which we have not identified any extraordinary circumstances that would preclude this categorical exclusion. Accordingly, NMFS has preliminarily determined that the issuance of the proposed IHA qualifies to be categorically excluded from further NEPA review. We will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the IHA request.

**Summary of Request**

On March 7, 2023, NMFS received a request from UT for an IHA to take marine mammals incidental to conducting a marine geophysical survey in coastal waters off of Texas. Following

NMFS’ review of the application, UT submitted a revised version on April 25, 2023. The application was deemed adequate and complete on April 27, 2023. UT’s request is for take of bottlenose dolphins, Atlantic spotted dolphins, and rough-toothed dolphin by Level B harassment only. Neither UT nor NMFS expect serious injury or mortality to result from this activity and, therefore, an IHA is appropriate.

**Description of Proposed Activity**

*Overview*

UT proposes to conduct a marine geophysical survey, specifically a low energy seismic survey, in coastal waters off of Texas during a 10 day period in the fall of 2023. The survey would take place in coastal waters off of Texas, in water depths of less than 20 meters (m). To complete this survey the vessel would tow one to two Generator-Injector (GI) airguns, each with a volume of 105 cubic inch (in<sup>3</sup>; 1,721 cubic cm (cm<sup>3</sup>)), for a total volume of 210 in<sup>3</sup> (3,441 cm<sup>3</sup>). The airguns would be deployed at a depth of about 4 m below the surface, spaced about 2 m apart, while the receiving system consists of four 25 m hydrophone streamers towed at a depth of about 2 m.

The purpose of the proposed survey is to validate novel dynamic positioning technology for improving the accuracy in time and space of high resolution 3-dimensional (HR3D) seismic datasets, in particular as it pertains to field technology of offshore carbon capture systems.

*Dates and Duration*

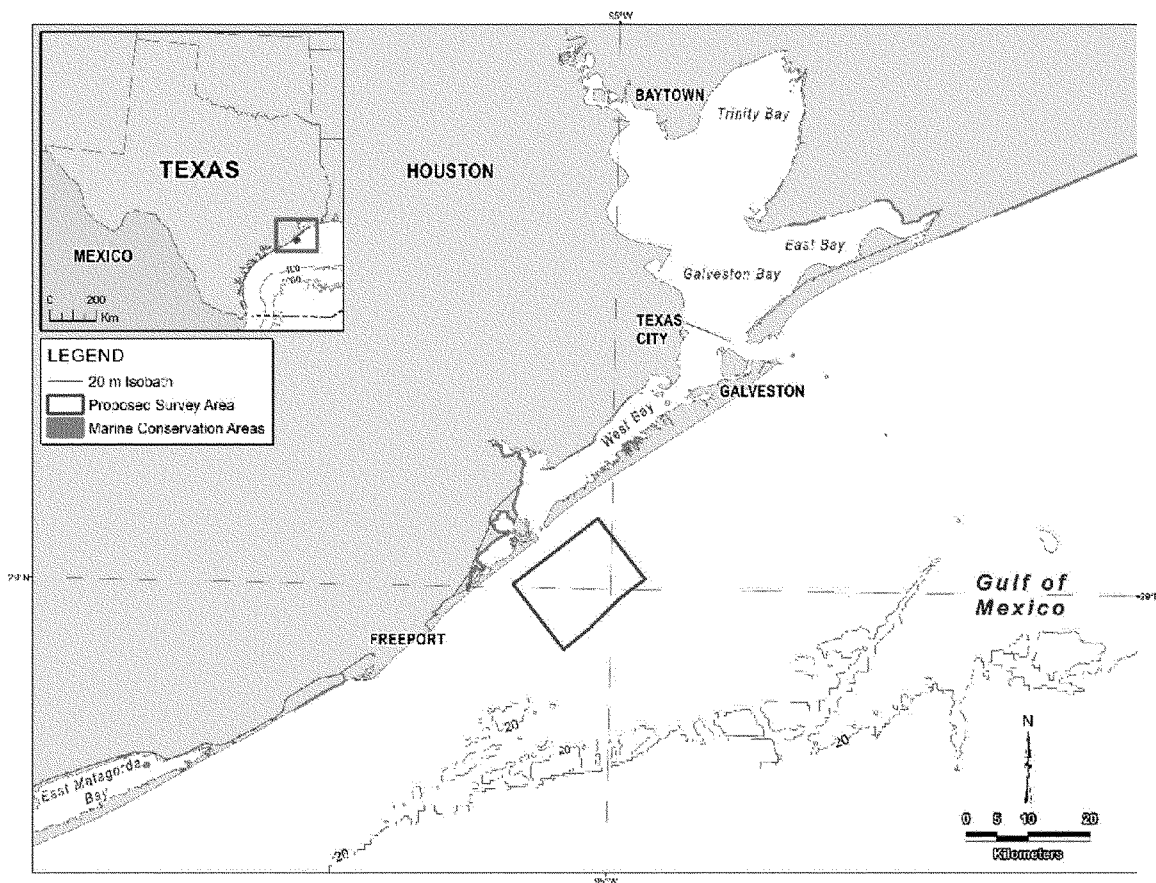
The proposed survey is planned to occur over a 10 day period during the fall of 2023 (the exact dates are uncertain). During that time, the airguns would operate continuously (*i.e.*, 24-hours per day).

*Specific Geographic Region*

The proposed survey area is 222 km<sup>2</sup> and would occur within the approximate area of 28.9–29.1° N latitude, 94.9–95.2° W longitude in the coastal waters off of Texas. This location is offshore San Luis Pass, which defines the southern tip of Galveston Island, Texas. The closest point of approach of the proposed survey area to the coast is approximately 3 kilometers (km). The proposed survey area is depicted in Figure 1, and the survey lines could occur anywhere within the survey area. The water depth of the proposed survey area ranges from 10 to 20 m. The survey vessel (the R/V Brooks McCall (McCall) or similar vessel operated by TDI-Brooks

International) would likely depart and return to Freeport or Galveston, Texas.

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**Figure 1-- Location of the Proposed Northwest Gulf of Mexico Survey.**

Note: Survey tracklines could occur anywhere within the proposed survey area.

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#### *Detailed Description of the Specified Activity*

The proposed survey would entail use of conventional seismic methodology. The survey would involve one source vessel, the McCall or similar, and would tow one or two 105 in<sup>3</sup> GI airguns with a total volume of up to 210 in<sup>3</sup>. The airgun array would be deployed at a depth of about 4 m below the surface, spaced about 2 m apart, and have a shot interval of 12.5 m about 5–10 seconds (s). The receiving system would consist of four 25 m solid state hydrophone streamers, spaced 10 m apart and towed at a depth of 2 m. As the airguns are towed along the survey lines, the hydrophone streamer would transfer data to the on-board processing system. Approximately 1,704 km of transect lines would be surveyed within the survey area. When not towing seismic survey gear, the McCall has a maximum speed of 11 knots (kn; 20.4 kilometers

per hour (kmh)), but cruises at an average speed of 4–5 kn (7.4–9.3 kmh) while towing airgun arrays. All survey effort would occur in water 10–20 m. The vessel would be self-contained, and the crew would live aboard the vessel.

Proposed mitigation, monitoring, and reporting measures are described in detail later in this Notice (please see Proposed Mitigation and Proposed Monitoring and Reporting).

#### **Description of Marine Mammals in the Area of Specified Activities**

Sections 3 and 4 of the application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history of the potentially affected species. NMFS fully considered all of this information, and we refer the reader to these descriptions, instead of reprinting the information. Additional information regarding population trends and threats may be found in NMFS' Stock Assessment Reports (SARs;

[www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments](https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments)) and more general information about these species (e.g., physical and behavioral descriptions) may be found on NMFS' website (<https://www.fisheries.noaa.gov/find-species>).

Table 1 lists all species or stocks for which take is expected and proposed to be authorized for this activity and summarizes information related to the population or stock, including regulatory status under the MMPA and Endangered Species Act (ESA) and potential biological removal (PBR), where known. PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (as described in NMFS' SARs). While no serious injury or mortality is anticipated or proposed to be authorized here, 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 1 are the most recent available at the time of publication (including from the draft 2022 SARs) and are available online at: [www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments](http://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments).

TABLE 1—SPECIES LIKELY IMPACTED BY THE SPECIFIED ACTIVITIES <sup>1</sup>

| Common name   | Scientific name                 | Stock                                      | ESA/MMPA status; strategic (Y/N) <sup>2</sup> | Stock abundance (CV, N <sub>min</sub> , most recent abundance survey) <sup>3</sup> | PBR               | Annual M/SI <sup>4</sup> | Gulf of Mexico population abundance; (Roberts <i>et al.</i> 2016) <sup>5</sup> |
|---|---------------------------------|--|---|--|-------------------|--------------------------|--|
| <b>Odontoceti (toothed whales, dolphins, and porpoises)</b> |                                 |  |   |  |                   |                          |  |
| <i>Family Delphinidae:</i>                                  |                                 |  |   |  |                   |                          |  |
| Atlantic spotted dolphin.                                   | <i>Stenella frontalis</i> ..... | Gulf of Mexico .....                       | -/-; N  | 21,506 (0.26; 17,339; 2018).   | 166 .....         | 36                       | 47,488   |
| Rough-toothed dolphin.                                      | <i>Steno bredanensis</i> .....  | Gulf of Mexico .....                       | -/-; N  | unk (n/a; unk; 2018)   | undetermined .... | 39                       | 4,853  |
| Bottlenose dolphin ...                                      | <i>Tursiops truncatus</i> ..... | Gulf of Mexico Western Coastal.            | -/-; N  | 20,759 (0.13; 18,585; 2018).   | 167 .....         | 36                       | 138,602  |
|   |                                 | Northern Gulf of Mexico Continental Shelf. | -/-; N  | 63,280 (0.11; 57,917; 2018).   | 556 .....         | 65                       | 138,602  |

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

<sup>2</sup> ESA status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

<sup>3</sup> NMFS marine mammal stock assessment reports online at: [www.nmfs.noaa.gov/pr/sars/](http://www.nmfs.noaa.gov/pr/sars/). CV is coefficient of variation; Nmin is the minimum estimate of stock abundance.

<sup>4</sup> 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, vessel strike). Annual M/SI (mortality/serious injury) often cannot be determined precisely and is in some cases presented as a minimum value or range.

As indicated above, all 3 species (with 4 managed stocks) in Table 1 temporally and spatially co-occur with the activity to the degree that take is reasonably likely to occur. All species that could potentially occur in the proposed survey areas are included in Table 2 of the IHA application. While the additional 11 species listed in Table 2 of UT's application have been infrequently sighted in the survey area, the temporal and/or spatial occurrence of these species is such that take is not expected to occur, and they are not discussed further beyond the explanation provided here. Species or stocks that only occur in deep waters (>200 m) within the Gulf of Mexico are unlikely to be observed during this survey where the maximum water depth is 20 m, and thus, the following species or stocks will not be considered further: offshore stock of bottlenose dolphins, pantropical spotted dolphin, spinner dolphin, striped dolphin, Clymene dolphin, Fraser's dolphin, Risso's dolphin, melon-headed whale, pygmy killer whale, false killer whale, killer whale, and short-finned pilot whale.

