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Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Seismic Surveys in Cook Inlet, Alaska; Notices

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XD830

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Seismic Surveys in Cook Inlet, Alaska

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

ACTION: Notice; issuance of an incidental harassment authorization.

SUMMARY: NMFS is issuing an Incidental Harassment Authorization in response to a request from SAExploration Inc. (SAE) for authorization to take marine mammals incidental to an oil and gas exploration seismic survey program in Cook Inlet, Alaska between May 13, 2015 and May 12, 2016.

DATES: *Effective:* May 13, 2015 through May 12, 2016.

ADDRESSES: Electronic copies of the IHA, application, and associated Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) may be obtained by writing to Jolie Harrison, Division Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East West Highway, Silver Spring, MD 20910, telephoning the contact listed below (see **FOR FURTHER INFORMATION CONTACT**), or visiting the internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm.* Documents cited in this notice may also be viewed, by appointment, during regular business hours, at the aforementioned address.

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

SUPPLEMENTARY INFORMATION:

Background

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

An authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. NMFS has defined ‘‘negligible impact’’ in 50 CFR 216.103 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.’’

Except with respect to certain activities not pertinent here, 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].

Summary of Request

On October 28, 2014, we received a request from SAE for authorization to take marine mammals incidental to seismic surveys in Cook Inlet, Alaska. After further correspondence and revisions by the applicant, we determined that the application was adequate and complete on January 12, 2015. On March 20, 2015, NMFS published a notice in the **Federal Register** of our proposal to issue an IHA with preliminary determinations (80 FR 14913). The filing of the notice initiated a 30-day public comment period. The comments and our responses are discussed later in this document.

SAE proposes to conduct oil and gas exploration seismic surveys. The activity will occur between May 13, 2015 and May 12, 2016, for a period of 160 days. The following specific aspects of the activity are likely to result in the take of marine mammals: Operation of seismic airguns in arrays of 440 in^3 and 1,760 in^3. Take, by Level B Harassment only, of individuals of beluga whale, humpback whale, minke whale, gray whale, harbor porpoise, Dall’s porpoise, killer whale, harbor seal, and Steller sea lion is anticipated to result from the specified activity.

Description of the Specified Activity

Overview

SAE plans to conduct 3D seismic surveys over multiple years in the marine waters of both upper and lower Cook Inlet. This authorization will cover activities occurring between May 13, 2015 and May 12, 2016. The ultimate survey area is divided into two units (upper and lower Cook Inlet). The total potential survey area is 3,934 square kilometers (1,519 square miles); however, only a portion (currently unspecified) of this area will ultimately be surveyed, and no more than 777 square kilometers (300 square miles) in a given year. The exact location of where the 2015 survey will be conducted is not known at this time, and probably will not be known until late spring 2015 when SAE’s clients have finalized their data acquisition needs.

The components of the project include laying recording sensors (nodes) on the ocean floor, operating seismic source vessels towing active air gun arrays, and retrieval of nodes. There will also be additional boat activity associated with crew transfer, recording support, and additional monitoring for marine mammals. The primary seismic source for offshore recording consists of a 2 × 880-cubic-inch tri-cluster array for a total of 1,760-cubic-inches (although a 440-cubic-inch array may be used in very shallow water locations as necessary). Each of the arrays will be deployed in a configuration outlined in Appendix A of the application. The arrays will be centered approximately 15 meters (50 feet) behind the source vessel stern, at a depth of 4 meters (12 feet), and towed along predetermined source lines at speeds between 7.4 and 9.3 kilometers per hour (4 and 5 knots). Two vessels with full arrays will be operating simultaneously in an alternating shot mode; one vessel shooting while the other is recharging. Shot intervals are expected to be about 16 seconds for each array resulting in an overall shot interval of 8 seconds considering the two alternating arrays. Operations are expected to occur 24 hours a day, with actual daily shooting to total about 12 hours. An acoustical positioning (or pinger) system will be used to position and interpolate the location of the nodes. A vessel-mounted transceiver calculates the position of the nodes by measuring the range and bearing from the transceiver to a small acoustic transponder fitted to every third node. The transceiver uses sonar to interrogate the transponders, which respond with short pulses that are used in measuring the range and bearing.

Several offshore vessels will be required to support recording, shooting, and housing in the marine and transition zone environments. Exact vessels to be used have not been determined.

Dates and Duration

The request for incidental harassment authorization is primarily for the 2015 Cook Inlet open water season. The plan is to conduct seismic surveys in the Upper Cook unit sometime between May 13, 2015 through May 12, 2016. The northern border of the seismic survey area depicted in Figure 1 takes into account the restriction that no activity occur between April 15 to October 15 in waters within 16 kilometers (10 miles) of the Susitna Delta (defined as the nearshore area between the mouths of the Beluga and the Little Susitna rivers). A small wedge of the upper Cook unit falls within 16 kilometers of the Beluga River mouth, but survey here will occur after October 15, taking into account any timing restrictions with nearshore beluga habitat. The seismic acquisition in lower Cook unit will initially begin in late August or mid-September, and run until December 15 taking into account any self-imposed location/timing restrictions to avoid encounters with sea otters or Steller's eiders. The exact survey dates in a given unit will depend on ice conditions, timing restrictions, and other factors. If the upper Cook Inlet seismic surveys are delayed by spring ice conditions, some survey may occur in lower Cook Inlet from March to May to maximize use of the seismic fleet. Actual data acquisition is expected to occur for only 2 to 3 hours at a time during each of the 3 to 4 daily slack tides. Thus, it is expected that the air guns will operate an average of about 8 to 10 total hours per day. It is estimated that it will take 160 days to complete both the upper and lower Cook units, and that no more than 777 square kilometers (300 square miles) of survey area will be shot in 2015.

Specified Geographic Region

The area of Cook Inlet that SAE plans to operate in has been divided into two subsections: Upper and Lower Cook Inlet. Upper Cook (2,126 square kilometers; 821 square miles) begins at the line delineating Cook Inlet beluga whale (*Delphinapterus leucas*) Critical Habitat Area 1 and 2, south to a line approximately 10 kilometers (6 miles) south of both the Lower Cook (1,808 square kilometer; 698 square mile) begins east of Kalgin Island and running along the east side of lower Cook Inlet to Anchor Point (Figure 2 in SAE application).

Detailed Description of Activities

The Notice of Proposed IHA (80 FR 14913, March 20, 2015) contains a full detailed description of the 3D seismic survey, including the recording system, sensor positioning, and seismic source. That information has not changed and is therefore not repeated here.

Comments and Responses

A Notice of Proposed IHA was published in the **Federal Register** on March 20, 2015 (80 FR 14913) for public comment. During the 30-day public comment period, NMFS received four comment letters from the following: The Natural Resource Defense Council (NRDC); the Marine Mammal Commission (MMC); Furie Operating Alaska LLC (Furie); and one private citizen.

All of the public comment letters received on the Notice of Proposed IHA (80 FR 14913, March 20, 2015) are available on the internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm.* Following is a summary of the public comments and NMFS' responses.

Comment 1: One private citizen requested that we deny issuance of the IHA because marine mammals would be killed as a result of the survey.

Response: Extensive analysis of the proposed 3D seismic survey was conducted in accordance with the MMPA, Endangered Species Act (ESA), and National Environmental Policy Act (NEPA). Pursuant to those statutes, we analyzed the impacts to marine mammals (including those listed as threatened or endangered under the ESA), their habitat (including critical habitat designated under the ESA), and to the availability of marine mammals for taking for subsistence uses. The MMPA analyses revealed that the activities would have a negligible impact on affected marine mammal species or stocks and would not have an unmitigable adverse impact on the availability of marine mammals for taking for subsistence uses. The ESA analysis concluded that the activities likely would not jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat. The NEPA analysis concluded that there would not be a significant impact on the human environment. Moreover, this activity is not expected to result in the death of any marine mammal species, and no such take is authorized.

Comment 2: Furie supports issuance of this IHA in a timely manner and urge NMFS to recognize the benefits of seismic surveys and subsequent development of energy resources.

Response: After careful evaluation of all comments and the data and information available regarding potential impacts to marine mammals and their habitat and to the availability of marine mammals for subsistence uses, NMFS has issued the final authorization to SAE to take marine mammals incidental to conducting a 3D seismic survey program in Cook Inlet for the period May 13, 2015 through May 12, 2016.

Comment 3: The MMC recommends that NMFS defer issuance of the IHA until such time as NMFS can, with reasonable confidence, support a conclusion that the activities would affect no more than a small number of Cook Inlet beluga whales and have no more than a negligible impact on the population. The MMC recommends that NMFS defer issuance until we have better information on the cause or causes of ongoing decline of the population and a reasonable basis for determining that authorizing additional takes would not contribute to or exacerbate that decline. The MMC continues to believe that any activity that may contribute to or that may worsen the observed decline should not be viewed as having a negligible impact on the population. The NRDC states that NMFS failed to meet both the ''small numbers'' and ''negligible impact'' standards.

Response: In accordance with our implementing regulations at 50 CFR 216.104(c), we use the best available scientific evidence to determine whether the taking by the specified activity within the specified geographic region will have a negligible impact on the species or stock and will not have an unmitigable adverse impact on the availability of such species or stock for subsistence uses. Based on the scientific evidence available, NMFS determined that the impacts of the 3D seismic survey program, which are primarily acoustic in nature, would meet these standards. Moreover, SAE proposed and NMFS has required in the IHA a rigorous mitigation plan to reduce impacts to Cook Inlet beluga whales and other marine mammals to the lowest level practicable, including measures to power down or shutdown airguns if any beluga whale is observed approaching or within the Level B harassment zone and restricting activities within a 10 mi (16 km) radius of the Susitna Delta from April 15 through October 15, which is an important area for beluga feeding and calving in the spring and summer months. This shutdown measure is more restrictive than the standard shutdown measures typically applied, and combined with the Susitna Delta exclusion (minimizing adverse effects to foraging), is expected to reduce both the scope and severity of potential harassment takes, ensuring that there are no energetic impacts from the harassment that would adversely affect reproductive rates or survivorship.

Our analysis indicates that issuance of this IHA will not contribute to or worsen the observed decline of the Cook Inlet beluga whale population. Additionally, the ESA Biological Opinion determined that the issuance of an IHA is not likely to jeopardize the continued existence of the Cook Inlet beluga whales or the western distinct population segment of Steller sea lions or destroy or adversely modify Cook Inlet beluga whale critical habitat. The Biological Opinion also outlined Terms and Conditions and Reasonable and Prudent Measures to reduce impacts, which have been incorporated into the IHA. Therefore, based on the analysis of potential effects, the parameters of the seismic survey, and the rigorous mitigation and monitoring program, NMFS determined that the activity would have a negligible impact on the population.

Moreover, the seismic survey would take only small numbers of marine mammals relative to their population sizes. The number of belugas likely to be taken represent less than 9.6% of the population. As described in the proposed IHA **Federal Register** notice, NMFS used a method that incorporates density of marine mammals overlaid with the anticipated ensonified area to calculate an estimated number of takes for belugas, which was estimated to be less than 10% of the stock abundance, which NMFS considers small. In addition to this quantitative evaluation, NMFS has also considered qualitative factors that further support the ''small numbers'' determination, including: (1) The seasonal distribution and habitat use patterns of Cook Inlet beluga whales, which suggest that for much of the time only a small portion of the population would be accessible to impacts from SAE's activity, as most animals are concentrated in upper Cook Inlet; and (2) the mitigation requirements, which provide spatio-temporal limitations that avoid impacts to large numbers of animals feeding and calving in the Susitna Delta and limit exposures to sound levels associated with Level B harassment. Based on all of this information, NMFS determined that the number of beluga whales likely to be taken is small. See response to Comment 5 and our small numbers analysis later in this document for more information about the small numbers determination for beluga whales and the other marine mammal species.

Comment 4: The MMC recommends that NMFS develop a policy that sets forth clear criteria and/or thresholds for determining what constitutes ''small numbers'' and ''negligible impact'' for the purpose of authorizing incidental takes of marine mammals. The MMC understands that NMFS has been working on developing a policy and would welcome an opportunity to discuss this policy further before it is finalized.

Response: NMFS is in the process of developing both a clearer policy to outline the criteria for determining what constitutes ''small numbers'' and an improved analytical framework for determining whether an activity will have a ''negligible impact'' for the purpose of authorizing takes of marine mammals. We fully intend to engage the MMC in these processes at the appropriate time.

Comment 5: The NRDC pointed by reference to the other proposed activities in Cook Inlet during the 2015 open water season. The NRDC and the MMC both note that NMFS must address the cumulative effects of activities in Cook Inlet on Cook Inlet beluga whales and whether the cumulative impacts of all the activities are having ''either individually or in combination'' a greater than negligible impact on marine mammals.

Response: Neither the MMPA nor NMFS' implementing regulations specify how to consider other activities and their impacts on the same populations when conducting a negligible impact analysis. However, 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 the negligible impact analysis via their impacts on the environmental baseline (*e.g.,* as reflected in the density/distribution and status of the species, population size and growth rate, and ambient noise).

In addition, cumulative effects were addressed in the EA and Biological Opinion prepared for this action. The cumulative effects section of the EA has been expanded from the draft EA to discuss potential effects in greater detail. These documents, as well as the Alaska Marine Stock Assessments and the most recent abundance estimate for Cook Inlet beluga whales (Shelden *et al.,* 2015, are part of NMFS' Administrative Record for this action, and provided the decision maker with information regarding other activities in the action area that affect marine mammals, an analysis of cumulative impacts, and other information relevant to the determination made under the MMPA.

Comment 6: The NRDC states that NMFS failed to account for survey duration in the estimation of beluga whale takes and that NMFS based beluga takes using a predictive habitat density model (Goetz *et al.,* 2012) that is based on data from summer months and confined to summer distribution when belugas are generally concentrated in the Upper Inlet, even though activity could occur year round.

Response: The numerical estimation of take for beluga whales does consider survey duration in the calculation. The Goetz et al 2012 model is the best available data for beluga density in Cook Inlet. The method used by NMFS to estimate take uses the best available data to most accurately estimate the number of belugas taken. This is done by multiplying the density of the area surveyed on a given day by the area ensonified on that day of surveying to yield the number of belugas that were likely exposed during that day of surveying. This is then added to the next day of surveying and so forth in an additive model until the number of 30 belugas is reached. If the number of 30 belugas is reached using this calculation before SAE has completed their 160 days of proposed surveying, survey activity must cease. Additionally, if they finish their 160 days without reaching the limit of 30 belugas their activity must still cease. The model, by being additive in nature for each day of surveying, accounts for the duration of the survey, as well as capturing a more specific density value than using an Inlet-wide density estimate.

Moreover, the model (or other numerical methods for estimating take) does not take into consideration the rigorous mitigation protocols that will be implemented by SAE to reduce the number of actual Level B harassment takes of Cook Inlet beluga whales. As mentioned previously, the IHA contains a condition restricting SAE's airgun operations within 10 mi (16 km) of the mean higher high water line of the Susitna Delta from April 15 through October 15. During this time, a significant portion of the Cook Inlet beluga whale population occurs in this area for feeding and calving. This setback distance includes the entire 160 dB radius of 5.9 mi (9.5 km) predicted for the full airgun array plus an additional 4.1 mi (6.5 km) of buffer, thus reducing the number of animals that may be exposed to Level B harassment thresholds. SAE is also required to shut down the airguns if any beluga whale is sighted approaching or entering the Level B harassment zone to avoid take. NMFS combined use of the National Marine Mammal Laboratory (NMML) model, which we determined to be the best available data upon which to base density estimates, with consideration of all of the mitigation measures required to be implemented to authorize 30 beluga whale takes. This approach is reasonable and does not contradict available science and data of beluga whale distribution and local abundance during the period of operations.

Comment 7: The NRDC states that in the case of marine mammals other than beluga whales, NMFS repeated past errors associated with its use of raw NMML survey data. Errors in the density calculations include the failure to incorporate correction factors for missed marine mammals in the analysis and the failure to fully account for survey duration by multiplying densities (which are calculated on an hourly basis) by the number of survey days but not the number of hours in a day.

Response: Correction factors for marine mammal surveys, with the exception of beluga whales, are not available for Cook Inlet. The primary purpose and focus of the NMFS aerial surveys in Cook Inlet for the past decade has been to monitor the beluga whale population. Although incidental observations of other marine mammals are noted during these surveys, they are focused on beluga whales. With the exception of the beluga whale, no detailed statistical analysis of Cook Inlet marine mammal survey results has been conducted, and no correction factors have been developed for Cook Inlet marine mammals. The only published Cook Inlet correction factor is for beluga whales. Developing correction factors for other marine mammals would have required different survey data collection and consideration of unavailable data such as Cook Inlet sight ability, movement patterns, tidal correlations and detailed statistical analyses. For example, other marine mammal numbers are often rounded to the nearest 10 or 100 during the NMFS aerial survey; resulting in unknown observation bias. Therefore, the data from the NMFS surveys are the best available and number of animals taken are still likely overestimated because of the assumption that there is a 100% turnover rate of marine mammals each day.

Survey duration was appropriately considered in the estimations by multiplying density by area of ensonification by number of survey days. NMFS does not calculate takes on an hourly basis, and, additionally, the multiple hours surveyed within a day are reflected in the area of ensonification, which considers the distance they can move within a day and is therefore larger than what would be covered in one hour. Additionally, as NMFS has used the density estimate from NMFS aerial surveys, multiplied by the area ensonified per day, multiplied by the number of days, this calculation produces the number instances of exposure during the survey. This is likely an overestimate of individuals taken by Level B harassment, as a single individual can be exposed on multiple days over the course of the survey, especially when a small patch of area is shot over a duration of five days. While protected species observers (PSOs) cannot detect every single animal within the Level B harassment zone, monitoring reports from similar activities indicate that sightings did not exceed anticipated estimates.

Comment 8: The NRDC commented that NMFS underestimated the size of SAE's impact area by: (1) Using an outdated and incorrect threshold for behavioral take; and (2) disregarding the best available evidence on the potential for temporary and permanent threshold shift on mid- and high-frequency cetaceans and on pinnipeds.

Response: The comment that NMFS uses an outdated and incorrect threshold for behavioral takes does not include any specific recommendations. NMFS uses 160 dB (rms) as the exposure level for estimating Level B harassment takes for most species in most cases. This threshold was established for underwater impulse sound sources based on measured avoidance responses observed in whales in the wild. Specifically, the 160 dB threshold was derived from data for mother-calf pairs of migrating gray whales (Malme *et al.,* 1983, 1984) and bowhead whales (Richardson et al., 1985, 1986) responding to seismic airguns (*e.g.,* impulsive sound source). We acknowledge there is more recent information bearing on behavioral reactions to seismic airguns, but those data only illustrate how complex and context-dependent the relationship is between the two. See 75 FR 49710, 49716 (August 13, 2010) (IHA for Shell seismic survey in Alaska). Accordingly, it is not a matter of merely replacing the existing threshold with a new one. NOAA is working to develop more sophisticated draft guidance for determining impacts from acoustic sources, including information for determining Level B harassment thresholds. Due to the complexity of the task, any guidance will require a rigorous review that includes internal agency review, public notice and comment, and additional external peer review before any final product is published. In the meantime, and taking into consideration the facts and available science, NMFS determined it is reasonable to use the 160 dB threshold for estimating takes of marine mammals in Cook Inlet by Level B harassment. However, we discuss the science on this issue qualitatively in our analysis of potential effects to marine mammals.

