FEDERAL REGISTER

Vol. 77 Wednesday,
No. 206 October 24, 2012

Part II

Department of Commerce

National Oceanic and Atmospheric Administration

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Marine Seismic Survey in the Beaufort and Chukchi Seas, Alaska; Notice

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XC091

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Marine Seismic Survey in the Beaufort and Chukchi Seas, Alaska

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

ACTION: Notice; issuance of an incidental take authorization.

SUMMARY: In accordance with the Marine Mammal Protection Act (MMPA) regulations, notification is hereby given that NMFS has issued an Incidental Harassment Authorization (IHA) to ION Geophysical (ION) to take, by harassment, small numbers of nine species of marine mammals incidental to in-ice marine seismic surveys in the Beaufort and Chukchi Seas, Alaska, during the fall and winter of 2012.

DATES: Effective October 17, 2011, through December 15, 2012.

ADDRESSES: Requests for information on the incidental take authorization should be addressed to P. Michael Payne, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910. A copy of the application containing a list of the references used in this document, NMFS' Environmental Assessment (EA), Finding of No Significant Impact (FONSI), and the IHA may be obtained by writing to the address specified above or visiting the Internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications.*

Documents cited in this notice may be viewed, by appointment, during regular business hours, at the aforementioned address.

FOR FURTHER INFORMATION CONTACT: Shane Guan, Office of Protected Resources, NMFS, (301) 427–8401 or Brad Smith, NMFS, Alaska Region, (907) 271–3023.

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 (Secretary) to allow, upon request, the incidental, but not intentional taking 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 regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

Authorization 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 taking 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.''

Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the U.S. can apply for an authorization to incidentally take small numbers of marine mammals by harassment. 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].

Section 101(a)(5)(D) establishes a 45-day time limit for NMFS review of an application followed by a 30-day public notice and comment period on any proposed authorizations for the incidental harassment of marine mammals. Within 45 days of the close of the comment period, NMFS must either issue or deny issuance of the authorization.

Summary of Request

NMFS received an application on March 1, 2012, from ION for the taking, by harassment, of marine mammals incidental to a marine seismic survey in ice in the Beaufort and Chukchi Seas, Alaska, during October through December 15, 2012. After addressing comments from NMFS, ION modified its application and submitted a revised application on June 11, 2012.

Description of the Specified Activity

ION's activities consist of a geophysical in-ice (seismic reflection/refraction) survey and related vessel operations to be conducted primarily in the Alaskan Beaufort and Chukchi seas from October to December 15, 2012. The primary survey area extends from the U.S.–Canadian border in the east to Point Barrow in the west. Two survey lines extend west of Point Barrow into the northern Chukchi Sea, and three short tracks are proposed near the U.S.–Russian border (see Figure 1 of ION's IHA application). The bathymetry of the proposed survey area ranges from shallow (<20 m [66 ft]) to relatively deep (>3,500 m [11,483 ft]) water over the continental shelf, the continental slope, and the abyssal plain.

The survey will be conducted from the seismic vessel *Geo Arctic* escorted by the *Polar Prince,* a medium class (100A) icebreaker. The survey grid consists of ~7,175 km (4,458 mi) of transect line, not including transits when the airguns are not operating. There may be small amounts of additional seismic operations associated with airgun testing, start up, and repeat coverage of any areas where initial data quality is sub-standard. The seismic source towed by the *Geo Arctic* would be an airgun array consisting of 26 active Sercel G-gun airguns with a total volume of 4,450 in^3. A single hydrophone streamer 4.5–9 km (2.8–5.6 mi) in length, depending on ice conditions, would be towed by the *Geo Arctic* to record the returning seismic signals.

The survey vessels arrived in the survey area from Canadian waters in early October and plan to begin data collection on or after October 15, 2012. After completion of the survey, or when ice and weather conditions dictate, the vessels will exit to the south, transiting through the Chukchi and Bering Seas. The *Polar Prince* may be used to perform an at-sea refueling (bunkering) operation to supply as much as 500 metric tons of Arctic diesel to the *Geo Arctic.* The *Polar Prince* will carry that fuel onboard at the start of the operation, and it will be transferred to the *Geo Arctic* if/when necessary. Depending on its own fuel consumption, the *Polar Prince* may then transit to Tuktoyuktuk, Canada to take on additional fuel for itself. Once the *Polar Prince* returns to the *Geo Arctic* the survey would continue. The entire refueling operation will therefore involve one fuel transfer and potentially one transit to and from Tuktoyuktuk. The refueling operation will likely take place in late October, at which time the

Geo Arctic will likely be in the eastern or east-central Alaskan Beaufort Sea.

ION's geophysical survey has been designed and scheduled to minimize potential effects to marine mammals, bowhead whales in particular, and subsistence users. For mitigation and operational reasons, the survey area has been bisected by a line that runs from 70.5° N. 150.5° W. to 73° N. 148° W. (see Figure 1 of ION's IHA application). Weather and ice permitting, ION plans to begin survey operations east of the line described above (eastern survey area) and in offshore waters (>1,000 m [3,281 ft]) where bowheads are expected to be least abundant in early October. This operational plan is based on the fact that only ~2% of bowhead whales observed by Bureau of Ocean Energy Management's (BOEM) aerial surveys from 1979–2007 occurred in areas of water depth >1,000 m (3,281 ft) (MMS, 2010), and on average ~97% of bowheads have passed through the eastern U.S. Beaufort Sea by October 15 (Miller *et al.,* 2002). The survey will then progress to shallower waters in the eastern survey area before moving to the western survey area in late October or early November 2012.

Ice conditions are expected to range from open water to 10/10 ice cover. However, the survey cannot take place in thick multi-year ice as both the icebreaker and seismic vessel must make continuous forward progress at 3–4 kts. In order for the survey to proceed, areas of high ice concentration can only consist of mostly newly forming juvenile first year ice or young first year ice less than 0.5 m (1.6 ft) thick. Sounds generated by the icebreaker and seismic vessel moving through these relatively light ice conditions are expected to be far below the high sound levels often attributed to icebreaking. These high sound levels (≤200 dB re 1 μPa [rms]) have been recorded from icebreakers during backing and ramming operations in very heavy ice conditions and are created by cavitation of the propellers as the vessel is slowed by the ice or reverses direction (Erbe and Farmer, 1998; Roth and Schmidt, 2010).

Acoustic Sources

(1) Seismic Airgun Array

The seismic source used during the project would be an airgun array consisting of 28 Sercel G-gun airguns, of which 26 would be active and have a total discharge volume of 4,450 in^3. The 28 airguns would be distributed in two sub-arrays with 14 airguns per sub-array. Individual airgun sizes range from 70 to 380 in^3. Airguns will be operated at 2,000 psi. The seismic array and a single hydrophone streamer 4.5–9 km (2.8–5.6 mi) in length would be towed behind the *Geo Arctic.* Additional specifications of the airgun array are provided in Appendix B of ION's IHA application.

(2) Echo Sounders

Both vessels will operate industry standard echo sounder/fathometer instruments for continuous measurements of water depth while underway. These instruments are used by all large vessels to provide routine water depth information to the vessel crew. Navigation echo sounders send a single, narrowly focused, high frequency acoustic signal directly downward to the sea floor. The sound energy reflected off the sea floor returns to the vessel where it is detected by the instrument, and the depth is calculated and displayed to the user. Source levels of navigational echo sounders of this type are typically in the 180–200 dB re 1 μPA-m (Richardson *et al.* 1995a).

The *Geo Arctic* will use one navigational echo sounder during the project. The downward facing single-beam Simrad EA600 operates at frequencies ranging from 38 to 200 kHz with an output power of 100–2000 Watts. Pulse durations are between 0.064 and 4.096 milliseconds, and the pulse repetition frequency (PRF or ping rate) depends on the depth range. The highest PRF at shallow depths is about 40 pings per second. It can be used for water depths up to 4,000 m (13,123 ft) and provides up to 1 cm (0.4 in) resolution.

The *Polar Prince* will use one echo sounder, an ELAC LAZ–72. The LAZ–72 has an operating frequency of 30 kHz. The ping rate depends on the water depth and the fastest rate, which occurs in shallow depths, is about 5 pings per second.