**Bottlenose Dolphin**

Bottlenose dolphins are cosmopolitan, occurring in tropical, subtropical, and temperate waters around the world

(Wells and Scott 2018). The bottlenose dolphin is the most widespread and common delphinid in coastal waters of the Gulf of Mexico (Würsig *et al.* 2000; Würsig 2017). While there are multiple stocks of bottlenose dolphins in the Gulf of Mexico, only the Northern Gulf of Mexico Continental Shelf and Gulf of Mexico Western Coastal stocks overlap with the study area, with the shelf stock assumed to occur in waters >20 m and the coastal stock assumed to occur in waters <20 m. Fall sightings have been made throughout the northern Gulf but primarily on the shelf, including within survey waters.

There are 31 bay, sound, and estuary (BSE) stocks in the northern Gulf of Mexico, which are small, resident populations of bottlenose dolphins that live inshore or, occasionally, close to shore or in passes, and are genetically discrete. There are two of the BSE stocks that occur near the survey area, the West Bay stock and the Galveston Bay/East Bay/Trinity Bay stock. The West Bay stock occurs within roughly 20 km of the survey area, but individuals from this stock are only likely to occur in inshore waters or, occasionally, up to 1 km from shore off San Luis Pass (Hayes *et al.* 2022). The Galveston Bay/East Bay/Trinity Bay stock occurs >20 km

away, with most individuals staying within 2 km from shore and up to 5 km out from the Galveston jetties and ship channel (Hayes *et al.* 2022). These areas in and near West Bay and Galveston Bay, along with numerous other ones along the coast of Texas, have been identified as year-round Biologically Important Areas (BIAs) for resident bottlenose dolphins (LeBresque *et al.* 2015). Due to the distance that the survey will occur off the coast (minimum 3 km) and general expectation that BSE dolphins are most likely to occur in inshore waters, we do not expect the survey to encounter any BSE stocks of bottlenose dolphins.

**Marine Mammal Hearing**

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Not all marine mammal species have equal hearing capabilities (*e.g.*, Richardson *et al.*, 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007, 2019) recommended that marine mammals be divided into hearing

groups based on directly measured (behavioral or auditory evoked potential techniques) or estimated hearing ranges (behavioral response data, anatomical modeling, etc.). Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.*, low-frequency

cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65-decibel (dB) threshold from the normalized composite audiograms, with the exception for lower limits for low-

frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. Marine mammal hearing groups and their associated hearing ranges are provided in Table 2.

TABLE 2—MARINE MAMMAL HEARING GROUPS  
[NMFS, 2018]

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

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

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä *et al.*, 2006; Kastelein *et al.*, 2009; Reichmuth and Holt, 2013).

For more detail concerning these groups and associated frequency ranges, please see NMFS (2018) for a review of available information.

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

This section provides a discussion of the ways in which components of the specified activity may impact marine mammals and their habitat. The Estimated Take of Marine Mammals section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The Negligible Impact Analysis and Determination section considers the content of this section, the Estimated Take of Marine Mammals section, and the Proposed Mitigation section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and whether those impacts are reasonably expected to, or reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

#### Description of Active Acoustic Sound Sources

This section contains a brief technical background on sound, 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.

Sound travels in waves, the basic components of which are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in hertz (Hz) or cycles per second. Wavelength is the distance between two peaks or corresponding points of a sound wave (length of one cycle). Higher frequency sounds have shorter wavelengths than lower frequency sounds, and typically attenuate (decrease) more rapidly, except in certain cases in shallower water. Amplitude is the height of the sound pressure wave or the “loudness” of a sound and is typically described using the relative unit of the dB. A sound pressure level (SPL) in dB is described as the ratio between a measured pressure and a reference pressure (for underwater sound, this is 1 microPascal ( $\mu\text{Pa}$ )) and is a logarithmic unit that accounts for large variations in amplitude; therefore, a relatively small change in dB corresponds to large changes in sound pressure. The source level (SL) represents the SPL referenced at a distance of 1 m from the source (referenced to 1  $\mu\text{Pa}$ ) while the received level is the SPL at the listener's position (referenced to 1  $\mu\text{Pa}$ ).

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 (Urlick, 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.

Sound exposure level (SEL; represented as dB re 1  $\mu\text{Pa}^2$  -s) represents the total energy contained within a pulse and considers both intensity and duration of exposure. Peak sound pressure (also referred to as zero-to-peak sound pressure or 0-p) 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. Another common metric is peak-to-peak sound pressure (pk-pk), which is the algebraic difference between the peak positive and peak negative sound pressures. Peak-to-peak pressure is typically approximately 6 dB higher than peak pressure (Southall *et al.*, 2007).

When underwater objects vibrate or activity occurs, sound-pressure waves are created. These waves alternately compress and decompress the water as the sound wave travels. Underwater sound waves radiate in a manner similar to ripples on the surface of a pond and may be either directed in a beam or beams or may radiate in all directions (omnidirectional sources), as is the case for pulses produced by the airgun arrays considered here. The compressions and decompressions associated with sound waves are detected as changes in

pressure by aquatic life and man-made sound receptors such as hydrophones.

Even in the absence of sound from the specified activity, the underwater environment is typically loud due to ambient sound. Ambient sound is defined as environmental background sound levels lacking a single source or point (Richardson *et al.*, 1995), and 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 the following (Richardson *et al.*, 1995):

- *Wind and waves*: The complex interactions between wind and water surface, including processes such as breaking waves and wave-induced bubble oscillations and cavitation, are a main source of naturally occurring ambient sound for frequencies between 200 Hz and 50 kHz (Mitson, 1995). In general, ambient sound levels tend to increase with increasing wind speed and wave height. Surf sound becomes important near shore, with measurements collected at a distance of 8.5 km from shore showing an increase of 10 dB in the 100 to 700 Hz band during heavy surf conditions;

- *Precipitation*: Sound from rain and hail impacting the water surface can become an important component of total sound at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times;

- *Biological*: 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; and

- *Anthropogenic*: Sources of ambient sound related to human activity include transportation (surface vessels), dredging and construction, oil and gas drilling and production, seismic surveys, sonar, explosions, and ocean acoustic studies. 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. Sound from identifiable anthropogenic sources other than the activity of interest (*e.g.*, a passing vessel) is sometimes termed background sound, as opposed to ambient sound.

The sum of the various natural and anthropogenic sound sources at any given location and time—which comprise “ambient” or “background” sound—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 this 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 a given activity may be a negligible addition to the local environment or could form a distinctive signal that may affect marine mammals. Details of source types are described in the following text.

Sounds are often considered to fall into one of two general types: Pulsed and non-pulsed (defined in the following). 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 Southall *et al.*, (2007) for an in-depth discussion of these concepts.

Pulsed 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 (ANSI, 1986, 2005; Harris, 1998; NIOSH, 1998; ISO, 2003) and occur either as isolated events or repeated in some succession. Pulsed 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.

Non-pulsed sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or non-continuous (ANSI, 1995; NIOSH, 1998). Some of these non-pulsed sounds can be transient signals of short duration but without the essential properties of pulses (*e.g.*, rapid rise time). Examples of non-pulsed sounds include those produced by

vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems (such as those used by the U.S. Navy). The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

Airgun arrays produce pulsed signals with energy in a frequency range from about 10–2,000 Hz, with most energy radiated at frequencies below 200 Hz. The amplitude of the acoustic wave emitted from the source is equal in all directions (*i.e.*, omnidirectional), but airgun arrays do possess some directionality due to different phase delays between guns in different directions. Airgun arrays are typically tuned to maximize functionality for data acquisition purposes, meaning that sound transmitted in horizontal directions and at higher frequencies is minimized to the extent possible.

#### *Acoustic Effects*

Here, we discuss the effects of active acoustic sources on marine mammals.

*Potential Effects of Underwater Sound*—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. The potential effects of underwater sound from active acoustic sources 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.*, 2004; Nowacek *et al.*, 2007; Southall *et al.*, 2007; Götz *et al.*, 2009). The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure. In general, sudden, high level sounds can cause hearing loss, as can longer exposures to lower level sounds. Temporary or permanent loss of hearing, if it occurs at all, will occur almost exclusively in cases where a noise is within an animal’s hearing frequency range. We first describe specific manifestations of acoustic effects before providing discussion specific to the use of airgun arrays.

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 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 corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological response. 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.

We describe the more severe effects of certain non-auditory physical or physiological effects only briefly as we do not expect that use of airgun arrays are reasonably likely to result in such effects (see below for further discussion). Potential effects from impulsive sound sources can range in severity from effects such as behavioral disturbance or tactile perception to physical discomfort, slight injury of the internal organs and the auditory system, or mortality (Yelverton *et al.*, 1973). 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). The survey activities considered here do not involve the use of devices such as explosives or mid-frequency tactical sonar that are associated with these types of effects.

**Threshold Shift**—Marine mammals exposed to high-intensity sound or to lower-intensity sound for prolonged periods can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Finneran, 2015). Threshold shift can be permanent (PTS), in which case the loss of hearing sensitivity is not fully recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time (Southall *et al.*, 2007). Repeated sound exposure that leads to TTS could cause PTS. In severe cases of PTS, there can be total or partial deafness while in most cases, the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985).

When PTS occurs, there is physical damage to the sound receptors in the ear (*i.e.*, tissue damage) whereas TTS represents primarily tissue fatigue and is reversible (Southall *et al.*, 2007). 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). Therefore, NMFS does not typically consider TTS to constitute auditory injury.

Relationships between TTS and PTS thresholds have not been studied in marine mammals. There is no PTS data for cetaceans, but such relationships are assumed to be similar to those in humans and other terrestrial mammals. PTS typically occurs at exposure levels at least several dBs above (a 40-dB threshold shift approximates PTS onset; *e.g.*, Kryter *et al.*, 1966; Miller, 1974) that inducing mild TTS (a 6-dB threshold shift approximates TTS onset; *e.g.*, Southall *et al.*, 2007). Based on data from terrestrial mammals, a precautionary assumption is that the PTS thresholds for impulse sounds (such as airgun pulses as received close to the source) are at least 6 dB higher than the TTS threshold on a peak-pressure basis and PTS cumulative sound exposure level thresholds are 15 to 20 dB higher than TTS cumulative sound exposure level thresholds (Southall *et al.*, 2007). Given the higher level of sound or longer exposure duration necessary to cause PTS as compared with TTS, it is considerably less likely that PTS could occur.

