publication of the final results of this review in the **Federal Register**. If a timely summons is filed at the U.S. Court of International Trade, the assessment instructions will direct CBP not to liquidate relevant entries until the time for parties to file a request for a statutory injunction has expired (*i.e.,* within 90 days of publication).

Cash Deposit Requirements

The following cash deposit requirements will be effective for all shipments of the subject merchandise entered, or withdrawn from warehouse, for consumption on or after the publication date of the final results of this administrative review, as provided by section 751(a)(2)(C) of the Act: (1) the cash deposit rate for the companies under review will be equal to the weighted-average dumping margin established in the final results of this review, except if the rate is *de minimis* (*i.e.,* less than 0.50 percent), in which case the cash deposit rate will be zero; (2) for previously reviewed or investigated companies not covered by this review, the cash deposit rate will continue to be the company-specific rate published for the most recently-completed segment of this proceeding in which they were examined; (3) if the exporter is not a firm covered in this review, a prior review, or the LTFV investigation, but the producer is, the cash deposit rate will be the rate established for the most recently-completed segment of this proceeding for the producer of the merchandise; and (4) the cash deposit rate for all other producers or exporters will continue to be 7.00 percent,[22] the all-others rate established in the *Amended Final.* These cash deposit requirements, when imposed, shall remain in effect until further notice.

Notification to Importers

This notice also serves as a preliminary reminder to importers of their responsibility under 19 CFR 351.402(f)(2) to file a certificate regarding the reimbursement of antidumping and/or countervailing duties prior to liquidation of the relevant entries during this review period. Failure to comply with this requirement could result in Commerce's presumption that reimbursement of antidumping and/or countervailing duties occurred and the subsequent assessment of double antidumping duties, and/or an increase in the amount of antidumping duties by the amount of the countervailing duties.

---

[22] *See Amended Final,* 86 FR at 50326.

Notification to Interested Parties

We are issuing and publishing these results in accordance with sections 751(a)(1) and 777(i)(1) of the Act, and 19 CFR 351.213 and 351.221(b)(4).

Dated: November 6, 2024.

Abdelali Elouaradia,
Deputy Assistant Secretary for Enforcement and Compliance.

Appendix I

List of Topics Discussed in the Preliminary Decision Memorandum

I. Summary
II. Background
III. Scope of the *Order*
IV. Discussion of the Methodology
V. Recommendation

Appendix II

List of Companies Not Selected for Individual Examination

1. Balkrishna Steel Forge Pvt. Ltd.
2. CD Industries (Prop. Kisaan Engineering Works Pvt. Ltd.)
3. Echjay Forgings Private Limited
4. Fivebros Forgings Private Limited
5. Goodluck India Limited; Goodluck Engineering Co.
6. Jai Auto Pvt. Ltd
7. Jay Jagdamba Limited
8. Jay Jagdamba Forgings Private Limited
9. Kisaan Die Tech Private Limited
10. Pradeep Metals Limited
11. R.N. Gupta & Company Limited

[FR Doc. 2024–26887 Filed 11–18–24; 8:45 am]

BILLING CODE 3510–DS–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[RTID 0648–XE398]

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to a Marine Geophysical Survey in the Northwest Gulf of Mexico

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 Texas in the northwest (NW) Gulf of Mexico (GOM). 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 the Request for Public Comments section 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 December 19, 2024.

ADDRESSES: Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service and should be submitted via email to *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: *https:// 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 below.

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 *https://www.fisheries.noaa.gov/permit/ incidental-take-authorizations-under-marine-mammal-protection-act* 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. Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not

intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are 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 monitoring and reporting of the takings. The definitions of all applicable MMPA statutory terms used above are included in the relevant sections below and can be found in section 3 of the MMPA (16 U.S.C. 1362) and NMFS regulations at 50 CFR 216.103.

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 NAO 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 July 25, 2024, NMFS received a request from UT for an IHA to take marine mammals incidental to a marine geophysical survey in coastal waters off Texas in the NW GOM. The application was deemed adequate and complete on September 24, 2024. UT's request is for take of bottlenose dolphins, Atlantic spotted dolphins, and rough-toothed dolphins 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

Researchers from UT propose to conduct a low-energy marine seismic survey using airguns as the acoustic source from the research vessel (R/V) Brooks McCall (McCall) or similar vessel operated by TDI-Brooks International. The proposed survey would occur within Texas State waters in the NW GOM from approximately January to April 2025. The proposed survey would occur within the Exclusive Economic Zone (EEZ) of the United States and in Texas State waters, in water depths less than 30 meters (m). To complete this high resolution 3D (HR3D) seismic survey, the McCall would tow a 2-airgun array with a total discharge volume of ~210 cubic inches (in³) at a depth of 3–4 m, with a shot interval of 12.5 m (5–10 seconds (s)) as the primary acoustic source. The airgun array receiver would consist of four 25-m-long solid-state hydrophone streamers, spaced 10 m apart. Approximately 4,440 km of seismic acquisition is proposed. The airgun array would introduce underwater sounds that may result in take, by Level B harassment, of marine mammals.

The purpose of the proposed survey is to study the geologic section beneath the GOM for secure, long-term, large-scale carbon dioxide storage and enhanced hydrocarbon recovery.

Dates and Duration

The proposed survey is anticipated to take place from January to April 2025. The survey is expected to last 23 days, including approximately 20 days of seismic operations and 3 days of transit and equipment deployment.

Specific Geographic Region

The proposed survey would occur within approximately lat. 27.1–29.6° N, long. 93.6–97.4° W, the EEZ of the United States and in Texas State waters, in water depths less than 30 m. The primary study area is around the 10 m isobaths, and if no suitable sites are within Texas State waters, the alternate study area is on the outer continental shelf within the 30 m isobaths. The region where the survey is proposed to occur is depicted in figure 1; the tracklines could occur anywhere within the polygon shown in figure 1. The McCall would likely mobilize and demobilize from the nearest available port.
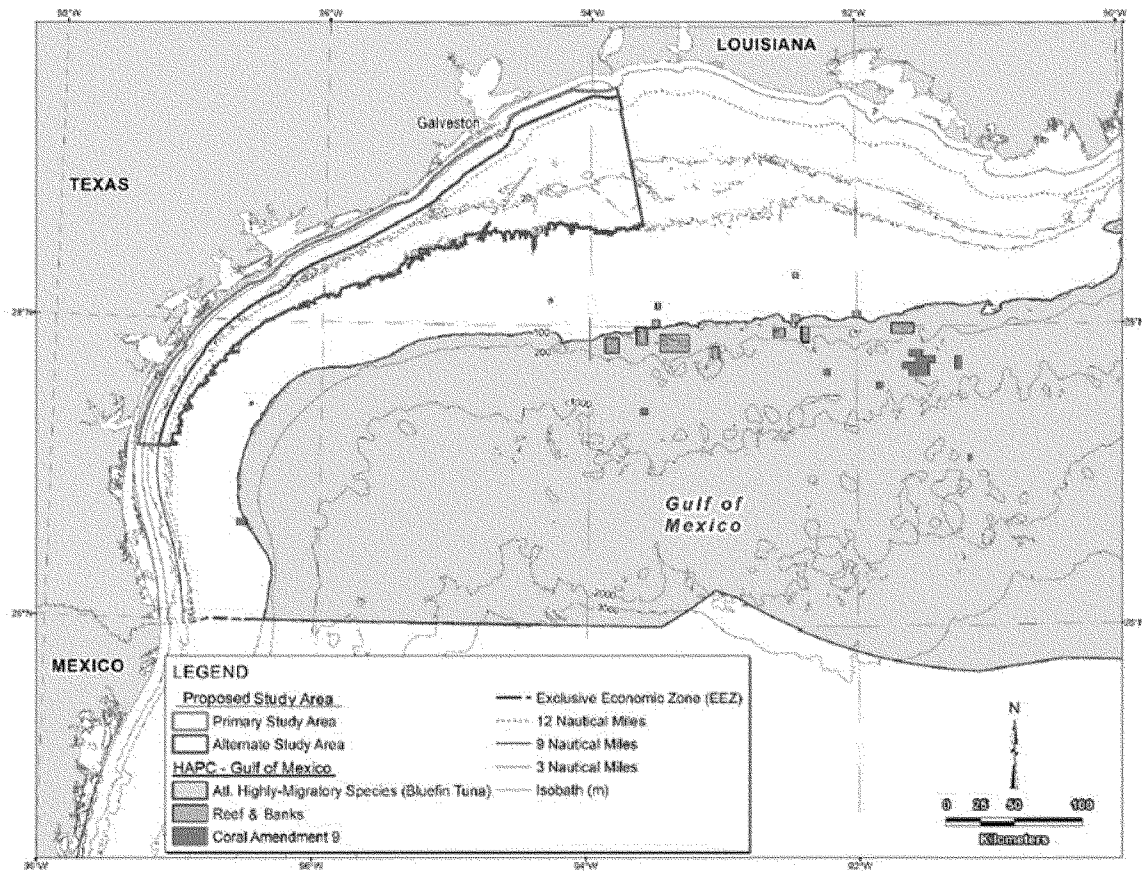
Figure 1 -- Location of the Proposed Seismic Survey in the NW GOM