Dates, Duration, and Region of Activity

The proposed geophysical survey would be conducted for ~76 days from approximately October 15 to December 15, 2012. Both the *Geo Arctic* and the *Polar Prince* entered the Alaskan Beaufort Sea from Canadian waters in early October. The survey area will be bounded approximately by 138° to 169° W. longitude and 70° to 73° N. latitude in water depths ranging from <20 to >3,500 m (66 to 11,483 ft) (see Figure 1 of ION's IHA application). For mitigation and operational reasons the survey area has been bisected by a line that runs from 70.5° N, 150.5° W to 73° N, 148° W. Weather and ice permitting, ION plans to begin survey operations east of the line (eastern survey area) in offshore waters (≤1,000 m [3,281 ft]) where bowheads are expected to be least abundant in early October. The survey will then progress to shallower waters in the eastern survey area before moving to the west survey area in late October or early November. The vessels will depart the region to the south via the Chukchi and Bering Seas and arrive in Dutch Harbor in mid- to late December.

Comments and Responses

A notice of NMFS' proposal to issue an IHA to ION was published in the **Federal Register** on August 17, 2012 (77 FR 49922). That notice described, in detail, ION's proposed activity, the marine mammal species that may be affected by the activity, and the anticipated effects on marine mammals and the availability of marine mammals for subsistence uses. During the 30-day public comment period, NMFS received comments from the following organizations: the Marine Mammal Commission (Commission), the North Slope Borough (NSB), Oceana, Ocean Conservation Research, Ocean Conservancy, PEW Environment Group (PEW), and a group joined by the Alaska Wilderness League, Audubon Alaska, Center for Biological Diversity, EarthJustice, Natural Resources Defense Council, Northern Alaska Environmental Center, Ocean Conservation Research, Pacific Environment, Sierra Club, and World Wildlife Fund (AWL *et al.*).

Any comments specific to ION's application that address the statutory and regulatory requirements or findings NMFS must make to issue an IHA are addressed in this section of the **Federal Register** notice.

General MMPA Issues and Impact Analyses

Comment 1: The Commission recommends that NMFS continue to include proposed incidental harassment authorization language, including the total number of estimated takes by Level A and Level B harassment, at the end of **Federal Register** notices but ensure that the language is consistent with that referenced in the main body of the corresponding notice.

Response: NMFS agrees with the Commission's recommendation and will, to the extent practicable, include proposed incidental harassment authorization language at the end of **Federal Register** notices. In addition, NMFS agrees that the language should be consistent with that referenced in the main body of the corresponding notice and will make every effort to ensure consistency. However, the total number of estimated takes by Level A and Level B harassment is presented in tables

within the subsection *Estimated Takes by Harassment* of the **Federal Register** notice, and it would be redundant to repeat this information within the proposed incidental harassment authorization language elsewhere in the same **Federal Register** notice.

Comment 2: The Commission recommends that NMFS propose to issue regulations under section 101(a)(5)(A) of the MMPA and a letter of authorization, rather than an incidental harassment authorization, for any proposed activities expected to cause a permanent threshold shift (PTS).

Response: The legal requirements and underlying analysis for the issuance of an IHA concerning take do not require the issuance of regulations and a letter of authorization in this particular case. In order to issue an authorization pursuant to Section 101(a)(5)(D) of the MMPA, NMFS must determine that the taking by harassment of small numbers of marine mammal species or stocks will have a negligible impact on affected species or stocks, and will not have an unmitigable adverse impact on the availability of affected species or stocks for taking for subsistence uses. If there were a potential for serious injury or mortality, NMFS could not issue an IHA. Instead, any incidental take authorization would need to be processed under Section 101(a)(5)(A) of the MMPA.

As described here and in previous FR notices, PTS is considered to be injury (Level A Harassment). However, an animal would need to stay very close to the sound source for an extended amount of time to incur a serious degree of PTS, which could increase the probability of mortality. In this case, it would be highly unlikely for this scenario to unfold given the nature of any anticipated acoustic exposures that could potentially result from a mobile marine mammal that is generally expected to avoid loud sounds swimming in the vicinity of an airgun array moving at 3–4 knots. Therefore, it is appropriate to issue an incidental take authorization under 101(a)(5)(D), as we have made the necessary findings (described elsewhere in this document) under that Section of the MMPA.

Comment 3: The Ocean Conservancy, Ocean Conservation Research, Oceana, and AWL *et al.* state the proposed seismic survey would result in harassment takes of a large number of marine mammals, specifically 250 bowhead whales, 4,300 beluga whales, and 60,000 ringed seals, all of which would be exposed to received levels above 160 dB (rms). Thus, the commenters assert that NMFS cannot satisfy MMPA's small number and negligible impact provisions.

Response: NMFS disagrees with the commenters' assessment. First, as mentioned in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012) and earlier in this document, the estimated takes of marine mammals are based on summer/fall marine mammal densities. With most marine mammals moving out of the proposed seismic area as winter approaches, the density would be lower and the actual numbers of takes would be far fewer than those calculated based on fall densities. As described in the Negligible Impact and Small Numbers Analysis and Determination section of this document, NMFS considers the number of authorized takes small.

As discussed in detail in the Negligible Impact and Small Numbers Analysis and Determination section of this document, most of the takes from ION's proposed in-ice seismic surveys are expected to be Level B behavioral harassment, in the form of startle behavior or vacating the area for the short duration of time when the seismic airgun is firing in the area. Animals could also change their behavior patterns during this short duration, butare expected to resume their normal activities and reoccupy the area as soon as the vessels move away. Additionally, since the proposed icebreaking seismic survey is planned outside the time when ice seals are giving birth and after approximately 97% of the bowhead population is expected to have moved through the area, no impacts on pups or calves are expected, and nor are there any orther areas of particular importance for reproduction or feeding that could be impacted. Therefore, any behavioral effects to ringed seals, bowheads, or other species are not expected to have significant impacts to individual fitness or the population. In addition, the mitigation and monitoring measures (described previously in this document) included in the IHA are expected to further reduce any potential disturbance to marine mammals. Last, a small number of takes in the form of PTS are being authorized, however, if incurred, they would be expected to be minor in degree (low intensity—a few dBs of loss at certain frequencies), and they are not expected because of a combination of mitigation and likely avoidance of high source levels. Mortality is neither authorized nor anticipated.

Therefore, NMFS believes that the take, by harassment, from ION's in-ice seismic survey will have a negligible impacton the affected species or stocks.

Comment 4: The Ocean Conservancy, Ocean Conservation Research, and AWL *et al.* claims that NMFS failed to consider cumulative impacts adequately. In addition, AWL *et al.* states that it is essential for NMFS to consider ION's proposed survey along with the impacts of Shell's exploratory drilling program in Beaufort and Chukchi Seas.

Response: Section 101(a)(5)(D) of the MMPA requires NMFS to make a determination that the harassment incidental to a specified activity will have a negligible impact on the affected species or stocks of marine mammals, and will not result in an unmitigable adverse impact on the availability of marine mammals for taking for subsistence uses. Neither the MMPA nor NMFS' implementing regulations specify how to consider other activities and their impacts on the same populations. 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 Environmental Assessment and biological opinion prepared for this action, both of which NMFS indicated would be completed prior to the issuance of an IHA (77 FR 49922; August 17, 2012). The Environmental Assessment's cumulative effects analysis included consideration of (among other things): BP Exploration (Alasks), Inc.'s (BPXA) ocean-bottom-cable seismic surveys in the Simpson Lagoon area of the Beaufort Sea; BPXA's proposed Northstar oil production activity in the Beaufort Sea; and Shell Offshore Inc.'s (Shell) proposed exploratory drilling activities in the Beaufort and Chukchi Seas, Arctic warming, subsistence hunting, and noise contribution from vessel traffic.

These documents, as well as the Alaska Marine Stock Assessments and the most recent abundance estimates for the affected species, 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 5: AWL *et al.* states that in determining whether to proceed with

ION's request, NMFS must also consider the extent of missing information as to both the environmental baseline in the Arctic and marine mammal responses to noise in general.

Response: NMFS has been conducting such analyses in both aspects since 2010 when it first received ION's IHA application.

Regarding the environmental baseline, as described in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012), where the marine mammal distribution and density data for fall and winter seasons in the Beaufort and Chukchi Seas were not available, NMFS used the summer and fall density data. This data is an appropriate proxy for this analysis because it is for the same species and because we assume it is an overestimate since animals are known to move out of the area in the winter (Allen and Angliss 2011).