For mid-frequency cetaceans in particular, potential protective mechanisms may help limit onset of TTS or prevent onset of PTS. Such mechanisms include dampening of hearing, auditory adaptation, or behavioral amelioration (*e.g.*, Nachtigall and Supin, 2013; Miller *et al.*, 2012; Finneran *et al.*, 2015; Popov *et al.*, 2016).

TTS is the mildest form of hearing impairment that can occur during exposure to sound (Kryter, 1985). 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. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals.

Marine mammal hearing plays a critical role in communication with other members of the species 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. 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 for successful mother and calf interactions could have more serious impacts.

Finneran *et al.* (2015) measured hearing thresholds in three captive bottlenose dolphins before and after exposure to 10 pulses produced by a seismic airgun in order to study TTS induced after exposure to multiple pulses. Exposures began at relatively low levels and gradually increased over a period of several months, with the highest exposures at peak SPLs from 196 to 210 dB and cumulative (unweighted) SELs from 193–195 dB. No substantial TTS was observed. In addition, behavioral reactions were observed that indicated that animals can learn behaviors that effectively mitigate noise exposures (although exposure patterns must be learned, which is less likely in wild animals than for the captive animals considered in this study). The authors noted that the failure to induce more significant auditory effects was likely due to the intermittent nature of exposure, the relatively low peak pressure produced by the acoustic source, and the low-frequency energy in airgun pulses as compared with the frequency range of best sensitivity for dolphins and other mid-frequency cetaceans.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin, beluga whale, harbor porpoise, and Yangtze finless porpoise) exposed to a limited number of sound sources (*i.e.*, mostly tones and octave-band noise) in laboratory settings (Finneran, 2015). The existing marine mammal TTS data come from a limited number of individuals within these species.

Critical questions remain regarding the rate of TTS growth and recovery after exposure to intermittent noise and the effects of single and multiple pulses. Data at present are also insufficient to construct generalized models for recovery and determine the time necessary to treat subsequent exposures as independent events. More

information is needed on the relationship between auditory evoked potential and behavioral measures of TTS for various stimuli. For summaries of data on TTS in marine mammals or for further discussion of TTS onset thresholds, please see Southall *et al.* (2007, 2019), Finneran and Jenkins (2012), Finneran (2015), and NMFS (2018).

**Behavioral Effects**—Behavioral disturbance may include a variety of effects, including subtle changes in behavior (e.g., minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Behavioral responses to sound are highly variable and context-specific, and any reactions depend on numerous intrinsic and extrinsic factors (e.g., species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (e.g., Richardson *et al.*, 1995; Wartzok *et al.*, 2003; Southall *et al.*, 2007, 2019; Weilgart, 2007; Archer *et al.*, 2010). Behavioral reactions can vary not only among individuals but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison *et al.*, 2012), and can vary depending on characteristics associated with the sound source (e.g., whether it is moving or stationary, number of sources, distance from the source). Please see Appendices B–C of Southall *et al.* (2007) for a review of studies involving marine mammal behavioral responses to sound.

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 (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. 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; NRC, 2003; Wartzok *et al.*, 2003). Controlled experiments with captive marine mammals have showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway *et al.*, 1997). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic 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). However, many delphinids approach acoustic source vessels with no apparent discomfort or obvious behavioral change (e.g., Barkaszi *et al.*, 2012).

Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (e.g., Lusseau and Bejder, 2007; Weilgart, 2007; NRC, 2005). However, there are broad categories of potential response, which we describe in greater detail here, that include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, and flight.

Changes in dive behavior can vary widely, and 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; Ng and Leung, 2003; Nowacek *et al.*, 2004; Goldbogen *et al.*, 2013a, b). Variations in dive behavior may reflect disruptions in biologically significant activities (e.g., foraging) or they may be of little biological significance. The impact of an alteration to dive behavior resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

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 appearance of secondary indicators (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). A determination of whether foraging disruptions incur fitness consequences would require information on or estimates 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.

Variations in respiration naturally vary with different behaviors and alterations to breathing 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. Various studies have shown that respiration rates may either be unaffected or could increase, depending on the species and signal characteristics, 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 (e.g., Kastelein *et al.*, 2001, 2005, 2006; Gailey *et al.*, 2007, 2016).

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, echolocation click production, calling, and singing. Changes in vocalization behavior in response to anthropogenic noise can occur for any of these modes and may result from a need to compete with an increase in background noise or may reflect increased vigilance or a startle response. In some cases, animals may cease sound production during production of aversive signals (Bowles *et al.*, 1994).

Avoidance is the displacement of an individual from an area or migration path as a result of the presence of sound or other stressors and is one of the most obvious manifestations of disturbance in marine mammals (Richardson *et al.*, 1995). Avoidance may be short-term, with animals returning to the area once the noise has ceased (e.g., Bowles *et al.*, 1994; Goold, 1996; Stone *et al.*, 2000; Morton and Symonds, 2002; Gailey *et al.*, 2007). 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., Bejder *et al.*, 2006; Teilmann *et al.*, 2006).

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). 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, marine mammal strandings (Evans and England, 2001). 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.

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of focus and attention (*i.e.*, when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors 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 (e.g., Beauchamp and Livoreil, 1997; Fritz *et al.*, 2002; Purser and Radford, 2011). In addition, chronic disturbance can cause population declines through reduction of fitness (e.g., decline in body condition) and subsequent reduction in reproductive success, survival, or both (e.g., Harrington and Veitch, 1992; Daan *et al.*, 1996; Bradshaw *et al.*, 1998). However, Ridgway *et al.* (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a five-day period did not cause any sleep deprivation or stress effects.

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Disruption of such functions resulting from reactions to stressors, such as sound exposure, are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.*, 2007). Consequently, a behavioral response lasting less than 1 day and not recurring on subsequent days is not considered

particularly severe unless it could directly affect reproduction or survival (Southall *et al.*, 2007). Note that there is a difference between multi-day substantive behavioral reactions and multi-day anthropogenic activities. For example, just because an activity lasts for multiple days does not necessarily mean that individual animals are either exposed to activity-related stressors for multiple days or, further, exposed in a manner resulting in sustained multi-day substantive behavioral responses.

Stone (2015) reported data from at-sea observations during 1,196 seismic surveys from 1994 to 2010. When arrays of large airguns (considered to be 500 in<sup>3</sup> or more) were firing, lateral displacement, more localized avoidance, or other changes in behavior were evident for most odontocetes.

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

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

The primary distinction between “stress” (which is adaptive and does not normally place an animal at risk) and “distress” is the cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose serious fitness consequences. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy

resources must be diverted from other functions. This state of distress will last until the animal replenishes its energetic reserves sufficiently to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well-studied through controlled experiments and for both laboratory and free-ranging animals (e.g., Holberton *et al.*, 1996; Hood *et al.*, 1998; Jessop *et al.*, 2003; Krausman *et al.*, 2004; Lankford *et al.*, 2005). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker, 2000; Romano *et al.*, 2002b) and, more rarely, studied in wild populations (e.g., Romano *et al.*, 2002a). In addition, any animal experiencing TTS would likely also experience stress responses (NRC, 2003).

**Auditory Masking**—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, navigation) (Richardson *et al.*, 1995; 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.

Under certain circumstances, significant masking could disrupt behavioral patterns, which in turn could affect fitness for survival and reproduction. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which occurs during the sound exposure. Because masking (without resulting in TTS) 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 predicting 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 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) 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 may be less 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).

Masking affects both senders and receivers of acoustic signals and 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). All anthropogenic sound sources, but especially chronic and lower-frequency signals (e.g., from vessel traffic), contribute to elevated ambient sound levels, thus intensifying masking.

Masking effects of pulsed sounds (even from large arrays of airguns) on marine mammal calls and other natural sounds are expected to be limited, although there are few specific data on this. Because of the intermittent nature and low duty cycle of seismic pulses, animals can emit and receive sounds in the relatively quiet intervals between pulses. However, in exceptional situations, reverberation occurs for much or all of the interval between pulses (e.g., Simard *et al.* 2005; Clark and Gagnon 2006), which could mask calls. Situations with prolonged strong reverberation are infrequent. However, it is common for reverberation to cause

some lesser degree of elevation of the background level between airgun pulses (e.g., Gedamke 2011; Guerra *et al.*, 2011, 2016; Klinck *et al.*, 2012; Guan *et al.*, 2015), and this weaker reverberation presumably reduces the detection range of calls and other natural sounds to some degree. Guerra *et al.* (2016) reported that ambient noise levels between seismic pulses were elevated as a result of reverberation at ranges of 50 km from the seismic source.

The sounds important to small odontocetes are predominantly at much higher frequencies than are the dominant components of airgun sounds, thus limiting the potential for masking. In general, masking effects of seismic pulses are expected to be minor, given the normally intermittent nature of seismic pulses.

#### Vessel Noise

Vessel noise from the McCall could affect marine animals in the proposed survey areas. Houghton *et al.* (2015) proposed that vessel speed is the most important predictor of received noise levels, and Putland *et al.* (2017) also reported reduced sound levels with decreased vessel speed. Sounds produced by large vessels generally dominate ambient noise at frequencies from 20 to 300 Hz (Richardson *et al.*, 1995). However, some energy is also produced at higher frequencies (Hermannsen *et al.*, 2014); low levels of high-frequency sound from vessels has been shown to elicit responses in harbor porpoise (Dyndo *et al.*, 2015). Increased levels of vessel noise have been shown to affect foraging by porpoise (Teilmann *et al.*, 2015; Wisniewska *et al.*, 2018); Wisniewska *et al.* (2018) suggested that a decrease in foraging success could have long-term fitness consequences.

Vessel noise, through masking, can reduce the effective communication distance of a marine mammal if the frequency of the sound source is close to that used by the animal, and if the sound is present for a significant fraction of time (e.g., Richardson *et al.* 1995; Clark *et al.*, 2009; Jensen *et al.*, 2009; Gervaise *et al.*, 2012; Hatch *et al.*, 2012; Rice *et al.*, 2014; Dunlop 2015; Erbe *et al.*, 2015; Jones *et al.*, 2017; Putland *et al.*, 2017). In addition to the frequency and duration of the masking sound, the strength, temporal pattern, and location of the introduced sound also play a role in the extent of the masking (Branstetter *et al.*, 2013, 2016; Finneran and Branstetter 2013; Sills *et al.*, 2017). Branstetter *et al.* (2013) reported that time-domain metrics are also important in describing and predicting masking. In order to compensate for increased ambient noise,

some cetaceans are known to increase the source levels of their calls in the presence of elevated noise levels from shipping, shift their peak frequencies, or otherwise change their vocal behavior (e.g., Martins *et al.*, 2016; O'Brien *et al.*, 2016; Tenessen and Parks 2016). Harp seals did not increase their call frequencies in environments with increased low-frequency sounds (Terhune and Bosker 2016). Holt *et al.* (2015) reported that changes in vocal modifications can have increased energetic costs for individual marine mammals. A negative correlation between the presence of some cetacean species and the number of vessels in an area has been demonstrated by several studies (e.g., Campana *et al.*, 2015; Culloch *et al.*, 2016).