Detailed Description of the Specified Activity

The procedures to be used for the proposed survey would be similar to those used during previous seismic surveys by UT and would use conventional seismic methodology. The survey would involve one source vessel, the McCall, or similar vessel operated by TDI-Brooks. During the low-energy HR3D seismic survey, the McCall would tow two Generator-Injector (GI) airguns with a total discharge volume of 210 in³. The airgun array would be deployed at a depth of about 3–4 m below the surface, spaced about 2 m apart, and have a shot interval of 12.5 m (about 5–10 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 4,440 km of seismic acquisition are planned. The survey would take place in water depths less than 30 m.

Proposed mitigation, monitoring, and reporting measures are described in

detail later in this document (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; *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 (M/SI) 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 2023 SARs) and are available online at: *https://www.fisheries.noaa.gov/ national/marine-mammal-protection/ marine-mammal-stock-assessments.*

TABLE 1—SPECIES [1] LIKELY AFFECTED BY THE SPECIFIED ACTIVITIES

Common name	Scientific name	Stock	ESA/ MMPA status; strategic (Y/N) [2]	Stock abundance (CV, N_{min}, most recent abundance survey) [3]	PBR	Annual M/SI [4]	GOM population abundance [5]
Odontoceti (toothed whales, dolphins, and porpoises)							
Family Delphinidae:							
Atlantic spotted dolphin.	*Stenella frontalis*	GOM	-/-; N	21,506 (0.26; 17,339; 2018).	166	[6] 36	[7] 12,240
Rough-toothed dolphin.	*Steno bredanensis*	GOM	-/-; N	unk (n/a; unk; 2018)	undetermined	39	4,853
Bottlenose dolphin	*Tursiops truncatus*	GOM Western Coastal	-/-; N	20,759 (0.13; 18,585; 2018).	167	36	[7] 151,886
		Northern GOM Continental Shelf.	-/-; N	63,280 (0.11; 57,917; 2018).	556	[5] 65	

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

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

[3] NMFS marine mammal stock assessment reports online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region.* CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance. In some cases, CV is not applicable.

[4] These values, found in NMFS's SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.,* commercial fisheries, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value or range. A CV associated with estimated mortality due to commercial fisheries is presented in some cases.

[5] Model-predicted stock abundance for Atlantic spotted dolphins and bottlenose dolphins from the most recent GOM density models (Garrison et al., 2023). Stock abundance for rough-toothed dolphins was taken from Roberts et al. (2016) density models, as Garrison et al. (2023) did not create a model for this species.

[6] M/SI is a minimum count and does not include projected mortality estimates for 2015–2019 due to the DWH oil spill.

[7] This estimate includes both coastal and continental shelf bottlenose dolphins from other stocks.

As indicated above, all three species (with four 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 GOM are unlikely to be observed during this survey where the maximum water depth is 30 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 GOM (Würsig *et al.,* 2000; Würsig 2017). While there are multiple stocks of bottlenose dolphins in the GOM, only the Northern GOM Continental Shelf and GOM 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. Five sightings totaling 12 animals were made during a UT geophysical survey on the Texas shelf during March 2024, which is within the proposed study area. All sightings were made in water <20 m deep (RPS 2024).

There are 31 bay, sound, and estuary (BSE) stocks in the northern GOM, 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. 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 (LeBrecque *et al.,* 2015). Due to the distance that the survey will occur off the coast (between 1 and 115 km) and general expectation that BSE dolphins are most likely to occur in inshore waters and around passes into 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.*). On October 24, 2024, NMFS published (89 FR 84872) the final Updated Technical Guidance, which includes updated thresholds and weighting functions to inform auditory injury estimates, and has replaced the 2018 Technical Guidance used previously (NMFS 2018). The updated hearing groups are presented below (table 2). The references, analysis, and methodology used in the development

of the hearing groups are described in NMFS' 2024 Technical Guidance, which may be accessed at: *https://www.fisheries.noaa.gov/national/* *marine-mammal-protection/marine-mammal-acoustic-technical-guidance.*

TABLE 2—MARINE MAMMAL HEARING GROUPS

[NMFS, 2024]

Hearing group^	Generalized hearing range*
Underwater:	
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 36* kHz.+
High-frequency (HF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz.
Very High-frequency (VHF) cetaceans (true porpoises, *Kogia,* river dolphins, Cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*).	200 Hz to 165 kHz.
Phocid pinnipeds (PW) (underwater) (true seals)	40 Hz to 90 kHz.
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 68 kHz.

^Southall *et al.,* 2019 indicates that as more data become available there may be separate hearing group designations for Very Low-Frequency cetaceans (blue, fin, right, and bowhead whales) and Mid-Frequency cetaceans (sperm, killer, and beaked whales). However, at this point, all baleen whales are part of the LF cetacean hearing group, and sperm, killer, and beaked whales are part of the HF cetacean hearing group. Additionally, recent data indicates that as more data become available for Monachinae seals, separate hearing group designations may be appropriate for the two phocid subfamilies (Ruscher *et al.,* 2021; Sills *et al.,* 2021).

*Represents the generalized hearing range for the entire group as a composite (*i.e.,* all species within the group), where individual species' hearing ranges may not be as broad. Generalized hearing range chosen based on ~65 dB threshold from composite audiogram, previous analysis in NMFS 2018, and/or data from Southall *et al.,* 2007; Southall *et al.,* 2019. Additionally, animals are able to detect very loud sounds above and below that "generalized" hearing range.

+NMFS is aware that the National Marine Mammal Foundation successfully collected preliminary hearing data on two minke whales during their third field season (2023) in Norway. These data have implications for not only the generalized hearing range for low-frequency cetaceans but also on their weighting function. However, at this time, no official results have been published. Furthermore, a fourth field season (2024) is proposed, where more data will likely be collected. Thus, it is premature for us to propose any changes to our current Updated Technical Guidance. However, mysticete hearing data is identified as a special circumstance that could merit re-evaluating the acoustic criteria in this document. Therefore, we anticipate that once the data from both field seasons are published, it will likely necessitate updating this document (*i.e.,* likely after the data gathered in the summer 2024 field season and associated analysis are published).

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 1 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 (µPa)) 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 µPa) while the received level is the SPL at the listener's position (referenced to 1 µPa).

Root mean square (RMS) is the quadratic mean sound pressure over the duration of an impulse. Root mean square is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick, 1983). Root mean square accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels (Hastings and Popper, 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units than by peak pressures.

Sound exposure level (SEL; represented as dB re 1 µPa^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 array 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 anthropogenic 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. 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.,* NMFS, 2018; 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 1 second), broadband, atonal transients (American National Standards Institute (ANSI), 1986, 2005; Harris, 1998; National Institute for Occupational Health and Safety (NIOSH), 1998; International Organization for Standardization (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 [1]—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

---

[1] Please refer to the information given previously (''Description of Active Acoustic Sound Sources'') regarding sound, characteristics of sound types, and metrics used in this document.

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.