Separately, regarding marine mammal responses to noise in general and as described in the *Potential Effects of the Specified Activity on Marine Mammals* section of the proposed IHA, while there are not data indicating the responses of every species to every specific sound source type, we believe that the large body of available information across multiple species and sound types allows us to reasonably anticipate likely responses to the proposed seismic airgun and icebreaking and make the findings necessary for issuance of this IHA.

Density Calculation and Take Estimate

Comment 6: PEW states that NMFS did not use the best available data for impact analysis, as most survey data NMFS were collected during the open water season that usually conclude by October.

Response: NMFS does not agree with PEW's statement that we did not use the best available data for impact analysis. As it was discussed in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012), the reason for using the fall marine mammal densities for take calculation is because the lack of marine mammal density data in the winter season. Nevertheless, the fall marine mammal density data NMFS and ION used are the best available data. In addition, during the initial impact analysis, NMFS Office of Protected Resources and ION consulted with NMFS National Marine Mammal Laboratory (NMML) to make sure that the marine mammal density data used for impact analysis are the best available data. Using marine mammal summer/fall density data results in over-estimates as the overwhelming majority marine mammals will have likely departed the Beaufort and Chukchi Seas by the start of winter (Mate *et al.* 2000; Miller *et al.* 2002; Frost *et al.* 2004; Suydam *et al.* 2005; Cameron and Boveng, 2009; Christie *et al.* 2010; Allen and Angliss 2011).

Comment 7: AWL *et al.* states that using density is unsuited for determining bowhead take during the fall migration. AWL *et al.* further argues that the bowhead whales would pass through the Beaufort and Chukchi Sea in the fall during their migration within a migratory corridor. AWL *et al.* then points out that it was not clear NMFS has adequately considered the migration of beluga whales in the Beaufort Sea as well. AWL *et al.* predicts that when taking the bowhead migration into account could dramatically increase the estimate of harassed whales.

Response: NMFS does not agree AWL *et al.'s* assessment. ION's in-ice seismic survey would only occur after the majority of bowhead and beluga whales have migrated out of the Beaufort Sea. In addition, as noted in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012), ION would start its seismic survey from the east and proceed westward, thereby overlapping with the fewest possible number of marine mammals later in the season. Therefore, using summer/fall marine mammal density to calculate takes in the Arctic when most animals have left the area is a reasonable and scientifically supportable approach, although, as stated it will result in an over-estimate of takes.

Comment 8: The Commission requests NMFS require ION to (1) consult with NMFS National Marine Mammal Laboratory (NMML) and other researchers and revise its expected density estimates for gray whales and bearded seals to reflect new information from passive acoustic recordings, and (2) include, as appropriate, an estimate of takes by Level A harassment for those species. Citing Stafford *et al.* (2007), Wang and Overland (2009), Shelden and Mocklin (2012), the Commission points out that acoustic data show that these species are present throughout the winter months. The NSB also expresses its concern that bowhead and gray whales may remain in the area much longer than previously thought. Oceana is also concerned that there could be Level A takes of bearded seals, though it recognizes that much of the bearded seal population will have already migrated into the Bering Sea.

Response: NMFS' Office of Protected Resources and ION worked extensively with NMFS' NMML on density estimates for all marine mammals (gray whales and bearded seals included) that could occur in the proposed survey area. The approaches took into account the best available scientific data on the abundance of marine mammals (gray whales and bearded seals included) that could potentially occur through the winter season, as well as estimates erred on the overestimation. NMFS and ION conducted a thorough review of acoustic recordings data pertaining to overwintering marine mammals (*e.g.,* Stafford *et al.* 2007; Roth 2008; MacIntyre and Stafford 2011; Shelden and Mocklin 2012). We concluded that although some marine mammals were detected in the Beaufort and Chukchi Seas during this time, none of the studies allowed us to identify specific density estimates. In addition, many studies show that marine mammal calling rates dropped significantly during the winter months (Roth 2008; MacIntyre and Stafford 2011), which is consistent with our prediction based on tagging research (Cameron and Boveng 2009; Harwood *et al.* 2012). The notion is also shared by Oceana as it stated in its comment that much of the population of bearded seals will have already migrated into the Bering Sea. These reviews support our initial analyses and the basis for marine mammal take estimates. Therefore, we do not believe it is necessary, nor is it feasible, to revise density estimates or to include gray whales and bearded seals in the Level A take estimates.

Finally, we acknowledge that bowhead and gray whales may remain in the Beaufort and Chukchi Seas during the timeframe of ION's proposed survey. To account for this possibility, NMFS relied on summer/fall data to estimate potential abundance of these species, which resulted in an over-estimate of take.

Comment 9: The Commission requests NMFS require ION to recalculate expected densities for bowhead whales based on (1) the corrected decrease in abundance of bowhead whales reported by Miller *et al.* (2002) for early and late October (*i.e.,* 78 percent) and (2) any additional information from more recent surveys, including acoustical surveys, conducted by NMFS' NMML and other researchers to assess the distribution and relative abundance of bowhead whales in the survey area from October through December.

Response: Through the process of analyzing the potential impacts of ION's in-ice seismic survey in the Beaufort and Chukchi Seas, NMFS' Office of Protected Resources and ION worked extensively with NMFS' NMML on marine mammal density estimates, including distribution and densities of

bowhead whales. The early October (October 1–15) bowhead abundance of 0.55 bowheads/100 km and the late October (October 15–31) abundance of 0.12 bowheads/100 km reported in Miller *et al.* (2002) were both calculated as overall averages across the four survey regions and all water depth strata. The reference density to which the 90% decrease from early October to late October adjustment was applied was based only on bowhead sightings in less than 200 m of water. Thus, data in table Appendix 9.1 in Miller *et al.* (2002), which excludes water depths >200 m, were used for the calculation. In that table, the mean number of bowheads/100 km seen from October 1–15 was 0.618 and the mean for October 16–31 was 0.089. This represents an 86% decrease from early to late October, which was rounded to 90%.

If the percentage decrease were left unrounded the average density for water depths <200 m in the Eastern Beaufort Sea in Table 2 of the ION's IHA application would become 0.0132 bowheads/km^2. Using this value the take calculations would be 282, instead of the 201 stated in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012).

NMFS and ION by focused on bowhead whale aerial surveys that were conducted in the spring of 2011 and 2012. We ultimately agreed that the aerial survey data being used for density calculations was the most appropriate and that any newer data (*i.e.* from 2011 surveys) was of no added value. More recent aerial survey data were not used for the direct calculation of densities in late October as there have been very few surveys conducted at that time of year in the eastern U.S. Beaufort in recent years. Although acoustic data can be useful in assessing distribution, and to a limited extent, relative abundance, however, as with acoustic data for other marine mammals, none of them provides a basis for density estimates.

Comment 10: The Commission requests NMFS provide stronger assurance that the actual number of takes would be negligible by (1) estimating the expected number of takes plus some measure of uncertainty in that estimate, (2) using maximum estimated densities of the marine mammals in the survey area to estimate takes, or (3) using some comparable approach that accounts for uncertainty and provides a high level of assurance that the actual taking would, in fact, be negligible. In addition, the Commission requests NMFS require ION to account for all sources of uncertainty in its estimation approach, including animals that may be present but not observed. Oceana and the NSB also express their concerns regarding the uncertainty of the impacts to marine mammals from ION's in-ice seismic survey during the winter season.

Response: NMFS believes that the analyses provided in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012) has already provided a well-founded assurance that the impacts from even the overestimated takes, which were based on summer-fall marine mammal density, would be negligible to marine mammal species and stocks in ION's in-ice seismic survey areas in the Beaufort and Chukchi Seas, and that the take would not have unmitigable impacts to subsistence use of these species and stocks. These analyses already took uncertainties of marine mammal winter distribution and densities into account and erred on the side of caution.

The determination regarding whether the total taking would have a negligible impact on the species or stocks is based on the species-specific average density, or based on allotted number from past chance occurrence, as described above and in the proposed **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012). More importantly, the negligible impact analysis is not simply an assessment of the number of takes, but rather includes consideration of the nature, context, and likely severity of the takes, as well as the anticipated effectiveness of the mitigation measures. As described later in this document, our analysis allowed us to determine that the total taking would have a negligible impact on the affected species.