Many odontocetes show considerable tolerance of vessel traffic, although they sometimes react at long distances if confined by ice or shallow water, if previously harassed by vessels, or have had little or no recent exposure to vessels (Richardson *et al.*, 1995). Dolphins of many species tolerate and sometimes approach vessels (e.g., Anderwald *et al.*, 2013). Some dolphin species approach moving vessels to ride the bow or stern waves (Williams *et al.*, 1992). Pirotta *et al.* (2015) noted that the physical presence of vessels, not just vessel noise, disturbed the foraging activity of bottlenose dolphins. Sightings of striped dolphin, Risso's dolphin, sperm whale, and Cuvier's beaked whale in the western Mediterranean were negatively correlated with the number of vessels in the area (Campana *et al.*, 2015).

Sounds emitted by the McCall are low frequency and continuous but would be widely dispersed in both space and time. Vessel traffic associated with the proposed survey is of low density compared to traffic associated with commercial shipping, industry support vessels, or commercial fishing vessels, and would therefore be expected to represent an insignificant incremental increase in the total amount of anthropogenic sound input to the marine environment, and the effects of vessel noise described above are not expected to occur as a result of this survey. In summary, project vessel sounds would not be at levels expected to cause anything more than possible localized and temporary behavioral changes in marine mammals, and would not be expected to result in significant negative effects on individuals or at the population level. In addition, in all oceans of the world, large vessel traffic is currently so prevalent that it is commonly considered a usual source of ambient sound (NSF-USGS 2011).

### Vessel Strike

Vessel collisions with marine mammals, or vessel strikes, can result in death or serious injury of the animal. Wounds resulting from vessel strike may include massive trauma, hemorrhaging, broken bones, or propeller lacerations (Knowlton and Kraus, 2001). An animal at the surface may be struck directly by a vessel, a surfacing animal may hit the bottom of a vessel, or an animal just below the surface may be cut by a vessel's propeller. Superficial strikes may not kill or result in the death of the animal. These interactions are typically associated with large whales (e.g., fin whales), which are occasionally found draped across the bulbous bow of large commercial vessels 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, with the probability of death or serious injury increasing as vessel speed increases (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).

Pace and Silber (2005) also found that the probability of death or serious injury increased rapidly with increasing vessel speed. Specifically, the predicted probability of serious injury or death increased from 45 to 75 percent as vessel speed increased from 10 to 14 kn (25.9 kmh), and exceeded 90 percent at 17 kn (31.5 kmh). Higher speeds during collisions result in greater force of impact, but higher speeds also appear to increase the chance of severe injuries or death through increased likelihood of collision by pulling whales toward the vessel (Clyne 1999; Knowlton *et al.*, 1995). In a separate study, Vanderlaan and Taggart (2007) analyzed the probability of lethal mortality of large whales at a given speed, showing that the greatest rate of change in the probability of a lethal injury to a large whale as a function of vessel speed occurs between 8.6 and 15 kn (15.9 and 27.8 kmh). The chances of a lethal injury decline from approximately 80 percent at 15 kn (27.8 kmh) to approximately 20 percent at 8.6 kn (15.9 kmh). At speeds below 11.8 kn (21.9 kmh), the chances of lethal injury drop below 50 percent, while the probability asymptotically increases toward one hundred percent above 15 kn (27.8 kmh).

The McCall will travel at a speed of 4–5 kn (7.4–9.3 kmh) while towing seismic survey gear. At this speed, both the possibility of striking a marine mammal and the possibility of a strike resulting in serious injury or mortality are discountable. At average transit speed, the probability of serious injury or mortality resulting from a strike is less than 50 percent. However, the likelihood of a strike actually happening is again discountable. Vessel strikes, as analyzed in the studies cited above, generally involve commercial shipping, which is much more common in both space and time than is geophysical survey activity. Jensen and Silber (2004) summarized vessel strikes of large whales worldwide from 1975–2003 and found that most collisions occurred in the open ocean and involved large vessels (e.g., commercial shipping). No such incidents were reported for geophysical survey vessels during that time period.

It is possible for vessel strikes to occur while traveling at slow speeds. For example, a hydrographic survey vessel traveling at low speed (5.5 kn; 10.2 kmh) while conducting mapping surveys off the central California coast struck and killed a blue whale in 2009. The State of California determined that the whale had suddenly and unexpectedly surfaced beneath the hull, with the result that the propeller severed the whale's vertebrae, and that this was an unavoidable event. This strike represents the only such incident in approximately 540,000 hours of similar coastal mapping activity ( $p = 1.9 \times 10^{-6}$ ; 95% CI =  $0-5.5 \times 10^{-6}$ ; NMFS, 2013b). In addition, a research vessel reported a fatal strike in 2011 of a dolphin in the Atlantic, demonstrating that it is possible for strikes involving smaller cetaceans to occur. In that case, the incident report indicated that an animal apparently was struck by the vessel's propeller as it was intentionally swimming near the vessel. While indicative of the type of unusual events that cannot be ruled out, neither of these instances represents a circumstance that would be considered reasonably foreseeable or that would be considered preventable.

Although the likelihood of the vessel striking a marine mammal is low, we propose a robust vessel strike avoidance protocol (see Proposed Mitigation), which we believe eliminates any foreseeable risk of vessel strike during transit. We anticipate that vessel collisions involving a seismic data acquisition vessel towing gear, while not impossible, represent unlikely, unpredictable events for which there are no preventive measures. Given the

proposed mitigation measures, the relatively slow speed of the vessel towing gear, the presence of bridge crew watching for obstacles at all times (including marine mammals), and the presence of marine mammal observers, the possibility of vessel strike is discountable and, further, were a strike of a large whale to occur, it would be unlikely to result in serious injury or mortality. No incidental take resulting from vessel strike is anticipated, and this potential effect of the specified activity will not be discussed further in the following analysis.

**Entanglement**—Entanglements occur when marine mammals become wrapped around cables, lines, nets, or other objects suspended in the water column. During seismic operations, numerous cables, lines, and other objects primarily associated with the airgun array and hydrophone streamers will be towed behind the McCall near the water's surface. However, we are not aware of any cases of entanglement of marine mammals in seismic survey equipment. Although entanglement with the streamer is theoretically possible, it has not been documented during hundreds of thousands of miles of industrial seismic cruises. There are no meaningful entanglement risks posed by the proposed survey, and entanglement risks are not discussed further in this document.

### Anticipated Effects on Marine Mammal Habitat

**Effects to Prey**—Marine mammal prey varies by species, season, and location and, for some, is not well documented. Fish react to sounds which are especially strong and/or intermittent low-frequency sounds, and behavioral responses such as flight or avoidance are the most likely effects. However, the reaction of fish to airguns depends on the physiological state of the fish, past exposures, motivation (e.g., feeding, spawning, migration), and other environmental factors. Several studies have demonstrated that airgun sounds might affect the distribution and behavior of some fishes, potentially impacting foraging opportunities or increasing energetic costs (e.g., Fewtrell and McCauley, 2012; Pearson *et al.*, 1992; Skalski *et al.*, 1992; Santulli *et al.*, 1999; Paxton *et al.*, 2017), though the bulk of studies indicate no or slight reaction to noise (e.g., Miller and Cripps, 2013; Dalen and Knutsen, 1987; Pena *et al.*, 2013; Chapman and Hawkins, 1969; Wardle *et al.*, 2001; Sara *et al.*, 2007; Jorgenson and Gyselman, 2009; Blaxter *et al.*, 1981; Cott *et al.*, 2012; Boeger *et al.*, 2006), and that, most commonly, while there are likely to be

impacts to fish as a result of noise from nearby airguns, such effects will be temporary. For example, investigators reported significant, short-term declines in commercial fishing catch rate of gadid fishes during and for up to five days after seismic survey operations, but the catch rate subsequently returned to normal (Engas *et al.*, 1996; Engas and Lokkeborg, 2002). Other studies have reported similar findings (Hassel *et al.*, 2004). Skalski *et al.*, (1992) also found a reduction in catch rates—for rockfish (*Sebastes* spp.) in response to controlled airgun exposure—but suggested that the mechanism underlying the decline was not dispersal but rather decreased responsiveness to baited hooks associated with an alarm behavioral response. A companion study showed that alarm and startle responses were not sustained following the removal of the sound source (Pearson *et al.*, 1992). Therefore, Skalski *et al.* (1992) suggested that the effects on fish abundance may be transitory, primarily occurring during the sound exposure itself. In some cases, effects on catch rates are variable within a study, which may be more broadly representative of temporary displacement of fish in response to airgun noise (*i.e.*, catch rates may increase in some locations and decrease in others) than any long-term damage to the fish themselves (Streever *et al.*, 2016).

Sound pressure levels of sufficient strength have been known to cause injury to fish and fish mortality and, in some studies, fish auditory systems have been damaged by airgun noise (McCauley *et al.*, 2003; Popper *et al.*, 2005; Song *et al.*, 2008). 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.* (2012b) 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; both of which are conditions unlikely to occur for this survey that is necessarily transient in any given location and likely result in brief, infrequent noise exposure to prey species in any given area. For this survey, the sound source is constantly moving, and most fish would likely avoid the sound source prior to receiving sound of sufficient intensity to cause physiological or anatomical damage. In addition, ramp-up may allow certain fish species the opportunity to move further away from the sound source.

A recent comprehensive review (Carroll *et al.*, 2017) found that results are mixed as to the effects of airgun noise on the prey of marine mammals. While some studies suggest a change in prey distribution and/or a reduction in prey abundance following the use of seismic airguns, others suggest no effects or even positive effects in prey abundance. As one specific example, Paxton *et al.* (2017), which describes findings related to the effects of a 2014 seismic survey on a reef off of North Carolina, showed a 78 percent decrease in observed nighttime abundance for certain species. It is important to note that the evening hours during which the decline in fish habitat use was recorded (via video recording) occurred on the same day that the seismic survey passed, and no subsequent data is presented to support an inference that the response was long-lasting. Additionally, given that the finding is based on video images, the lack of recorded fish presence does not support a conclusion that the fish actually moved away from the site or suffered any serious impairment. In summary, this particular study corroborates prior studies indicating that a startle response or short-term displacement should be expected.

A recent review article concluded that, while laboratory results provide scientific evidence for high-intensity and low-frequency sound-induced physical trauma and other negative effects on some fish and invertebrates, the sound exposure scenarios in some cases are not realistic to those encountered by marine organisms during routine seismic operations (Carroll *et al.*, 2017). The review finds that there has been no evidence of reduced catch or abundance following seismic activities for invertebrates, and that there is conflicting evidence for fish with catch observed to increase, decrease, or remain the same. Further, where there is evidence for decreased catch rates in response to airgun noise, these findings provide no information about the underlying biological cause of catch rate reduction (Carroll *et al.*, 2017).