The comment that NMFS disregarded the best available evidence on the potential for temporary and permanent threshold shift on mid- and high-frequency cetaceans and on pinnipeds does not contain any specific recommendations. We acknowledge there is more recent information available bearing on the relevant exposure levels for assessing temporary and permanent hearing impacts. (See NMFS' **Federal Register** notice (78 FR 78822, December 27, 2013) for NMFS' draft guidance for assessing the onset of permanent and temporary threshold shift.) Again, NMFS will be issuing guidance, but that process is not complete, so we did not use it to assign new thresholds for calculating take estimates for hearing impacts. However, we did consider the information, and it suggests the current 180 and 190 dB thresholds are appropriate and that they likely overestimate potential for hearing impacts. See 75 FR 49710, 49715, 49724 (August 13, 2010) (IHA for Shell seismic survey in Alaska; responses to comment 8 and comment 27). Moreover, the required mitigation is designed to ensure there are no exposures at levels thought to cause hearing impairment, and, for several of the marine mammal species in the project area, mitigation measures are designed to reduce or eliminate exposure to Level B harassment thresholds.

Comment 9: The NRDC comments that the proposed mitigation measures fail to meet the MMPA's ''least practicable adverse impact'' standard. The NRDC provides a list of approximately eight measures that NMFS ''failed to consider or adequately consider.''

Response: NMFS provided a detailed discussion of proposed mitigation measures and the MMPA's ''least practicable impact'' standard in the notice of the proposed IHA (80 FR 14913, March 20, 2015), which are repeated in the ''Mitigation'' section of this notice. The measures that NMFS allegedly failed to consider or adequately consider are identified and discussed below:

(1) Field testing and use of alternative technologies, such as vibroseis and gravity gradiometry, to reduce or eliminate the need for airguns and delaying seismic acquisition in higher density areas until the alternative technology of marine vibroseis becomes available: SAE requested takes of marine mammals incidental to the seismic survey operations described in the IHA application, which identified airgun arrays as the technique SAE would employ to acquire seismic data. It would be inappropriate for NMFS to change the specified activity and it is beyond the scope of the request for takes incidental to SAE's operation of airguns and other active acoustic sources.

SAE knows of no current technology scaled for industrial use that is reliable enough to meet the environmental challenges of operating in Cook Inlet. SAE is aware that many prototypes are currently in development, and may ultimately incorporate these new technologies into their evaluation process as they enter commercial viability. However, none of these technologies are currently ready for use on a large scale in Cook Inlet. As this technology is developed, SAE will evaluate its utility for operations in the Cook Inlet environment.

(2) Required use of the lowest practicable source level in conducting airgun activity: SAE determined that the 1760 in^3 array provides the data required for SAE's operations.

(3) Seasonal exclusions around river mouths, including early spring (pre-April 14) exclusions around the Beluga River and Susitna Delta, and avoidance of other areas that have a higher probability of beluga occurrence: NMFS has required a 10 mile (16 km) exclusion zone around the Susitna Delta (which includes the Beluga River) in this IHA. This mitigation mirrors a measure in the Incidental Take Statement for the 2012 and 2013 Biological Opinions. Seismic survey operations involving the use of airguns will be prohibited in this area between April 15 and October 15. In both the MMPA and ESA analysis, NMFS determined that this date range is sufficient to protect Cook Inlet beluga whales and the critical habitat in the Susitna Delta. While data indicate that belugas may use this part of the inlet year round, peak use occurs from early May to late September. NMFS added a 2-week buffer on both ends of this peak usage period to add extra protection to feeding and calving belugas. (In addition, the Alaska Department of Fish and Game (ADF&G) prohibits the use of airguns within 1 mi (1.6 km) of the mouth of any stream listed by the ADF&G on the Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes. See additional explanation in ''Mitigation Measures Considered but not Required'' section, later in this document.)

(4) Limitation of the mitigation airgun to the longest shot interval necessary to carry out its intended purpose: This general comment contained no specific recommendations. SAE requires shot intervals of 50m at a speed of 4–5 knots to obtain the information from their survey. However NMFS has added a mitigation measure that SAE reduce the shot interval for the mitigation gun to one shot per minute.

(5) Immediate suspension of airgun activity, pending investigation, if any beluga strandings occur within or within an appropriate distance of the survey area. The IHA requires SAE to immediately cease activities and report unauthorized takes of marine mammals, such as live stranding, injury, serious injury, or mortality. NMFS will review the circumstances of SAE's unauthorized take and determine if additional mitigation measures are needed before activities can resume to minimize the likelihood of further unauthorized take and to ensure MMPA compliance. SAE may not resume activities until notified by NMFS. Separately the IHA includes measures if injured or dead marine mammals are sighted and the cause cannot be easily determined. In those cases, NMFS will review the circumstances of the stranding event while SAE continues with operations.

(6) Establishment of a larger exclusion zone for beluga whales that is not predicated on the detection of whale aggregations or cow-calf pairs: Both the proposed IHA notice and the issued IHA contain a requirement for SAE to delay the start of airgun use or shutdown the airguns if a beluga whale is visually sighted or detected by passive acoustic monitoring approaching or within the 160-dB disturbance zone until the animal(s) are no longer present within the 160-dB zone. The measure applies to the sighting of any beluga whale, not just sightings of groups or cow-calf pairs.

Comment 10: The MMC suggests additional mitigation measures are used including: (1) Aerial surveys, (2) passive acoustic monitoring, as well as (3) a 30 minute post-activity monitoring period.

Response: NMFS provided a detailed discussion of proposed mitigation measures and the MMPA's ''least practicable impact'' standard in the notice of the proposed IHA (80 FR 14913, March 20, 2015), which are repeated in the ''Mitigation'' section of this notice. The measures that NMFS allegedly failed to consider or adequately consider are identified and discussed below:

(1) Use of advance aerial surveys to redirect activity is not required for this action. Aerial surveys for this project could be used for monitoring the disturbance zone to the 160dB level (6.83 km). However, exposures that occur in this zone, or Level B takes, are already accounted for in the take estimation section below. Visual observers, which are already known to be effective in this environment, will adhere to strict standards for preventing animals from entering the 180dB/190dB injury exclusion zone, as well as monitoring for animals that may be traveling in the direction of or approaching the injury exclusion zone. The prohibitive cost of daily aerial surveys for a survey area of only 777km^2, combined with the limited added value given the general effectiveness of vessel and land-based observers, and considering the fact that we believe that the activity will have a negligible impact even in the absence of mitigation make the suite of mitigation measures we have included adequate to achieve the least practicable adverse impact.

(2) The passive acoustic monitoring plan for Apache Alaska Corporation's 2012 survey anticipated the use of a bottom-mounted telemetry buoy to broadcast acoustic measurements using a radio-system link back to a monitoring vessel. Although a buoy was deployed during the first week of surveying under the 2012 IHA, it was not successful. Upon deployment, the buoy immediately turned upside down due to the strong current in Cook Inlet. After retrieval, the buoy was not redeployed and the survey used a single omni-directional hydrophone lowered from the side of the mitigation vessel. During the entire 2012 survey season, Apache's PAM equipment yielded only six confirmed marine mammal detections, one of which was a Cook Inlet beluga whale. The single Cook Inlet beluga whale detection did not, however, result in a shutdown procedure.

Additionally, Joint Base Elmendorf-Fort Richardson, the National Marine Mammal Laboratory, and Alaska Department of Fish & Game conducted a 2012 study (Gillespie *et al.,* 2013) to determine if beluga whale observations at the mouth of Eagle River corresponded with acoustic detections received by a PAMBuoy data collection system. The PAMBuoy data collection system was deployed in the mouth of

Eagle River from 12–31 August 2012. This study was a trial period conducted with one hydrophone at the mouth of the river. Overall, it was successful in detecting beluga whale echolocation clicks and whistles, but came with several limitations:

- The PAM system was able to reliably detect all whales approaching or entering the river but still performs less well than a human observer;
- Sounds from vessels in Cook Inlet (*e.g.* vessel noise) have a large chance of interfering with detections from PAM. The mouth of Eagle River has very little vessel traffic, which is likely why the study was successful there and not likely to be successful in Cook Inlet;
- PAMbouys could be a navigational hazard in Cook Inlet for commercial, subsistence, and sport fishing, as well as the commercial vessel traffic traveling through Cook Inlet;
- The limited testing in a very small area should not become the new standard of monitoring in the entire Cook Inlet. The tide, vessel traffic, bathymetry, and substrate of Cook Inlet are far more complex than the study area;
- It appears the hydrophone must be hardwired to the shore which is not practical for mobile marine seismic operations;
- Currently, deployment of the system is done by walking tripods onto the mudflats. This is not feasible for the vast majority of the SAE project area. Walking onto the mudflats in parts of Cook Inlet also poses a safety risk;
- The study found considerable investment would be necessary to develop an ice and debris proof mounting system. Other issues with hydrophone configuration include: At extreme low tides, the hydrophone was uncovered and therefore not usable; the hydrophone had to be located in such a position so that it could be occasionally visually inspected; hydrophone battery supply has to constantly be checked; the costs and practicalities of long-term hydrophone mounting and data transmission have not been determined.; and only one hydrophone was tested, and SAE would need several hydrophones;
- Observer sightings and acoustic detections of belugas generally corresponded with one another. Thus PAMBuoys would be simply duplicating PSO and aerial efforts;
- The wireless modem that transmits the acoustic data to the ''base station'' was only tested to 3.2 km; and
- The study did not conclude anything about the detection range of the system, except that it was greater than 400 m.

NMFS has been made aware of an over-the-side hydrophone that has successfully detected belugas in Eagle River, Alaska. Upon beginning operations, SAE has 30 days to acquire a hydrophone that covers a frequency range of 0.1–160 kHz to allow detecting both social and echolocation signals, with a system sensitivity in the range −165 to −185 dB re1 V/μPa, and floor noise spectra similar to Beaufort Sea State 0. SAE will use this hydrophone during nighttime ramp-ups from the mitigation airgun to detect beluga whales, humpbacks, and Steller sea lions that may be within the 160dB disturbance zone.

(3) A post-activity monitoring period of 30 minutes has been added as a requirement for this activity. This monitoring period after the cessation of airgun operations can provide useful observations to compare the behavior and abundance of animals during different scenarios of various noise levels. This change has been noted in the Authorization text.

Comment 11: The MMC notes that NMFS is reviewing two other IHA applications for proposed seismic surveys in Cook Inlet in 2015 and that it is not clear whether these applications are seeking separate authorizations for some or all of the same activities. NMFS needs to adopt policies and institute procedures to ensure that separate applications to conduct essentially the same activities in the same areas are considered more holistically. If indeed the applicants are proposing to conduct multiple seismic surveys within the same area, it would increase the numbers of marine mammals taken and expose beluga whales and other marine mammals to unnecessary, avoidable risks. Section 101(a)(5)(D)(ii)(I) of the MMPA directs NMFS to structure IHAs so that they prescribe ''other means of effecting the least practicable impact on such species or stock and its habitat.'' Allowing multiple operators to obtain separate IHAs to conduct duplicative surveys is inconsistent with that mandate. Data sharing and collaboration is critical in habitat areas used by endangered populations, such as Cook Inlet beluga whales. The MMC recommends that NMFS encourage SAE and other applicants proposing to conduct seismic surveys in Cook Inlet in 2015 to collaborate on those surveys and, to the extent possible, submit a single application seeking authorization for incidental harassment of marine mammals.

In a similar comment, the NRDC expressed concern over the number of activities proposed in the same area for the same season referencing applications for: Furie, Bluecrest, Buccaneer, and Apache.

Response: We agree and have encouraged SAE to cooperate with other interested parties to minimize the impacts of new seismic surveys in the region. Apache has told NMFS that their proposed activities are a separate project to that of SAE. Currently, SAE works with other oil and gas operators in the area to enter into cooperative agreements. Sometimes these negotiations are successful, but at other times the companies cannot reach an agreement acceptable to both parties. SAE will continue its discussions with other operators in Cook Inlet to find opportunities to joint venture in oil and gas operations, including seismic data acquisition.

The portion of the statute cited by the MMC refers to the need to require mitigation measures to ensure that the specified activity for which take is authorized in that particular authorization ''effects the least practicable impact.'' SAE proposed and NMFS has required a rigorous mitigation and monitoring plan to ensure that SAE's program meets that standard. Moreover, NMFS will not issue IHAs to other applicants if the negligible impact standard cannot be met.

Lastly, there are no applications being processed for Furie or Buccaneer. Apache does not anticipate conducting seismic activity in the 2015 season. Additionally, the activities proposed by Bluecrest are not seismic surveys and in a far southerly portion of the Inlet, with no overlap with SAE's activities.

Comment 12: Both the NRDC and the MMC comment that authorization should not be issued until the Cook Inlet Beluga Whale Take Recovery Plan is finalized and published.

Response: The Cook Inlet Beluga Whale Recovery Plan is still under development and will not be available in time to authorize activities for the 2015 open water season. It is possible the Recovery Plan will be available for next season. It is not necessary to have the Recovery Plan finalized to authorize SAE's activity, as NMFS is still able to make a negligible impact determination for beluga whales.

Comment 13: The MMC comments that various applicants in the Cook Inlet region have used differing density estimates for calculating take of marine mammal species in the Inlet and that all applicants should use the same densities.

Response: The density estimates used by SAE specifically for harbor porpoises, harbor seals, and killer whales are the best available science at this time. The data are from NMFS aerial surveys over a ten year period (2000–2012). NMFS is working with applicants to incorporate these density estimates into future applications and take authorizations. However, where applicable, density estimates and derived take estimation may vary based on site-specific knowledge of abundance, density, seasonality, or other qualities that could allow for a more nuanced assessment of the presence of a particular stock in a given location.

Comment 14: The MMC also comments that in the application, SAE states it will only survey in an area of 777km² but that the proposed action area is much larger. The MMC requests that SAE specify the area in which they expect to operate so that take estimations more accurately reflect the scope of the project.

Response: Due to the nature of SAE's work, contracts are awarded throughout the season and the exact locations of operation are not known to SAE at the time of the application. However, SAE has provided how much area they plan to survey and NMFS has calculated take estimation using the number of survey days requested and daily ensonified area to calculate take instead of the 777km² unique area specified in the application to ensure a robust calculation of exposures to the 160dB level.

Comment 15: The MMC comments that SAE should be required to investigate and report on detection probabilities from various observation platforms for differing sea states and light conditions.

Response: NMFS acknowledges that collecting detection probabilities from various platforms under different conditions would be very useful information and could better inform monitoring reports by discerning how many animals were likely taken. However, constructing a study to investigate detection probabilities requires a great deal of planning and many more observers than are involved in this survey. NMFS would like to work with the MMC in the future to discuss how best to conduct this work and refine detection probabilities for seismic surveys.

Comment 16: The NRDC comments on several issues under NEPA, related to cumulative effects and the suite of alternatives. These comments are: (1) NEPA mandates that NMFS may not authorize activities while a programmatic EIS is underway; (2) The No Action alternative must assume SAE will not conduct the proposed activity; and (3) The third alternative with additional mitigation measures is not sufficiently analyzed and defined.

Response: The NEPA analysis is an important component of our process. Our responses to the issues raised by the NRDC are as follows:

(1) The regulatory text referenced by NRDC in their comments, 40 CFR 1506.1, states that ''While work on a required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment.'' NRDC is likely referencing NMFS' **Federal Register** Notice of Intent to Prepare an EIS for Cook Inlet (79 FR 61616; October 14, 2014). That provision is not applicable here as NMFS' decision to prepare an EIS is not required, but rather voluntary. The programmatic EIS is meant to address hypothetical increasing future levels of activity in Cook Inlet, not a specific proposed project. Lastly, the regulatory text references activities that are expected to have a significant impact on the human environment, and NMFS has determined that this activity will not have such an impact, as specified in the Finding of No Significant Impact (FONSI). At this time, NMFS is evaluating each activity individually, taking into consideration cumulative impacts, with an EA, to determine if the action under consideration can support a FONSI.

(2) The No Action alternative in NMFS' draft EA for this activity was written to reflect a situation in which NMFS did not authorize the activity and the survey went forward without mitigation and monitoring. However, after further consideration, NMFS has decided to modify the No Action alternative to represent a situation in which NMFS did not issue an authorization and the applicant did not conduct their proposed activity. These changes are reflected in the Final EA.

(3) The third alternative in the EA is a scenario that includes all of the mitigation measures of the preferred alternative, as well as additional cutting edge technologies that have been suggested by commenters in previous authorizations, including NRDC. However, this alternative does not contain the more detailed analysis requested by NRDC because many of the included technologies are not viable at this time. Many are still in the developmental or preliminary testing phase, or do not currently have guidelines pertaining to appropriate operating conditions around marine mammals, such as unmanned aerial vehicles. The No Action alternative and the Preferred alternative both contain more in-depth analyses as appropriate.

Comment 17: The NRDC comments that the dates in the proposed IHA suggest a curtailing of public review in violation of the Administrative Procedure Act.

Response: The date provided in the proposed IHA was the date proposed by the applicant originally for this work. Due to the time required to analyze and respond to comments sufficiently, this date was postponed and the authorization will be effective on: May 13, 2015.

Comment 18: The MMC comments that the use of a 2.5 turnover factor in take estimation of harbor seals is inappropriate. The MMC requests that NMFS use the same density × daily ensonified area × number of days formula used for the other species. The MMC also notes that if NMFS uses a turnover factor that it should consult the literature to create a more biologically relevant turnover factor than Wood *et al.* 2012.

Response: After reviewing the Commission's comment, NMFS decided to adjust the method used to estimate take for harbor seals in Cook Inlet. The daily ensonified area × number of survey days × density method yields an estimate of instances of take that is 19,315. Not only is this likely an overestimate of instances, but it is also significantly higher than the number of individual harbor seals expected to be exposed, as described in more details in the Estimated Take section. NMFS applied the survey method used by SAE, patch shooting, and applied the number of days required to shoot a patch to estimate the number of days an animal at a given haulout could be exposed. This is an average of 3 days, but no more than 5. When this factor is applied to the overestimate of exposures by using the ensonified daily area method, the number of exposed seals is much lower, at 6,438. This number may be reduced even further as individuals could be exposed at multiple patches. Separately, NMFS then considered the harbor seal densities alongside monitoring reports from Apache's work in 2012. NMFS looked at the monitoring reports from Apache's aerial surveys in June and used correction factors from the literature to determine the number of seals in the water. This number was also multiplied to match the number of SAE's proposed survey days (160) to yield a number of 8,250 instances of take, notably lower than 19,315. Additionally, in their 147 days of surveying, Apache reported sightings of 285 seals. While it is understood that this is lower than the actual number of exposures, as all seals in the 160dB range are not visible, this number is 131 times smaller than the calculated number of exposures using the daily ensonified area method. These methods are discussed in greater detail in the Takes Estimation section of this document, but in summary we concluded that not more than 25% of the population of harbor seals would be taken.