Regarding the requirement for ION to account for all sources of uncertainty in its estimation approach, including animals that may be present but not observed, NMFS believes that all population survey studies, as well as density estimates, take into account for marine mammals not observed during the survey.

Acoustic Impacts

Comment 11: PEW states that NMFS needs to ensure that best science is used when considering permitting an IHA to authorize Level A harassment of marine mammals, since this is the first time Level A take is being proposed.

Response: NMFS has relied on the best available scientific information to support the issuance of ION's authorization. In the case of authorizing Level A harassment, NMFS has estimated that no more than 1 bowhead whale, 3 beluga whales, and 4 ringed seals could, although unlikely, experience minor permanent threshold shifts of hearing sensitivity (PTS). The available data and analyses, as described more fully in the proposed IHA, include extrapolation results of many studies on marine mammal noise-induced temporary threshold shifts of hearing sensitivities (TTS) (Kryter 1985; Richardson *et al.* 1995; Kastak *et al.* 1999; Schlundt *et al.* 2000; Finneran *et al.* 2002; 2005; Nachtigall *et al.* 2003; 2004; Kastak *et al.* 2004; 2005; Southall *et al.* 2007; Mooney *et al.* 2009a; 2009b; Finneran *et al.* 2010a; 2010b). An extensive review of TTS studies and experiments prompted NMFS to conclude that possibility of minor PTS in the form of slight upward shift of hearing threshold at certain frequency bands by a few individuals of marine mammals is extremely low, but not unlikely.

Comment 12: Citing NMFS' 1995 **Federal Register** notice (60 FR 28379), AWL *et al.* argues that since the proposed seismic survey has the potential to cause permanent hearing loss in marine mammals, the impact must constitute ''serious injury.'' Ocean Conservancy also states that PTS equals ''serious injury''. AWL *et al.* further states that marine mammals enter the 180/190 dB re 1 μPa exclusion zones have at least the potential to suffer serious injury, and thus AWL *et al.* assumes that at least 23 beluga whales, 6 bowhead whales, and 277 ringed seals could potentially suffer serious injury as a result of the survey. Oceana also expresses its concern that serious injury could occur to marine mammals.

Response: Our understanding of noise-induced impacts on marine mammals has evolved over the past two decades and we no longer believe, based on the best available data, that PTS equals ''serious injury.'' As described in detail in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012), the potential Level A takes would be limited to minor degrees of PTS by 1 bowhead whale, 3 beluga whales, and 4 ringed seals. This level of injury is different from ''serious injury,'' which is defined as ''any injury that will likely result in mortality'' (50 CFR 229.2).

Noise-induced threshold shifts (TS, include PTS) are defined as increases in the threshold of audibility (*i.e.,* the sound has to be louder to be detected) of the ear at a certain frequency or range of frequencies (ANSI 1995; Yost 2000). Several important factors relate to the magnitude of TS, such as level, duration, spectral content (frequency range), and temporal pattern (continuous, intermittent) of exposure (Yost 2000; Henderson *et al.* 2008). TS occurs in terms of frequency range

(hertz [Hz] or kHz), hearing threshold level (dB), or both frequency and hearing threshold level (CDC 2004).

In addition, there are different degrees of PTS: Ranging from slight/mild to moderate and from severe to profound (Clark 1981). Profound PTS or the complete loss of the ability to hear in one or both ears is commonly referred to as deafness (CDC 2004; WHO 2006). High-frequency PTS, presumably as a normal process of aging that occurs in humans and other terrestrial mammals, has also been demonstrated in captive cetaceans (Ridgway and Carder 1997; Yuen *et al.* 2005; Finneran *et al.* 2005a; Houser and Finneran 2006; Finneran *et al.* 2007a; Schlundt *et al.* 2011) and in stranded individuals (Mann *et al.* 2010).

In terms of what is analyzed for the potential PTS (Level A harassment) in marine mammals as a result of ION's in-ice seismic survey, if it occurs, NMFS has determined that the levels would be slight/mild because research shows that most cetaceans (and particularly Arctic cetaceans) show relatively high levels of avoidance when received sound pulse levels exceed 160 dB re 1 µPa (rms) (review in Richardson *et al.* 1995; Southall *et al.* 2007), and it is uncommon to sight Arctic cetaceans within the 180 dB radius, especially for prolonged duration. Results from monitoring programs associated with seismic activities in the Arctic have shown significant responses by cetaceans at levels much lower than 180 dB. These results have been used by agencies to support monitoring requirements within distances where received levels fall below 160 dB and even 120 dB. Thus, very few animals would be exposed to sound levels of 180 dB re 1 µPa (rms) regardless of detectability by protected species observers. Avoidance varies among individuals and depends on their activities or reasons for being in the area, and occasionally a few individual Arctic cetaceans will tolerate sound levels above 160 dB. Tolerance of levels above 180 dB is infrequent, regardless of the circumstances. Therefore, a calculation of the number of cetaceans potentially exposed to >180 dB that is based simply on density would be a gross overestimate of the actual numbers exposed to 180 dB. Such calculations would be misleading unless avoidance response behaviors were taken into account to estimate what fraction of those originally present within the soon-to-be ensonified to >180 dB zone (as estimated from density) would still be there by the time levels reach 180 dB.

Comment 13: The Ocean Conservancy and AWL *et al.* state that NMFS' analysis underestimated the impact of stress and the effects of airguns on bowhead whales.

Response: NMFS does not agree with the assessment. The **Federal Register** for the proposed IHA (77 FR 49922; August 17, 2012) provided an analysis of the potential stress response to marine mammals (bowhead included) that could result from ION's in-ice seismic survey. However, almost no information is available on sound-induced stress in marine mammals, or on its potential (alone or in combination with other stressors) to affect the long-term well-being or reproductive success of marine mammals (Fair and Becker 2000; Hildebrand 2005; Wright *et al.* 2007a, 2007b). Nevertheless, extrapolation of information regarding stress responses in other species is applicable because the responses are highly consistent among all species in which they have been examined to date, especially considering that marine mammals will likely respond in a manner consistent with other species studied (Wright *et al.* 2007a). In the section discussing non-auditory effects, NMFS summarized that a range of issues may arise from an extended stress response from noise exposure, which include suppression of reproduction (physiologically and behaviorally), accelerated aging and sickness-like symptoms. Such long-term effects, if they occur, would be mainly associated with chronic noise exposure, which is characteristic of some seismic surveys and exposure situations (McCauley *et al.* 2000b; Nieukirk *et al.* 2009) but not of some others. As described in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012), ION's in-ice seismic survey would be performed in a limited area for a short duration (a total 76 days). In addition, the source vessel would be in constant movement as it acquires seismic data and [would not overlap with individuals for a substantial period of time]. Therefore, we have concluded that marine mammals would not suffer from chronic and long-term, noise exposure.

In addition, NMFS provided more detailed analyses on noise-induced stress in its EA for the issuance of an IHA to ION (NMFS 2012), which also included three specific studies concerning marine mammals (Thomas *et al.* 1990; Romano *et al.* 2004; Rolland *et al.* 2012). These studies point out that short-term noise exposure, such as those animals being tested for TTS, only induced stress-immune system change during intense noise exposure (Romano *et al.* 2004), while during playbacks of recorded drilling noise to four captive beluga whales showed no changes in blood levels of stress-related hormones (Thomas *et al.* 1990).

Comment 14: Citing Lucke *et al.* (2009) TTS experiment on a harbor porpoise, the AWL *et al.* points out that a harbor porpoise experienced TTS when exposed to airgun noise at 164 dB, a significantly lower level than what NMFS predicts.