In summary, impacts of the specified activity on marine mammal prey species will likely be limited to behavioral responses, the majority of prey species will be capable of moving out of the area during the survey, a rapid return to normal recruitment, distribution, and behavior for prey species is anticipated, and, overall, impacts to prey species will be minor and temporary. Prey species exposed to sound might move away from the sound source, experience TTS, experience masking of biologically

relevant sounds, or show no obvious direct effects. Mortality from decompression injuries is possible in close proximity to a sound, but only limited data on mortality in response to airgun noise exposure are available (Hawkins *et al.*, 2014). The most likely impacts for most prey species in the survey area would be temporary avoidance of the area. The proposed survey would move through an area relatively quickly, limiting exposure to multiple impulsive sounds. In all cases, sound levels would return to ambient once the survey moves out of the area or ends and the noise source is shut down and, when exposure to sound ends, behavioral and/or physiological responses are expected to end relatively quickly (McCauley *et al.*, 2000b). The duration of fish avoidance of a given area after survey effort stops is unknown, but a rapid return to normal recruitment, distribution, and behavior is anticipated. While the potential for disruption of spawning aggregations or schools of important prey species can be meaningful on a local scale, the mobile and temporary nature of this survey and the likelihood of temporary avoidance behavior suggest that impacts would be minor.

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

Soundscapes are also defined by, and acoustic habitat influenced by, the total contribution of anthropogenic sound. This may include incidental emissions from sources such as vessel traffic, or may be intentionally introduced to the marine environment for data acquisition purposes (as in the use of airgun arrays). 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 see also the previous discussion on masking under “Acoustic Effects”),

which may range from local effects for brief periods of time to chronic effects over large areas and for long durations. Depending on the extent of effects to habitat, animals may alter their communications signals (thereby potentially expending additional energy) or miss acoustic cues (either conspecific or adventitious). For more detail on these concepts see, *e.g.*, Barber *et al.*, 2010; Pijanowski *et al.*, 2011; Francis and Barber, 2013; Lillis *et al.*, 2014.

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). Although the signals emitted by seismic airgun arrays are generally low frequency, they would also likely be of short duration and transient in any given area due to the nature of these surveys. As described previously, exploratory surveys such as these cover a large area but would be transient rather than focused in a given location over time and therefore would not be considered chronic in any given location.

Based on the information discussed herein, we conclude that impacts of the specified activity are not likely to have more than short-term adverse effects on any prey habitat or populations of prey species. Further, any impacts to marine mammal habitat are not expected to result in significant or long-term consequences for individual marine mammals, or to contribute to adverse impacts on their populations.

#### Estimated Take of Marine Mammals

This section provides an estimate of the number of incidental takes proposed for authorization through the IHA, which will inform both NMFS' consideration of "small numbers," and the negligible impact determinations.

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

Authorized takes would be by Level B harassment only, in the form of disruption of behavioral patterns for

individual marine mammals resulting from exposure to sound from low energy seismic airguns. Based on the nature of the activity, Level A harassment is neither anticipated nor proposed to be authorized. As described previously, no serious injury or mortality is anticipated or proposed to be authorized for this activity. Below we describe how the proposed take numbers are estimated.

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

#### Acoustic Thresholds

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

**Level B Harassment**—Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source or exposure context (*e.g.*, frequency, predictability, duty cycle, duration of the exposure, signal-to-noise ratio, distance to the source), the environment (*e.g.*, bathymetry, other noises in the area, predators in the area), and the receiving animals (hearing, motivation, experience, demography, life stage, depth) and can be difficult to predict (*e.g.*, Southall *et al.*, 2007, 2021; Ellison *et al.*, 2012). Based on what the available science indicates and the practical need to use a threshold based on a metric that is both predictable and measurable for most activities, NMFS typically uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. NMFS generally predicts that marine mammals are likely to be

behaviorally harassed in a manner considered to be Level B harassment when exposed to underwater anthropogenic noise above root-mean-squared pressure received levels (RMS SPL) of 120 dB (re 1  $\mu$ Pa) for continuous (*e.g.*, vibratory pile driving, drilling) and above RMS SPL 160 dB re 1  $\mu$ Pa for non-explosive impulsive (*e.g.*, seismic airguns) or intermittent (*e.g.*, scientific sonar) sources. 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.

UT's proposed survey includes the use of impulsive seismic sources (*e.g.*, GI-airgun) and therefore, the 160 dB re 1  $\mu$ Pa (rms) criteria is applicable for analysis of Level B harassment.

**Level A harassment**—NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) (Technical Guidance, 2018) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). UT's proposed survey includes the use of impulsive sources.

These thresholds are provided in the Table 3 and 4 below. The references, analysis, and methodology used in the development of the thresholds are described in NMFS' 2018 Technical Guidance, which may be accessed at: [www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance](http://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance).

#### Ensonified Area

Here, we describe operational and environmental parameters of the activity that are used in estimating the area ensonified above the acoustic thresholds, including source levels and transmission loss coefficient.

The proposed survey would entail the use of up to two 105 in<sup>3</sup> airguns with a maximum total discharge of 210 in<sup>3</sup> at a tow depth of 3–4 m. Lamont-Doherty Earth Observatory (L-DEO) model results were used to determine the 160 dB<sub>rms</sub> radius for the two-airgun array in water depths >100 m. Received sound

levels were predicted by L-DEO's model (Diebold *et al.*, 2010) as a function of distance from the airguns for the two 105 in<sup>3</sup> airguns with a maximum total discharge of 210 in<sup>3</sup>. This modeling approach uses ray tracing for the direct wave traveling from the array to the receiver and its associated source ghost (reflection at the air-water interface in the vicinity of the array), in a constant-velocity half-space (infinite

homogenous ocean layer, unbounded by a seafloor).

The proposed surveys would acquire data with up to two 105-in<sup>3</sup> GI guns (separated by up to 2.4 m) at a tow depth of ~3–4 m. The shallow-water radii are obtained by scaling the empirically derived measurements from the Gulf of Mexico calibration survey to account for the differences in volume and tow depth between the calibration survey (6,600 in<sup>3</sup> at 6 m tow depth) and the proposed survey (210 in<sup>3</sup> at 4 m tow

depth). A simple scaling factor is calculated from the ratios of the isopleths calculated by the deep-water L-DEO model, which are essentially a measure of the energy radiated by the source array.

L-DEO's methodology is described in greater detail in UT's IHA application. The estimated distances to the Level B harassment isopleth for the proposed airgun configuration are shown in Table 3.

TABLE 3—PREDICTED RADIAL DISTANCES FROM THE R/V BROOKS MCCALL SEISMIC SOURCE TO ISOPLETHS CORRESPONDING TO LEVEL B HARASSMENT THRESHOLD

| Airgun configuration     | Water depth (m) | Predicted distances (m) to 160 dB received sound level |
|--------------------------|-----------------|--|
| Two 105-in GI guns ..... | <100            | <sup>1</sup> 1,750                                     |

<sup>1</sup> Distance is based on empirically derived measurements in the Gulf of Mexico with scaling applied to account for differences in tow depth.

The ensonified area associated with Level A harassment is more technically challenging to predict due to the need to account for a duration component. Therefore, NMFS developed an optional user spreadsheet tool to accompany the Technical Guidance (2018) that can be used to relatively simply predict an isopleth distance for use in conjunction with marine mammal density or occurrence to help predict potential takes. We note that because of some of the assumptions included in the methods underlying this optional tool, we anticipate that the resulting isopleth estimates are typically going to be overestimates of some degree, which may result in an overestimate of potential take by Level A harassment. However, this optional tool offers the best way to estimate isopleth distances when more sophisticated modeling methods are not available or practical. Table 4 presents the modeled PTS isopleths for mid-frequency cetaceans, the only hearing group for which takes are expected, based on L-DEO modeling incorporated in the companion User Spreadsheet (NMFS 2018).

TABLE 4—MODELED RADIAL DISTANCES TO ISOPLETHS CORRESPONDING TO LEVEL A HARASSMENT THRESHOLDS

| Hearing group                | MF  |
|------------------------------|-----|
| PTS Peak .....               | 1.5 |
| PTS SEL <sub>cum</sub> ..... | 0   |

Predicted distances to Level A harassment isopleths, which vary based on marine mammal hearing groups,

were calculated based on modeling performed by L-DEO using the Nucleus software program and the NMFS User Spreadsheet, described below. The acoustic thresholds for impulsive sounds (*e.g.*, airguns) contained in the Technical Guidance (2018) were presented as dual metric acoustic thresholds using both SEL<sub>cum</sub> and peak sound pressure metrics (NMFS 2016a). As dual metrics, NMFS considers onset of PTS (Level A harassment) to have occurred when either one of the two metrics is exceeded (*i.e.*, metric resulting in the largest isopleth). The SEL<sub>cum</sub> metric considers both level and duration of exposure, as well as auditory weighting functions by marine mammal hearing group. In recognition of the fact that the requirement to calculate Level A harassment ensonified areas could be more technically challenging to predict due to the duration component and the use of weighting functions in the new SEL<sub>cum</sub> thresholds, NMFS developed an optional User Spreadsheet that includes tools to help predict a simple isopleth that can be used in conjunction with marine mammal density or occurrence to facilitate the estimation of take numbers.

The SEL<sub>cum</sub> for the two-GI airgun array is derived from calculating the modified farfield signature. The farfield signature is often used as a theoretical representation of the source level. To compute the farfield signature, the source level is estimated at a large distance (right) below the array (*e.g.*, 9 km), and this level is back projected mathematically to a notional distance of

1 m from the array's geometrical center. However, it has been recognized that the source level from the theoretical farfield signature is never physically achieved at the source when the source is an array of multiple airguns separated in space (Tolstoy *et al.*, 2009). Near the source (at short ranges, distances <1 km), the pulses of sound pressure from each individual airgun in the source array do not stack constructively as they do for the theoretical farfield signature. The pulses from the different airguns spread out in time such that the source levels observed or modeled are the result of the summation of pulses from a few airguns, not the full array (Tolstoy *et al.*, 2009). At larger distances, away from the source array center, sound pressure of all the airguns in the array stack coherently, but not within one time sample, resulting in smaller source levels (a few dB) than the source level derived from the farfield signature. Because the farfield signature does not take into account the interactions of the two airguns that occur near the source center and is calculated as a point source (single airgun), the modified farfield signature is a more appropriate measure of the sound source level for large arrays. For this smaller array, the modified farfield changes will be correspondingly smaller as well, but this method is used for consistency across all array sizes.

Auditory injury for all species is unlikely to occur given the small modeled zones of injury (estimated zone less than 2 m for mid-frequency cetaceans). Additionally, animals are expected to have aversive/compensatory

behavior in response to the activity (Nachtigall *et al.*, 2018) further limiting the likelihood of auditory injury for all species. UT did not request authorization of take by Level A harassment, and no take by Level A harassment is proposed for authorization by NMFS.