Auditory Injury (AUD INJ) and Permanent Threshold Shift (PTS)— NMFS defines auditory injury as "damage to the inner ear that can result

in destruction of tissue . . . which may or may not result in PTS'' (NMFS, 2024). NMFS defines PTS as a permanent, irreversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level (NMFS, 2024). PTS does not generally affect more than a limited frequency range, and an animal that has PTS has incurred some level of hearing loss at the relevant frequencies; typically, animals with PTS are not functionally deaf (Au and Hastings, 2008; Finneran, 2016). Available data from humans and other terrestrial mammals indicate that a 40-dB threshold shift approximates PTS onset (see Ward *et al.,* 1958, 1959, 1960; Kryter *et al.,* 1966; Miller, 1974; Ahroon *et al.,* 1996; Henderson *et al.,* 2008). PTS levels for marine mammals are estimates, as with the exception of a single study unintentionally inducing PTS in a harbor seal (Kastak *et al.,* 2008), there are no empirical data measuring PTS in marine mammals largely due to the fact that, for various ethical reasons, experiments involving anthropogenic noise exposure at levels inducing PTS are not typically pursued or authorized (NMFS, 2018).

Temporary Threshold Shift (TTS). A temporary, reversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level (NMFS, 2018). Based on data from marine mammal TTS measurements (see Southall *et al.,* 2007, 2019), a TTS of 6 dB is considered the minimum threshold shift clearly larger than any day-to-day or session-to-session variation in a subject's normal hearing ability (Finneran *et al.,* 2000, 2002; Schlundt *et al.,* 2000). As described in Finneran (2015), marine mammal studies have shown the amount of TTS increases with SEL$_{cum}$ in an accelerating fashion: at low exposures with lower SEL$_{cum,}$ the amount of TTS is typically small and the growth curves have shallow slopes. At exposures with higher SEL$_{cum}$, the growth curves become steeper and approach linear relationships with the noise SEL.

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 (similar to those discussed in auditory masking, below). 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 takes place during

a time when the animal is traveling through the open ocean, 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/calf interactions could have more serious impacts. We note that reduced hearing sensitivity as a simple function of aging has been observed in marine mammals, as well as humans and other taxa (Southall *et al.,* 2007), so we can infer that strategies exist for coping with this condition to some degree, though likely not without cost.

Many studies have examined noise-induced hearing loss in marine mammals (see Finneran (2015) and Southall *et al.* (2019) for summaries). TTS is the mildest form of hearing impairment that can occur during exposure to sound (Kryter, 2013). 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. For cetaceans, published data on the onset of TTS are limited to captive bottlenose dolphin (*Tursiops truncatus*), beluga whale, harbor porpoise, and Yangtze finless porpoise (*Neophocoena asiaeorientalis*) (Southall *et al.,* 2019). These studies examine hearing thresholds measured in marine mammals before and after exposure to intense or long-duration sound exposures. The difference between the pre-exposure and post-exposure thresholds can be used to determine the amount of threshold shift at various post-exposure times.

The amount and onset of TTS depends on the exposure frequency. Sounds at low frequencies, well below the region of best sensitivity for a species or hearing group, are less hazardous than those at higher frequencies, near the region of best sensitivity (Finneran and Schlundt, 2013). At low frequencies, onset-TTS exposure levels are higher compared to those in the region of best sensitivity (*i.e.,* a low frequency noise would need to be louder to cause TTS onset when TTS exposure level is higher), as shown for harbor porpoises and harbor seals (Kastelein *et al.,* 2019a, 2019c). Note that in general, harbor seals and harbor porpoises have a lower TTS onset than other measured pinniped or cetacean species (Finneran, 2015). In addition, TTS can accumulate across multiple exposures, but the resulting TTS will be

less than the TTS from a single, continuous exposure with the same SEL (Mooney *et al.,* 2009; Finneran *et al.,* 2010; Kastelein *et al.,* 2014, 2015). This means that TTS predictions based on the total, cumulative SEL will overestimate the amount of TTS from intermittent exposures, such as sonars and impulsive sources. Nachtigall *et al.* (2018) describe measurements of hearing sensitivity of multiple odontocete species (bottlenose dolphin, harbor porpoise, beluga, and false killer whale (*Pseudorca crassidens*)) when a relatively loud sound was preceded by a warning sound. These captive animals were shown to reduce hearing sensitivity when warned of an impending intense sound. Based on these experimental observations of captive animals, the authors suggest that wild animals may dampen their hearing during prolonged exposures or if conditioned to anticipate intense sounds. Another study showed that echolocating animals (including odontocetes) might have anatomical specializations that might allow for conditioned hearing reduction and filtering of low-frequency ambient noise, including increased stiffness and control of middle ear structures and placement of inner ear structures (Ketten *et al.,* 2021). Data available on noise-induced hearing loss for mysticetes are currently lacking (NMFS, 2018). Additionally, the existing marine mammal TTS data come from a limited number of individuals within these species.

Relationships between TTS and PTS thresholds have not been studied in marine mammals, and there is no PTS data for cetaceans. However, such relationships are assumed to be similar to those in humans and other terrestrial mammals. PTS typically occurs at exposure levels at least several dB above that inducing mild TTS (*e.g.,* a 40-dB threshold shift approximates PTS onset (Kryter *et al.,* 1966; Miller, 1974), while a 6-dB threshold shift approximates TTS onset (Southall *et al.,* 2007, 2019). Based on data from terrestrial mammals, a precautionary assumption is that the PTS thresholds for impulsive sounds (such as impact pile driving 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, 2019). 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.

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 shown 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 briefly reacts to 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). 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 affect 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.

Visual tracking, passive acoustic monitoring (PAM), and movement recording tags were used to quantify sperm whale behavior prior to, during, and following exposure to airgun arrays at received levels in the range 140–160 dB at distances of 7–13 km, following a phase-in of sound intensity and full array exposures at 1–13 km (Madsen *et al.,* 2006; Miller *et al.,* 2009). Sperm whales did not exhibit horizontal avoidance behavior at the surface. However, foraging behavior may have been affected. The sperm whales exhibited 19 percent less vocal, or buzz, rate during full exposure relative to post exposure, and the whale that was approached most closely had an extended resting period and did not resume foraging until the airguns had ceased firing. The remaining whales continued to execute foraging dives throughout exposure; however, swimming movements during foraging dives were 6 percent lower during exposure than control periods (Miller *et al.,* 2009). These data raise concerns that seismic surveys may impact foraging behavior in sperm whales, although more data are required to understand whether the differences were due to exposure or natural variation in sperm whale behavior (Miller *et al.,* 2009).

Changes 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. For example, in the presence of potentially masking signals, humpback whales and killer whales have been observed to increase the length of their songs or amplitude of calls (Miller *et al.,* 2000; Fristrup *et al.,* 2003; Foote *et al.,* 2004; Holt *et al.,* 2012), while right whales have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.,* 2007). In some cases, animals may cease sound production during production of aversive signals (Bowles *et al.,* 1994).

Cerchio *et al.* (2014) used PAM to document the presence of singing humpback whales off the coast of northern Angola and to opportunistically test for the effect of seismic survey activity on the number of singing whales. Two recording units were deployed between March and December 2008 in the offshore environment; numbers of singers were counted every hour. Generalized Additive Mixed Models were used to assess the effect of survey day (seasonality), hour (diel variation), moon phase, and received levels of noise (measured from a single pulse during each 10 minutes sampled period) on singer number. The number of singers significantly decreased with increasing received level of noise, suggesting that humpback whale communication was disrupted to some extent by the survey activity.

Castellote *et al.* (2012) reported acoustic and behavioral changes by fin whales in response to shipping and airgun noise. Acoustic features of fin whale song notes recorded in the Mediterranean Sea and northeast Atlantic Ocean were compared for areas with different shipping noise levels and traffic intensities and during a seismic airgun survey. During the first 72 hours of the survey, a steady decrease in song received levels and bearings to singers indicated that whales moved away from the acoustic source and out of the study area. This displacement persisted for a time period well beyond the 10-day duration of seismic airgun activity, providing evidence that fin whales may avoid an area for an extended period in the presence of increased noise. The authors hypothesize that fin whale acoustic communication is modified to compensate for increased background noise and that a sensitization process may play a role in the observed temporary displacement.