Response: NMFS does not agree with AWL *et al.'s* assessment. AWL *et al.* erroneously interpreted the results of the TTS-induced sound exposure level (SEL) in Lucke *et al.* (2009) to be sound pressure level (SPL) that NMFS uses for the threshold of PTS. In their paper, Lucke *et al.* (2009) found a threshold shift (TS) of a harbor porpoise after exposing it to airgun noise with peak-to-peak (pk-pk) received SPL at 200.2 dB_{pk-pk} re 1 µPa, which according to the authors, corresponds to SEL of 164.5 dB re 1 μPa^2s after integrating exposure. It is important to understand that SPL and SEL are two very different ways to express the relative sound intensity. NMFS currently uses root-mean-square (rms) of received SPL at 180 dB and 190 dB re 1 µPa as the threshold above which PTS could occur for cetaceans and pinnipeds, respectively, and that TTS is thought to occur below these levels. However, TTS experiments so far have shown that in almost all cases TTS would occur at levels much higher than the 180 and 190 dB re 1 µPa thresholds. It is difficult to determine the equivalent of rms SPL from the reported pk-pk SPL in Lucke *et al.* (2009) because the airgun noise is a broadband impulse. Although it is a standard practice to subtract 9 dB from pk-pk SPL of a sinusoidal signal to convert it to rms SPL, for boardband signal from seismic surveys, the difference could be as large as 16 dB (Harris *et al.* 2001; McCauley *et al.* 2000). If we applied the 16 dB difference and convert the pk-pk reported in Lucke *et al.* (2009), the rms SPL for harbor porpoise to experience TTS would be 184 dB re 1 µPa, and the received levels associated with PTS (Level A harassment) would be higher than that. This is still above NMFS 180 dB_{rms} re 1 µPa threshold for injury.

Nevertheless, NMFS recognizes that the TTS threshold of harbor porpoise is lower that other cetacean species (bottlenose dolphin and beluga whale) tested (*e.g.,* Finneran *et al.* 2002), and is discussed in the **Federal Register** notice of the proposed IHA (77 FR 49922; August 17, 2012), as well as the EA for the issuance of the IHA to ION (NMFS 2012).

Comment 15: Citing Kastak *et al.* (2008) and Jujawa and Liberman (2009), AWL *et al.* states that anthropogenic sound can induce PTS at lower levels

than anticipated. In addition, AWL states that new data indicate that mid-frequency cetaceans, such as bottlenose dolphins and beluga whales have greater sensitivity to sounds within their best hearing range than was supposed at the time Southall *et al.* (2007) was published.

Response: NMFS agrees that PTS could occur at relatively lower levels, such as at levels normally would only cause TTS, if the animal experiences repeated exposures at very close distances to the sound source. These long term effects are well known in terrestrial mammals (Yost 2000; Henderson *et al.* 2008) and is acknowledged in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012) that repeated exposure to elevated noise that causes TTS could eventually result in PTS. However, as mentioned in detailed in the proposed IHA, ION's in-ice seismic survey would be performed in a limited area for a short duration of a total 76 days. In addition, the source vessel would be in constant movement as it acquires seismic data and any overlap between the vessel and affected species would be minimal and short-lived. Therefore, NMFS considers it highly unlikely many animals would be repeatedly exposed to received levels that would cause TTS.

As far as the hearing sensitivity of mid-frequency cetaceans is concerned, it is well known that mid-frequency cetaceans have greater sensitivity to sounds within their best hearing ranges, which are typically between 10–100 kHz (Johnson 1967; Hall and Johnson 1972; White *et al.* 1978; Awbrey *et al.* 1988; Johnson *et al.* 1989; Ridgway *et al.* 2001). Further TTS research on a bottlenose dolphin exposed to pure tones suggests that mid-frequency cetacean tends to be more vulnerable (in terms of TTS occurrence) at their most sensitive hearing range (Finneran *et al.* 2010). However, the majority of acoustic energy from a seismic airgun, vessel and icebreaking noise is under 1 kHz (Richardson *et al.* 1995), which is expected to have less impact on the most sensitive hearing ranges of these cetaceans.

Comment 16: AWL *et al.* argues that NMFS' justifications for the use of a correction factor of only counting 10% marine mammals being exposure to received levels at Level A would show no avoidance and thus subject to PTS and that exposure will only be brief are both flawed and unsupported by survey data and scientific evidence. Citing Arctic seismic survey monitoring and mitigation reports from previous years, AWL *et al.* states that marine mammals, especially ice seals, do not always avoid loud noises, and that marine mammals routinely stray too close to the airguns, even during daylight hours. The Commission also requests NMFS require ION provide a scientific basis for any conclusions about the animals' responses to the airguns. The Commission further requests NMFS require ION to revise the estimated number of Level A harassment takes to include all marine mammals that may be exposed to source levels greater than or equal to 180 and 190 dB re 1 μPa for cetaceans and pinnipeds, respectively.

Response: NMFS does not agree with AWL *et al.'s* assessment. As discussed earlier in the response to Comment 13, NMFS' current Level A take threshold of 180 dB re 1 μPa for cetaceans is appropriate. Marine mammals found in these zones are not expected to experience TTS (a form of Level B Harassment), much less PTS (Level A Harassment) even if they are exposed to a few seismic impulses. On the other hand, almost all marine mammals that underwent TTS experiments showed strong aversive behavioral reactions when the received noise levels approached to levels that could cause TTS (*e.g.,* Nachtigall *et al.* 2004; Fineran and Schlundt 2004; Lucke *et al.* 2009), despite the fact that these animals are trained and food-reinforced to participate the studies. Simply because previous seismic survey monitoring reports reveal that marine mammals were observed in the exclusion zones does not mean the animals necessarily experienced TTS, much less PTS..

The 10% correction factor used by NMFS is appropriate for estimating likely Level A Harassment takes, since there is evidence suggesting that most, if not all, marine mammals would avoid the noise levels that could cause immediate PTS (as described in the Estimated Take section below.

NMFS does not agree with the Commission's recommendation. Again, there is a difference between potential TTS (Level B Harassment), potential PTS (Level A Harassment) and serious injury. As described in detail in the response to Comment 13, the 180/190 dB re 1 μPa are the current standards used to prevent marine mammals from experiencing injury, which is equated with PTS, not TTS, which occurs at substantively lower received levels than PTS. In fact, all studies on marine mammal TTS have pointed out that TTS occurs at a received levels higher than NMFS current 180/190 dB re 1 μPa threshold (*e.g.,* Finneran *et al.* 2000; 2002; Lucke *et al.* 2009). Even if the animal is exposed multiple times at levels higher than the 180/190 dB re 1 μPa threshold and receives TTS, it is not considered physical injury. TTS, which is also referred to as auditory fatigue, is a reversible hearing threshold shift and it often recovers within minutes to hours (Ward 1997; Finneran *et al.* 2000; 2002). The numbers AWL *et al.* cited in their comment are the estimates of marine mammals that could occur within NMFS 180/190 dB re 1 μPa exclusion zones, which do not represent the number of animals that would receive TTS, not to mention PTS. In fact, NMFS considers in most cases all animals would avoid staying within the zones long enough to receive TTS. Therefore, most marine mammals will not experience TTS, which means the occurrence of PTS would be even lower.

Finally, even if the animal receives PTS, this does not equate to serious injury. As stated earlier in response to Comment 13, NMFS defines injury as ''any injury that will likely result in mortality'' (50 CFR 229.2), which, based on the best available science and NMFS' judgment, does not include PTS. .

Comment 17: The AWL *et al.* states that the current NMFS 160-dB re 1 μPa threshold for Level B harassment is arbitrary and non-conservative. Citing papers by Clark and Gagnon (2006), Risch *et al.* (2012), Bain and Williams (2006), Miller *et al.* (1999; 2005), the AWL *et al.* argues that in many cases marine mammals respond to much lower noise levels.

Response: NMFS does not agree with AWL *et al.'s* assessment, as the papers AWL cited do not necessarily indicate that the animals exposed under the certain received levels constitute a ''take'' as defined under the MMPA. Clark and Gagnon (2006) reported that fin whales (*Balaenoptera physalus*) in the northeast Pacific Ocean went silent for an extended period starting soon after the onset of a seismic survey in the area, and Risch *et al.* (2012) reported that humpback whale (*Megaptera novaeangliae*) song in the Stellwagen Bank National Marine Sanctuary was reduced, concurrent with transmissions of an Ocean Acoustic Waveguide Remote Sensing experiment that produced series of frequency modulated pulses approximately 200 km away in the Gulf of Maine. Although Miller *et al.* (1999) reported that bowhead whale deflection may occur about 35 km (21.7 mi) to the east of the seismic operations, no SPL measurement to that distance was provided, except noting that received levels at 30 km (18.6 mi) were about 107–126 dB re 1 μPa rms, depending on propagation. In addition, Miller *et al.* (2005) and Bain and Williams (2006) observed that marine mammal densities were generally lower

during seismic surveys and were seen moving away from seismic sources, even in areas where received levels were far below 160 dB re 1 µPa. Nevertheless, Miller *et al.* (2005) noted that bowhead whales have been sighted within the ''safety radius'' without any observed behavioral responses.