*Marine Mammal Occurrence*

In this section we provide information about the occurrence of marine mammals, including density or other relevant information which will inform the take calculations.

For the proposed survey area in the northwest Gulf of Mexico, UT determined that the best source of density data for marine mammal species that might be encountered in the project area was habitat-based density modeling conducted by Garrison *et al.* (2022). The Garrison *et al.* (2022) data provides

abundance estimates for marine mammal species in the Gulf of Mexico within 40 km<sup>2</sup> hexagons (~3.9 km sides and ~7 km across from each side) on a monthly basis. To calculate expected densities specific to the survey area, UT created a 7-km perimeter around the survey area and used that perimeter to select the density hexagons for each species in each month. The 7-km distance was chosen for the perimeter to ensure that at least one full density hexagon outside the survey area in all directions was selected, providing a more robust sample for the calculations. They then calculated the mean of the predicted densities from the selected cells for each species and month. The highest mean monthly density was chosen for each species from the months of September to December (*i.e.*, the months within which the survey is

expected to occur). NMFS concurred with this approach to calculate species density.

Rough-toothed dolphins were not modeled by Garrison *et al.* (2022) due to a lack of sightings, so habitat-based marine mammal density estimates from Roberts *et al.* (2016) were used. The Roberts *et al.* (2016) models consisted of 10 km x 10 km grid cells containing average annual densities for U.S. waters in the Gulf of Mexico. The same 7 km perimeter described above was used to select grid cells from the Roberts *et al.* (2016) dataset, and the mean of the selected grid cells for rough-toothed dolphins was calculated to estimate the annual average density of the species in the survey area. Estimated densities used and Level B harassment ensonified areas to inform take estimates are presented in Table 5.

TABLE 5—MARINE MAMMAL DENSITIES AND TOTAL ENSONIFIED AREA OF ACTIVITIES IN THE PROPOSED SURVEY AREA

| Species                               | Estimated density (#/km <sup>2</sup> ) | Level B ensonified area (km <sup>2</sup> ) |
|---------------------------------------|--|--|
| Atlantic spotted dolphin .....        | <sup>b</sup> 0.00082                   | 7,866                                      |
| Bottlenose dolphin <sup>a</sup> ..... | <sup>b</sup> 0.34024                   | 7,866                                      |
| Rough-toothed dolphin .....           | <sup>c</sup> 0.00362                   | 7,866                                      |

<sup>a</sup>Bottlenose dolphin density estimate does not differentiate between coastal and shelf stocks.  
<sup>b</sup>Density calculated from Garrison *et al.* (2022).  
<sup>c</sup>Density calculated from Roberts *et al.* (2016).

*Take Estimation*

Here, we describe how the information provided above is synthesized to produce a quantitative estimate of the take that is reasonably likely to occur and proposed for authorization. In order to estimate the number of marine mammals predicted to be exposed to sound levels that would result in Level B harassment, radial distances from the airgun array to

the predicted isopleth corresponding to the Level B harassment threshold was calculated, as described above. Those radial distances were then used to calculate the area(s) around the airgun array predicted to be ensonified to sound levels that exceed the harassment thresholds. The area expected to be ensonified on 1 day was determined by multiplying the number of line km possible in 1 day by two times the 160-dB radius plus adding endcaps to the

start and beginning of the line. The daily ensonified area was then multiplied by the number of survey days (10 days). The highest mean monthly density for each species was then multiplied by the total ensonified area to calculate the estimated takes of each species.

No takes by Level A harassment are expected or proposed for authorization. Estimated takes for the proposed survey are shown in Table 6.

TABLE 6—ESTIMATED TAKE PROPOSED FOR AUTHORIZATION

| Species                               | Stock                                      | Estimated take | Proposed authorized take | Stock abundance <sup>1</sup> | Percent of stock |
|---------------------------------------|--|----------------|--------------------------|------------------------------|------------------|
|                                       |  | Level B        | Level B                  |                              |                  |
| Atlantic spotted dolphin .....        | Gulf of Mexico .....                       | 6              | <sup>2</sup> 26          | 21,506                       | 0.12             |
| Bottlenose dolphin <sup>3</sup> ..... | Gulf of Mexico Western Coastal .....       | 2,676          | 2,676                    | 20,759                       | 12.89            |
|                                       | Northern Gulf of Mexico Continental Shelf. |                |                          | 63,280                       | 4.23             |
| Rough-toothed dolphin .....           | Gulf of Mexico .....                       | 28             | 28                       | <sup>2</sup> 4,853           | 0.58             |

<sup>1</sup> Stock abundance for Atlantic spotted dolphins and bottlenose dolphins was taken from Garrison *et al.* (2022). Stock abundance for rough-toothed dolphins was taken from Roberts *et al.* (2016), as Garrison *et al.* (2022) did not create a model for this species.

<sup>2</sup> Proposed take increased to mean group size from Maze-Foley and Mullin (2006).

<sup>3</sup> Estimated take for bottlenose dolphins is not apportioned to stock, as density information does not differentiate between coastal and shelf dolphins. However, based on the proposed survey depths, we expect that most of the takes would be from the coastal stock, but some takes could be from the shelf stock. Percent of stock was calculated as if all takes proposed for authorization accrued to the single stock with the lowest population abundance.

### Proposed Mitigation

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

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

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

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

Mitigation measures that would be adopted during the planned survey include, but are not limited to: (1) vessel speed or course alteration, provided that doing so would not compromise operation safety requirements; (2) monitoring a pre-start clearance zone; and (3) ramp-up procedures.

#### Vessel-Visual Based Mitigation Monitoring

Visual monitoring requires the use of trained observers (herein referred to as visual protected species observers (PSOs)) to scan the ocean surface visually for the presence of marine mammals. PSOs shall establish and monitor a pre-start clearance zone and,

to the extent practicable, a Level B harassment zone (Table 3). These zones shall be based upon the radial distance from the edges of the acoustic source (rather than being based on the center of the array or around the vessel itself). During pre-start clearance (*i.e.*, before ramp-up begins), the pre-start clearance zone is the area in which observations of marine mammals within the zone would prevent airgun operations from beginning (*i.e.*, ramp-up). The pre-start clearance zone encompasses the area at and below the sea surface out to a radius of 200 meters from the edges of the airgun array.

During survey operations (*e.g.*, any day on which use of the acoustic source is planned to occur, and whenever the acoustic source is in the water, whether activated or not), a minimum of two PSOs must be on duty and conducting visual observations at all times during daylight hours (*i.e.*, from 30 minutes prior to sunrise through 30 minutes following sunset). Visual monitoring must begin no less than 30 minutes prior to ramp-up and must continue until one hour after use of the acoustic source ceases or until 30 minutes past sunset. Visual PSOs must coordinate to ensure 360 degree visual coverage around the vessel from the most appropriate observation posts, and must conduct visual observations using binoculars and the naked eye while free from distractions and in a consistent, systematic, and diligent manner.

PSOs shall establish and monitor a pre-start clearance zone and to the extent practicable, a Level B harassment zone. These zones shall be based upon the radial distance from the edges of the acoustic source (rather than being based on the center of the array or around the vessel itself).

Any observations of marine mammals by crew members shall be relayed to the PSO team. During good conditions (*e.g.*, daylight hours, Beaufort sea state (BSS) 3 or less), visual PSOs shall conduct observations when the acoustic source is not operating for comparison of sightings rates and behavior with and without use of the acoustic source and between acquisition periods, to the maximum extent practicable.

Visual PSOs may be on watch for a maximum of 4 consecutive hours followed by a break of at least 1 hour between watches and may conduct a maximum of 12 hours of observation per 24-hour period.

#### Pre-Start Clearance and Ramp-Up

Ramp-up is the gradual and systematic increase of emitted sound levels from an acoustic source. Ramp-up would begin with one GI airgun 105 in<sup>3</sup>

first being activated, followed by the second after 5 minutes. The intent of pre-clearance observation (30 minutes) is to ensure no marine mammals are observed within the pre-start clearance zone prior to the beginning of ramp-up. The intent of ramp-up is to warn marine mammals in the vicinity of survey activities and to allow sufficient time for those animals to leave the immediate vicinity. A ramp-up procedure, involving a stepwise increase in the number of airguns are activated and the full volume is achieved, is required at all times as part of the activation of the acoustic source. All operators must adhere to the following pre-clearance and ramp-up requirements:

(1) The operator must notify a designated PSO of the planned start of ramp-up as agreed upon with the lead PSO; the notification time should not be less than 60 minutes prior to the planned ramp-up in order to allow PSOs time to monitor the pre-start clearance zone for 30 minutes prior to the initiation of ramp-up (pre-start clearance);

- Ramp-ups shall be scheduled so as to minimize the time spent with the source activated prior to reaching the designated run-in;

- One of the PSOs conducting pre-start clearance observations must be notified again immediately prior to initiating ramp-up procedures and the operator must receive confirmation from the PSO to proceed;

- Ramp-up may not be initiated if any marine mammal is within the pre-start clearance zone. If a marine mammal is observed within the pre-start clearance zone during the 30 minutes pre-clearance period, ramp-up may not begin until the animal(s) has been observed exiting the zone or until an additional time period has elapsed with no further sightings (15 minutes for small dolphins and 30 minutes for all other species);

- Ramp-up must begin by activating the first airgun for 5 minutes and then adding the second airgun; and

- PSOs must monitor the pre-start clearance zone during ramp-up, and ramp-up must cease and the source must be shut down upon detection of a marine mammal within the pre-start clearance zone. Once ramp-up has begun, observations of marine mammals for which take authorization is granted within the pre-start clearance zone does not require shutdown.

(2) If the acoustic source is shut down for brief periods (*i.e.*, less than 30 minutes) for reasons other than implementation of prescribed mitigation (*e.g.*, mechanical difficulty), it may be activated again without ramp-up if PSOs

have maintained constant observation and no detections of marine mammals have occurred within the pre-start clearance zone. For any longer shutdown, pre-start clearance observation and ramp-up are required. Ramp-up may occur at times of poor visibility (*e.g.*, BSS 4 or greater), including nighttime, if appropriate visual monitoring has occurred with no detections of marine mammals in the 30 minutes prior to beginning ramp-up. Acoustic source activation may only occur at night where operational planning cannot reasonably avoid such circumstances.

- Testing of the acoustic source involving all elements requires ramp-up. Testing limited to individual source elements or strings does not require ramp-up but does require a 30 minute pre-start clearance period.

#### *Shutdown Procedures*

The shutdown requirement will be waived for small dolphins. As defined here, the small dolphin group is intended to encompass those members of the Family Delphinidae most likely to voluntarily approach the source vessel for purposes of interacting with the vessel and/or airgun array (*e.g.*, bow riding). This exception to the shutdown requirement applies solely to specific genera of small dolphins—*Steno*, *Stenella*, and *Tursiops*. As *Tursiops* and *Steno* are the only species expected to potentially be encountered, there is no shutdown requirement included in the proposed IHA for species for which take is proposed to be authorized.