Seismic pulses at average received levels of 131 dB re 1 μPa^2-s caused blue whales to increase call production (Di Iorio and Clark, 2010). In contrast, McDonald *et al.* (1995) tracked a blue whale with seafloor seismometers and reported that it stopped vocalizing and changed its travel direction at a range of 10 km from the acoustic source vessel (estimated received level 143 dB pk-pk). Blackwell *et al.,* (2013) found that bowhead whale call rates dropped significantly at onset of airgun use at sites with a median distance of 41–45 km from the survey. Blackwell *et al.* (2015) expanded this analysis to show that whales actually increased calling rates as soon as airgun signals were detectable before ultimately decreasing calling rates at higher received levels (*i.e.,* 10-minute cumulative sound exposure level (SEL$_{cum)}$ of ~127 dB). Overall, these results suggest that bowhead whales may adjust their vocal output in an effort to compensate for noise before ceasing vocalization effort and ultimately deflecting from the acoustic source (Blackwell *et al.,* 2013, 2015). These studies demonstrate that even low levels of noise received far from the source can induce changes in vocalization and/or behavior for mysticetes.

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). For example, gray whales are known to change direction—deflecting from customary migratory paths—in order to avoid noise from seismic surveys (Malme *et al.,* 1984). Humpback whales show avoidance behavior in the presence of an active seismic array during observational studies and controlled exposure experiments in western Australia (McCauley *et al.,* 2000). 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).

Forney *et al.* (2017) detail the potential effects of noise on marine mammal populations with high site fidelity, including displacement and auditory masking, noting that a lack of observed response does not imply absence of fitness costs and that

apparent tolerance of disturbance may have population-level impacts that are less obvious and difficult to document. Avoidance of overlap between disturbing noise and areas and/or times of particular importance for sensitive species may be critical to avoiding population-level impacts because (particularly for animals with high site fidelity) there may be a strong motivation to remain in the area despite negative impacts. Forney *et al.,* (2017) state that, for these animals, remaining in a disturbed area may reflect a lack of alternatives rather than a lack of effects.

Forney *et al.* (2017) specifically discuss beaked whales, stating that until recently most knowledge of beaked whales was derived from strandings, as they have been involved in atypical mass stranding events associated with mid-frequency active sonar (MFAS) training operations. Given these observations and recent research, beaked whales appear to be particularly sensitive and vulnerable to certain types of acoustic disturbance relative to most other marine mammal species. Individual beaked whales reacted strongly to experiments using simulated MFAS at low received levels, by moving away from the sound source and stopping foraging for extended periods. These responses, if on a frequent basis, could result in significant fitness costs to individuals (Forney *et al.,* 2017). Additionally, difficulty in detection of beaked whales due to their cryptic surfacing behavior and silence when near the surface pose problems for mitigation measures employed to protect beaked whales. Forney *et al.,* (2017) specifically states that failure to consider both displacement of beaked whales from their habitat and noise exposure could lead to more severe biological consequences.

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 5-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 1 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 in³ or more in that study) were firing, lateral displacement, more localized avoidance, or other changes in behavior were evident for most odontocetes. However, significant responses to large arrays were found only for the minke whale and fin whale. Behavioral responses observed included changes in swimming or surfacing behavior, with indications that cetaceans remained near the water surface at these times. Cetaceans were recorded as feeding less often when large arrays were active. Behavioral observations of gray whales during a seismic survey monitored whale movements and respirations pre-, during, and post-seismic survey (Gailey *et al.,* 2016). Behavioral state and water depth were the best "natural" predictors of whale movements and respiration and, after considering natural variation, none of the response variables were significantly associated with seismic survey or vessel sounds.

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). For example, Rolland *et al.,* (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. These and other studies lead to a reasonable expectation that some marine mammals will experience physiological stress responses upon exposure to acoustic stressors and that it is possible that some of these would be classified as ''distress.'' In addition, any animal experiencing TTS would likely also experience stress responses (NRC, 2003).

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 TS) 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 detection of mysticete communication calls and other potentially important natural sounds such as those produced by surf and some prey species. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (*e.g.,* Clark *et al.,* 2009) 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. Based on measurements in deep water of the Southern Ocean, Gedamke (2011) estimated that the slight elevation of background noise levels during intervals between seismic pulses reduced blue and fin whale communication space by as much as 36–51 percent when a seismic survey was operating 450–2,800 km away. Based on preliminary modeling, Wittekind *et al.,* (2016) reported that airgun sounds could reduce the communication range of blue and fin whales 2,000 km from the seismic source. Nieukirk *et al.,* (2012) and Blackwell *et al.,* (2013) noted the potential for masking effects from seismic surveys on large whales.

Some baleen and toothed whales are known to continue calling in the presence of seismic pulses, and their calls usually can be heard between the pulses (*e.g.,* Nieukirk *et al.,* 2012; Thode *et al.,* 2012; Bröker *et al.,* 2013; Sciacca *et al.,* 2016). Cerchio *et al.,* (2014) suggested that the breeding display of humpback whales off Angola could be disrupted by seismic sounds, as singing activity declined with increasing received levels. In addition, some cetaceans are known to change their calling rates, shift their peak frequencies, or otherwise modify their vocal behavior in response to airgun sounds (*e.g.,* Di Iorio and Clark 2010; Castellote *et al.,* 2012; Blackwell *et al.,* 2013, 2015). The hearing systems of baleen whales are more sensitive to low-frequency sounds than are the ears of the small odontocetes that have been studied directly (*e.g.,* MacGillivray *et al.,* 2014). 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 mammals 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. 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).

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.

Baleen whales are thought to be more sensitive to sound at these low frequencies than are toothed whales (*e.g.,* MacGillivray *et al.,* 2014), possibly causing localized avoidance of the proposed survey area during seismic operations. 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). Pirotta *et al.,* (2015) noted that the physical presence of vessels, not just ship noise, disturbed the foraging activity of bottlenose dolphins. There is little data on the behavioral reactions of beaked whales to vessel noise, though they seem to avoid approaching vessels (*e.g.,* Würsig *et al.,* 1998) or dive for an extended period when approached by a vessel (*e.g.,* Kasuya, 1986).

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 knots (kn; 26 kilometers per hour (kph)), and exceeded 90 percent at 17 kn (31 kph). 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 (28 kph). The chances of a lethal injury decline from approximately 80 percent at 15 kn (28 kph) to approximately 20 percent at 8.6 kn (16 kph). At speeds below 11.8 kn (22 kph), the chances of lethal injury drop below 50 percent, while the probability asymptotically increases toward 100 percent above 15 kn (28 kph).

The McCall will travel at a speed of 4–5 kn (7–9 kph) 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 to 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 kph)) 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 percent confidence interval = 0–5.5 $\times 10^{-6}$; NMFS, 2013). 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.

Stranding—When a living or dead marine mammal swims or floats onto shore and becomes "beached" or incapable of returning to sea, the event is a "stranding" (Geraci *et al.,* 1999; Perrin and Geraci, 2002; Geraci and Lounsbury, 2005; NMFS, 2007). The legal definition for a stranding under the MMPA is that a marine mammal is dead and is on a beach or shore of the United States; or in waters under the jurisdiction of the United States (including any navigable waters); or a marine mammal is alive and is on a beach or shore of the United States and is unable to return to the water; on a beach or shore of the United States and, although able to return to the water, is in need of apparent medical attention; or in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance.

Marine mammals strand for a variety of reasons, such as infectious agents, biotoxicosis, starvation, fishery interaction, vessel strike, unusual oceanographic or weather events, sound exposure, or combinations of these stressors sustained concurrently or in series. However, the cause or causes of most strandings are unknown (Geraci *et al.,* 1976; Eaton, 1979; Odell *et al.,* 1980; Best, 1982). Numerous studies suggest that the physiology, behavior, habitat relationships, age, or condition of cetaceans may cause them to strand or might predispose them to strand when exposed to another phenomenon. These suggestions are consistent with the conclusions of numerous other studies that have demonstrated that combinations of dissimilar stressors commonly combine to kill an animal or dramatically reduce its fitness, even though one exposure without the other does not produce the same result (Chroussos, 2000; Creel, 2005; DeVries

et al., 2003; Fair and Becker, 2000; Foley *et al.,* 2001; Moberg, 2000; Relyea, 2005a; 2005b, Romero, 2004; Sih *et al.,* 2004).