Description of Marine Mammals in the Area of the Specified Activity

Marine mammals most likely to be found in the upper Cook activity area are the beluga whale (*Delphinapterus leucas*), harbor porpoise (*Phocoena phocoena*), and harbor seal (*Phoca vitulina*). However, these species are found there in low numbers, and generally only during the summer fish runs (Nemeth *et al.* 2007, Boveng *et al.* 2012). These species are also found in the Lower Cook Inlet survey area along with humpback whales (*Megaptera novaeangliae*), minke whales (*Balaenoptera acutorostra*), gray whales (*Eschrichtius robustus*), killer whales (*Orcinus orca*), Dall's porpoise (*Phocoenoides dalli*), and Steller sea lions (*Eumetopia jubatus*). Minke whales have been considered migratory in Alaska (Allen and Angliss, 2014) but have recently been observed off Cape Starichkof and Anchor Point year-round (Owl Ridge, 2014). Humpback and gray whales are seasonal in Lower Cook, while the remaining species could be encountered at any time of the year. During marine mammal monitoring conducted off Cape Starichkof between May and August 2013, observers recorded small numbers of humpback whales, minke whales, gray whales, killer whales, and Steller sea lions, and moderate numbers of harbor porpoises and harbor seals (Owl Ridge, 2014). This survey also recorded a single beluga observed 6 kilometers north of Cape Starichkof in August 2013. The stock sizes for marine mammals found in the project area in Cook Inlet are shown in Table 1.

TABLE 1—MARINE MAMMALS INHABITING THE COOK INLET ACTION AREA

Species	Stock	ESA/MMPA status [1]; Strategic (Y/N)	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	Relative occurrence in Cook Inlet; season of occurrence
Humpback whale	Central North Pacific.	E/D;Y	7,469 (0.095; 5,833; 2000)	Occasionally seen in Lower Inlet, summer.
Minke whale	Alaska	-;N	1,233 (0.034; N/A; 2003)	Infrequently occur but reported year-round.
Gray whale	Eastern North Pacific.	-;N	19,126 (0.071; 18,017; 2007)	Rare migratory visitor; late winter.
Killer whale	Alaska Resident	-;N	2,347 (N/A; 2,084; 2009)	Occasionally sighted in Lowe Cook Inlet.
	Alaska Transient	-:N	345 (N/A; 303; 2003).	
Beluga whale	Cook Inlet	E/D;Y	312 (0.10; 280; 2012)	Use upper Inlet in summer and lower in winter: annual.
Harbor porpoise	Gulf of Alaska	-;Y	31,046 (0.214; 25,987; 1998)	Widespread in the Inlet: annual (less in winter).
Dall's porpoise	Alaska			Infrequently found in Lower Inlet.
Steller sea lion	Western DPS	E/D;Y	79,300 (N/A; 45,659; 2012)	Primarily found in lower Inlet.
Harbor seal	Cook Inlet/Shelikof	-;N	22,900 (0.053; 21,896; 2006)	Frequently found in upper and lower inlet; annual (more in northern Inlet in summer).

Source: Allen and Angliss (20142, 2013), Carretta *et al.* (2013), Zerbini *et al.* (2006)

Humpback Whale (Megaptera novaeangliae)

Although there is considerable distributional overlap in the humpback whale stocks that use Alaska, the whales seasonally found in lower Cook Inlet are probably of the Central North Pacific stock. Listed as endangered under the Endangered Species Act (ESA), this stock has recently been estimated at 7,469, with the portion of the stock that feeds in the Gulf of Alaska estimated at 2,845 animals (Allen and Angliss 2014). The Central North Pacific stock winters in Hawaii and summers from British Columbia to the Aleutian Islands (Calambokidis *et al.* 1997), including Cook Inlet.

Humpback use of Cook Inlet is largely confined to lower Cook Inlet. They have been regularly seen near Kachemak Bay during the summer months (Rugh *et al.* 2005a), and there is a whale-watching venture in Homer capitalizing on this seasonal event. There are anecdotal observations of humpback whales as far north as Anchor Point, with recent summer observations extending to Cape Starichkof (Owl Ridge 2014). Humpbacks might be encountered in the vicinity of Anchor Point if seismic operations were to occur off the point during the summer. However, SAE plans, for the most part, to limit seismic activity along the Kenai Peninsula to during the spring and fall.

Minke Whale (Balaenoptera acutorostra)

Minke whales are the smallest of the rorqual group of baleen whales reaching lengths of up to 35 feet. They are also the most common of the baleen whales, although there are no population estimates for the North Pacific, although estimates have been made for some portions of Alaska. Zerbini *et al.* (2006) estimated the coastal population between Kenai Fjords and the Aleutian Islands at 1,233 animals.

During Cook Inlet-wide aerial surveys conducted from 1993 to 2004, minke whales were encountered only twice (1998, 1999), both times off Anchor Point 16 miles northwest of Homer. A minke whale was also reported off Cape Starichkof in 2011 (A. Holmes, pers. comm.) and 2013 (E. Fernandez and C. Hesselbach, pers. comm.), suggesting this location is regularly used by minke whales, including during the winter. Recently, several minke whales were recorded off Cape Starichkof in early summer 2013 during exploratory drilling conducted there (Owl Ridge 2014). There are no records north of Cape Starichkof, and this species is unlikely to be seen in upper Cook Inlet. There is a chance of encountering this whale during seismic operations along the Kenai Peninsula in lower Cook Inlet.

Gray Whale (Eschrichtius robustus)

Each spring, the Eastern North Pacific stock of gray whale migrates 8,000 kilometers (5,000 miles) northward from breeding lagoons in Baja California to feeding grounds in the Bering and Chukchi seas, reversing their travel again in the fall (Rice and Wolman 1971). Their migration route is for the most part coastal until they reach the feeding grounds. A small portion of whales do not annually complete the full circuit, as small numbers can be found in the summer feeding along the Oregon, Washington, British Columbia, and Alaskan coasts (Rice *et al.* 1984, Moore *et al.* 2007).

Human exploitation reduced this stock to an estimated ''few thousand'' animals (Jones and Schwartz 2002). However, by the late 1980s, the stock was appearing to reach carrying capacity and estimated to be at 26,600 animals (Jones and Schwartz 2002). By 2002, that stock had been reduced to about 16,000 animals, especially following unusually high mortality events in 1999 and 2000 (Allen and Angliss 2014). The stock has continued to grow since then and is currently estimated at 19,126 animals with a minimum estimate of 18,017 (Carretta *et al.* 2013). Most gray whales migrate past the mouth of Cook Inlet to and from northern feeding grounds. However, small numbers of summering gray whales have been noted by fisherman near Kachemak Bay and north of Anchor Point. Further, summering gray whales were seen offshore of Cape Starichkof by marine mammal observers monitoring Buccaneer's Cosmopolitan drilling program in 2013 (Owl Ridge 2014). Regardless, gray whales are not expected to be encountered in upper Cook Inlet, where there are no records, but might be encountered during seismic operations along the Kenai Peninsula south of Ninilchik. However, seismic surveys are not planned in this region during the summer months when gray whales are most expected.

Beluga Whale (Delphinapterus leucas)

The Cook Inlet beluga whale Distinct Population Segment (DPS) is a small geographically isolated population that is separated from other beluga populations by the Alaska Peninsula. The population is genetically (mtDNA) distinct from other Alaska populations suggesting the Peninsula is an effective barrier to genetic exchange (O'Corry-Crowe *et al.* 1997) and that these whales may have been separated from other stocks at least since the last ice age. Laidre *et al.* (2000) examined data from more than 20 marine mammal surveys conducted in the northern Gulf of Alaska and found that sightings of belugas outside Cook Inlet were exceedingly rare, and these were composed of a few stragglers from the Cook Inlet DPS observed at Kodiak Island, Prince William Sound, and Yakutat Bay. Several marine mammal surveys specific to Cook Inlet (Laidre *et al.* 2000, Speckman and Piatt 2000), including those that concentrated on beluga whales (Rugh *et al.* 2000, 2005a), clearly indicate that this stock largely confines itself to Cook Inlet. There is no indication that these whales make forays into the Bering Sea where they might intermix with other Alaskan stocks.

The Cook Inlet beluga DPS was originally estimated at 1,300 whales in 1979 (Calkins 1989) and has been the focus of management concerns since experiencing a dramatic decline in the 1990s. Between 1994 and 1998 the stock declined 47 percent which was attributed to overharvesting by subsistence hunting. Subsistence hunting was estimated to annually remove 10 to 15 percent of the population during this period. Only five belugas have been harvested since 1999, yet the population has continued to decline, with the most recent estimate at only 312 animals (Allen and Angliss 2014). NMFS listed the population as ''depleted'' in 2000 as a consequence of the decline, and as ''endangered'' under the Endangered Species Act (ESA) in 2008 when the population failed to recover following a moratorium on subsistence harvest. In April 2011, NMFS designated critical habitat for the beluga under the ESA (Figure 3). The most recent aerial survey, conducted in 2014, suggests that the Cook Inlet population of belugas is comprised of 340 individuals (Shelden *et al,* 2015).

Prior to the decline, this DPS was believed to range throughout Cook Inlet and occasionally into Prince William Sound and Yakutat (Nemeth *et al.* 2007). However the range has contracted coincident with the population reduction (Speckman and Piatt 2000). During the summer and fall beluga whales are concentrated near the Susitna River mouth, Knik Arm, Turnagain Arm, and Chickaloon Bay (Nemeth *et al.* 2007) where they feed on migrating eulachon (*Thaleichthys pacificus*) and salmon (*Onchorhyncus spp.*) (Moore *et al.* 2000). Critical Habitat Area 1 reflects this summer distribution (Figure 5 in SAE Application). During the winter, beluga whales concentrate in deeper waters in the mid-inlet to Kalgin Island, and in the shallow waters along the west shore of Cook Inlet to Kamishak Bay (Critical Habitat Area 2; Figure 5 in SAE Application). Some whales may also winter in and near Kachemak Bay.

Harbor Porpoise (Phocoena phocoena)

Harbor porpoise are small (1.5 meters length), relatively inconspicuous toothed whales. The Gulf of Alaska Stock is distributed from Cape Suckling to Unimak Pass and was most recently estimated at 31,046 animals (Allen and Angliss 2014). They are found primarily in coastal waters less than 100 meters (100 meters) deep (Hobbs and Waite 2010) where they feed on Pacific herring (*Clupea pallasii*), other schooling fishes, and cephalopods.

Although they have been frequently observed during aerial surveys in Cook Inlet, most sightings are of single animals, and are concentrated at Chinitna and Tuxedni bays on the west side of lower Cook Inlet (Rugh *et al.* 2005a). Dahlheim *et al.* (2000) estimated the 1991 Cook Inlet-wide population at only 136 animals. However, they are one of the three marine mammals (besides belugas and harbor seals) regularly seen in upper Cook Inlet (Nemeth *et al.* 2007), especially during spring eulachon and summer salmon runs. Because harbor porpoise have been observed throughout Cook Inlet during the summer months, including mid-inlet waters, they could be encountered during seismic operations in upper Cook Inlet.

Dall's Porpoise (Phocoenoides dalli)

Dall's porpoise are widely distributed throughout the North Pacific Ocean including Alaska, although they are not found in upper Cook Inlet and the shallower waters of the Bering, Chukchi, and Beaufort Seas (Allen and Angliss 2014). Compared to harbor porpoise, Dall's porpoise prefer the deep offshore and shelf slope waters. The Alaskan population has been estimated at 83,400 animals (Allen and Angliss 2014), making it one of the more common cetaceans in the state. Dall's porpoise have been observed in lower Cook Inlet, including Kachemak Bay and near Anchor Point (Owl Ridge 2014), but sightings there are rare. There is a remote chance that Dall's porpoise might be encountered during seismic operations along the Kenai Peninsula.

Killer Whale (Orcinus orca)

Two different stocks of killer whales inhabit the Cook Inlet region of Alaska: The Alaska Resident Stock and the Gulf of Alaska, Aleutian Islands, Bering Sea Transient Stock (Allen and Angliss 2014). The resident stock is estimated at

2,347 animals and occurs from Southeast Alaska to the Bering Sea (Allen and Angliss 2014). Resident whales feed exclusively on fish and are genetically distinct from transient whales (Saulitis *et al.* 2000). The transient whales feed primarily on marine mammals (Saulitis *et al.* 2000). The transient population inhabiting the Gulf of Alaska shares mitochondrial DNA haplotypes with whales found along the Aleutian Islands and the Bering Sea suggesting a common stock, although there appears to be some subpopulation genetic structuring occurring to suggest the gene flow between groups is limited (see Allen and Angliss 2014). For the three regions combined, the transient population has been estimated at 587 animals (Allen and Angliss 2014).

Killer whales are occasionally observed in lower Cook Inlet, especially near Homer and Port Graham (Shelden *et al.* 2003, Rugh *et al.* 2005a). A concentration of sightings near Homer and inside Kachemak Bay may represent high use or may reflect high observer-effort, given most records are from a whale-watching venture based in Homer. The few whales that have been photographically identified in lower Cook Inlet belong to resident groups more commonly found in nearby Kenai Fjords and Prince William Sound (Shelden *et al.* 2003). Prior to the 1980s, killer whale sightings in upper Cook Inlet were very rare. During aerial surveys conducted between 1993 and 2004, killer whales were observed on only three flights, all in the Kachemak and English Bay area (Rugh *et al.* 2005a). However, anecdotal reports of killer whales feeding on belugas in upper Cook Inlet began increasing in the 1990s, possibly in response to declines in sea lion and harbor seal prey elsewhere (Shelden *et al.* 2003). These sporadic ventures of transient whales into beluga summering grounds have been implicated as a possible contributor to decline of Cook Inlet belugas in the 1990s, although the number of confirmed mortalities from killer whales is small (Shelden *et al.* 2003). If killer whales were to venture into upper Cook Inlet in 2015, they might be encountered during both seismic operations in both upper and lower Cook Inlet.

Steller Sea Lion (Eumetopia jubatus)

The Western Stock of the Steller sea lion is defined as all populations west of longitude 144 °W. to the western end of the Aleutian Islands. The most recent estimate for this stock is 45,649 animals (Allen and Angliss 2014), considerably less than that estimated 140,000 animals in the 1950s (Merrick *et al.* 1987). Because of this dramatic decline, the stock was listed under the ESA as a threatened DPS in 1990, and relisted as endangered in 1997. Critical habitat was designated in 1993, and is defined as a 20-nautical-mile radius around all major rookeries and haulout sites. The 20-nautical-mile buffer was established based on telemetry data that indicated these sea lions concentrated their summer foraging effort within this distance of rookeries and haul outs.

Steller sea lions inhabit lower Cook Inlet, especially in the vicinity of Shaw Island and Elizabeth Island (Nagahut Rocks) haulout sites (Rugh *et al.* 2005a), but are rarely seen in upper Cook Inlet (Nemeth *et al.* 2007). Of the 42 Steller sea lion groups recorded during Cook Inlet aerial surveys between 1993 and 2004, none were recorded north of Anchor Point and only one in the vicinity of Kachemak Bay (Rugh *et al.* 2005a). Marine mammal observers associated with Buccaneer's drilling project off Cape Starichkof did observe seven Steller sea lions during the summer of 2013 (Owl Ridge 2014).

The upper reaches of Cook Inlet may not provide adequate foraging conditions for sea lions for establishing a major haul out presence. Steller sea lions feed largely on walleye pollock (*Theragra chalcogramma*), salmon (*Onchorhyncus spp.*), and arrowtooth flounder (*Atheresthes stomias*) during the summer, and walleye pollock and Pacific cod (*Gadus macrocephalus*) during the winter (Sinclair and Zeppelin 2002), none of which, except for salmon, are found in abundance in upper Cook Inlet (Nemeth *et al.* 2007). Steller sea lions are unlikely to be encountered during seismic operations in upper Cook Inlet, but they could possibly be encountered along the Kenai Peninsula, especially closer to Anchor Point.

Harbor Seal (Phoca vitulina)

With more than 150,000 animals state-wide (Allen and Angliss 2014), harbor seals are one of the more common marine mammal species in Alaskan waters. They are most commonly seen hauled out at tidal flats and rocky areas. Harbor seals feed largely on schooling fish such a walleye pollock, Pacific cod, salmon, Pacific herring, eulachon, and squid. Although harbor seals may make seasonal movements in response to prey, they are resident to Alaska and do not migrate.

The Cook Inlet/Shelikof Stock, ranging from approximately Anchorage down along the south side of the Alaska Peninsula to Unimak Pass, has been recently estimated at a stable 22,900 (Allen and Angliss 2014). Large numbers concentrate at the river mouths and embayments of lower Cook Inlet, including the Fox River mouth in Kachemak Bay (Rugh *et al.* 2005a). Montgomery *et al.* (2007) recorded over 200 haulout sites in lower Cook Inlet alone. However, only a few dozens to a couple hundred seals seasonally occur in upper Cook Inlet (Rugh *et al.* 2005a), mostly at the mouth of the Susitna River where their numbers vary in concert with the spring eulachon and summer salmon runs (Nemeth *et al.* 2007, Boveng *et al.* 2012). In 2012, up to 100 harbor seals were observed hauled out at the mouths of the Theodore and Lewis rivers during monitoring activity associated with SAE's (with Apache) 2012 Cook Inlet seismic program. Montgomery *et al.* (2007) also found seals elsewhere in Cook Inlet to move in response to local steelhead (*Onchorhynchus mykiss*) and salmon runs. Harbor seals may be encountered during seismic operations in both upper and lower Cook Inlet.

Potential Effects of the Specified Activity on Marine Mammals

This section includes a summary and discussion of the ways that components (*e.g.,* seismic airgun operations, vessel movement) of the specified activity, including mitigation, may impact marine mammals. The ''Estimated Take by Incidental Harassment'' section later in this document will include a quantitative analysis of the number of individuals that are expected to be taken by this activity. The ''Negligible Impact Analysis'' section will include the analysis of how this specific activity will impact marine mammals and will consider the content of this section, the ''Estimated Take by Incidental Harassment'' section, the ''Mitigation'' section, and the ''Anticipated Effects on Marine Mammal Habitat'' section to draw conclusions regarding the likely impacts of this activity on the reproductive success or survivorship of individuals and from that on the affected marine mammal populations or stocks.

Operating active acoustic sources, such as airgun arrays, has the potential for adverse effects on marine mammals. The majority of anticipated impacts will be from the use of acoustic sources.