To address these observations, it is important to understand that the vocal behaviors shown by fin and humpback whales, as reported by Clark and Gagnon (2006) and Risch *et al.* (2012), are considered to be related to mating activities, which do not apply to bowhead whales and other marine mammal species in the Beaufort and Chukchi Seas during ION's in-ice seismic survey. Second, as stated in the past, NMFS does not believe that minor course corrections during a migration or temporarily moving away from seismic source, as observed by Miller *et al.* (1999; 2005) and Bain and Williams (2005) equate to ''take'' under the MMPA. This conclusion is based on controlled exposure experiments conducted on migrating gray whales exposed to the U.S. Navy's low frequency sonar (LFA) sources (Tyack 2009). When the source was placed in the middle of the migratory corridor, the whales were observed deflecting around the source during their migration. However, such minor deflection is considered not to be biologically significant. To show the contextual nature of this minor behavioral modification, recent monitoring studies of Canadian seismic operations indicate that when not migrating, but involved in feeding, bowhead whales do not move away from a noise source at an SPL of 160 dB. Therefore, while bowheads may avoid an area of 20 km (12.4 mi) around a noise source, when that determination requires a post-survey computer analysis to find that bowheads have made a 1 or 2 degree course change, NMFS believes that does not rise to a level of a ''take.'' NMFS therefore continues to estimate ''takings'' under the MMPA from impulse noises, such as seismic, as being at a distance of 160 dB re 1 µPa. Although it is possible that marine mammals could react to any sound levels detectable above the ambient noise level within the animals' respective frequency response range, this does not mean that such animals would react in a biologically significant way. According to experts on marine mammal behavior, the degree of reaction which constitutes a ''take,'' *i.e.,* a reaction that could potentially disrupt the migration, breathing, nursing, breeding, feeding, or sheltering, etc., of a marine mammal is complex and context specific, and it depends on several variables in addition to the received level of the sound by the animals. These additional variables include, but are not limited to, other source characteristics (such as frequency range, duty cycle, continuous vs. impulse vs. intermittent sounds, duration, moving vs. stationary sources, etc.); specific species, populations, and/or stocks; prior experience of the animals (naive vs. previously exposed); habituation or sensitization of the sound by the animals; and behavior context (whether the animal perceives the sound as predatory or simply annoyance), etc. (Southall *et al.* 2007).

Based on the information and data summarized in Southall *et al.* (2007), and on information from various studies, NMFS believes that the onset for behavioral harassment is largely context dependent, and there are many studies showing marine mammals do not show behavioral responses when exposed to multiple pulses at received levels above 160 dB re 1 µPa (*e.g.,* Malme *et al.* 1983; Malme *et al.* 1984; Richardson *et al.* 1986; Akamatsu *et al.* 1993; Madsen and Møhl 2000; Harris *et al.* 2001; Miller *et al.* 2005). Therefore, although using a uniform SPL of 160-dB for the onset of behavioral harassment for impulse noises may not capture all of the nuances of different marine mammal reactions to sound, it is an appropriate way to manage and regulate anthropogenic noise impacts on marine mammals. Therefore, unless and until an improved approach is developed and peer-reviewed, NMFS will continue to use the 160–dB threshold for determining the level of take of marine mammals by Level B harassment for impulse noise (such as from airguns).

Comment 18: Citing the Expert Panel Review of Statoil and ION's 2011 monitoring plans, the AWL *et al.* states that the noise from seismic airgun arrays as ''a mixed impulsive/continuous noise source'' and that ''NMFS should evaluate its impacts on that basis.''

Response: NMFS does not agree with the AWL *et al.'s* statement. First, nowhere in the Expert Panel's report did it states that airgun sound is ''a mixed impulsive/continuous noise source''. It has been well understood that the source characteristics from a seismic airgun (or airgun array) are impulsive, with no continuous acoustic components (Richardson *et al.* 1995). What the Expert Panel stated in its report is that ''seismic airgun signals should not be treated as truly impulsive when received at ranges where sound propagation is known to remove the impulsive nature of these signals'', which means that the signals become ''stretched'' at very large distance due to reverberation and multipath propagation. Furthermore, the Expert Panel stated that ''[o]ver very short ranges where potential hearing loss (temporary or permanent) can occur, airgun impulses retain their impulsive features and should be considered as impulses.''

Although it has been known that at long distances an impulse acoustic signal will lose its pulse feature by stretching its duration due to multipath propagation, these signals (or noises) are still fundamentally different from other non-impulse noise sources such as those from vibratory pile driving, drilling, and dredging based on the following characteristics:

First, the elongated pulse signals from the airgun array at far distances are caused by multipath propagation in a reverberant environment (Greene and Richardson 1988; Richardson *et al.* 1995; Madsen *et al.* 2002; Lurton 2002), which is different from other non-pulse signals at closer distances, which is composed of mostly direct sound. The reverberation part of the sound in the ocean behaves differently compared to the direct sound and early surface and bottom reflections from the perspective of the receiver. The direct sound and early reflections follow the inverse square law, with the addition of absorption effects in the case of early reflections, and so their amplitude varies with distance. However the reverberant part of the sound remains relatively constant up to a large distance with the position of the receiver. Therefore, as distance increases from the source, the component of reverberant sounds increases against the direct sound. In addition, the reverberant energy is less directional and is distributed more uniformly around the ambient environment of the animal. As shown in human psychoacoustics, these characteristics in a reverberant field provide distance cues to the listener as to how far away the source is located (Howard and Angus 2006). Therefore, at a distance where the airgun signals have been ''stretched'' to non-pulse, the receiving animals would be able to correctly perceive that these sounds are coming from far away, and would thus be less likely to be affected behaviorally as behavior responses are not solely dependent on received levels. Other factors such as distance to the source, movement of the source, source characteristics, and the receiver's (*i.e.,* animal's) age, sex, motivation states, and prior experience, etc. probably play more significant roles in determining the responses of the animals that are

being exposed to lower levels of noises than solely the received sound level.

Second, even though during horizontal propagation, the initial short pulse could be ''stretched'' from milliseconds when emitted to about 0.25–0.5 second long at a few kilometers in shallow water (Richardson *et al.* 1995), the noise duration is still very short when compared to those ''conventional'' non-pulse noise sources (vibratory pile driving, drilling, and dredging, etc.) for which NMFS applies a 120 dB threshold for assessing behavioral harassment. The empirical measurements of a 3,000 in3 airgun array received signal characteristics showed that its pulse duration was stretched to 0.2 second at approximately 1.3 km (0.8 mi), to 0.5 second at approximately 10 km (6.2 mi), and to about 1.8 seconds at 80 km (50 mi) from the source (O'Neill *et al.* 2011). Based on the airgun array's firing rate of 0.1 Hz (1 shot every 10 seconds), the duty cycle was only 18% for the signal at 80 km (50 mi) (1.8 seconds on for every 10 seconds). Conversely, the ''conventional'' non-pulse noises from vibratory pile driving, drilling, and dredging typically last much longer (minutes to hours) with very brief (seconds for vibratory pile driving) intervals.

Therefore, NMFS does not agree that it is appropriate to treat elongated airgun pulses at long distances as a ''conventional'' non-pulse signal and apply the 120 dB behavioral response threshold to that received sound.

Comment 19: Citing Madsen (2005), the AWL *et al.* states that ''the threshold's basis in the root mean square (''RMS'') of sound pressure, rather than in peak pressure, is non-conservative.'' The AWL *et al.* further claims that studies have criticized the use of RMS for seismic sound because of the degree to which pulsed sounds must be ''stretched,'' resulting in significant potential underestimates of marine mammal take. The AWL *et al.* predicts that if NMFS would modify its threshold estimates to use the peak pressure level instead of RMS, the estimated number of marine mammal takes could be significantly higher than the number of takes NMFS intends to authorize in for this survey.