There is no conclusive evidence that exposure to airgun noise results in behaviorally-mediated forms of injury. Behaviorally-mediated injury (*i.e.,* mass stranding events) has been primarily associated with beaked whales exposed to mid-frequency active (MFA) naval sonar. MFA sonar and the alerting stimulus used in Nowacek *et al.,* (2004) are very different from the noise produced by airguns. One should therefore not expect the same reaction to airgun noise as to these other sources.

It is important to distinguish between energy (loudness, measured in dB) and frequency (pitch, measured in Hz). In considering the potential impacts of mid-frequency components of airgun noise (1–10 kHz, where beaked whales can be expected to hear) on marine mammal hearing, one needs to account for the energy associated with these higher frequencies and determine what energy is truly "significant." Although there is mid-frequency energy associated with airgun noise (as expected from a broadband source), airgun sound is predominantly below 1 kHz (Breitzke *et al.,* 2008; Tashmukhambetov *et al.,* 2008; Tolstoy *et al.,* 2009). As stated by Richardson *et al.,* (1995), "[. . .] most emitted [seismic airgun] energy is at 10–120 Hz, but the pulses contain some energy up to 500–1,000 Hz." Tolstoy *et al.,* (2009) conducted empirical measurements, demonstrating that sound energy levels associated with airguns were at least 20 dB lower at 1 kHz (considered "mid-frequency") compared to higher energy levels associated with lower frequencies (below 300 Hz) ("all but a small fraction of the total energy being concentrated in the 10–300 Hz range" [Tolstoy *et al.,* 2009]), and at higher frequencies (*e.g.,* 2.6–4 kHz), power might be less than 10 percent of the peak power at 10 Hz (Yoder, 2002). Energy levels measured by Tolstoy *et al.,* (2009) were even lower at frequencies above 1 kHz. In addition, as sound propagates away from the source, it tends to lose higher-frequency components faster than low-frequency components (*i.e.,* low-frequency sounds typically propagate longer distances than high-frequency sounds) (Diebold *et al.,* 2010). Although higher-frequency components of airgun signals have been recorded, it is typically in surface-ducting conditions (*e.g.,* DeRuiter *et al.,* 2006; Madsen *et al.,* 2006) or in shallow water, where there are advantageous propagation conditions for the higher frequency (but low-energy) components of the airgun signal (Hermannsen *et al.,*

2015). This should not be of concern because the likely behavioral reactions of beaked whales that can result in acute physical injury would result from noise exposure at depth (because of the potentially greater consequences of severe behavioral reactions). In summary, the frequency content of airgun signals is such that beaked whales will not be able to hear the signals well (compared to MFA sonar), especially at depth where we expect the consequences of noise exposure could be more severe.

Aside from frequency content, there are other significant differences between MFA sonar signals and the sounds produced by airguns that minimize the risk of severe behavioral reactions that could lead to strandings or deaths at sea, *e.g.,* significantly longer signal duration, horizontal sound direction, typical fast and unpredictable source movement. All of these characteristics of MFA sonar tend towards greater potential to cause severe behavioral or physiological reactions in exposed beaked whales that may contribute to stranding. Although both sources are powerful, MFA sonar contains significantly greater energy in the mid-frequency range, where beaked whales hear better. Short-duration, high energy pulses—such as those produced by airguns—have greater potential to cause damage to auditory structures (though this is unlikely for high-frequency cetaceans, as explained later in this document), but it is longer duration signals that have been implicated in the vast majority of beaked whale strandings. Faster, less predictable movements in combination with multiple source vessels are more likely to elicit a severe, potentially anti-predator response. Of additional interest in assessing the divergent characteristics of MFA sonar and airgun signals and their relative potential to cause stranding events or deaths at sea is the similarity between the MFA sonar signals and stereotyped calls of beaked whales' primary predator: the killer whale (Zimmer and Tyack, 2007). Although generic disturbance stimuli—as airgun noise may be considered in this case for beaked whales—may also trigger antipredator responses, stronger responses should generally be expected when perceived risk is greater, as when the stimulus is confused for a known predator (Frid and Dill, 2002). In addition, because the source of the perceived predator (*i.e.,* MFA sonar) will likely be closer to the whales (because attenuation limits the range of detection of mid-frequencies) and moving faster (because it will be on faster-moving vessels), any antipredator

response would be more likely to be severe (with greater perceived predation risk, an animal is more likely to disregard the cost of the response; Frid and Dill, 2002). Indeed, when analyzing movements of a beaked whale exposed to playback of killer whale predation calls, Allen *et al.,* (2014) found that the whale engaged in a prolonged, directed avoidance response, suggesting a behavioral reaction that could pose a risk factor for stranding. Overall, these significant differences between sound from MFA sonar and the mid-frequency sound component from airguns and the likelihood that MFA sonar signals will be interpreted in error as a predator are critical to understanding the likely risk of behaviorally-mediated injury due to seismic surveys.

The available scientific literature also provides a useful contrast between airgun noise and MFA sonar regarding the likely risk of behaviorally-mediated injury. There is strong evidence for the association of beaked whale stranding events with MFA sonar use, and particularly detailed accounting of several events is available (*e.g.,* a 2000 Bahamas stranding event for which investigators concluded that MFA sonar use was responsible; Evans and England, 2001). D'Amico *et al.,* (2009) reviewed 126 beaked whale mass stranding events over the period from 1950 (*i.e.,* from the development of modern MFA sonar systems) through 2004. Of these, there were two events where detailed information was available on both the timing and location of the stranding and the concurrent nearby naval activity, including verification of active MFA sonar usage, with no evidence for an alternative cause of stranding. An additional 10 events were at minimum spatially and temporally coincident with naval activity likely to have included MFA sonar use and, despite incomplete knowledge of timing and location of the stranding or the naval activity in some cases, there was no evidence for an alternative cause of stranding. The U.S. Navy has publicly stated agreement that five such events since 1996 were associated in time and space with MFA sonar use, either by the U.S. Navy alone or in joint training exercises with the North Atlantic Treaty Organization. The U.S. Navy additionally noted that, as of 2017, a 2014 beaked whale stranding event in Crete coincident with naval exercises was under review and had not yet been determined to be linked to sonar activities (U.S. Navy, 2017). Separately, the International Council for the Exploration of the Sea reported in 2005

that, worldwide, there have been about 50 known strandings, consisting mostly of beaked whales, with a potential causal link to MFA sonar (ICES, 2005). In contrast, very few such associations have been made to seismic surveys, despite widespread use of airguns as a geophysical sound source in numerous locations around the world.

A review of possible stranding associations with seismic surveys (Castellote and Llorens, 2016) states that, "[s]peculation concerning possible links between seismic survey noise and cetacean strandings is available for a dozen events but without convincing causal evidence." The authors' search of available information found 10 events worth further investigation via a ranking system representing a rough metric of the relative level of confidence offered by the data for inferences about the possible role of the seismic survey in a given stranding event. Only three of these events involved beaked whales. Whereas D'Amico *et al.,* (2009) used a 1–5 ranking system, in which "1" represented the most robust evidence connecting the event to MFA sonar use, Castellote and Llorens (2016) used a 1–6 ranking system, in which "6" represented the most robust evidence connecting the event to the seismic survey. As described above, D'Amico *et al.,* (2009) found that 2 events were ranked "1" and 10 events were ranked "2" (*i.e.,* 12 beaked whale stranding events were found to be associated with MFA sonar use). In contrast, Castellote and Llorens (2016) found that none of the three beaked whale stranding events achieved their highest ranks of 5 or 6. Of the 10 total events, none achieved the highest rank of 6. Two events were ranked as 5: one stranding in Peru involving dolphins and porpoises and a 2008 stranding in Madagascar. This latter ranking can only be broadly associated with the survey itself, as opposed to use of seismic airguns. An investigation of this stranding event, which did not involve beaked whales, concluded that use of a high-frequency mapping system (12-kHz multibeam echosounder) was the most plausible and likely initial behavioral trigger of the event, which was likely exacerbated by several site- and situation-specific secondary factors. The review panel found that seismic airguns were used after the initial strandings and animals entering a lagoon system, that airgun use clearly had no role as an initial trigger, and that there was no evidence that airgun use dissuaded animals from leaving (Southall *et al.,* 2013).