Acoustic Impacts

When considering the influence of various kinds of sound on the marine environment, it is necessary to understand that different kinds of marine life are sensitive to different frequencies of sound. Based on available behavioral data, audiograms have been derived using auditory evoked potentials, anatomical modeling, and other data. Southall *et al.* (2007) designated ''functional hearing groups'' for marine mammals and estimate the lower and upper frequencies of functional hearing of the groups. The functional groups and the associated frequencies are indicated below (note that animals are less sensitive to sounds at the outer edge of their functional range and most sensitive to sounds of frequencies within a smaller range somewhere in the middle of their functional hearing range) and have been modified slightly from Southall *et al.* 2007 to incorporate some newer information:

- Low frequency cetaceans (13 species of mysticetes): functional hearing is estimated to occur between approximately 7 Hz and 30 kHz; (Ketten and Mountain 2009; Tubelli *et al.* 2012)
- Mid-frequency cetaceans (32 species of dolphins, six species of larger toothed whales, and 19 species of beaked and bottlenose whales): Functional hearing is estimated to occur between approximately 150 Hz and 160 kHz; (Southall *et al.* 2007)
- High frequency cetaceans (eight species of true porpoises, six species of river dolphins, Kogia, the franciscana, and four species of cephalorhynchids): Functional hearing is estimated to occur between approximately 200 Hz and 180 kHz; (Southall *et al* 2007)
- Phocid pinnipeds in Water: Functional hearing is estimated to occur between approximately 75 Hz and 100 kHz; (Hemilä *et al.* 2006; Mulsow *et al.* 2011; Reichmuth *et al.* 2013) and
- Otariid pinnipeds in Water: Functional hearing is estimated to occur between approximately 100 Hz and 40 kHz. (Reichmuth *et al.* 2013)

As mentioned previously in this document, nine marine mammal species (seven cetacean and two pinniped species) are likely to occur in the seismic survey area. Of the seven cetacean species likely to occur in SAE's project area, three classified as a low-frequency cetaceans (humpback, minke, gray whale), two are classified as mid-frequency cetaceans (beluga and killer whales), and two are classified as a high-frequency cetaceans (Dall's and harbor porpoise) (Southall *et al.,* 2007). Of the two pinniped species likely to occur in SAE's project area, one is classified as a phocid (harbor seal), and one is classified as an otariid (Steller sea lion). A species' functional hearing group is a consideration when we analyze the effects of exposure to sound on marine mammals.

1. Potential Effects of Airgun Sounds on Marine Mammals

The effects of sounds from airgun pulses might include one or more of the following: Tolerance, masking of natural sounds, behavioral disturbance, and temporary or permanent hearing impairment or non-auditory effects (Richardson *et al.,* 1995). As outlined in previous NMFS documents, the effects of noise on marine mammals are highly variable, often depending on species and contextual factors (based on Richardson *et al.,* 1995).

Tolerance: Numerous studies have shown that pulsed sounds from air guns are often readily detectable in the water at distances of many kilometers. Numerous studies have also shown that marine mammals at distances more than a few kilometers from operating survey vessels often show no apparent response. That is often true even in cases when the pulsed sounds must be readily audible to the animals based on measured received levels and the hearing sensitivity of that mammal group. In general, pinnipeds and small odontocetes (toothed whales) seem to be more tolerant of exposure to air gun pulses than baleen whales. Although various toothed whales, and (less frequently) pinnipeds have been shown to react behaviorally to airgun pulses under some conditions, at other times, mammals of both types have shown no overt reactions. Weir (2008) observed marine mammal responses to seismic pulses from a 24 airgun array firing a total volume of either 5,085 in^3 or 3,147 in^3 in Angolan waters between August 2004 and May 2005. Weir recorded a total of 207 sightings of humpback whales (n = 66), sperm whales (n = 124), and Atlantic spotted dolphins (n = 17) and reported that there were no significant differences in encounter rates (sightings/hr) for humpback and sperm whales according to the airgun array's operational status (*i.e.,* active versus silent).

Behavioral Disturbance: Marine mammals may behaviorally respond when exposed to anthropogenic noise. These behavioral reactions are often shown as: Changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where noise sources are located; and/or flight responses (*e.g.,* pinnipeds flushing into water from haulouts or rookeries).

The biological significance of many of these behavioral disturbances is difficult to predict. The consequences of behavioral modification to individual fitness can range from none up to potential changes to growth, survival, or reproduction, depending on the context, duration, and degree of behavioral modification. Examples of behavioral modifications that could impact growth, survival or reproduction include: Drastic changes in diving/surfacing/swimming patterns that lead to stranding (such as those associated with beaked whale strandings related to exposure to military mid-frequency tactical sonar); longer-term abandonment of habitat that is specifically important for feeding, reproduction, or other critical needs, or significant disruption of feeding or social interaction resulting in substantive energetic costs, inhibited breeding, or prolonged or permanent cow-calf separation.

The onset of behavioral disturbance from anthropogenic noise depends on both external factors (characteristics of noise sources and their paths) and the receiving animals (hearing, motivation, experience, demography) and is also difficult to predict (Southall *et al.,* 2007).

Toothed whales. Few systematic data are available describing reactions of toothed whales to noise pulses. However, systematic work on sperm whales (Tyack *et al.,* 2003) has yielded an increasing amount of information about responses of various odontocetes to seismic surveys based on monitoring studies (*e.g.,* Stone, 2003; Smultea *et al.,* 2004; Moulton and Miller, 2005). Stone *et al.,* 2003 reported reduced sighting rates of small odontoceter during periods of shooting during seismic surveys with large airgun arryas. Moulton and Miller (2004) also found that the range of audibility of seismic pules for mid-sized odontecetes was largely underestimated by models.

Seismic operators and marine mammal observers sometimes see dolphins and other small toothed whales near operating airgun arrays, but, in general, there seems to be a tendency for most delphinids to show some limited avoidance of seismic vessels operating large airgun systems. However, some dolphins seem to be attracted to the seismic vessel and floats, and some ride the bow wave of the seismic vessel even when large arrays of airguns are firing. Nonetheless, there have been indications that small toothed whales sometimes move away or maintain a somewhat greater distance from the vessel when a large array of airguns is operating than when it is silent (*e.g.,* Goold, 1996a,b,c; Calambokidis and Osmek, 1998; Stone, 2003). The beluga may be a species that (at least in certain geographic areas) shows long-distance avoidance of seismic vessels. Aerial surveys during seismic operations in the southeastern Beaufort Sea recorded much lower sighting rates of beluga whales within 10–20 km (6.2–12.4 mi) of an active seismic vessel. These results were consistent with the low number of beluga sightings reported by observers aboard the seismic vessel, suggesting that some belugas might have been avoiding the seismic operations at distances of 10–20 km (6.2–12.4 mi) (Miller *et al.,* 2005).

Captive bottlenose dolphins and (of more relevance in this project) beluga whales exhibit changes in behavior when exposed to strong pulsed sounds similar in duration to those typically used in seismic surveys (Finneran *et al.,* 2002, 2005). However, the animals tolerated high received levels of sound (pk–pk level >200 dB re 1 μPa) before exhibiting aversive behaviors.

Observers stationed on seismic vessels operating off the United Kingdom from 1997–2000 have provided data on the occurrence and behavior of various toothed whales exposed to seismic pulses (Stone, 2003; Gordon *et al.,* 2004). Killer whales were found to be significantly farther from large airgun arrays during periods of shooting compared with periods of no shooting. The displacement of the median distance from the array was approximately 0.5 km (0.3 mi) or more. Killer whales also appear to be more tolerant of seismic shooting in deeper water.

Reactions of toothed whales to large arrays of airguns are variable and, at least for delphinids, seem to be confined to a smaller radius than has been observed for mysticetes. However, based on the limited existing evidence, belugas should not necessarily generally be grouped with delphinids in the ‘‘less responsive’’ category.

Pinnipeds. Pinnipeds are not likely to show a strong avoidance reaction to the airgun sources used. Visual monitoring from seismic vessels has shown only slight (if any) avoidance of airguns by pinnipeds and only slight (if any) changes in behavior. Monitoring work in the Alaskan Beaufort Sea during 1996–2001 provided considerable information regarding the behavior of Arctic ice seals exposed to seismic pulses (Harris *et al.,* 2001; Moulton and Lawson, 2002). These seismic projects usually involved arrays of 6 to 16 airguns with total volumes of 560 to 1,500 in^3. The combined results suggest that some seals avoid the immediate area around seismic vessels. In most survey years, ringed seal sightings tended to be farther away from the seismic vessel when the airguns were operating than when they were not (Moulton and Lawson, 2002). However, these avoidance movements were relatively small, on the order of 100 m (328 ft) to a few hundreds of meters, and many seals remained within 100–200 m (328–656 ft) of the trackline as the operating airgun array passed by. Seal sighting rates at the water surface were lower during airgun array operations than during no-airgun periods in each survey year except 1997. Similarly, seals are often very tolerant of pulsed sounds from seal-scaring devices (Mate and Harvey, 1987; Jefferson and Curry, 1994; Richardson *et al.,* 1995a). However, initial telemetry work suggests that avoidance and other behavioral reactions by two other species of seals, grey and harbor seals, to small airgun sources may at times be stronger than evident to date from visual studies of pinniped reactions to airguns (Thompson *et al.,* 1998). Even if reactions of the species occurring in the activity area are as strong as those evident in the telemetry study, reactions are expected to be confined to relatively small distances and durations, with no long-term effects on pinniped individuals or populations.

Masking: Masking is the obscuring of sounds of interest by other sounds, often at similar frequencies. Marine mammals use acoustic signals for a variety of purposes, which differ among species, but include communication between individuals, navigation, foraging, reproduction, avoiding predators, and learning about their environment (Erbe and Farmer, 2000; Tyack, 2000). Masking, or auditory interference, generally occurs when sounds in the environment are louder than, and of a similar frequency to, auditory signals an animal is trying to receive. Masking is a phenomenon that affects animals trying to receive acoustic information about their environment, including sounds from other members of their species, predators, prey, and sounds that allow them to orient in their environment. Masking these acoustic signals can disturb the behavior of individual animals, groups of animals, or entire populations.

Masking occurs when anthropogenic sounds and signals (that the animal utilizes) overlap at both spectral and temporal scales. For the airgun sound generated from the seismic surveys, sound will consist of low frequency (under 500 Hz) pulses with extremely short durations (less than one second). Lower frequency man-made sounds are more likely to affect detection of potentially important natural sounds such as surf and prey noise, or communication calls for low frequency specialists. There is little concern regarding masking near the sound source due to the brief duration of these pulses and relatively longer silence between air gun shots (approximately 12 seconds). However, at long distances (over tens of kilometers away), due to multipath propagation and reverberation, the durations of airgun pulses can be ‘‘stretched’’ to seconds with long decays (Madsen *et al.,* 2006), although the intensity of the sound is greatly reduced.

This could affect communication signals used by low frequency mysticetes when they occur near the noise band and thus reduce the communication space of animals (*e.g.,* Clark *et al.,* 2009) and cause increased stress levels (*e.g.,* Foote *et al.,* 2004; Holt *et al.,* 2009); however, no baleen whales are expected to occur within the action area. Marine mammals are thought to be able to compensate for masking by adjusting their acoustic behavior by shifting call frequencies, and/or increasing call volume and vocalization rates. For example, blue whales were found to increase call rates when exposed to seismic survey noise in the St. Lawrence Estuary (Di Iorio and Clark, 2010). The North Atlantic right whales (*Eubalaena glacialis*) exposed to high shipping noise increase call frequency (Parks *et al.,* 2007), while some humpback whales respond to low-frequency active sonar playbacks by increasing song length (Miller *et al.,* 2000). Additionally, beluga whales have been known to change their vocalizations in the presence of high background noise possibly to avoid masking calls (Au *et al.,* 1985; Lesage *et al.,* 1999; Scheifele *et al.,* 2005). Although some degree of masking is inevitable when high levels of manmade broadband sounds are introduced into the sea, marine mammals have evolved systems and behavior that function to reduce the impacts of masking. Structured signals, such as the echolocation click sequences of small toothed whales, may be readily detected even in the presence of strong background noise because their frequency content and temporal features usually differ strongly from those of the background noise (Au and Moore, 1988, 1990). The components of background noise that are similar in frequency to the sound signal in question primarily determine the degree of masking of that signal.

Redundancy and context can also facilitate detection of weak signals. These phenomena may help marine mammals detect weak sounds in the presence of natural or manmade noise. Most masking studies in marine mammals present the test signal and the masking noise from the same direction. The sound localization abilities of marine mammals suggest that, if signal and noise come from different directions, masking would not be as severe as the usual types of masking studies might suggest (Richardson *et al.,* 1995). The dominant background noise may be highly directional if it comes from a particular anthropogenic source such as a ship or industrial site. Directional hearing may significantly reduce the masking effects of these sounds by improving the effective signal-to-noise ratio. In the cases of higher frequency hearing by the bottlenose dolphin, beluga whale, and killer whale, empirical evidence confirms that masking depends strongly on the relative directions of arrival of sound signals and the masking noise (Penner *et al.,* 1986; Dubrovskiy, 1990; Bain *et al.,* 1993; Bain and Dahlheim, 1994). Toothed whales and probably other marine mammals as well, have additional capabilities besides directional hearing that can facilitate detection of sounds in the presence of background noise. There is evidence that some toothed whales can shift the dominant frequencies of their echolocation signals from a frequency range with a lot of ambient noise toward frequencies with less noise (Au *et al.,* 1974, 1985; Moore and Pawloski, 1990; Thomas and Turl, 1990; Romanenko and Kitain, 1992; Lesage *et al.,* 1999). A few marine mammal species are known to increase the source levels or alter the frequency of their calls in the presence of elevated sound levels (Dahlheim, 1987; Au, 1993; Lesage *et al.,* 1993, 1999; Terhune, 1999; Foote *et al.,* 2004; Parks *et al.,* 2007, 2009; Di Iorio and Clark, 2009; Holt *et al.,* 2009).

These data demonstrating adaptations for reduced masking pertain mainly to the very high frequency echolocation signals of toothed whales. There is less information about the existence of corresponding mechanisms at moderate or low frequencies or in other types of marine mammals. For example, Zaitseva *et al.* (1980) found that, for the bottlenose dolphin, the angular separation between a sound source and a masking noise source had little effect on the degree of masking when the sound frequency was 18 kHz, in contrast to the pronounced effect at higher frequencies. Directional hearing has been demonstrated at frequencies as low as 0.5–2 kHz in several marine mammals, including killer whales (Richardson *et al.,* 1995a). This ability may be useful in reducing masking at these frequencies. In summary, high levels of sound generated by anthropogenic activities may act to mask the detection of weaker biologically important sounds by some marine mammals. This masking may be more prominent for lower frequencies. For higher frequencies, such as that used in echolocation by toothed whales, several mechanisms are available that may allow them to reduce the effects of such masking.

Threshold Shift (noise-induced loss of hearing)—When animals exhibit reduced hearing sensitivity (*i.e.,* sounds must be louder for an animal to detect them) following exposure to an intense sound or sound for long duration, it is referred to as a noise-induced threshold shift (TS). An animal can experience temporary threshold shift (TTS) or permanent threshold shift (PTS). TTS can last from minutes or hours to days (*i.e.,* there is complete recovery), can occur in specific frequency ranges (*i.e.,* an animal might only have a temporary loss of hearing sensitivity between the frequencies of 1 and 10 kHz), and can be of varying amounts (for example, an animal's hearing sensitivity might be reduced initially by only 6 dB or reduced by 30 dB). PTS is permanent, but some recovery is possible. PTS can also occur in a specific frequency range and amount as mentioned above for TTS.

The following physiological mechanisms are thought to play a role in inducing auditory TS: Effects to sensory hair cells in the inner ear that reduce their sensitivity, modification of the chemical environment within the sensory cells, residual muscular activity in the middle ear, displacement of certain inner ear membranes, increased blood flow, and post-stimulatory reduction in both efferent and sensory neural output (Southall *et al.,* 2007). The amplitude, duration, frequency, temporal pattern, and energy distribution of sound exposure all can affect the amount of associated TS and the frequency range in which it occurs. As amplitude and duration of sound exposure increase, so, generally, does the amount of TS, along with the recovery time. For intermittent sounds, less TS could occur than compared to a continuous exposure with the same energy (some recovery could occur between intermittent exposures depending on the duty cycle between sounds) (Kryter *et al.,* 1966; Ward, 1997). For example, one short but loud (higher SPL) sound exposure may induce the same impairment as one longer but softer sound, which in turn may cause more impairment than a series of several intermittent softer sounds with the same total energy (Ward, 1997). Additionally, though TTS is temporary, prolonged exposure to sounds strong enough to elicit TTS, or shorter-term exposure to sound levels well above the TTS threshold, can cause PTS, at least in terrestrial mammals (Kryter, 1985). In the case of the seismic survey, animals are not expected to be exposed to levels high enough or durations long enough to result in PTS.

PTS is considered auditory injury (Southall *et al.,* 2007). Irreparable damage to the inner or outer cochlear hair cells may cause PTS; however, other mechanisms are also involved, such as exceeding the elastic limits of certain tissues and membranes in the middle and inner ears and resultant changes in the chemical composition of the inner ear fluids (Southall *et al.,* 2007).

Although the published body of scientific literature contains numerous theoretical studies and discussion papers on hearing impairments that can occur with exposure to a loud sound, only a few studies provide empirical information on the levels at which noise-induced loss in hearing sensitivity occurs in nonhuman animals. For marine mammals, published data are limited to the captive bottlenose dolphin, beluga, harbor porpoise, and Yangtze finless porpoise (Finneran *et al.,* 2000, 2002, 2003, 2005, 2007, 2010a, 2010b; Finneran and Schlundt, 2010; Lucke *et al.,* 2009; Mooney *et al.,* 2009a, 2009b; Popov *et al.,* 2011a, 2011b; Kastelein *et al.,* 2012a; Schlundt *et al.,* 2000; Nachtigall *et al.,* 2003, 2004). For pinnipeds in water, data are limited to measurements of TTS in harbor seals, an elephant seal, and California sea lions (Kastak *et al.,* 1999, 2005; Kastelein *et al.,* 2012b).

Marine mammal hearing plays a critical role in communication with conspecifics, and interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (*i.e.,* recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious (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 occurs during a time where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during time when communication is critical for successful mother/calf interactions could have more serious impacts. Similarly, depending on the degree and frequency range, the effects of PTS on an animal could range in severity, although it is considered generally more serious because it is a permanent condition. Of note, 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.

Given the higher level of sound necessary to cause PTS as compared with TTS, it is considerably less likely that PTS would occur during the seismic surveys in Cook Inlet. Cetaceans generally avoid the immediate area around operating seismic vessels, as do some other marine mammals. Some pinnipeds show avoidance reactions to airguns, but their avoidance reactions are generally not as strong or consistent as those of cetaceans, and occasionally they seem to be attracted to operating seismic vessels (NMFS, 2010).

Non-auditory Physical Effects: Non-auditory physical effects might occur in marine mammals exposed to strong underwater pulsed sound. Possible types of non-auditory physiological effects or injuries that theoretically might occur in mammals close to a strong sound source include stress, neurological effects, bubble formation, and other types of organ or tissue damage. Some marine mammal species (*i.e.,* beaked whales) may be especially susceptible to injury and/or stranding when exposed to strong pulsed sounds.