#### *Vessel Strike Avoidance Measures*

These measures apply to all vessels associated with the planned survey activity; however, we note that these requirements do not apply in any case where compliance would create an imminent and serious threat to a person or vessel or to the extent that a vessel is restricted in its ability to maneuver and, because of the restriction, cannot comply. These measures include the following:

- (1) Vessel operators and crews must maintain a vigilant watch for all marine mammals and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any marine mammal. A single marine mammal at the surface may indicate the presence of submerged animals in the vicinity of the vessel; therefore, precautionary measures should be exercised when an animal is observed. A visual observer aboard the vessel must monitor a vessel strike avoidance zone around the vessel (specific distances detailed below), to

ensure the potential for strike is minimized. Visual observers monitoring the vessel strike avoidance zone can be either third-party observers or crew members, but crew members responsible for these duties must be provided sufficient training to (1) distinguish marine mammals from other phenomena and (2) broadly to identify a marine mammal as a baleen whale, sperm whale, or other marine mammals;

- (2) Vessel speeds must be reduced to 10 kn (18.5 kph) or less when mother and calf pairs, pods, or large assemblages of cetaceans are observed near a vessel;

- (3) All vessels must maintain a minimum separation distance of 100 m from sperm whales;

- (4) All vessels must maintain a minimum separation distance of 500 m baleen whales. If a baleen whale is sighted within the relevant separation distance, the vessel must steer a course away at 10 knots or less until the 500-m separation distance has been established. If a whale is observed but cannot be confirmed as a species other than a baleen whale, the vessel operator must assume that it is a baleen whale and take appropriate action.

- (5) All vessels must, to the maximum extent practicable, attempt to maintain a minimum separation distance of 50 m from all other marine mammals, with an understanding that at times this may not be possible (*e.g.*, for animals that approach the vessel); and

- (6) When marine mammals are sighted while a vessel is underway, the vessel should take action as necessary to avoid violating the relevant separation distance (*e.g.*, attempt to remain parallel to the animal's course, avoid excessive speed or abrupt changes in direction until the animal has left the area). This does not apply to any vessel towing gear or any vessel that is navigationally constrained.

Based on our evaluation of the applicant's proposed measures, NMFS has preliminarily determined that the proposed mitigation measures provide the means of effecting the least practicable impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

#### **Proposed Monitoring and Reporting**

In order to issue an IHA for an activity, section 101(a)(5)(D) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104(a)(13) indicate that requests for authorizations must include

the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present while conducting the activities. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

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

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

#### *Vessel-Based Visual Monitoring*

As described above, PSO observations would take place during daytime airgun operations. Two visual PSOs would be on duty at all time during daytime hours. Monitoring shall be conducted in accordance with the following requirements:

- (1) UT must work with the selected third-party observer provider to ensure PSOs have all equipment (including backup equipment) needed to adequately perform necessary tasks, including accurate determination of distance and bearing to observed marine mammals, and to ensure that PSOs are capable of calibrating equipment as

necessary for accurate distance estimates and species identification. See Condition 5(d) in the IHA for list of equipment.

PSOs must have the following requirements and qualifications:

(1) PSOs shall be independent, dedicated and trained and must be employed by a third-party observer provider;

(2) PSOs shall have no tasks other than to conduct visual observational effort, collect data, and communicate with and instruct relevant vessel crew with regard to the presence of protected species and mitigation requirements (including brief alerts regarding maritime hazards);

(3) PSOs shall have successfully completed an approved PSO training course appropriate for their designated task (visual);

(4) NMFS must review and approve PSO resumes accompanied by a relevant training course information packet that includes the name and qualifications (*i.e.*, experience, training completed, or educational background) of the instructor(s), the course outline or syllabus, and course reference material as well as a document stating successful completion of the course;

(5) PSOs must successfully complete relevant training, including completion of all required coursework and passing (80 percent or greater) a written and/or oral examination developed for the training program;

(6) PSOs must have successfully attained a bachelor's degree from an accredited college or university with a major in one of the natural sciences, a minimum of 30 semester hours or equivalent in the biological sciences, and at least one undergraduate course in math or statistics; and

(7) The educational requirements may be waived if the PSO has acquired the relevant skills through alternate experience. Requests for such a waiver shall be submitted to NMFS and must include written justification. Requests shall be granted or denied (with justification) by NMFS within one week of receipt of submitted information. Alternate experience that may be considered includes, but is not limited to:

- Secondary education and/or experience comparable to PSO duties;
- Previous work experience conducting academic, commercial, or government-sponsored protected species surveys; or
- Previous work experience as a PSO; the PSO should demonstrate good standing and consistently good performance of PSO duties.

At least one visual PSO must be unconditionally approved (*i.e.*, have a minimum of 90 days at-sea experience working in that role at the particular Tier level (1–3) with no more than 18 months elapsed since the conclusion of the at-sea experience). One PSO with such experience shall be designated as the lead for the entire PSO team. The lead PSO shall serve as primary point of contact for the vessel operator. To the maximum extent practicable, the duty schedule shall be planned such that unconditionally-approved PSOs are on duty with conditionally-approved PSOs.

PSOs must use standardized electronic data collection forms. At a minimum, the following information must be recorded:

- Vessel name, vessel size and type, maximum speed capability of vessel;
- Dates (MM/DD/YYYY format) of departures and returns to port with port name;
- PSO names and affiliations, PSO identification (ID; initials or other identifier);
- Date (MM/DD/YYYY) and participants of PSO briefings;
- Visual monitoring equipment used (description);
- PSO location on vessel and height (in meters) of observation location above water surface;
- Watch status (description);
- Dates (MM/DD/YYYY) and times (Greenwich mean time (GMT) or coordinated universal time (UTC)) of survey on/off effort and times (GMC/UTC) corresponding with PSO on/off effort;
- Vessel location (decimal degrees) when survey effort began and ended and vessel location at beginning and end of visual PSO duty shifts;
- Vessel location (decimal degrees) at 30-second intervals if obtainable from data collection software, otherwise at practical regular interval;
- Vessel heading (compass heading) and speed (in knots) at beginning and end of visual PSO duty shifts and upon any change;
- Water depth (in meters) (if obtainable from data collection software);
- Environmental conditions while on visual survey (at beginning and end of PSO shift and whenever conditions change significantly), including BSS and any other relevant weather conditions including cloud cover, fog, sun glare, and overall visibility to the horizon;
- Factors that may have contributed to impaired observations during each PSO shift change or as needed as environmental conditions changed

(description) (*e.g.*, vessel traffic, equipment malfunctions); and

- Vessel/Survey activity information (and changes thereof) (description), such as acoustic source power output while in operation, number and volume of acoustic source operating in the array, tow depth of the acoustic source, and any other notes of significance (*i.e.*, pre-start clearance, ramp-up, shutdown, testing, shooting, ramp-up completion, end of operations, streamers, *etc.*).

The following information should be recorded upon visual observation of any marine mammal:

- Sighting ID (numeric);
- Watch status (sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/platform);
- Location of PSO/observer (description);
- Vessel activity at the time of the sighting (*e.g.*, deploying, recovering, testing, shooting, data acquisition, other);
- PSO who sighted the animal/PSO ID;
- Time and date of sighting (GMT/UTC, MM/DD/YYYY);
- Initial detection method (description);
- Sighting cue (description);
- Vessel location at time of sighting (decimal degrees);
- Water depth (in meters);
- Direction of vessel's travel (compass direction);
- Speed (knots) of the vessel from which the observation was made;
- Direction of animal's travel relative to the vessel (description, compass heading);
- Bearing to sighting (degrees);
- Identification of the animal (*e.g.*, genus/species, lowest possible taxonomic level, or unidentified) and the composition of the group if there is a mix of species;
- Species reliability (an indicator of confidence in identification) (1 = unsure/possible, 2 = probable, 3 = definite/sure, 9 = unknown/not recorded);
- Estimated distance to the animal (meters) and method of estimating distance;
- Estimated number of animals (high, low, and best) (numeric);
- Estimated number of animals by cohort (adults, yearlings, juveniles, calves, group composition, *etc.*);
- Description (as many distinguishing features as possible of each individual seen, including length, shape, color, pattern, scars or markings, shape and size of dorsal fin, shape of head, and blow characteristics);
- Detailed behavior observations (*e.g.*, number of blows/breaths, number of

surfaces, breaching, spyhopping, diving, feeding, traveling; as explicit and detailed as possible; note any observed changes in behavior);

- Animal's closest point of approach (in meters) and/or closest distance from any element of the acoustic source;
- Description of any actions implemented in response to the sighting (*e.g.*, delays, shutdown, ramp-up) and time and location of the action.
- Photos (Yes or No);
- Photo Frame Numbers (List of numbers); and
- Conditions at time of sighting (Visibility; BSS).

#### Reporting

UT must submit a draft comprehensive report to NMFS on all activities and monitoring results within 90 days of the completion of the survey or expiration of the IHA, whichever comes sooner. The report would describe the activities that were conducted and sightings of marine mammals. The report would provide full documentation of methods, results, and interpretation pertaining to all monitoring. The 90-day report would summarize the dates and locations of survey operations, and all marine mammal sightings (dates, times, locations, activities, associated seismic survey activities).

The draft report shall also include geo-referenced time-stamped vessel tracklines for all time periods during which airguns were operating. Tracklines should include points recording any change in airgun status (*e.g.*, when the airguns began operating, when they were turned off, or when they changed from full array to single gun or vice versa). Geographic information system (GIS) files shall be provided in Environmental Systems Research Institute (ESRI) shapefile format and include the UTC date and time, latitude in decimal degrees, and longitude in decimal degrees. All coordinates shall be referenced to the WGS84 geographic coordinate system. In addition to the report, all raw observational data shall be made available to NMFS. A final report must be submitted within 30 days following resolution of any comments on the draft report.

#### Reporting Injured or Dead Marine Mammals

**Sighting of injured or dead marine mammals**—In the event that personnel involved in survey activities covered by the authorization discover an injured or dead marine mammal, UT shall report the incident to the OPR, NMFS, and the NMFS Southeast Regional Stranding

Coordinator as soon as feasible. The report must include the following information:

- Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);
- Species identification (if known) or description of the animal(s) involved;
- Condition of the animal(s) (including carcass condition if the animal is dead);
- Observed behaviors of the animal(s), if alive;
- If available, photographs or video footage of the animal(s); and
- General circumstances under which the animal was discovered.