However, one of these stranding events, involving two Cuvier's beaked whales, was contemporaneous with and

reasonably associated spatially with a 2002 seismic survey in the Gulf of California conducted by Lamont-Doherty Earth Observatory (L–DEO), as was the case for the 2007 Gulf of Cadiz seismic survey discussed by Castellote and Llorens (also involving two Cuvier's beaked whales). Neither event was considered a "true atypical mass stranding" (according to Frantzis (1998)) as used in the analysis of Castellote and Llorens (2016). While we agree with the authors that this lack of evidence should not be considered conclusive, it is clear that there is very little evidence that seismic surveys should be considered as posing a significant risk of acute harm to beaked whales or other high frequency cetaceans. We have considered the potential for the proposed surveys to result in marine mammal stranding and, based on the best available information, do not expect a stranding to occur.

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. 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 5 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).

SPLs 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.,* (2012) 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 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.

Available data suggest that cephalopods are capable of sensing the particle motion of sounds and detect low frequencies up to 1–1.5 kHz, depending on the species, and so are likely to detect airgun noise (Kaifu *et al.,* 2008; Hu *et al.,* 2009; Mooney *et al.,* 2010; Samson *et al.,* 2014). Auditory injuries (lesions occurring on the statocyst sensory hair cells) have been reported upon controlled exposure to low-frequency sounds, suggesting that cephalopods are particularly sensitive to low-frequency sound (Andre *et al.,* 2011; Sole *et al.,* 2013). Behavioral responses, such as inking and jetting, have also been reported upon exposure to low-frequency sound (McCauley *et al.,* 2000b; Samson *et al.,* 2014). Similar to fish, however, the transient nature of the survey leads to an expectation that effects will be largely limited to behavioral reactions and would occur as a result of brief, infrequent exposures.

A 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 generally 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 NMFS' consideration of "small numbers," the negligible impact determinations, and impacts on subsistence uses.

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, *i.e.,* use of a low energy 2-airgun array, auditory injury (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 likely 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 auditory injury 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 (referenced to 1 micropascal (re 1 µPa)) for continuous (*e.g.,* vibratory pile driving, drilling) and above RMS SPL 160 dB re 1 µPa for non-explosive impulsive (*e.g.,* seismic airguns) or intermittent (*e.g.,* scientific sonar) sources. 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-airguns) and therefore, the 160 dB re 1 µPa (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 seismic sources (*i.e.* airguns).

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

TABLE 3—NMFS' 2018 [1] THRESHOLDS IDENTIFYING THE ONSET OF PERMANENT THRESHOLD SHIFT
[PTS]

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

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

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

[1] UT previously used modeling based on NMFS' 2018 technical guidance in order to calculate their isopleths. Based on the outcome of these comparisons/analyses using the Updated 2024 Technical Guidance, the low-frequency cetacean isopleth is slightly higher using the updated guidance, and the high-frequency cetacean and very-high frequency cetacean are the same as those calculated using the 2018 Technical Guidance. Therefore, the isopleths based on the 2018 Technical Guidance will be used as the basis for take numbers and mitigation zones for this IHA.

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.

When the Technical Guidance was initially published (NMFS, 2016), in recognition of the fact that ensonified area/volume could be more technically challenging to predict because of the duration component in the new thresholds, we developed a user spreadsheet that includes tools to help predict a simple isopleth that can be used in conjunction with marine mammal density or occurrence to help predict takes. We note that because of some of the assumptions included in the methods used for these tools, we anticipate that isopleths produced are typically going to be overestimates of some degree, which may result in some degree of overestimation of Level A

harassment take. However, these tools offer the best way to predict appropriate isopleths when more sophisticated 3D modeling methods are not available, and NMFS continues to develop ways to quantitatively refine these tools and will qualitatively address the output where appropriate.

The proposed survey would entail the use up to two 105 in³ airguns with a maximum total discharge of 210 in³ at a tow depth of 3–4 m. UT used modeling by Lamont-Doherty Earth Observatory (L–DEO), which determines the 160 dB$_{rms}$ radius for the airgun source down to a maximum depth of 2,000 m. Received sound levels have been predicted by L–DEO's model (Diebold *et al.,* 2010) as a function of distance from the 2-airgun array. 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 homogeneous ocean layer, unbounded by a seafloor).

The proposed low-energy survey would acquire data with up to two 105-in³ GI guns, towed in-line, at a depth of 3–4 m. The shallow-water radii are obtained by scaling the empirically derived measurements from the GOM calibration survey to account for the differences in volume and tow depth between the calibration survey (6,600 in³ at 6 m tow depth) and the proposed survey (210 in³ 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 4.

TABLE 4—PREDICTED RADIAL DISTANCES FROM THE R/V MCCALL SEISMIC SOURCE TO ISOPLETH CORRESPONDING TO LEVEL B HARASSMENT THRESHOLD

Airgun configuration	Max tow depth (m)	Water depth (m)	Predicted distances (in m) to the Level B harassment threshold
2 105-in³ airguns	4	<100	1,750

TABLE 5—MODELED RADIAL DISTANCE TO ISOPLETHS CORRESPONDING TO LEVEL A HARASSMENT THRESHOLDS

[NMFS 2018]

	High frequency cetaceans
PTS SEL$_{cum}$	0
PTS Peak	*1.5

*The largest distance of the dual criteria (SEL$_{cum}$ or Peak) was used to estimate threshold distances and potential takes by Level A harassment.

Table 5 presents the modeled Level A harassment isopleths for the high-frequency cetacean hearing group based on L–DEO modeling incorporated in the companion user spreadsheet, for the low-energy surveys with the shortest shot interval (*i.e.,* greatest potential to cause auditory injury or PTS based on accumulated sound energy) (NMFS 2018). Although NMFS' 2024 Updated Technical Guidance was finalized on October 24, 2024 (89 FR 84872), there was no meaningful change in the auditory injury (Level A harassment) isopleths, so the values based on the 2018 guidance was used here.

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 contained in the NMFS Technical Guidance were presented as dual metric acoustic thresholds using both SEL$_{cum}$ and peak sound pressure metrics (NMFS, 2024). As dual metrics, NMFS considers onset of PTS (Level A harassment) to have occurred when either one of the two metrics is exceeded (*i.e.,* metric resulting in the largest isopleth). The SEL$_{cum}$ metric considers both level and duration of exposure, as well as auditory weighting functions by marine mammal hearing group.

The SEL$_{cum}$ for the 2-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 large array effect near the source and is calculated as a point source, the farfield signature is not an appropriate measure of the sound source level for large arrays. See UT's application for further detail on acoustic modeling.

Auditory injury is unlikely to occur for high-frequency cetaceans, given the very small modeled zones of injury for those species (all estimated zones are less than 10 m for high-frequency cetaceans), in the context of distributed source dynamics.

In consideration of the received sound levels in the near-field as described above, we expect the potential for Level A harassment of high-frequency cetaceans to be de minimis, even before the likely moderating effects of aversion and/or other compensatory behaviors (*e.g.,* Nachtigall *et al.,* 2018) are considered. We do not anticipate that Level A harassment is a likely outcome for any high-frequency cetacean and do not propose to authorize any take by Level A harassment for these species.

The Level A and Level B harassment estimates are based on a consideration of the number of marine mammals that could be within the area around the operating airgun array where received levels of sound ≥160 dB re 1 µPa rms are predicted to occur. The estimated numbers are based on the densities (numbers per unit area) of marine mammals expected to occur in the area in the absence of seismic surveys. To the extent that marine mammals tend to move away from seismic sources before the sound level reaches the criterion level and tend not to approach an operating airgun array, these estimates likely overestimate the numbers actually exposed to the specified level of sound.