Response: NMFS does not agree with the AWL *et al.*'s statement. First, there is no scientific basis that the use of root-mean-square (rms) for sound pressure is less conservative than using peak pressure (which includes zero-peak pressure and peak-peak pressure). All of these are valid terms to express acoustic pressure and other physical oscillations (*e.g.,* alternating electrical current). NMFS chooses to use rms because it was first established to regulate underwater noise impacts to marine mammals and that rms uses the product mean of acoustic pressures, which provides a more consistent result when dealing with multiple impulses such as pile driving. For a sinusoidal signal, the relationship between rms level and peak pressure level is that the rms level of a given sinusoidal signal is always 3 dB lower than the zero-peak level, and 9 dB lower than the peak-peak level. Therefore, for example, if the peak levels would be used to set the threshold for marine mammal disturbance, it would be 163 dB re 1 μPa (0-peak) or 169 dB re 1 μPa (peak-peak), instead of the current 160 dB re 1 μPa (rms).

Second, it is not true that the use of rms for calculating the levels of seismic impulse, or any other acoustic impulse, the pulsed sound ''must be stretched''. The concern raised by Madsen (2005) was the perceived lack of a standardized window for calculating the rms levels during averaging. Citing a 2003 **Federal Register** notice (68 FR 9991; March 3, 2003), Madsen (2005) stated ''[t]he rms measure critically relies upon choosing the size of averaging window for the squared pressures. Derivation of this window is not standardized, which can lead to 2–12 dB differences in rms sound pressure for the same wave form.'' However, NMFS actually uses a standard 90% energy window when performing rms calculation for impulse sounds.

Comment 20: The Ocean Conservation Research is concerned that acoustic impacts on the habitat, especially other marine organisms were not analyzed. In addition, citing Roth *et al.* (2012), the Ocean Conservation Research points out that the overall ambient noise levels could increase by 8 dB as a result of the seismic survey.

Response: NMFS does not agree with the Ocean Conservation Research's assessment. The **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012) provided an analysis on the potential impacts of marine mammal habitat. The acoustic impacts on other marine organisms in the context of their value in marine mammal habitat, including planktonic species, invertebrates, and fish species are further analyzed in detail in the Environmental Assessment for the issuance of the IHA. Regarding the Ocean Conservation Research's concern of the raising ambient noise due to seismic survey in the Arctic, NMFS agrees that such concerns are valid, as was reported by Roth *et al.* (2012) that the average ambient noise in the Chukchi and Beaufort Seas increased by 2–8 dB in September and early October in all years between 2006 and 2009. However, ION's in-ice seismic survey is short in duration, will be confined to a limited area, and will occur from mid- to late-October through December, outside the time period of concern. The overall impact to the Beaufort and Chukchi Sea ecosystem, including marine mammal habitat, is not expected to be significant.

Monitoring and Mitigation Issues

Comment 21: PEW states that NMFS should exclude important habitat from the survey area and institute time- and place-based restriction before permitting activities. Especially, PEW requested NMFS consider excluding Hanna and Herald Shoals, the Barrow Canyon, and the Chukchi Sea ice lead system.

Response: Although the Hanna Shoals are located in the U.S. EEZ, the majority of the Herald Shoals are located in the Russian EEZ. Nevertheless, both areas are outside ION's seismic survey area. Although Barrow Canyon, which is on the edge of the proposed in-ice seismic survey boundary, is considered as an important feeding area for bowhead whales primarily due to its high productivity, it is only important to marine mammals during the open water summer and early fall seasons, which ends in September (Suydam *et al.* 2005; Ashjian *et al.* 2010; Moore *et al.* 2010). The Chukchi Sea ice lead system along the entire Alaskan coastline serves as an important corridor for migrating marine mammals such as bowhead whales, especially during the spring (Braham *et al.* 1980). PEW even acknowledged in its comments to NMFS on the draft *Environmental Impact Statement (EIS) on the Effects of Oil and Gas Activities in the Arctic Ocean* (NMFS 2012a) that the bowhead whale population ''travels along the Chukchi Sea coast during spring months, from March through June.'' In addition, it is well known that bowhead whale fall migration does not necessarily follow the lead system (Huntington and Quakenbush 2009; Quakenbush *et al.* 2010; Allen and Angliss 2011). Considering that ION's in-ice seismic survey is designed specifically to avoid encountering large numbers of marine mammals after the majority of the animals have migrated out of the Beaufort and Chukchi Seas, NMFS does not believe that time and area restrictions are scientifically supportable or would provide any meaningful benefit to marine mammals.

Comment 22: AWL *et al.* claims that NMFS did not fully consider the impacts of ION's survey on migrating bowhead whale mother and calf pairs,

as cows and calves are known to favor the tail end of the spring and fall migrations. Citing NMFS 2008 and 2011 Biological Opinions, AWL *et al.* states that females with young bowhead whales are more responsive to noise and human disturbance than other and that cow/calf pairs typically migrate through the area later in the season (*i.e.,* late September/October). AWL *et al.* points out that in 2006 NMFS required a 120-dB exclusion zone for four or more cow-calf pairs to reduce impacts on mother-calf pairs. In addition, the Commission also recommends NMFS require ION to establish and monitor adequately both a 160- and 120-dB re 1 μPa disturbance zone around all sound sources and to not initiate or continue an activity if (1) an aggregation of bowhead whales or gray whales (12 or more whales of any age/sex class that appear to be engaged in a non-migratory, significant biological behavior (*e.g.,* feeding, socializing)) is observed within the 160-dB re 1 μPa, or (2) a female-calf pair is observed within the 120-dB re 1 μPa zone.

Response: NMFS recognizes that bowhead cow and calf pairs are more prone to human disturbance than other individuals, and that they normally follow the tail-end of the migration. However, as discussed in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012), ION's in-ice seismic survey will occur in the very latter part of the bowhead whale season (beginning after mid-October) and we expect very few exposures. Research indicates that on average about 97% of the bowhead whales would have passed through eastern of the Beaufort Sea by October 15 (Miller *et al.* 2002), and that all studies point that majority of the bowhead whales will be out of the Beaufort and Chukchi Seas (Allen and Angliss 2011). More importantly, ION plans to conduct its survey in an east to west fashion (the fall migration of bowhead whales occurs in an east to west direction), which would further reduce the potential takes of the few remaining whales. In addition, as discussed in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012) and in the Environmental Assessment, daylight hours during ION's in-ice seismic survey would be very limited, which makes aerial surveys unfeasible. Therefore, based on our knowledge of bowhead whale migration and the practicability in carry out the monitoring and mitigation measures, NMFS will not require ION implement the 120-dB exclusion zone for cow-calf pairs nor the 160-dB exclusion zone for an aggregation of 12 or more whales, and concludes that the potential impacts to bowhead whale cow-calf pairs are extremely unlikely.

Comment 23: AWL *et al.* states that NMFS should require ION provide additional clarification about the location and timing of its surveying. AWL *et al.* points out that the proposed IHA describes the surveying as beginning in deeper water (>1,000 m) in the eastern half of the survey area before moving to the west in late October or early November. AWL *et al.* states that bowhead migration has the potential to extend into late October and even November. AWL *et al.* further states that NMFS must specify the earliest date at which ION may survey in more shallow waters near the migration corridor, and include the specific timing of ION's operation in its conclusions and recommendations.

Response: NMFS believes that ION's survey plan is adequately described in its application and the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012). ION entered the U.S. Beaufort Sea survey area from Canadian waters in early October and plans to begin data collection in mid-October 2012. Therefore, the actual seismic survey would not start until after mid-October due to logistical delays. Weather and ice permitting, ION plans to begin survey operations east of the Beaufort Sea and in offshore waters (>1,000 m [3,281 ft]) where bowheads are expected to be least abundant in mid-October. This operational plan is based on the fact that only ~2% of bowhead whales observed by Bureau of Ocean Energy Management's (BOEM) aerial surveys from 1979–2007 occurred in areas of water depth >1,000 m (3,281 ft) (MMS 2010), and on average ~97% of bowheads have passed through the eastern U.S. Beaufort Sea by October 15 (Miller *et al.* 2002). The survey would then progress to shallower waters in the eastern survey area before moving to the western survey area in late October or early November 2012. NMFS has conducted thorough analysis on potential disturbances of bowhead whales and other marine mammals in the entire Beaufort and Chukchi Seas for the period of ION's in-ice seismic survey and reached a negligible determination. Finally, at this point it is clear that the delay of ION's in-ice seismic survey into mid- to late October would further reduce impacts to marine mammals in the action area.