Classic stress responses begin when an animal's central nervous system perceives a potential threat to its homeostasis. That perception triggers stress responses regardless of whether a stimulus actually threatens the animal; the mere perception of a threat is sufficient to trigger a stress response (Moberg, 2000; Sapolsky *et al.,* 2005; Seyle, 1950). Once an animal's central nervous system perceives a threat, it mounts a biological response or defense that consists of a combination of the four general biological defense responses: Behavioral responses; autonomic nervous system responses; neuroendocrine responses; or immune responses.

In the case of many stressors, an animal's first and most economical (in terms of biotic costs) response is behavioral avoidance of the potential stressor or avoidance of continued exposure to a stressor. An animal's second line of defense to stressors involves the sympathetic part of the autonomic nervous system and the classical ''fight or flight'' response, which includes the cardiovascular system, the gastrointestinal system, the exocrine glands, and the adrenal medulla to produce changes in heart rate, blood pressure, and gastrointestinal activity that humans commonly associate with ''stress.'' These responses have a relatively short duration and may or may not have significant long-term effects on an animal's welfare.

An animal's third line of defense to stressors involves its neuroendocrine or sympathetic nervous systems; the system that has received the most study has been the hypothalmus-pituitary-adrenal system (also known as the HPA axis in mammals or the hypothalamus-pituitary-interrenal axis in fish and some reptiles). Unlike stress responses associated with the autonomic nervous 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 (Moberg, 1987; Rivier, 1995), altered metabolism (Elasser *et al.,* 2000), reduced immune competence (Blecha, 2000), and behavioral disturbance. Increases in the circulation of glucocorticosteroids (cortisol, corticosterone, and aldosterone in marine mammals; see Romano *et al.,* 2004) have been equated with stress for many years.

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and distress is the biotic 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 a risk to the animal's welfare. 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 biotic functions, which impair those functions that experience the diversion. For example, when mounting a stress response diverts energy away from growth in young animals, those animals may experience stunted growth. When mounting a stress response diverts energy from a fetus, an animal's reproductive success and fitness will suffer. In these cases, the animals will have entered a pre-pathological or pathological state which is called ''distress'' (sensu Seyle, 1950) or ''allostatic loading'' (sensu McEwen and Wingfield, 2003). This pathological state will last until the animal replenishes its biotic reserves sufficient to restore normal function. Note that these examples involved a long-term (days or weeks) stress response due to exposure to stimuli.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses have also been documented fairly well through controlled experiment; because this physiology exists in every vertebrate that has been studied, it is not surprising that stress responses and their costs have been documented in both laboratory and free-living animals (for examples see, Holberton *et al.,* 1996; Hood *et al.,* 1998; Jessop *et al.,* 2003; Krausman *et al.,* 2004; Lankford *et al.,* 2005; Reneerkens *et al.,* 2002; Thompson and Hamer, 2000). Although no information has been collected on the physiological responses of marine mammals to anthropogenic sound exposure, studies of other marine animals and terrestrial animals would lead us to expect some marine mammals to experience physiological stress responses and, perhaps, physiological responses that would be classified as ''distress'' upon exposure to anthropogenic sounds.

For example, Jansen (1998) reported on the relationship between acoustic exposures and physiological responses that are indicative of stress responses in humans (*e.g.,* elevated respiration and increased heart rates). Jones (1998) reported on reductions in human performance when faced with acute, repetitive exposures to acoustic disturbance. Trimper *et al.* (1998) reported on the physiological stress responses of osprey to low-level aircraft noise while Krausman *et al.* (2004) reported on the auditory and physiology stress responses of endangered Sonoran pronghorn to military overflights. Smith *et al.* (2004a, 2004b) identified noise-induced physiological transient stress responses in hearing-specialist fish (*i.e.,* goldfish) that accompanied short- and long-term hearing losses. Welch and Welch (1970) reported physiological and behavioral stress responses that accompanied damage to the inner ears of fish and several mammals.

Hearing is one of the primary senses marine mammals use to gather information about their environment and communicate with conspecifics. Although empirical information on the effects of sensory impairment (TTS, PTS, and acoustic masking) on marine mammals remains limited, we assume that reducing a marine mammal's ability to gather information about its environment and communicate with other members of its species would induce stress, based on data that terrestrial animals exhibit those responses under similar conditions (NRC, 2003) and because marine mammals use hearing as their primary sensory mechanism. Therefore, we assume that acoustic exposures sufficient to trigger onset PTS or TTS would be accompanied by physiological stress responses. However, marine mammals also might experience stress responses at received levels lower than those necessary to trigger onset TTS. Based on empirical studies of the time required to recover from stress responses (Moberg, 2000), NMFS also assumes that stress responses could persist beyond the time interval required for animals to recover from TTS and might result in pathological and pre-pathological states that would be as significant as behavioral responses to TTS. Resonance effects (Gentry, 2002) and direct noise-induced bubble formations (Crum *et al.,* 2005) are implausible in the case of exposure to an impulsive broadband source like an airgun array. If seismic surveys disrupt diving patterns of deep-diving species, this might result in bubble formation and a form of the bends, as speculated to occur in beaked whales exposed to sonar. However, there is no specific evidence of this upon exposure to airgun pulses. Additionally, no beaked whale species occur in the seismic survey area.

In general, very little is known about the potential for strong, anthropogenic underwater sounds to cause non-auditory physical effects in marine mammals. Such effects, if they occur at all, would presumably be limited to short distances and to activities that extend over a prolonged period. The available data do not allow identification of a specific exposure level above which non-auditory effects can be expected (Southall *et al.,* 2007) or any meaningful quantitative predictions of the numbers (if any) of marine mammals that might be affected in those ways. There is no definitive evidence that any of these effects occur even for marine mammals in close proximity to large arrays of airguns. In addition, marine mammals that show behavioral avoidance of seismic vessels, including belugas and some pinnipeds, are especially unlikely to incur non-auditory impairment or other physical effects. Therefore, it is unlikely that such effects would occur during SAE's surveys given the brief duration of exposure and the planned monitoring and mitigation measures described later in this document.

Stranding and Mortality: Marine mammals close to underwater detonations of high explosive can be killed or severely injured, and the auditory organs are especially susceptible to injury (Ketten *et al.* 1993; Ketten 1995). Airgun pulses are less energetic and their peak amplitudes have slower rise times. To date, there is no evidence that serious injury, death, or stranding by marine mammals can occur from exposure to air gun pulses, even in the case of large air gun arrays.

However, in past IHA notices for seismic surveys, commenters have referenced two stranding events allegedly associated with seismic activities, one off Baja California and a second off Brazil. NMFS has addressed this concern several times, including in the **Federal Register** notice announcing the IHA for Apache Alaska's first seismic survey in 2012. Readers are encouraged to review NMFS's response to comments on this matter found in 69 FR 74905 (December 14, 2004), 71 FR 43112 (July 31, 2006), 71 FR 50027 (August 24, 2006), 71 FR 49418 (August 23, 2006), and 77 FR 27720 (May 11, 2012).

Beluga whale strandings in Cook Inlet are not uncommon; however, these events often coincide with extreme tidal fluctuations (''spring tides'') or killer whale sightings (Shelden *et al.,* 2003). For example, in August 2012, a group of Cook Inlet beluga whales stranded in the mud flats of Turnagain Arm during low tide and were able to swim free with the flood tide. No strandings or marine mammals in distress were observed during the 2D test survey conducted by Apache in March 2011, and none were reported by Cook Inlet inhabitants. As a result, NMFS does not expect any marine mammals will incur serious injury or mortality in Cook Inlet or strand as a result of the seismic survey.

2. Potential Effects From Pingers on Marine Mammals

Active acoustic sources other than the airguns will be used for SAE's oil and gas exploration seismic survey program in Cook Inlet. The specifications for the pingers (source levels and frequency ranges) were provided earlier in this document. In general, pingers are known to cause behavioral disturbance and are commonly used to deter marine mammals from commercial fishing gear or fish farms. Due to the potential to change marine mammal behavior, shut downs described for airguns will also be applied to pinger use.

Vessel Impacts

Vessel activity and noise associated with vessel activity will temporarily increase in the action area during SAE's seismic survey as a result of the operation of nine vessels. To minimize the effects of vessels and noise associated with vessel activity, SAE will follow NMFS's Marine Mammal Viewing Guidelines and Regulations and will alter heading or speed if a marine mammal gets too close to a vessel. In addition, vessels will be operating at slow speed (4–5 knots) when conducting surveys and in a purposeful manner to and from work sites in as direct a route as possible. Marine mammal monitoring observers and passive acoustic devices will alert vessel captains as animals are detected to ensure safe and effective measures are applied to avoid coming into direct contact with marine mammals. Therefore, NMFS neither anticipates nor authorizes takes of marine mammals from ship strikes.

Odontocetes, such as beluga whales, killer whales, and harbor porpoises, often show tolerance to vessel activity; however, they may react at long distances if they are confined by ice, shallow water, or were previously harassed by vessels (Richardson *et al.,* 1995). Beluga whale response to vessel noise varies greatly from tolerance to extreme sensitivity depending on the activity of the whale and previous experience with vessels (Richardson *et al.,* 1995). Reactions to vessels depend on whale activities and experience, habitat, boat type, and boat behavior (Richardson *et al.,* 1995) and may include behavioral responses, such as altered headings or avoidance (Blane and Jaakson, 1994; Erbe and Farmer, 2000); fast swimming; changes in vocalizations (Lesage *et al.,* 1999; Scheifele *et al.,* 2005); and changes in dive, surfacing, and respiration patterns.

There are few data published on pinniped responses to vessel activity, and most of the information is anecdotal (Richardson *et al.,* 1995). Generally, sea lions in water show tolerance to close and frequently approaching vessels and sometimes show interest in fishing vessels. They are less tolerant when hauled out on land; however, they rarely react unless the vessel approaches within 100–200 m (330–660 ft; reviewed in Richardson *et al.,* 1995).

Entanglement

Although some of SAE's equipment contains cables or lines, the risk of entanglement is extremely remote. Additionally, mortality from entanglement is not anticipated. The material used by SAE and the amount of slack is not anticipated to allow for marine mammal entanglements.

Anticipated Effects on Marine Mammal Habitat

The primary potential impacts to marine mammal habitat and other marine species are associated with elevated sound levels produced by airguns and other active acoustic sources. However, other potential impacts to the surrounding habitat from physical disturbance are also possible. This section describes the potential impacts to marine mammal habitat from the specified activity. Because the marine mammals in the area feed on fish and/or invertebrates there is also information on the species typically preyed upon by the marine mammals in the area. As noted earlier, upper Cook Inlet is an important feeding and calving area for the Cook Inlet beluga whale and critical habitat has been designated for this species in the seismic survey area.

Common Marine Mammal Prey in the Project Area

Fish are the primary prey species for marine mammals in upper Cook Inlet. Beluga whales feed on a variety of fish, shrimp, squid, and octopus (Burns and Seaman, 1986). Common prey species in Knik Arm include salmon, eulachon and cod. Harbor seals feed on fish such as pollock, cod, capelin, eulachon, Pacific herring, and salmon, as well as a variety of benthic species, including crabs, shrimp, and cephalopods. Harbor seals are also opportunistic feeders with their diet varying with season and location. The preferred diet of the harbor seal in the Gulf of Alaska consists of pollock, octopus, capelin, eulachon, and Pacific herring (Calkins, 1989). Other prey species include cod, flat fishes, shrimp, salmon, and squid (Hoover, 1988). Harbor porpoises feed primarily on Pacific herring, cod, whiting (hake), pollock, squid, and octopus (Leatherwood *et al.,* 1982). In the upper Cook Inlet area, harbor porpoise feed on squid and a variety of small schooling fish, which would likely include Pacific herring and eulachon (Bowen and Siniff, 1999; NMFS, unpublished data). Killer whales feed on either fish or other marine mammals depending on genetic type (resident versus transient respectively). Killer whales in Knik Arm are typically the transient type (Shelden *et al.,* 2003) and feed on beluga whales and other marine mammals, such as harbor seal and harbor porpoise. The Steller sea lion diet consists of a variety of fishes (capelin, cod, herring, mackerel, pollock, rockfish, salmon, sand lance, etc.), bivalves, squid, octopus, and gastropods.

Potential Impacts on Prey Species

With regard to fish as a prey source for cetaceans and pinnipeds, fish are known to hear and react to sounds and to use sound to communicate (Tavolga *et al.,* 1981) and possibly avoid predators (Wilson and Dill, 2002). Experiments have shown that fish can sense both the strength and direction of sound (Hawkins, 1981). Primary factors determining whether a fish can sense a sound signal, and potentially react to it, are the frequency of the signal and the strength of the signal in relation to the natural background sound level.

Fishes produce sounds that are associated with behaviors that include territoriality, mate search, courtship, and aggression. It has also been speculated that sound production may provide the means for long distance communication and communication under poor underwater visibility conditions (Zelick *et al.,* 1999), although the fact that fish communicate at low-frequency sound levels where the masking effects of ambient noise are naturally highest suggests that very long distance communication would rarely be possible. Fishes have evolved a diversity of sound generating organs and acoustic signals of various temporal and spectral contents. Fish sounds vary in structure, depending on the mechanism used to produce them (Hawkins, 1993). Generally, fish sounds are predominantly composed of low frequencies (less than 3 kHz).

Since objects in the water scatter sound, fish are able to detect these objects through monitoring the ambient noise. Therefore, fish are probably able to detect prey, predators, conspecifics, and physical features by listening to environmental sounds (Hawkins, 1981). There are two sensory systems that enable fish to monitor the vibration-based information of their surroundings. The two sensory systems, the inner ear and the lateral line, constitute the acoustico-lateralis system.

Although the hearing sensitivities of very few fish species have been studied to date, it is becoming obvious that the intra- and inter-specific variability is considerable (Coombs, 1981). Nedwell *et al.* (2004) compiled and published available fish audiogram information. A noninvasive electrophysiological recording method known as auditory brainstem response is now commonly used in the production of fish audiograms (Yan, 2004). Popper and Carlson (1998) and the Navy (2001) found that fish generally perceive underwater sounds in the frequency range of 50–2,000 Hz, with peak sensitivities below 800 Hz. Even though some fish are able to detect sounds in the ultrasonic frequency range, the thresholds at these higher frequencies tend to be considerably higher than those at the lower end of the auditory frequency range.

Fish are sensitive to underwater impulsive sounds due to swim bladder resonance. As the pressure wave passes through a fish, the swim bladder is rapidly squeezed as the high pressure wave, and then the under pressure component of the wave, passes through the fish. The swim bladder may repeatedly expand and contract at the high sound pressure levels, creating pressure on the internal organs surrounding the swim bladder.

Literature relating to the impacts of sound on marine fish species can be divided into the following categories: (1) Pathological effects; (2) physiological effects; and (3) behavioral effects. Pathological effects include lethal and sub-lethal physical damage to fish; physiological effects include primary and secondary stress responses; and behavioral effects include changes in exhibited behaviors of fish. Behavioral changes might be a direct reaction to a detected sound or a result of the anthropogenic sound masking natural sounds that the fish normally detect and to which they respond. The three types of effects are often interrelated in complex ways. For example, some physiological and behavioral effects could potentially lead to the ultimate pathological effect of mortality. Hastings and Popper (2005) reviewed what is known about the effects of sound on fishes and identified studies needed to address areas of uncertainty relative to measurement of sound and the responses of fishes. Popper *et al.* (2003/2004) also published a paper that reviews the effects of anthropogenic sound on the behavior and physiology of fishes.

The level of sound at which a fish will react or alter its behavior is usually well above the detection level. Fish have been found to react to sounds when the sound level increased to about 20 dB above the detection level of 120 dB (Ona, 1988); however, the response threshold can depend on the time of year and the fish's physiological condition (Engas *et al.,* 1993). In general, fish react more strongly to pulses of sound rather than a continuous signal (Blaxter *et al.,* 1981), and a quicker alarm response is elicited when the sound signal intensity rises rapidly compared to sound rising more slowly to the same level.

Investigations of fish behavior in relation to vessel noise (Olsen *et al.,* 1983; Ona, 1988; Ona and Godo, 1990) have shown that fish react when the sound from the engines and propeller exceeds a certain level. Avoidance reactions have been observed in fish such as cod and herring when vessels approached close enough that received sound levels are 110 dB to 130 dB (Nakken, 1992; Olsen, 1979; Ona and Godo, 1990; Ona and Toresen, 1988). However, other researchers have found that fish such as polar cod, herring, and capelin are often attracted to vessels (apparently by the noise) and swim toward the vessel (Rostad *et al.,* 2006). Typical sound source levels of vessel noise in the audible range for fish are 150 dB to 170 dB (Richardson *et al.,* 1995).

Carlson (1994), in a review of 40 years of studies concerning the use of underwater sound to deter salmonids from hazardous areas at hydroelectric dams and other facilities, concluded that salmonids were able to respond to low-frequency sound and to react to sound sources within a few feet of the source. He speculated that the reason that underwater sound had no effect on salmonids at distances greater than a few feet is because they react to water particle motion/acceleration, not sound pressures. Detectable particle motion is produced within very short distances of a sound source, although sound pressure waves travel farther.

Potential Impacts to the Benthic Environment

SAE's seismic survey requires the deployment of a submersible recording system in the inter-tidal and marine zones. An autonomous ''nodal'' (*i.e.,* no cables) system would be placed on the seafloor by specific vessels in lines parallel to each other with a node line spacing of 402 m (0.25 mi). Each nodal ''patch'' will have 32 node lines parallel to each other. The lines generally run perpendicular to the shoreline. An entire patch will be placed on the seafloor prior to airgun activity. As the patches are surveyed, the node lines will be moved either side to side or inline to the next location. Placement and retrieval of the nodes may cause temporary and localized increases in turbidity on the seafloor. The substrate of Cook Inlet consists of glacial silt, clay, cobbles, pebbles, and sand (Sharma and Burrell, 1970). Sediments like sand and cobble dissipate quickly when suspended, but finer materials like clay and silt can create thicker plumes that may harm fish; however, the turbidity created by placing and removing nodes on the seafloor will settle to background levels within minutes after the cessation of activity.

In addition, seismic noise will radiate throughout the water column from airguns and pingers until it dissipates to background levels. No studies have demonstrated that seismic noise affects the life stages, condition, or amount of food resources (fish, invertebrates, eggs) used by marine mammals, except when exposed to sound levels within a few meters of the seismic source or in few very isolated cases. NMFS has also required a seasonal closure near the Susitna River Delta from April 15 to October 15, which is an essential foraging location for Cook Inlet belugas. Where fish or invertebrates did respond to seismic noise, the effects were temporary and of short duration. Consequently, disturbance to fish species due to the activities associated with the seismic survey (i.e, placement and retrieval of nodes and noise from sound sources) will be short term and fish will be expected to return to their pre-disturbance behavior once seismic survey activities cease.