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 NW GOM, 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.,* (2023). The Garrison *et al.,* (2023) data provides abundance estimates for marine mammal species in the GOM within 40 km^2 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 calculated the mean of the predicted densities from the cells within the combined survey area (primary and alternate survey area) for each species and month. The highest mean monthly density was chosen for each species from the months of January to April (*i.e.,* the months within which the survey is expected to occur).

Rough-toothed dolphins were not modeled by Garrison *et al.,* (2023) 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 GOM. The combined survey area 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 6.

TABLE 6—MARINE MAMMAL DENSITIES AND TOTAL ENSONIFIED AREA OF ACTIVITIES IN THE PROPOSED SURVEY AREA

Species	Estimated density (#/km^2)	Level B ensonified area (km^2)
Atlantic spotted dolphin	[b] 0.0043	1,522
Bottlenose dolphin [a]	[b] 0.8596	1,522
Rough-toothed dolphin	[c] 0.0037	1,522

[a] Bottlenose dolphin density estimate does not differentiate between coastal and shelf stocks.

[b] Density calculated from Garrison *et al.,* (2023).

[c] 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 (20 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 7.

TABLE 7—ESTIMATED TAKE PROPOSED FOR AUTHORIZATION

Common name	Stock	Estimated Level B take	Proposed authorized Level B take	Stock abundance [1]	Percent of stock
Atlantic spotted dolphin	GOM	7	[2] 26	21,506	0.12
Bottlenose dolphin [3]	GOM Western Coastal	1,309	1,309	20,759	6.31
	Northern GOM Continental Shelf			63,280	2.07
Rough-toothed dolphin	GOM	6	[2] 14	4,853	0.29

[1] Stock abundance for Atlantic spotted dolphins and bottlenose dolphins was taken from Garrison *et al.,* (2023). Stock abundance for rough-toothed dolphins was taken from Roberts *et al.,* (2016), as Garrison *et al.,* (2023) did not create a model for this species.
[2] Proposed take increased to mean group size from Maze-Foley and Mullin (2006).
[3] 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.

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 4). 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 1 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 (sometimes referred to as ''soft start'') means the gradual and systematic increase of emitted sound levels from an airgun array. The intent of pre-start 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 the ramp-up is to warn marine mammals of pending seismic survey operations and to allow sufficient time for those animals to leave the immediate vicinity prior to the sound source reaching full intensity. A ramp-up procedure, involving a stepwise increase in the number of airguns firing and total array volume until all operational airguns are activated and the full volume is achieved, is required at all times as part of the activation of the airgun array. All operators must adhere to the following pre-start clearance and ramp-up requirements:

• 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 delphinids and 30 minutes for all other species).

• Ramp-up must begin by activating one GI airgun for no less than 5 minutes and then activating the second airgun. The operator must provide information to the PSO documenting that appropriate procedures were followed.

• 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.

• 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 of an airgun array requires the immediate de-activation of all individual airgun elements of the array. Any PSO on duty will have the authority to call for shutdown of the airgun array. The operator must also establish and maintain clear lines of communication directly between PSOs on duty and crew controlling the airgun array to ensure that shutdown commands are conveyed swiftly while allowing PSOs to maintain watch. 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, Stenella, 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. UT must implement shutdown if a marine mammal species for which take was not authorized or a species for which authorization was granted but the authorized takes have been met approaches the Level B harassment zone.

We include this small dolphin exception because shutdown requirements for these species under all circumstances represent practicability concerns without likely commensurate benefits for the animals in question. Small dolphins are generally the most commonly observed marine mammals in the specific geographic region and would typically be the only marine mammals likely to intentionally approach the vessel. As described above, auditory injury is extremely unlikely to occur for high-frequency cetaceans (*e.g.,* delphinids), as this group is relatively insensitive to sound produced at the predominant frequencies in an airgun pulse while also having a relatively high threshold for the onset of auditory injury (*i.e.,* permanent threshold shift).

A large body of anecdotal evidence indicates that small dolphins commonly approach vessels and/or towed arrays during active sound production for purposes of bow riding with no apparent effect observed (*e.g.,* Barkaszi *et al.,* 2012; Barkaszi and Kelly, 2018). The potential for increased shutdowns resulting from such a measure would require the McCall to revisit the missed track line to reacquire data, resulting in an overall increase in the total sound energy input to the marine environment and an increase in the total duration over which the survey is active in a given area.

Vessel Strike Avoidance Mitigation Measures

Vessel personnel should use an appropriate reference guide that includes identifying information on all marine mammals that may be encountered. Vessel operators must comply with the below measures except under extraordinary circumstances when the safety of the vessel or crew is in doubt or the safety of life at sea is in question. 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.

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 always be exercised. A visual observer aboard the vessel must monitor a vessel strike avoidance zone around the vessel (separation distances stated below). Visual observers monitoring the vessel strike avoidance zone may be third-party observers (*i.e.,* PSOs) or crew members, but crew members responsible for these duties must be provided sufficient training to (1) distinguish marine mammals from other phenomena and (2) broadly to identify a marine mammal as a right whale, other whale (defined in this context as sperm whales or baleen whales other than right whales), or other marine mammals.

Vessel speeds must be reduced to 10 kn (18.5 kph) or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near a vessel. The vessel must maintain a minimum separation distance of 500 m from 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 is 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. All vessels must maintain a minimum separation distance of 100 m from sperm whales. 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).

When marine mammals are sighted while a vessel is underway, the vessel shall 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). If marine mammals are sighted within the relevant separation distance, the vessel must reduce speed and shift the engine to neutral, not engaging the engines until animals are clear of the area. This does not apply to any vessel towing gear or any vessel that is navigationally constrained.

Based on our evaluation of the applicant's proposed measures, as well as other measures considered by NMFS, 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. During seismic survey operations, two visual PSOs would be on duty at all times during daytime hours. The operator will 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. SIO must use dedicated, trained, and NMFS-approved PSOs. At least one visual PSO aboard the vessel must have a minimum of 90 days at-sea experience working in those roles, respectively, with no more than 18 months elapsed since the conclusion of the at-sea experience. One visual PSO with such experience shall be designated as the lead for the entire protected species observation team. The lead PSO shall serve as primary point of contact for the vessel operator and ensure all PSO requirements per the IHA are met. To the maximum extent practicable, the experienced PSOs should be scheduled to be on duty with those PSOs with appropriate training but who have not yet gained relevant experience. The PSOs must have no tasks other than to conduct observational effort, record observational data, and communicate with and instruct relevant vessel crew with regard to the presence of marine mammals and mitigation requirements. PSO resumes shall be provided to NMFS for approval. Monitoring shall be conducted in accordance with the following requirements:

• PSOs shall be independent, dedicated, trained visual PSOs and must be employed by a third-party observer provider.

• PSOs shall have no tasks other than to conduct 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).

• PSOs shall have successfully completed an approved PSO training course appropriate for their designated task.

• 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.

• 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.

• 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.

• 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 1 week of receipt of submitted information. Alternate experience that may be considered includes, but is not limited to (1) secondary education and/or experience comparable to PSO duties; (2) previous work experience conducting academic, commercial, or government-sponsored protected species surveys; or (3) previous work experience as a PSO; the PSO should demonstrate good standing and consistently good performance of PSO duties.

• For data collection purposes, PSOs shall use standardized electronic data collection forms. PSOs shall record detailed information about any implementation of mitigation requirements, including the distance of animals to the airgun array and description of specific actions that ensued, the behavior of the animal(s), any observed changes in behavior before and after implementation of mitigation, and if shutdown was implemented, the length of time before any subsequent ramp-up of the airgun array. If required mitigation was not implemented, PSOs should record a description of the circumstances. At a minimum, the following information must be recorded:

○ Vessel name, vessel size and type, maximum speed capability of vessel;

○ Dates (MM/DD/YYYY) of departures and returns to port with port name;

○ PSO names and affiliations, PSO 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 (meters) of observation location above water surface;

○ Watch status (description);

○ Dates (MM/DD/YYYY) and times (Greenwich Mean 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 (knots) at beginning and end of visual PSO duty shifts and upon any change;

○ Water depth (meters) (if obtainable from data collection software);

○ Environmental conditions while on visual survey (at beginning and end of PSO shift and whenever conditions changed 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 airgun power output while in operation, number and volume of airguns operating in the array, tow depth of the array, and any other notes of significance (*i.e.,* pre-start clearance, ramp-up, shutdown, testing, shooting, ramp-up completion, end of operations, streamers, *etc.*).