**Vessel strike**—In the event of a vessel strike of a marine mammal by any vessel involved in the activities covered by the authorization, UT shall report the incident to OPR, NMFS and to the NMFS Southeast Regional Stranding Coordinator as soon as feasible. The report must include the following information:

- Time, date, and location (latitude/longitude) of the incident;
- Vessel's speed during and leading up to the incident;
- Vessel's course/heading and what operations were being conducted (if applicable);
- Status of all sound sources in use;
- Description of avoidance measures/requirements that were in place at the time of the strike and what additional measure were taken, if any, to avoid strike;
- Environmental conditions (*e.g.*, wind speed and direction, BSS, cloud cover, visibility) immediately preceding the strike;
- Species identification (if known) or description of the animal(s) involved;
- Estimated size and length of the animal that was struck;
- Description of the behavior of the animal immediately preceding and following the strike;
- If available, description of the presence and behavior of any other marine mammals present immediately preceding the strike;
- Estimated fate of the animal (*e.g.*, dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and
- To the extent practicable, photographs or video footage of the animal(s).

#### Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be

reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.*, population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be "taken" through harassment, NMFS considers other factors, such as the likely nature of any impacts or responses (*e.g.*, intensity, duration), the context of any impacts or responses (*e.g.*, critical reproductive time or location, foraging impacts affecting energetics), as well as effects on habitat, and the likely effectiveness of the mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS' 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 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).

To avoid repetition, the discussion of our analysis applies to all the species listed in Table 1, given that the anticipated effects of this activity on these different marine mammal stocks are expected to be similar. There is little information about the nature or severity of the impacts, or the size, status, or structure of any of these species or stocks that would lead to a different analysis for this activity.

NMFS does not anticipate that serious injury or mortality would occur as a result from low-energy survey, and no serious injury or mortality is proposed to be authorized. As discussed in the Potential Effects of Specified Activities on Marine Mammals and Their Habitat section, non-auditory physical effects and vessel strike are not expected to occur. NMFS expects that all potential take would be in the form of Level B behavioral harassment in the form of temporary avoidance of the area or decreased foraging (if such activity was occurring), responses that are considered to be of low severity and with no lasting biological consequences (*e.g.*, Southall *et al.*, 2007, 2021).

In addition to being temporary, the maximum expected Level B harassment

zone around the survey vessel is 1,750 m. Therefore, the ensonified area surrounding the vessel is relatively small compared to the overall distribution of animals in the area and their use of the habitat. Feeding behavior is not likely to be significantly impacted as prey species are mobile and are broadly distributed throughout the survey area; therefore, marine mammals that may be temporarily displaced during survey activities are expected to be able to resume foraging once they have moved away from areas with disturbing levels of underwater noise. Because of the short duration (10 days) of the disturbance and the availability of similar habitat and resources in the surrounding area, the impacts to marine mammals and the food sources that they utilize are not expected to cause significant or long-term consequences for individual marine mammals or their populations.

There are no rookeries, mating, or calving grounds known to be biologically important to marine mammals within the planned survey area and there are no feeding areas known to be biologically important to marine mammals within the survey area. There is no designated critical habitat for any ESA-listed marine mammals within the project area.

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

- (1) No serious injury or mortality is anticipated or proposed to be authorized;
- (2) No Level A harassment is anticipated, even in the absence of mitigation measures or proposed to be authorized;
- (3) Take is anticipated to be by Level B harassment only consisting of temporary behavioral changes of small percentages of the affected species due to avoidance of the area around the survey vessel. The relatively short duration of the proposed survey (10 days) would further limit the potential impacts of any temporary behavioral changes that would occur;
- (4) The availability of alternate areas of similar habitat value for marine mammals to temporarily vacate the survey area during the proposed survey to avoid exposure to sounds from the activity;
- (5) Foraging success is not likely to be significantly impacted as effects on prey species for marine mammals would be temporary and spatially limited; and

(6) The proposed mitigation measures, including visual monitoring, ramp-ups, and shutdowns are expected to minimize potential impacts to marine mammals.

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

#### Small Numbers

As noted previously, only take of small numbers of marine mammals may be authorized under section 101(a)(5)(A) and (D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. When the predicted number of individuals to be taken is fewer 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 B harassment of 3 marine mammal species with four managed stocks. The total amount of takes proposed for authorization relative to the best available population abundance is less than 5 percent for 3 managed stocks and less than 13 percent for 1 managed stock (Gulf of Mexico Western Coastal stock of bottlenose dolphin assuming all takes by Level B harassment are of this stock; see Take Estimation subsection) (Table 6). The take numbers proposed for authorization are considered conservative estimates for purposes of the small numbers determination as they assume all takes represent different individual animals, which is unlikely to be the case.

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

taken relative to the population size of the affected species or stocks.

#### Unmitigable Adverse Impact Analysis and Determination

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

#### Endangered Species Act

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

No incidental take of ESA-listed species is proposed for authorization or expected to result from this activity. Therefore, NMFS has determined that formal consultation under section 7 of the ESA is not required for this action.

#### Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to UT for conducting marine geophysical surveys in the northwest Gulf of Mexico within Texas State waters during fall 2023, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. A draft of the proposed IHA can be found at: <https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-research-and-other-activities>.

#### Request for Public Comments

We request comment on our analyses, the proposed authorization, and any other aspect of this notice of proposed IHA for the proposed marine geophysical survey. We also request comment on the potential renewal of this proposed IHA as described in the paragraph below. Please include with your comments any supporting data or literature citations to help inform decisions on the request for this IHA or a subsequent renewal IHA.

On a case-by-case basis, NMFS may issue a one-time, 1-year renewal IHA following notice to the public providing an additional 15 days for public

comments when (1) up to another year of identical or nearly identical activities as described in the Description of Proposed Activity section of this notice is planned, or (2) the activities as described in the Description of Proposed Activity section of this notice would not be completed by the time the IHA expires and a renewal would allow for completion of the activities beyond that described in the *Dates and Duration* section of this notice, provided all of the following conditions are met:

- A request for renewal is received no later than 60 days prior to the needed renewal IHA effective date (recognizing that the renewal IHA expiration date cannot extend beyond one year from expiration of the initial IHA).

- The request for renewal must include the following:

(1) An explanation that the activities to be conducted under the requested renewal IHA are identical to the activities analyzed under the initial IHA, are a subset of the activities, or include changes so minor (*e.g.*, reduction in pile size) that the changes do not affect the previous analyses, mitigation and monitoring requirements, or take estimates (with the exception of reducing the type or amount of take).

(2) A preliminary monitoring report showing the results of the required monitoring to date and an explanation showing that the monitoring results do not indicate impacts of a scale or nature not previously analyzed or authorized.

Upon review of the request for renewal, the status of the affected species or stocks, and any other pertinent information, NMFS determines that there are no more than minor changes in the activities, the mitigation and monitoring measures will remain the same and appropriate, and the findings in the initial IHA remain valid.

Dated: August 3, 2023.

**Kimberly Damon-Randall,**

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

[FR Doc. 2023-16945 Filed 8-7-23; 8:45 am]

BILLING CODE 3510-22-P

## DEPARTMENT OF COMMERCE

### National Oceanic and Atmospheric Administration

[RTID 0648-XD200]

#### New England Fishery Management Council; Public Meeting; Correction

**AGENCY:** National Marine Fisheries Service (NMFS), National Oceanic and

Atmospheric Administration (NOAA), Commerce.

**ACTION:** Notice of correction of a public meeting.

**SUMMARY:** The New England Fishery Management Council (Council) is scheduling a public meeting of its Risk Policy Working Group (RPWG) to consider actions affecting New England fisheries in the exclusive economic zone (EEZ). This meeting will be held as a webinar. Recommendations from this group will be brought to the full Council for formal consideration and action, if appropriate.

**DATES:** This meeting will be held on Tuesday, August 22, 2023, at 9 a.m.

**ADDRESSES:** This meeting will be held as a webinar only. Webinar registration URL information: <https://attendee.gotowebinar.com/register/7355629868155270240>.

*Council address:* New England Fishery Management Council, 50 Water Street, Mill 2, Newburyport, MA 01950.

**FOR FURTHER INFORMATION CONTACT:** Thomas A. Nies, Executive Director, New England Fishery Management Council; telephone: (978) 465-0492.

**SUPPLEMENTARY INFORMATION:** The original notice published in the **Federal Register** on July 31, 2023 (88 FR 49451). The original notice announced that the meeting would be a hybrid in-person meeting as well as a webinar. This notice corrects the meeting to be a webinar meeting only. All other information previously published remains unchanged.

#### Special Accommodations

This meeting is physically accessible to people with disabilities. Requests for sign language interpretation or other auxiliary aids should be directed to Thomas A. Nies, Executive Director, at (978) 465-0492, at least 5 days prior to the meeting date.

*Authority:* 16 U.S.C. 1801 *et seq.*

Dated: August 3, 2023.

**Rey Israel Marquez,**

*Acting Deputy Director, Office of Sustainable Fisheries, National Marine Fisheries Service.*

[FR Doc. 2023-16963 Filed 8-7-23; 8:45 am]

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## DEPARTMENT OF COMMERCE

### National Oceanic and Atmospheric Administration

#### Notice of Availability of Final Management Plan and Final Environmental Assessment for Stellwagen Bank National Marine Sanctuary

**AGENCY:** Office of National Marine Sanctuaries (ONMS), National Ocean Service (NOS), National Oceanic and Atmospheric Administration (NOAA), Department of Commerce (DOC).

**ACTION:** Notice; notice of availability of a final management plan and final environmental assessment.

**SUMMARY:** On February 13, 2020, NOAA initiated a review of the Stellwagen Bank National Marine Sanctuary (SBNMS or the sanctuary) management plan to evaluate substantive progress toward implementing the goals of the sanctuary and to make revisions to the management plan as necessary to fulfill the purposes and policies of the NMSA. NOAA anticipated that management plan changes would require preparation of environmental analysis under the National Environmental Policy Act (NEPA), and initiated public scoping meetings to gather information and other comments from individuals, organizations, tribes, and government agencies on the scope, types, and significance of issues related to the SBNMS management plan and the proper scope of environmental analysis for the management plan review. NOAA is providing notice of availability of a final management plan and a final environmental assessment (EA) for SBNMS.

**DATES:** The final management plan and final environmental assessment are now available.

**ADDRESSES:** To obtain a copy of the final management plan, final environmental assessment, and finding of no significant impact (FONSI), contact the Management Plan Review Coordinator at Stellwagen Bank National Marine Sanctuary, Alice Stratton, 175 Edward Foster Road, Scituate, MA 02066, 203-882-6515, [sbnmsmanagementplan@noaa.gov](mailto:sbnmsmanagementplan@noaa.gov). Copies can also be downloaded from the Stellwagen Bank National Marine Sanctuary website at <https://stellwagen.noaa.gov/management/>.

**FOR FURTHER INFORMATION CONTACT:** Alice Stratton, 203-882-6515, [sbnmsmanagementplan@noaa.gov](mailto:sbnmsmanagementplan@noaa.gov).

**SUPPLEMENTARY INFORMATION:**