Based on the preceding discussion, the activity is not expected to have any habitat-related effects that could cause significant or long-term consequences for individual marine mammals or their populations.

Mitigation

In order to issue an incidental take authorization (ITA) under section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses (where relevant).

Mitigation Measures in SAE's Application

For the mitigation measures, SAE listed the following protocols to be implemented during its seismic survey program in Cook Inlet.

1. Operation of Mitigation Airgun at Night

SAE will conduct both daytime and nighttime operations. Nighttime operations will be initiated only if a ''mitigation airgun'' (typically the 10 in^3) has been continuously operational from the time that PSO monitoring has ceased for the day. Seismic activity will not ramp up from an extended shut-down (*i.e.,* when the airgun has been down with no activity for at least 10 minutes) during nighttime operations, and survey activities will be suspended until the following day. At night, the vessel captain and crew will maintain lookout for marine mammals and will order the airgun(s) to be shut down if marine mammals are observed in or about to enter the established exclusion zones.

2. Exclusion and Disturbance Zones

SAE will establish exclusion zones to avoid Level A harassment (''injury exclusion zone'') of all marine mammals and to avoid Level B harassment (''disturbance exclusion zone'') of any beluga whales or groups of five or more killer whales or harbor porpoises detected within the designated zones. The injury exclusion zone will correspond to the area around the source within which received levels equal or exceed 180 dB re 1 μPa [rms] for cetaceans and 190 dB re 1 μPa [rms] for pinnipeds, and SAE will shut down or power down operations if any marine mammals are seen approaching or entering this zone (more detail below). The disturbance exclusion zone will correspond to the area around the source within which received levels equal or exceed 160 dB re 1 μPa [rms] and SAE will implement power down and/or shutdown measures, as appropriate, if any beluga whales, humpback whales, Steller sea lions, or group of five or more killer whales or harbor porpoises are seen entering or approaching the disturbance exclusion zone.

3. Power Down and Shutdown Procedures

A power down is the immediate reduction in the number of operating energy sources from a full array firing to a mitigation airgun. A shutdown is the immediate cessation of firing of all energy sources. The arrays will be immediately powered down whenever a marine mammal is sighted approaching close to or within the applicable exclusion zone of the full arrays but is outside the applicable exclusion zone of the single source. If a marine mammal is sighted within the applicable exclusion zone of the single energy source, the entire array will be shutdown (*i.e.,* no sources firing). Following a power down or a shutdown, airgun activity will not resume until the marine mammal has clearly left the applicable injury or disturbance exclusion zone. The animal will be considered to have cleared the zone if it: (1) Is visually observed to have left the zone; (2) has not been seen within the zone for 15 minutes in the case of pinnipeds and small odontocetes; or (3) has not been seen within the zone for 30 minutes in the case of large odontocetes, including killer whales and belugas.

Visual monitoring by qualified PSOs will continue for 30 minutes after a shutdown or at the end of a period of seismic surveying to monitor for animals returning to the previously ensonified area.

4. Ramp-Up Procedures

A ramp-up of an airgun array provides a gradual increase in sound levels, and involves a step-wise increase in the number and total volume of air guns firing until the full volume is achieved. The purpose of a ramp-up (or ''soft start'') is to ''warn'' cetaceans and pinnipeds in the vicinity of the airguns and to provide the time for them to leave the area and thus avoid any potential injury or impairment of their hearing abilities.

During the seismic survey, the seismic operator will ramp up the airgun array slowly at a rate of no more than 6 dB per 5-minute period. Ramp-up is used at the start of airgun operations, after a power- or shut-down, and after any period of greater than 10 minutes in duration without airgun operations (''extended shutdown'').

A full ramp-up after a shutdown will not begin until there has been a minimum of 30 minutes of observation of the applicable exclusion zone by PSOs to assure that no marine mammals are present. The entire exclusion zone must be visible during the 30-minute lead-in to a full ramp up. If the entire exclusion zone is not visible, then ramp-up from a cold start cannot begin. If a marine mammal(s) is sighted within the injury exclusion zone during the 30-minute watch prior to ramp-up, ramp-up will be delayed until the marine mammal(s) is sighted outside of the zone or the animal(s) is not sighted for at least 15–30 minutes: 15 minutes for small odontocetes and pinnipeds (*e.g.* harbor porpoises, harbor seals, and Steller sea lions), or 30 minutes for large odontocetes (*e.g.,* killer whales and beluga whales).

5. Speed or Course Alteration

If a marine mammal is detected outside the injury exclusion zone and, based on its position and the relative motion, is likely to enter that zone, the vessel's speed and/or direct course may, when practical and safe, be changed to avoid the marine mammal and also minimize the effect on the seismic program. This can be used in coordination with a power down procedure. The marine mammal activities and movements relative to the seismic and support vessels will be closely monitored to ensure that the marine mammal does not approach within the applicable exclusion radius. If the mammal appears likely to enter the exclusion radius, further mitigative actions will be taken, *i.e.,* either further course alterations, power down, or shut down of the airgun(s).

6. Measures for Beluga Whales and Groups of Killer Whales and Harbor Porpoises

The following are additional protective measures for beluga whales and groups of five or more killer whales and harbor porpoises. Specifically, a 160-dB vessel monitoring zone will be established and monitored in Cook Inlet during all seismic surveys. If a beluga whale or groups of five or more killer whales and/or harbor porpoises are visually sighted approaching or within the 160-dB disturbance zone, survey activity will not commence until the animals are no longer present within the 160-dB disturbance zone. Whenever any beluga whales or groups of five or more killer whales and/or harbor porpoises are detected approaching or within the 160-dB disturbance zone, the airguns may be powered down before the animal is within the 160-dB disturbance zone, as an alternative to a complete shutdown. If a power down is not sufficient, the sound source(s) will be shut-down until the animals are no longer present within the 160-dB zone.

Additional Mitigation Measures Required by NMFS

In addition to the mitigation measures above, NMFS requires implementation of the following mitigation measures.

SAE will not operate airguns within 10 miles (16 km) of the mean higher high water (MHHW) line of the Susitna Delta (Beluga River to the Little Susitna River) between April 15 and October 15. The purpose of this mitigation measure is to protect beluga whales in the designated critical habitat in this area that is important for beluga whale feeding and calving during the spring and fall months. The range of the setback required by NMFS was designated to protect this important habitat area and also to create an effective buffer where sound does not encroach on this habitat. This seasonal exclusion will be in effect from April 15-October 15. Activities may occur within this area from October 16–April 14.

A ''mitigation airgun'' (10in^3) will be operated at approximately one shot per minute, only during daylight and when there is good visibility, and will not be operated for longer than 3 hours in duration. In cases when the next start-up after the turn is expected to be during lowlight or low visibility, use of the mitigation airgun may be initiated 30 minutes before darkness or low visibility conditions occur and may be operated until the start of the next seismic acquisition line. The mitigation gun must still be operated at approximately one shot per minute.

When nighttime operations ramp up from the mitigation airgun, SAE will be required to use passive acoustic monitoring for at least 30 minutes prior to ramp-up to detect beluga whales, humpback whales, and Steller sea lions that may be within the 160dB disturbance zone. The support vessel must remain sufficiently distant from the seismic source vessel to ensure that beluga whales, if present and vocalizing, can be detected. Passive acoustic monitoring must continue throughout seismic operations occurring between local sunset and sunrise.

NMFS requires that SAE must suspend seismic operations if a live marine mammal stranding is reported in Cook Inlet coincident to, or within 72 hours of, seismic survey activities involving the use of airguns (regardless of any suspected cause of the stranding). The shutdown must occur if the animal is within a distance two times that of the 160 dB isopleth of the largest airgun array configuration in use. This distance was chosen to create an additional buffer beyond the distance at which animals would typically be considered harassed, as animals involved in a live stranding event are likely compromised, with potentially increased susceptibility to stressors, and the goal is to decrease the likelihood that they are further disturbed or impacted by the seismic survey, regardless of what the original cause of the stranding event was. Shutdown procedures will remain in effect until NMFS determines and advises SAE that all live animals involved in the stranding have left the area (either of their own volition or following herding by responders).

Finally, NMFS requires that if any marine mammal species are encountered during seismic activities for which take is not authorized, and are likely to be exposed to sound pressure levels (SPLs) greater than or equal to 160 dB re 1 μPa (rms), then SAE must alter speed or course, power down or shut down the sound source to avoid take of those species.

Mitigation Conclusions

NMFS has carefully evaluated SAE's mitigation measures and considered a range of other measures in the context of ensuring that NMFS prescribes the means of aeffecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat. Our evaluation of mitigation measures included consideration of the following factors in relation to one another:

- The manner in which, and the degree to which, the successful implementation of the measures are expected to minimize adverse impacts to marine mammals;
- The proven or likely efficacy of the specific measure to minimize adverse impacts as planned; and
- The practicability of the measure for applicant implementation.

Any mitigation measure(s) prescribed by NMFS should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the general goals listed below:

1. Avoidance or minimization of injury or death of marine mammals wherever possible (goals 2, 3, and 4 may contribute to this goal).

2. A reduction in the numbers of marine mammals (total number or number at biologically important time or location) exposed to received levels of seismic airguns, or other activities expected to result in the take of marine mammals (this goal may contribute to 1, above, or to reducing harassment takes only).

3. A reduction in the number of times (total number or number at biologically important time or location) individuals would be exposed to received levels of seismic airguns or other activities expected to result in the take of marine mammals (this goal may contribute to 1, above, or to reducing harassment takes only).

4. A reduction in the intensity of exposures (either total number or number at biologically important time or location) to received levels of seismic airguns or other activities expected to result in the take of marine mammals (this goal may contribute to 1, above, or to reducing the severity of harassment takes only).

5. Avoidance or minimization of adverse effects to marine mammal habitat, paying special attention to the food base, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during a biologically important time.

6. For monitoring directly related to mitigation—an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation.

Based on our evaluation of the applicant's mitigation measures, as well as other measures considered by NMFS, NMFS has determined that the mitigation measures provide the means of effecting the least practicable adverse impact on marine mammals species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Monitoring and Reporting

Monitoring Measures

1. Visual Vessel-based Monitoring

Vessel-based monitoring for marine mammals will be done by experienced PSOs throughout the period of marine survey activities. PSOs will monitor the occurrence and behavior of marine mammals near the survey vessel during all daylight periods (nautical dawn to nautical dusk) during operation and during most daylight periods when airgun operations are not occurring. PSO duties will include watching for and identifying marine mammals, recording their numbers, distances, and reactions to the survey operations, and documenting observed ''take by harassment'' as defined by NMFS.

A minimum number of seven PSOs (two per source vessel and two per support vessel, with one additional PSO on the mitigation vessel to operate the hydrophone) will be required onboard the survey vessel to meet the following criteria: (1) 100 percent monitoring coverage during all periods of survey operations in daylight (nautical twilight-dawn to nautical twilight-dusk; (2) maximum of 4 consecutive hours on watch per PSO; and (3) maximum of 12 hours of watch time per day per PSO.

PSO teams will consist of NMFS-approved field biologists. An experienced field crew leader will supervise the PSO team onboard the survey vessel. SAE will have PSOs aboard three vessels: the two source vessels and one support vessel (*M/V Dreamcatcher*). Two PSOs will be on the source vessels, and three PSOs will be on the support vessel to observe and implement the exclusion, power down, and shut down areas. When marine mammals are about to enter or are sighted within designated harassment and exclusion zones, airgun or pinger operations will be powered down (when applicable) or shut down immediately. The vessel-based observers will watch for marine mammals during all periods when sound sources are in operation and for a minimum of 30 minutes prior to the start of airgun or pinger operations after an extended shut down as well as 30 minutes after the end of airgun operation.

The observer(s) will watch for marine mammals from the best available vantage point on the source and support vessels, typically the flying bridge. The observer(s) will scan systematically with the unaided eye and 7x50 reticle binoculars, assisted by 40x80 long-range binoculars.

All observations will be recorded in a standardized format. When a mammal sighting is made, the following information about the sighting will be recorded:

- Species, group size, age/size/sex categories (if determinable), sighting cue, behavior when first sighted and after initial sighting, time of sighting, heading (if consistent), bearing and distance from the PSO, direction and speed relative to vessel, apparent reaction to activities (*e.g.,* none, avoidance, approach, paralleling, etc.), closest point of approach, and behavioral pace;
- Time, location, speed, activity of the vessel (*e.g.,* seismic airguns off, pingers on, etc.), sea state, ice cover, visibility, and sun glare; and
- The positions of other vessel(s) in the vicinity of the PSO location.

The ship's position, speed of support vessels, and water temperature, water depth, sea state, ice cover, visibility, and sun glare will also be recorded at the start and end of each observation watch, every 30 minutes during a watch, and whenever there is a change in any of those variables.

2. Visual Shore-Based Monitoring

In addition to the vessel-based PSOs, SAE will utilize shore-based monitoring daily in the event of summer seismic activity occurring nearshore to Cook Inlet beluga Critical Habitat Area 1, to visually monitor for marine mammals. The shore-based PSOs will scan the area prior to, during, and after the airgun operations and will be in contact with the vessel-based PSOs via radio to communicate sightings of marine mammals approaching or within the project area. This communication will allow the vessel-based observers to go on a ''heightened'' state of alert regarding occurrence of marine mammals in the area and aid in timely implementation of mitigation measures.

Reporting Measures

Immediate reports will be submitted to NMFS if 25 belugas are detected in the Level B disturbance exclusion zone to evaluate and make necessary adjustments to monitoring and mitigation. If the number of detected takes for any marine mammal species is met or exceeded, SAE will immediately cease survey operations involving the use of active sound sources (*e.g.,* airguns and pingers) and notify NMFS.

1. Weekly Reports

SAE will submit a weekly field report to NMFS Headquarters as well as the Alaska Regional Office, no later than close of business each Thursday during the weeks when in-water seismic survey activities take place. The weekly field reports will summarize species detected (number, location, distance from seismic vessel, behavior), in-water activity occurring at the time of the sighting (discharge volume of array at time of sighting, seismic activity at time of sighting, visual plots of sightings, and number of power downs and shutdowns), behavioral reactions to in-water activities, and the number of marine mammals exposed.

2. Monthly Reports

Monthly reports will be submitted to NMFS for all months during which in-water seismic activities take place. The monthly report will contain and summarize the following information:

- Dates, times, locations, heading, speed, weather, sea conditions (including Beaufort sea state and wind force), and associated activities during all seismic operations and marine mammal sightings.
- Species, number, location, distance from the vessel, and behavior of any sighted marine mammals, as well as associated seismic activity (number of power-downs and shutdowns), observed throughout all monitoring activities.
- An estimate of the number (by species) of: (i) Pinnipeds that have been exposed to the seismic activity (based on visual observation) at received levels greater than or equal to 160 dB re 1 μPa (rms) and/or 190 dB re 1 μPa (rms) with a discussion of any specific behaviors those individuals exhibited; and (ii) cetaceans that have been exposed to the seismic activity (based on visual observation) at received levels greater than or equal to 160 dB re 1 μPa (rms) and/or 180 dB re 1 μPa (rms) with a discussion of any specific behaviors those individuals exhibited.
- A description of the implementation and effectiveness of the: (i) Terms and conditions of the Biological Opinion's Incidental Take Statement (ITS); and (ii) mitigation measures of the IHA. For the Biological Opinion, the report shall confirm the implementation of each Term and Condition, as well as any conservation recommendations, and describe their effectiveness for minimizing the adverse effects of the action on ESA-listed marine mammals.

3. Annual Reports

SAE will submit an annual report to NMFS's Permits and Conservation Division within 90 days after the end of operations on the water or at least 90 days prior to requiring a subsequent authorization, whichever comes first. The annual report will include:

- Summaries of monitoring effort (*e.g.,* total hours, total distances, and marine mammal distribution through the study period, accounting for sea state and other factors affecting visibility and detectability of marine mammals).
- Analyses of the effects of various factors influencing detectability of marine mammals (*e.g.,* sea state, number of observers, and fog/glare).
- Species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/gender categories (if determinable), group sizes, and ice cover.
- Analyses of the effects of survey operations.
- Sighting rates of marine mammals during periods with and without seismic survey activities (and other variables that could affect detectability), such as: (i) Initial sighting distances versus survey activity state; (ii) closest point of approach versus survey activity state; (iii) observed behaviors and types of movements versus survey activity state; (iv) numbers of sightings/individuals seen versus survey activity state; (v) distribution around the source vessels versus survey activity state; and (vi) numbers of animals detected in the 160 dB harassment (disturbance exclusion) zone.

NMFS will review the draft annual report. SAE must then submit a final annual report to the Chief, Permits and Conservation Division, Office of Protected Resources, NMFS, within 30 days after receiving comments from NMFS on the draft annual report. If NMFS has no comment on the draft annual report, the draft report shall be considered to be the final report.

4. Notification of Injured or Dead Marine Mammals

In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by this Authorization, such as an injury (Level A harassment), serious injury or mortality (*e.g.,* ship-strike, gear interaction, and/or entanglement), SAE shall immediately cease the specified activities and immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, her designees, and the Alaska Regional Stranding Coordinators. The report must include the following information:

- Time, date, and location (latitude/longitude) of the incident;
- Name and type of vessel involved;
- Vessel's speed during and leading up to the incident;
- Description of the incident;
- Status of all sound source use in the 24 hours preceding the incident;
- Water depth;
- Environmental conditions (*e.g.,* wind speed and direction, Beaufort sea state, cloud cover, and visibility);
- Description of all marine mammal observations in the 24 hours preceding the incident;
- Species identification or description of the animal(s) involved;
- Fate of the animal(s); and
- Photographs or video footage of the animal(s) (if equipment is available).

Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS shall work with SAE to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. SAE may not resume their activities until notified by NMFS via letter or email, or telephone.

In the event that SAE discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (*i.e.,* in less than a moderate state of decomposition as described in the next paragraph), SAE will immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, her designees, and the NMFS Alaska Stranding Hotline. The report must include the same information identified in the paragraph above. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with SAE to determine whether modifications in the activities are appropriate.

In the event that SAE discovers an injured or dead marine mammal, and the lead PSO determines that the injury or death is not associated with or related to the authorized activities (*e.g.,* previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), SAE shall report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, her designees, the NMFS Alaska Stranding Hotline, and the Alaska

Regional Stranding Coordinators within 24 hours of the discovery. SAE shall provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network. Activities may continue while NMFS reviews the circumstances of the incident.

Monitoring Results From Previously Authorized Activities

While SAE has previously applied for Authorizations for work in Cook Inlet, Alaska, work was not conducted upon receiving the Authorization. SAE has previously conducted work under Incidental Harassment Authorizations in the Beaufort Sea.

Estimated Take by Incidental Harassment

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; 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]. Only take by Level B behavioral harassment is anticipated as a result of the seismic survey program with mitigation measures. Anticipated impacts to marine mammals are associated with noise propagation from the sound sources (*e.g.,* airguns and pingers) used in the seismic survey; no take is expected to result from vessel strikes because of the slow speed of the vessels (4–5 knots).