• Upon visual observation of any marine mammals, the following information must be recorded:

○ 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/ID;

○ Time/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 (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/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 (meters) and/or closest distance from any element of the airgun array;

○ 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/No);

○ Photo Frame Numbers (List of numbers); and

○ Conditions at time of sighting (Visibility; BSS).

Reporting

UT shall submit a draft comprehensive report 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 must describe all activities conducted and sightings of marine mammals, must provide full documentation of methods, results, and interpretation pertaining to all monitoring, and must summarize the dates and locations of survey operations and all marine mammal sightings (dates, times, locations, activities, associated survey activities). The draft report shall also include geo-referenced time-stamped vessel tracklines for all time periods during which airgun arrays were operating. Tracklines should

include points recording any change in airgun array status (*e.g.,* when the sources began operating, when they were turned off, or when they changed operational status such as from full array to single gun or vice versa). Geographic Information System files shall be provided in Environmental Systems Research Institute 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. The report must summarize data collected as described above in Proposed Monitoring and Reporting. A final report must be submitted within 30 days following resolution of any comments on the draft report.

Reporting Injured or Dead Marine Mammals

Discovery of injured or dead marine mammals—In the event that personnel involved in the survey activities discover an injured or dead marine mammal, UT shall report the incident to the Office of Protected Resources (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 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 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 marine mammal 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 Atlantic spotted dolphins, bottlenose dolphins, and rough-toothed dolphins, 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 of UT's planned survey, even in the absence of mitigation, 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 above, 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). These low-level impacts of behavioral harassment are not likely to impact the overall fitness of any individual or lead to population level effects of any species. As described above, auditory injury (Level A harassment) is not expected to occur given the estimated small size of the Level A harassment zones.

In addition, 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 (20 survey days) and temporary nature of the disturbance and the availability of similar habitat and resources in the surrounding area, the impacts to marine mammals and marine mammal prey species are not expected to cause significant or long-term fitness consequences for individual marine mammals or their populations.

Additionally, the acoustic "footprint" of the proposed survey would be very small relative to the ranges of all marine mammals that would potentially be affected. Sound levels would increase in the marine environment in a relatively small area surrounding the vessel compared to the range of the marine mammals within the proposed survey area. The seismic array would be active 24 hours per day throughout the duration of the proposed survey. However, the very brief overall duration of the proposed survey (20 survey days) would further limit potential impacts that may occur as a result of the proposed activity.

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 any of the species or stocks through effects on annual rates of recruitment or survival:

• No serious injury or mortality is anticipated or authorized;

• No auditory injury (Level A harassment) is anticipated or proposed to be authorized;

• The proposed activity is temporary and of relatively short duration (23 days total with 20 days of planned survey activity);

• The anticipated impacts of the proposed activity on marine mammals would be temporary behavioral changes due to avoidance of the ensonified area, which is relatively small (see tables 4 and 5);

• The availability of alternative 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 is readily abundant;

• The potential adverse effects on fish or invertebrate species that serve as prey species for marine mammals from the proposed survey would be temporary and spatially limited and impacts to marine mammal foraging would be minimal; and

• The proposed mitigation measures are expected to reduce the number and severity of takes, to the extent practicable, by visually detecting marine mammals within the established zones and implementing corresponding

mitigation measures (*e.g.,* delay; ramp-up).

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 sections 101(a)(5)(A) and (D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. 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.

The number of takes NMFS proposes to authorize is below one-third of the modeled abundance for all relevant populations (specifically, take of individuals is less than 7 percent of the most appropriate abundance estimate for each stock, see table 6). This is conservative because this approach assumes all takes are of different individual animals, which is likely not the case. Some individuals may be encountered multiple times in a day, but PSOs would count them as separate individuals if they cannot be identified.

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 of 1973 (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 coastal waters off Texas in the NW GOM from approximately January to April 2025, 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 1 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: November 12, 2024.

Kimberly Damon-Randall,

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

[FR Doc. 2024–26903 Filed 11–18–24; 8:45 am]

BILLING CODE 3510–22–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[RTID 0648–XE444]

Atlantic Highly Migratory Species; Advisory Panel

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

ACTION: Notice; solicitation of nominations.

SUMMARY: NMFS solicits nominations for the Atlantic Highly Migratory Species (HMS) Advisory Panel (AP). NMFS consults with and considers the comments and views of the HMS AP when preparing and implementing

Fishery Management Plans (FMPs) or FMP amendments for Atlantic tunas, swordfish, sharks, and billfish. Nominations are being sought to fill approximately one-third (12) of the seats on the HMS AP, each with a 3-year appointment. NMFS will consider individuals with definable interests in recreational and commercial fishing and related industries, including those from the environmental community, academia, and non-governmental organizations, for membership on the HMS AP.

DATES: Submit nominations on or before December 19, 2024.

ADDRESSES: You may submit nominations and requests for the Advisory Panel Statement of Organization, Practices, and Procedures by email to *HMSAP.Nominations@ noaa.gov.* Include in the subject line the following identifier: ''HMS AP Nominations.''

FOR FURTHER INFORMATION CONTACT: Anna Quintrell at 301–427–7861 or via email at *HMSAP.Nominations@ noaa.gov.*

SUPPLEMENTARY INFORMATION: HMS fisheries (tunas, swordfish, sharks, and billfish) are managed under the 2006 Consolidated HMS FMP and its amendments pursuant to the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; 16 U.S.C. 1801 *et seq.*) and consistent with the Atlantic Tunas Convention Act (16 U.S.C. 971 *et seq.*). HMS implementing regulations are at 50 CFR part 635.

The Magnuson-Stevens Act requires NMFS to establish an AP for each HMS FMP (16 U.S.C. 1854(g)(1)(A)–(B)). Since the inception of the AP in 1998, NMFS has consulted with and considered the comments and views of AP members when preparing and implementing HMS FMPs or FMP amendments. In this notice, NMFS solicits nominations for the HMS AP. Nominations are being sought to fill approximately one-third (12) of the seats on the HMS AP for 3-year appointments. NMFS will consider individuals with definable interests in recreational and commercial fishing and related industries, including those from the environmental community, academia, and non-governmental organizations for membership on the HMS AP as described below.

Procedures and Guidelines

Nomination Procedures for Appointments to the AP

Nomination packages should include:

1. The name and contact information, including mailing address, email address, and phone number of the nominee;

2. A description of the nominee's interest in HMS or HMS fisheries, or in particular species of tunas, swordfish, sharks, or billfish;

3. A statement of the nominee's background and/or qualifications;

4. A list of outreach resources that the nominee has at their disposal to communicate qualifications for HMS AP membership; and

5. A written commitment that the nominee shall actively participate in good faith in the meetings and tasks of the HMS AP.

Advisory Panel members will be required to comply with applicable rules of conduct, including all ethics requirements. Qualification for membership includes experience in one or more of the following:

1. HMS recreational fisheries;

2. HMS commercial fisheries;

3. Fishery-related industries (*e.g.,* marinas, bait and tackle shops);

4. The scientific community working with HMS; and/or

5. Representation of a private, non-governmental, regional, national, or international organization that represents marine fisheries, or environmental, governmental, or academic interests regarding HMS.

HMS AP Tenure

Members are appointed for 3-year terms. Approximately one-third of the members' terms expire on December 31 of each year. NMFS is seeking nominations for terms beginning January 2025 and expiring December 2027.

Members can serve a maximum of three consecutive terms (a total of 9 consecutive years). Afterwards, a member must then sit off the HMS AP for a single year before becoming eligible to apply for a new term.

Participants

NMFS will accept nominations for the HMS AP that allow for representation from commercial and recreational fishing interests, academic/scientific interests, and the environmental/non-governmental organization community, for individuals who are knowledgeable about HMS and/or HMS fisheries. Current representation on the HMS AP, as shown in table 1, consists of 12 members representing commercial interests, 12 members representing recreational interests, 4 members representing environmental interests, 4 academic representatives, and the ICCAT Advisory Committee Chair.