SAE requests authorization to take nine marine mammal species by Level B harassment. These nine marine mammal species are: Cook Inlet beluga whale; humpback whale; minke whale; killer whale; harbor porpoise; Dall's porpoise; gray whale; harbor seal; and Steller sea lion.

For impulse sounds, such as those produced by airgun(s) used in the seismic survey, NMFS uses the 160 dB re 1 μPa (rms) isopleth to indicate the onset of Level B harassment. The current Level A (injury) harassment threshold is 180 dB (rms) for cetaceans and 190 dB (rms) for pinnipeds. The NMFS annual aerial survey data from 2002–2012 was used to derive density estimates for each species (number of individuals/km^2), and is a large source of the data in the Goetz *et al* 2012 model used for beluga density estimation in this Authorization.

Applicable Zones for Estimating ''Take by Harassment''

To estimate potential takes by Level B harassment for this Authorization, as well as for mitigation radii to be implemented by PSOs, ranges to the 160 dB (rms), 180 dB, and 190 dB isopleths were estimated at three different water depths (5 m, 25 m, and 45 m) . The distances to this threshold for the nearshore survey locations are provided in Table 4 in SAE's application. The distances to the thresholds provided in Table 4 in SAE's application correspond to the broadside and endfire directions.

Compared to the airguns, the relevant isopleths for the positioning pinger are quite small. The distances to the 190, 180, and 160 dB (rms) isopleths are 1 m, 3 m, and 25 m (3.3, 10, and 82 ft), respectively.

Estimates of Marine Mammal Density

SAE used one method to estimate densities for Cook Inlet beluga whales and another method for the other marine mammals in the area expected to be taken by harassment. Both methods are described in this document.

1. Beluga Whale Density Estimates

In similar fashion to a previous IHA issued to Apache, SAE used a habitat-based model developed by Goetz *et al.* (2012a). Information from that model has once again been used to estimate densities of beluga whales in Cook Inlet and we consider it to be the best available information on beluga density. A summary of the model is provided here, and additional detail can be found in Goetz *et al.* (2012a). To develop NMML's estimated densities of belugas, Goetz *et al.* (2012a) developed a model based on aerial survey data, depth soundings, coastal substrate type, environmental sensitivity index, anthropogenic disturbance, and anadromous fish streams to predict beluga densities throughout Cook Inlet. The result of this work is a beluga density map of Cook Inlet, which easily sums the belugas predicted within a given geographic area. NMML developed its predictive habitat model from the distribution and group size of beluga whales observed between 1994 and 2008. A 2-part ''hurdle'' model (a hurdle model in which there are two processes, one generating the zeroes and one generating the positive values) was applied to describe the physical and anthropogenic factors that influence (1) beluga presence (mixed model logistic regression) and (2) beluga count data (mixed model Poisson regression). Beluga presence was negatively associated with sources of anthropogenic disturbance and positively associated with fish availability and access to tidal flats and sandy substrates. Beluga group size was positively associated with tidal flats and proxies for seasonally available fish. Using this analysis, Goetz *et al.* (2012) produced habitat maps for beluga presence, group size, and the expected number of belugas in each 1 km^2 cell of Cook Inlet. The habitat-based model developed by NMML uses a Geographic Information System (GIS). A GIS is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information; that is, data identified according to location. However, the Goetz *et al.* (2012) model does not incorporate seasonality into the density estimates. Rather, SAE factors in seasonal considerations of beluga density into the design of the survey tracklines and locations (as discussion in more detail later in this document) in addition to other factors such as weather, ice conditions, and seismic needs.

2. Non-Beluga Whale Species Density Estimates

Densities of other marine mammal species in the project area were estimated from the annual aerial surveys conducted by NMFS for Cook Inlet beluga whale between 2000 and 2012 in June (Rugh *et al.,* 2000, 2001, 2002, 2003, 2004b, 2005b, 2006, 2007; Shelden *et al.,* 2008, 2009, 2010, 2012; Hobbs *et al.,* 2011). These surveys were flown in June to collect abundance data of beluga whales, but sightings of other marine mammals were also reported. Although these data were only collected in one month each year, these surveys provide the best available relatively long term data set for sighting information in the project area. The general trend in marine mammal sighting is that beluga whales and harbor seals are the species seen most frequently in upper Cook Inlet, with concentrations of harbor seals near haul out sites on Kalgin Island and of beluga whales near river mouths, particularly the Susitna River. The other marine mammals of interest for this authorization (humpback whales, gray whales, minke whales, killer whales, harbor porpoises, Dall's porpoises, Steller sea lions) are observed infrequently in upper Cook Inlet and more commonly in lower Cook Inlet. In addition, these densities are calculated based on a relatively large area that was surveyed, much larger than the proposed area for a given year of seismic data acquisition. Furthermore, these annual aerial surveys are conducted only in June (numbers from August surveys were not used because the area surveyed was not provided), so it does not account for seasonal variations in distribution or habitat use of each species.

Table 5 in SAE's application provides a summary of the results of NMFS aerial survey data collected in June from 2000 to 2012. To estimate density of marine mammals, total number of individuals (other species) observed for the entire survey area by year (surveys usually last several days) was divided by the approximate total area surveyed for each year (density = individuals/km^2). As noted previously, the total number of animals observed for the entire survey includes both lower and upper Cook Inlet, so the total number reported and used to calculate density is higher than the number of marine mammals anticipated to be observed in the project area. In particular, the total number of harbor seals observed on several surveys is very high due to several large haul outs in lower and middle Cook Inlet. The table below (Table 2) provides average density estimates for gray whales, harbor seals, harbor porpoises, killer whales, and Steller sea lions over the 2000–2012 period.

TABLE 2—ANIMAL DENSITIES IN COOK INLET

Species	Average density (animals/km^2)
Humpback whale	0.0024
Gray whale	9.45E–05
Minke whale	1.14E–05
Killer whale	0.0008
Dall's porpoise	0.0002
Harbor porpoise	0.0033
Harbor seal	0.28
Steller sea lion	0.008

Calculation of Takes by Harassment

1. Beluga Whales

As a result of discussions with NMFS, SAE has used the NMML model (Goetz *et al.,* 2012a) for the estimate of takes in this Authorization. SAE has established two zones (Zone 1 and Zone 2) and proposes to conduct seismic surveys within all, or part of these zones; to be determined as weather, ice, and priorities dictate, which can be found in the attached figure which will be posted at *http://www.nmfs.noaa.gov/pr/permits/incidental/oilgas.htm*

Based on information using Goetz *et al.* model (2012a), SAE derived one density estimate for beluga whales in Upper Cook Inlet (*i.e.,* north of the Forelands) and another density estimate for beluga whales in Lower Cook Inlet (*i.e.,* south of the Forelands). The density estimate for Upper Cook Inlet is 0.0212 and is 0.0056 for Lower Cook Inlet. SAE's seismic operational area will be determined as weather, ice, and priorities dictate. SAE has requested a maximum allowed take for Cook Inlet beluga whales of 30 individuals. SAE will operate in a portion of the total seismic operation area of 3,934 km^2 (1,519 mi^2), such that when one multiplies the anticipated beluga whale density based on the seismic survey operational area times the area to be ensonified to the 160-dB isopleth of 9.5 km (5.9 mi) and takes the number of days into consideration, estimated takes will not exceed 30 beluga whales.

In order to estimate when that level is reached, SAE is using a formula based on the total potential area of each seismic survey project zone (including the 160 dB buffer) and the average density of beluga whales for each zone. Daily take is calculated as the product of a daily ensonified area times the density in that area. Then daily take is summed across all the days of the survey until the survey approaches 30 takes.

TABLE 3—EXPECTED BELUGA WHALE TAKES, TOTAL AREA OF ZONE, AND AVERAGE BELUGA WHALE DENSITY ESTIMATES

	Expected Beluga takes from NMML model (including the 160 dB buffer)	Total area of zone (km^2) (including the 160 dB buffer)	Average take density (dx)
Zone 1—Upper Inlet	28	2,126	d_1 = 0.0212
Zone 2—Lower Inlet	29	1,808	d_2 = 0.0056

SAE will limit surveying in the seismic survey area (Zones 1 and 2 presented in Figures 1 and 2 of SAE's application) to ensure a maximum of 30 beluga takes during the open water season. In order to ensure that SAE does not exceed 30 beluga whale takes, the following equation is being used:

$$* \; d_x = \frac{\text{Expected Beluga Density from the NMML model in Zone X}}{\text{Total Area of Zone X including 160 dB buffer}}$$

$$* \; A_x = \text{Actual Area Surveyed (km}^2\text{) including 160 dB buffer in Zone X}$$

This formula also allows SAE to have flexibility to prioritize survey locations in response to local weather, ice, and operational constraints. SAE may choose to survey portions of a zone or a zone in its entirety, and the analysis in this Authorization takes this into account. Using this formula, if SAE surveys the entire area of Zone 1 (1,319 km^2), then essentially none of Zone 2 will be surveyed because the input in the calculation denoted by d_2A_2 will essentially need to be zero to ensure that the total allotted take of beluga whales is not exceeded. The use of this formula will ensure that SAE's seismic survey will not exceed 30 calculated beluga takes.

Operations are required to cease once SAE has conducted seismic data acquisition in an area where multiplying the applicable density by the total ensonified area out to the 160-dB isopleth equaled 30 beluga whales, using the equation provided above. If 30 belugas are visually observed before the calculation reaches 30 belugas, SAE is also required to cease survey activity.

2. Humpback Whales

Although the density for humpback whales in Cook Inlet according to NMML surveys is 0.0024 animals per km^2, it is widely known that humpbacks occur with greater frequency in the lower inlet, and are rarely sighted in the upper inlet. Apache data has indicated that take of two humpback whales is possible, but existing observation data of humpback whales in Cook Inlet supports that this is extremely unlikely. No more than two humpback whales have ever been recorded in a single season by NMFS observers or PSOs on board seismic vessels in Cook Inlet. Therefore, while the occurrence of two humpbacks is rare but possible, it is unlikely that more than five humpbacks will be exposed by Level B harassment based on known distribution of humpbacks in Cook Inlet.

3. Steller Sea Lions

The density estimate used in the Authorization for Steller sea lions included NMFS data that includes animals at sea lion haulouts that are within Cook Inlet, but are well south of the action area. An anomalous sighting of 20 animals occurred along the southern edge of the action area, far from any known haulouts or rookeries (such a large congregation of Steller sea lions far from haulouts or rookeries is unusual) which is included in NMFS' revised estimate of Steller sea lion take, but does not include animals observed outside of the action area. Based on monitoring reports of other seismic activities in Cook Inlet, there are typically one or two Steller sea lions within the action area per year. Two individuals were observed by Apache PSOs in 2014 and three groups totaling about four animals were observed in 2012. Because of this data, NMFS has revised its take estimate to 25 individuals, which will account for what one may expect seismic vessels implementing mitigation measures to encounter in a year, but allows for the possibility that the survey may encounter an anomalously large group such as was observed by NMFS aerial observers near the southern portion of the action area in 2006.

While the NMML survey data reports an average density of 0.008281 Steller sea lions per km^2 in the action area, NMFS aerial survey data indicate a maximum density of 0.003518 Steller sea lions per km^2 with in the action area (20 animals/5,684 km^2). Given the size and location of the action area, we have determined that authorizing take of 25 Steller sea lions is most appropriate and reflects appropriate use of the best available scientific data.

4. Harbor seals

As noted above, using the daily ensonified area × number of survey days × density method results in a reasonable estimate of the instances of take, but likely significantly overestimates the number of individual animals expected to be taken. With most species, even this overestimated number is still very small, and additional analysis is not really necessary to ensure minor impacts. However, because of the number and density of harbor seals in the area, a more accurate understanding of the number of individuals likely taken is necessary to fully analyze the impacts and ensure that the total number of harbor seals taken is small.

As described below, we believe that the modeled number of estimated instances of take referenced above may actually be high, based on monitoring results from the area. The density estimate from NMFS aerial surveys includes harbor seal haulouts far south of the action area that may never move to an ensonified area. Further, we believe that we can reasonably estimate the comparative number of individual harbor seals that will likely be taken, based both on monitoring data, operational information, and an a general understanding of harbor seal habitat use.

Using the daily ensonified area × number of survey days × density formula (based on surveying 6.7 source lines per day), the number of instances of exposure above the 160-dB threshold estimated for SAE's activity in Cook Inlet is 19,315. However, when we examine monitoring data from previous activities, it is clear this number is an overestimate—compared to both aerial and vessel based observation efforts. Apache's monitoring report from 2012 details that they saw 2,474 harbor seals from 29 aerial flights (over 29 days) in the vicinity of the survey during the month of June, which is the peak month for harbor seal haulout. In surveying the literature, correction factors to account for harbor seals in water based on land counts vary from 1.2 to 1.65 (CITE). Using the most conservative factor of 1.65 (allowing us to consider that some of the other individuals on land may have entered the water at other points in day), if Apache saw 2,474 seals hauled out then there were an estimated 1,500 seals in the water during those 29 days. If, because there were only 29 surveys, we conservatively multiply by 5.5 to estimate the number of seals that might have been seen if the aerial surveys were conducted for 160 days, this yields an estimate of 8,250 instances of seal exposure in the water, which is far less than the estimated 19,315. That the number of potential instances of exposure is likely less than 19,315 is also supported by the visual observations from PSOs on board vessels. PSOs sighted a total of 285 seals in water over 147 days of activity which would rise to about 310 is adjusted to reflect 160 days of effort. Given the size of the disturbance zone for these activities, it is likely that not all harbor seals that were exposed were seen by PSOs, however 310 is still far less than the estimate of 19,315 given by the density calculations.

Further, based on the residential nature of harbor seals and the number of patches SAE plans to shoot, it is possible to reasonably estimate the number of individual harbor seals exposed, given the instances of exposures. Based on an estimate of 32 patches in 160 days, SAE will shoot one patch in 5 days. If seals are generally returning to haulouts in the survey area over the 5 days of any given patch shoot, than any given seal in the area could be exposed a minimum of one day and a maximum of all five days, with an average of 3 days. If the original exposure estimate using density is 19,315 exposures, then when divided by three (the average number of times an animal could be exposed during the shooting of one patch), the expected number of individuals exposed is 6,438, which is approximately 28% of the population. This number is also likely an overestimate given that adjoining patches may be shot, meaning the same seals could be exposed over multiple patches. Given these multiple methods, as well as the behavioral preferences of harbor seals for haulouts in certain parts of the Inlet (Montgomery *et al.,* 2007), and high concentrations at haulouts in the lower Inlet (Boveng *et al.*), it is unreasonable to expect that more than 25% of the population, or 5,725 individuals, will be taken by Level B harassment during SAE's activity.

5. Other Marine Mammal Species

The estimated takes of other Cook Inlet marine mammals that may be potentially harassed during the seismic surveys was calculated by multiplying the following:

- Average density estimates (derived from NMFS aerial surveys from 2000–2012 and presented in Table 3 in this document)
- the area ensonified by levels ≥160 dB re μPa rms in one day (calculated using the total ensonified area per day of 414.92 km^2, which is derived by applying the buffer distance to the 160 dB isopleth to the area of 6 survey tracklines),
- the number of potential survey days (160).

This equation provides the number of instances of take that will occur in the duration of the survey, but overestimates the number of individual animals taken because not every exposure on every successive day is expected to be a new individual. Especially with resident species, re-exposures of individuals are expected across the months of the survey.

SAE anticipates that a crew will collect seismic data for 8–10 hours per day over approximately 160 days over the course of 8 to 9 months each year. It is assumed that over the course of these 160 days, no more than 777 km^2 will be surveyed in total, but areas can be surveyed more than once. It is important to note that environmental conditions (such as ice, wind, fog) will play a significant role in the actual operating days; therefore, these estimates are conservative in order to provide a basis for probability of encountering these marine mammal species in the project area.

Summary of Level B Harassment Takes

Table 4 outlines the density estimates used to estimate Level B harassment takes, the requested Level B harassment take levels, the abundance of each species in Cook Inlet, the percentage of each species or stock estimated to be taken, and current population trends.

TABLE 4—DENSITY ESTIMATES, LEVEL B HARASSMENT TAKE LEVELS, SPECIES OR STOCK ABUNDANCE, PERCENTAGE OF POPULATION TO BE TAKEN, AND SPECIES TREND STATUS

Species	Average density (#individuals/km^2)	Level B take	Abundance	Percentage of population	Trend
Beluga whale	Upper=0.0212; Lower=0.0056.	30	312	9.6	Decreasing.
Humpback whale	0.0024	5	7,469	0.067	Southeast Alaska increasing.
Minke whale	1.14E–05	1	1,233	0.06	No reliable information.
Gray whale	5.33E–05	7	19,126	0.033	Stable/increasing.
Killer whale	0.00082	55	2,347 (resident) 345 (transient)	2.34 15.9	Resident stock possibly increasing. Transient stock stable.
Harbor porpoise	0.0033	219	31,046	0.70	No reliable information.
Dall's porpoise	0.0002	14	83,400	0.016	No reliable information.
Harbor seal	0.28	5,725	22,900	25	Stable.
Steller sea lion	0.0082	25	45,649	0.055	Decreasing but with regional variability (some stable or increasing).

Analyses and Determinations

Negligible Impact Analysis

Negligible impact is ''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 Level B harassment 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 behavioral harassment, NMFS must consider other factors, such as the likely nature of any responses (their intensity, duration, etc.), the context of any responses (critical reproductive time or location, feeding, migration, etc.), as well as the number and nature of estimated Level A harassment takes, the number of estimated mortalities, effects on habitat, and the status of the species.

To avoid repetition, the discussion of our analyses applies to all the species listed in Table 4, divided in some places by group, given than the anticipated effects of the seismic survey on marine mammals are expected to be relatively similar in nature. Where there is information about the size, status, or structure of any species or stock that would lead to a different analysus (*e.g.* beluga whales), species-specific factors have been identified. In some cases however, we add species-specific information regarding effects (including on habitat) that also informed our analysis.

Given the required mitigation and related monitoring, no injuries or mortalities are anticipated to occur as a result of SAE's seismic survey in Cook Inlet, and none are authorized. Additionally, animals in the area are not expected to incur hearing impairment (*i.e.,* TTS or PTS) or non-auditory physiological effects. The number of takes that are authorized are expected to be limited to short-term Level B behavioral harassment. The seismic airguns do not operate continuously over a 24-hour period. Rather airguns are operational for a few hours at a time totaling about 10 hours a day.

The addition of nine vessels, and noise due to vessel operations associated with the seismic survey, is not outside the present experience of marine mammals in Cook Inlet, although levels may increase locally. Given the large number of vessels in Cook Inlet and the apparent habituation to vessels by Cook Inlet beluga whales and the other marine mammals that may occur in the area, vessel activity and noise is not expected to have effects that could cause significant or long-term consequences for individual marine mammals or their populations.

Cook Inlet beluga whales, the western DPS of Steller sea lions, and Central North Pacific humpback whales are listed as endangered under the ESA. These stocks are also considered depleted under the MMPA. The estimated annual rate of decline for Cook Inlet beluga whales was 0.6 percent between 2002 and 2012. Steller sea lion trends for the western stock are variable throughout the region with some decreasing and others remaining stable or even indicating slight increases. The Central North Pacific population of humpbacks is known to be increasing, with different techniques predicting abundance increases between 4.9 to 7 percent annually. The other seven species that may be taken by harassment during SAE's seismic survey program are not listed as threatened or endangered under the ESA nor as depleted under the MMPA.

Cetaceans. Odontocete (including Cook Inlet beluga whales, killer whales, and harbor porpoises) reactions to seismic energy pulses are usually thought to be limited to shorter distances from the airgun(s) than are those of mysticetes, in part because odontocete low-frequency hearing is assumed to be less sensitive than that of mysticetes. Belugas in the Canadian Beaufort Sea in summer appear to be fairly responsive to seismic energy, with few being sighted within 10–20 km (6–12 mi) of seismic vessels during aerial surveys (Miller *et al.,* 2005). However, Cook Inlet belugas are more accustomed to anthropogenic sound than beluga whales in the Beaufort Sea. Therefore, the results from the Beaufort Sea surveys do not directly translate to potential reactions of Cook Inlet beluga whales. Also, due to the dispersed distribution of beluga whales in Cook Inlet during winter and the concentration of beluga whales in upper Cook Inlet from late April through early fall, belugas will likely occur in small numbers in the majority of SAE's survey area during the majority of SAE's annual operational timeframe of April through December. For the same reason, as well as mitigation measures, it is unlikely that animals will be exposed to received levels capable of causing injury.

Potential impacts to marine mammal habitat were discussed previously in this document (see the ''Anticipated Effects on Habitat'' section). Although some disturbance is possible to food sources of marine mammals, the impacts are anticipated to be minor enough as to not affect annual rates of recruitment or survival of marine mammals in the area. Based on the size of Cook Inlet where feeding by marine mammals occurs versus the localized area of the marine survey activities, any missed feeding opportunities in the direct project area will be minor based on the fact that other feeding areas exist elsewhere. Taking into account the mitigation measures that are planned, effects on cetaceans are generally expected to be restricted to avoidance of a limited area around the survey operation and short-term changes in behavior, falling within the MMPA definition of ''Level B harassment''. Animals are not expected to permanently abandon any area that is surveyed, and any behaviors that are interrupted during the activity are expected to resume once the activity ceases. Only a small portion of marine mammal habitat will be affected at any time, and other areas within Cook Inlet will be available for necessary biological functions.

In addition, of specific importance to belugas, NMFS seasonally restricts seismic survey operations in the area known to be important for beluga whale feeding, calving, or nursing. The primary location for these biological life functions occurs in the Susitna Delta region of upper Cook Inlet. NMFS proposes to implement a 16 km (10 mi) seasonal exclusion from seismic survey operations in this region from April 15–October 15. The highest concentrations of belugas are typically found in this area from early May through September each year. NMFS has incorporated a 2-week buffer on each end of this seasonal use timeframe to account for any anomalies in distribution and marine mammal usage. Additionally, in the event that a beluga is seen outside of the seasonal restricted area and buffer, seismic operations are required to shut down if a beluga is seen anywhere in the 160dB disturbance zone.

Mitigation measures such as controlled vessel speed, dedicated marine mammal observers, speed and course alterations, and shutdowns or power downs when marine mammals are seen within defined ranges designed both to avoid injury and disturbance will further reduce short-term reactions and minimize any effects on hearing sensitivity. In all cases, the effects of the seismic survey are expected to be short-term, with no lasting biological consequence. Therefore, the exposure of cetaceans to SAE's seismic survey activity, operation is not anticipated to have an adverse effect on annual rates of recruitment or survival of the affected species or stocks of cetaceans, and therefore will have a negligible impact on them.

Pinnipeds (harbor seals, Steller sea lions). Some individual pinnipeds may be exposed to sound from the seismic surveys more than once during the timeframe of the project. Taking into account the mitigation measures that are planned, effects on pinnipeds are generally expected to be restricted to avoidance of a limited area around the survey operation and short-term changes in behavior, falling within the MMPA definition of ''Level B harassment.'' Animals are not expected to permanently abandon any area that is surveyed, and any behaviors that are interrupted during the activity are expected to resume once the activity ceases. Only a small portion of pinniped habitat will be affected at any time, and other areas within Cook Inlet will be available for necessary biological functions. In addition, the area where the survey will take place is not known to be an important location where pinnipeds haul out. The closest known haul-out site is located on Kalgin Island, which is about 22 km from the McArther River. More recently, some large congregations of harbor seals have been observed hauling out in upper Cook Inlet. However, mitigation measures, such as vessel speed, course alteration, and visual monitoring, and restrictions will be implemented to help reduce impacts to the animals. Therefore, the exposure of pinnipeds to sounds produced by this phase of SAE's seismic survey is not anticipated to have an adverse effect on annual rates of recruitment or survival on those pinniped species or stocks, and therefore will have a negligible impact.

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

Small Numbers Analysis

The requested takes authorized annually represent 9.6 percent of the Cook Inlet beluga whale population of approximately 312 animals (Allen and Angliss, 2014), 2.34 percent of the Alaska resident stock and 15.9 percent of the Gulf of Alaska, Aleutian Island and Bering Sea stock of killer whales (1,123 residents and 345 transients), 0.70 percent of the Gulf of Alaska stock of approximately 31,046 harbor porpoises, 0.067 percent of the 7,469 Central North Pacific humpback whales, 0.06 percent of the 1,233 Alaska minke whales, 0.016 percent of the 83,400 Gulf of Alaska Dall's porpoise, and 0.033 percent of the eastern North Pacific stock of approximately 19,126 gray whales. The take requests presented for harbor seals represent 25 percent of the Cook Inlet/Shelikof stock of approximately 22,900 animals. The requested takes for Steller sea lions represent 0.055 percent of the U.S. portion of the western stock of approximately 45,649 animals. These take estimates represent the percentage of each species or stock that could be taken by Level B behavioral harassment.

NMFS finds that any incidental take reasonably likely to result from the effects of the activity, as authorized to be mitigated through this IHA, will be limited to small numbers relative to the affected species or stocks. In addition to the quantitative methods used to estimate take, NMFS also considered qualitative factors that further support the ''small numbers'' determination, including: (1) The seasonal distribution and habitat use patterns of Cook Inlet beluga whales, which suggest that for much of the time only a small portion of the population will be accessible to impacts from SAE's activity, as most animals are found in the Susitna Delta region of Upper Cook Inlet from early May through September; (2) other cetacean species and Steller sea lions are not common in the seismic survey area; (3) the mitigation requirements, which provide spatio-temporal limitations that avoid impacts to large numbers of belugas feeding and calving in the Susitna Delta and limit exposures to sound levels associated with Level B harassment; (4) the monitoring requirements and mitigation measures described earlier in this document for all marine mammal species that will further reduce the amount of takes; and (5) monitoring results from previous activities that indicated low numbers of beluga whale sightings within the Level B disturbance exclusion zone and low levels of Level B harassment takes of other marine mammals. Therefore, NMFS determined that the numbers of animals likely to be taken are small.

Impact on Availability of Affected Species for Taking for Subsistence Uses

Relevant Subsistence Uses

The subsistence harvest of marine mammals transcends the nutritional and economic values attributed to the animal and is an integral part of the cultural identity of the region's Alaska Native communities. Inedible parts of the whale provide Native artisans with materials for cultural handicrafts, and the hunting itself perpetuates Native traditions by transmitting traditional skills and knowledge to younger generations (NOAA, 2007).

The Cook Inlet beluga whale has traditionally been hunted by Alaska Natives for subsistence purposes. For several decades prior to the 1980s, the Native Village of Tyonek residents were the primary subsistence hunters of Cook Inlet beluga whales. During the 1980s and 1990s, Alaska Natives from villages in the western, northwestern, and North Slope regions of Alaska either moved to or visited the south central region and participated in the yearly subsistence harvest (Stanek, 1994). From 1994 to 1998, NMFS estimated 65 whales per year (range 21–123) were taken in this harvest, including those successfully taken for food and those struck and lost. NMFS concluded that this number was high enough to account for the estimated 14 percent annual decline in the population during this time (Hobbs *et al.,* 2008). Actual mortality may have been higher, given the difficulty of estimating the number of whales struck and lost during the hunts. In 1999, a moratorium was enacted (Pub. L. 106–31) prohibiting the subsistence take of Cook Inlet beluga whales except through a cooperative agreement between NMFS and the affected Alaska Native organizations. Since the Cook Inlet beluga whale harvest was regulated in 1999 requiring cooperative agreements, five beluga whales have been struck and harvested. Those beluga whales were harvested in 2001 (one animal), 2002 (one animal), 2003 (one animal), and 2005 (two animals). The Native Village of Tyonek agreed not to hunt or request a hunt in 2007, when no co-management agreement was to be signed (NMFS, 2008a).

On October 15, 2008, NMFS published a final rule that established long-term harvest limits on Cook Inlet beluga whales that may be taken by Alaska Natives for subsistence purposes (73 FR 60976). That rule prohibits harvest for a 5-year interval period if the average stock abundance of Cook Inlet beluga whales over the prior five-year interval is below 350 whales. Harvest levels for the current 5-year planning interval (2013–2017) are zero because the average stock abundance for the previous five-year period (2008–2012) was below 350 whales. Based on the average abundance over the 2002–2007 period, no hunt occurred between 2008 and 2012 (NMFS, 2008a). The Cook Inlet Marine Mammal Council, which managed the Alaska Native Subsistence fishery with NMFS, was disbanded by a unanimous vote of the Tribes' representatives on June 20, 2012. At this time, no harvest is expected in 2015 or, likely, in 2016.

Data on the harvest of other marine mammals in Cook Inlet are lacking. Some data are available on the subsistence harvest of harbor seals, harbor porpoises, and killer whales in Alaska in the marine mammal stock assessments. However, these numbers are for the Gulf of Alaska including Cook Inlet, and they are not indicative of the harvest in Cook Inlet.

There is a low level of subsistence hunting for harbor seals in Cook Inlet. Seal hunting occurs opportunistically among Alaska Natives who may be fishing or travelling in the upper Inlet near the mouths of the Susitna River, Beluga River, and Little Susitna River. Some data are available on the subsistence harvest of harbor seals, harbor porpoises, and killer whales in Alaska in the marine mammal stock assessments. However, these numbers are for the Gulf of Alaska including Cook Inlet, and they are not indicative of the harvest in Cook Inlet. Some detailed information on the subsistence harvest of harbor seals is available from past studies conducted by the Alaska Department of Fish & Game (Wolfe *et al.,* 2009). In 2008, 33 harbor seals were taken for harvest in the Upper Kenai-Cook Inlet area. In the same study, reports from hunters stated that harbor seal populations in the area were increasing (28.6%) or remaining stable (71.4%). The specific hunting regions identified were Anchorage, Homer, Kenai, and Tyonek, and hunting generally peaks in March, September, and November (Wolfe *et al.,* 2009).

Potential Impacts on Availability for Subsistence Uses

Section 101(a)(5)(D) also requires NMFS to determine that the taking will not have an unmitigable adverse effect on the availability of marine mammal species or stocks for subsistence use. NMFS has defined ''unmitigable adverse impact'' in 50 CFR 216.103 as an impact resulting from the specified activity: (1) That is likely to reduce the availability of the species to a level insufficient for a harvest to meet subsistence needs by: (i) Causing the marine mammals to abandon or avoid hunting areas; (ii) Directly displacing subsistence users; or (iii) Placing physical barriers between the marine mammals and the subsistence hunters; and (2) That cannot be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met.

The primary concern is the disturbance of marine mammals through the introduction of anthropogenic sound into the marine environment during the seismic survey. Marine mammals could be behaviorally harassed and either become more difficult to hunt or temporarily abandon traditional hunting grounds. The other anthropogenic activities proposed for Cook Inlet in the 2015 open water season that require an Authorization are spread throughout the Inlet and not concentrated in the area of SAE's activity, lessening the concern about spatial overlap. However, the seismic survey will not have any impacts to beluga harvests as none currently occur in Cook Inlet. Additionally, subsistence harvests of other marine mammal species are limited in Cook Inlet.

Plan of Cooperation or Measures To Minimize Impacts to Subsistence Hunts

Regulations at 50 CFR 216.104(a)(12) require IHA applicants for activities that take place in Arctic waters to provide a Plan of Cooperation or information that identifies what measures have been taken and/or will be taken to minimize adverse effects on the availability of marine mammals for subsistence purposes. The entire upper Cook unit and a portion of the lower Cook unit falls north of 60° N, or within the region NMFS has designated as an Arctic subsistence use area. There are several villages in SAE's project area that have traditionally hunted marine mammals, primarily harbor seals. Tyonek is the only tribal village in upper Cook Inlet with a tradition of hunting marine mammals, in this case harbor seals and beluga whales. However, for either species the annual recorded harvest since the 1980s has averaged about one or fewer of either species (Fall *et al.* 1984, Wolfe *et al.* 2009, SRBA and HC 2011), and there is currently a moratorium on subsistence harvest of belugas. Further, many of the seals that are harvested are done incidentally to salmon fishing or moose hunting (Fall *et al.* 1984, Merrill and Orpheim 2013), often near the mouths of the Susitna Delta rivers (Fall *et al.* 1984) north of SAE's seismic survey area.

Villages in lower Cook Inlet adjacent to SAE's seismic area (Kenai, Salamatof, and Ninilchik) have either not traditionally hunted beluga whales, or at least not in recent years, and rarely do they harvest sea lions. Between 1992 and 2008, the only reported sea lion harvests from this area were two Steller sea lions taken by hunters from Kenai (Wolfe *et al.* 2009). These villages more commonly harvest harbor seals, with Kenai reporting an average of about 13 per year between 1992 and 2008 (Wolfe *et al.* 2009). According to Fall *et al.* (1984), many of the seals harvested by hunters from these villages were taken on the west side of the inlet during hunting excursions for moose and black bears (or outside SAE's lower Cook unit). Although marine mammals remain an important subsistence resource in Cook Inlet, the number of animals annually harvested are low, and are primarily harbor seals. Much of the harbor seal harvest occurs incidental to other fishing and hunting activities, and at areas outside of the SAE's seismic areas such as the Susitna Delta or the west side of lower Cook Inlet. Also, SAE is unlikely to conduct seismic activity in the vicinity of any of the river mouths where large numbers of seals haul out.

SAE has identified the following features that are intended to reduce impacts to subsistence users:

• In-water seismic activities will follow mitigation procedures to minimize effects on the behavior of marine mammals and, therefore, opportunities for harvest by Alaska Native communities.

SAE and NMFS recognize the importance of ensuring that ANOs and federally recognized tribes are informed, engaged, and involved during the permitting process and will continue to work with the ANOs and tribes to discuss operations and activities.

From mid-March through April 2015, SAE met with the following communities and organizations: Nikiski, Ninilchik Native Association Inc., Tyonek Native Corporation, Tyonek Village, Ninilchik, Nikiski Facilities Group, and United Cook Inlet Drift Association. These meetings were meant to inform the audience about the project as well as listen to concerns and comments. There will also be a review of permit stipulations and a permit matrix developed for the crews. The means of communications and contacts list is developed and implemented into the project, found in SAE's Plan of Cooperation. The use of PSOs/MMO's on board the vessels will ensure that appropriate precautions are taken to avoid harassment of marine mammals. If a conflict does occur with project activities involving subsistence or fishing, the project manager will immediately contact the affected party to resolve the conflict. If avoidance is not possible, the project manager will initiate communication with the Operations Supervisor to resolve the issue and plan an alternative course of action. The communications will involve the Permits Manager and the Anchorage Office of SAE.

Unmitigable Adverse Impact Analysis and Determination

The project will not have any effect on beluga whale harvests because no beluga harvest will take place in 2015. Additionally, the seismic survey area is not an important native subsistence site for other subsistence species of marine mammals, and Cook Inlet contains a relatively small proportion of marine mammals utilizing Cook Inlet; thus, the number harvested is expected to be extremely low. The timing and location of subsistence harvest of Cook Inlet harbor seals may coincide with SAE's project, but because this subsistence hunt is conducted opportunistically and at such a low level (NMFS, 2013c), SAE's program is not expected to have an impact on the subsistence use of harbor seals. Moreover, the survey will result in only temporary disturbances. Accordingly, the specified activity will not impact the availability of these other marine mammal species for subsistence uses.

NMFS anticipates that any effects from SAE's seismic survey on marine mammals, especially harbor seals and Cook Inlet beluga whales, which are or have been taken for subsistence uses, will be short-term, site specific, and limited to inconsequential changes in behavior and mild stress responses. NMFS does not anticipate that the authorized taking of affected species or stocks will reduce the availability of the species to a level insufficient for a harvest to meet subsistence needs by: (1) Causing the marine mammals to abandon or avoid hunting areas; (2) directly displacing subsistence users; or (3) placing physical barriers between the marine mammals and the subsistence hunters; and that cannot be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met. Based on the description of the specified activity, the measures described to minimize adverse effects on the availability of marine mammals for subsistence purposes, and the required mitigation and monitoring measures, NMFS has determined that there will not be an unmitigable adverse impact on subsistence uses from SAE's activities.

Endangered Species Act (ESA)

There are three marine mammal species listed as endangered under the ESA with confirmed or possible occurrence in the project area: The Cook Inlet beluga whale, the western DPS of Steller sea lion, and the Central North Pacific humpback whale. In addition, the action could occur within 10 miles of designated critical habitat for the Cook Inlet beluga whale. NMFS's Permits and Conservation Division has initiated consultation with NMFS' Alaska Region Protected Resources Division under section 7 of the ESA. This consultation concluded on May 7, 2015, when a Biological Opinion was issued. The Biological Opinion determined that the issuance of an IHA is not likely to jeapordize the continued existence of the Cook Inlet beluga whales, Central North Pacific humpback whales, or western distinct population segment of Steller sea lions or destroy or adversely modify Cook Inlet beluga whale critical habitat. Finally, the Alaska region issued an Incidental Take Statement (ITS) for Cook Inlet beluga whales, humpback whales, and Steller sea lions. The ITS contains reasonable and prudent measures implemented by the terms and conditions to minimize the effect of this take.

National Environmental Policy Act (NEPA)

NMFS prepared an EA that includes an analysis of potential environmental effects associated with NMFS' issuance of an IHA to SAE to take marine mammals incidental to conducting a 3D seismic survey program in Cook Inlet, Alaska. NMFS has finalized the EA and prepared a FONSI for this action. Therefore, preparation of an Environmental Impact Statement is not necessary.

Authorization

As a result of these determinations, NMFS has issued an IHA to SAE for the take of marine mammals incidental to conducting a seismic survey program in Cook Inlet, Alaska, from May 13, 2015 through May 12, 2016, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Dated: May 12, 2015.

Donna S. Wieting,

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

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