Comment 24: The Commission requests that NMFS require ION to (1) record, analyze, and report (within five days of collecting the data) the results of measurements of vessel sounds, including the icebreaking vessel and (2) adjust the size of the 120–dB re 1 μPa harassment zone and revise the estimated number of animals expected to be taken by Level B harassment for all icebreaking activities, as necessary.

Response: NMFS worked with ION on its sound source verification (SSV) measures when it first submitted its IHA application in 2010 and has continued to do so for the 2012 application. Due to the unique situation of the in-ice seismic survey, the traditional method of SSV test using bottom mounted hydrophone would not work. NMFS and ION have agreed to use the SSV measurements that ION collected in the ice-free Canadian Beaufort Sea, coupling with the in-situ sound velocity profile measurements in the seismic survey areas in the Beaufort and Chukchi Seas, to model the exclusion zones (180 and 190 dB re 1 μPa for cetaceans and pinnipeds, respectively) and behavioral harassment zones (160 and 120 dB re 1 μPa for seismic airgun array and icebreaking activity, respectively). However, after NMFS published its proposed IHA, ION informed NMFS that direct SSV measurements of airgun would be possible in the U.S. Beaufort Sea based on ice condition prediction. Therefore, ION will be conducting traditional SSV tests on its airgun array prior to conducting seismic surveys and submit the results within five days of collecting the data. ION will also adjust the size of the take zones based on the SSV tests. Nevertheless, NMFS does not believe direct SSV test in open water would be a good indicator for measuring icebreaking noise, since this would be an underestimate of noise produced during actual icebreaking activities. Therefore, for icebreaking activities, ION would use its seismic survey streamer to measure its noise during actual icebreaking, which is described in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012). In addition, overwintering buoys deployed by ION and its partner would also provide better estimates of noise levels from icebreaking activities. However, these are no SSV measurements as these measurements could not be carried out under controlled test setting. Nevertheless, NMFS believes that the 160–dB re 1 μPa harassment zone from the seismic airgun array would surpass the 120–dB re 1 μPa harassment zone from icebreaking activity based on acoustic modeling. Therefore, the 160–dB re 1 μPa received level from the airgun array would determine the numbers of marine mammals being taken.

Comment 25: The NSB is concerned that ION's in-ice seismic survey would

be conducted during the time when visibility would be poor most of the time. The Commission and NSB request that NMFS require ION to use active acoustic monitoring, whenever practicable, to supplement visual monitoring during the implementation of its mitigation measures for all activities that generate sound. The NSB further recommends ION deploy their own acoustic recorders and collect the acoustic data.

Response: As noted, NMFS' analyses on the potential impacts on marine mammals likely overestimates the number of animals taken and our analysis of the nature, context, and severity of those takes allowed to conclude that the taking will have a negligible impact on affected species or stocks. Further, NMFS has concluded that acoustic monitoring for ION's in-ice seismic survey is not necessary or practicable. In the Environmental Assessment prepared by NMFS, NMFS considered requiring ION to employ a near real-time passive acoustic monitoring (PAM) and active acoustic monitoring (AAM) program. These measures would supplement visual observation that is already required for ION. However, we determined these technologies should not be utilized in this particular instance because (1) the technologies are still being developed and thus, the efficacy of these measures for ION's survey would be questionable; and (2) the use of PAM, in particular, would require an additional icebreaker to serve as a PAM platform. After consulting with ION, we determined that a second icebreaker would not be practicable from an operational and economic perspective and could also result in additional environmental impacts such as additional noise being introduced into the water and disturbed habitat by additional icebreaking activities. Although NMFS has required the use of PAM in past IHAs (*e.g.,* Houser *et al.* 2008; McPherson *et al.* 2012) and it has shown to be able to detect marine mammals beyond visual observation, as explained previously, we do not believe PAM is an appropriate mitigation tool for ION's project.

Nevertheless, NMFS requires ION to work with other oil and gas companies in the Arctic to deploy overwintering acoustic sensors to assess the impacts of its in-ice seismic survey and provide a baseline of the acoustic environment and marine mammal distribution during the winter season.

Comment 26: The Commission requests that NMFS specify reduced vessel speeds of 9 knots or less when in transit and 5 knots or less when weather conditions or darkness reduce visibility.

Response: NMFS does not agree with the Commission's recommendation of specifying vessel speeds of 9 knots or less when in transit and 5 knots or less when weather conditions or darkness reduce visibility. As NMFS discussed with ION, stipulating vessel speed during transit would severely hamper its proposed seismic survey activity, and would not be practicable. In any event, ION has indicated that its seismic vessel and icebreaker would normally move at a speed of 9–12 knots during transit and 4–5 knots during seismic survey.

NEPA and Miscellaneous Issues

Comment 27: Noting that NMFS is still working on the Arctic EIS, AWL *et al.* and Oceana state that NEPA regulations makes clear that agencies should not proceed with authorizations for individual projects like the ION proposal until an ongoing programmatic EIS is complete.

Response: NMFS does not agree with AWL *et al.* and Oceana's statement. While the Final EIS is still being developed, NMFS conducted a thorough analysis of the affected environment and environmental consequences from ION's in-ice seismic survey in the Beaufort and Chukchi Seas in 2012 and prepared an EA specific to the seismic survey program proposed to be conducted by ION. The analysis contained in that EA warranted a finding of no significant impact.

The analysis contained in the Final EIS will apply more broadly to multiple Arctic oil and gas operations over an extended period. NMFS' issuance of the IHA to ION for the taking of several species of marine mammals incidental to conducting its in-ice seismic survey in the Beaufort and Chukchi Seas in 2012, as analyzed in the EA, is not expected to significantly affect the quality of the human environment. Additionally, the EA contained a full analysis of cumulative impacts.

Comment 28: PEW states that traditional knowledge needs to be better incorporated into NMFS' analyses.

Response: NMFS agrees that traditional knowledge (TK) is generally useful in understanding the potential environmental and subsistence impacts from activities such as ION's in-ice seismic survey. In fact, TK has been an important factor during NMFS analyses and review process of ION's in-ice seismic survey project, especially for the environmental analysis under the National Environmental Policy Act (NMFS 2012b). For instance, part of the analysis on bowhead whale westbound migration that does not depend on the Chukchi Sea ice lead system is from TK as described in Huntington and Quakenbush (2009).

Description of Marine Mammals in the Area of the Specified Activity

The marine mammal species under NMFS jurisdiction most likely to occur in the seismic survey area include two cetacean species, beluga (*Delphinapterus leucas*) and bowhead whales (*Balaena mysticetus*), and two pinniped species, ringed (*Phoca hispida*) and bearded (*Erignathus barbatus*) seals

Three additional cetacean species and two pinniped species: Harbor porpoise (*Phocoena phocoena*), gray whale (*Eschrichtius robustus*), and minke whale (*Balaenoptera acutorostrata*); and spotted (*P. largha*) and ribbon seals (*Histriophoca fasciata*) could also occur in the project area.

The bowhead whale is listed as ''endangered'' under the Endangered Species Act (ESA) and as depleted under the MMPA. Certain stocks or populations of gray and beluga whales and spotted seals are listed as endangered or proposed for listing under the ESA; however, none of those stocks or populations occur in the proposed activity area. The ESA-listed western North Pacific gray whale population occurs in the West Pacific, and the ESA-listed Cook Inlet beluga population resides in Cook Inlet, Alaska. The southern distinct population segment of spotted seal that is listed under the ESA is found in Liaodong Bay, China, and Peter the Great Bay, Russia. Additionally, the ribbon seal is considered a ''species of concern'', meaning that NMFS has some concerns regarding status and threats to this species, but for which insufficient information is available to indicate a need to list the species under the ESA. Bearded and ringed seals are ''candidate species'' under the ESA, meaning they are currently being considered for listing.

ION's application contains information on the status, distribution, seasonal distribution, and abundance of each of the species under NMFS' jurisdiction mentioned. Please refer to the application for that information (see **ADDRESSES**). Additional information can also be found in the NMFS Stock Assessment Reports (SAR). The Alaska 2011 SAR is available at: *http://www.nmfs.noaa.gov/pr/pdfs/sars/ak2011.pdf.*

Potential Effects of the Specified Activity on Marine Mammals

Operating active acoustic sources such as airgun arrays and icebreaking activities have the potential for adverse effects on marine mammals.

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. The Notice of Proposed IHA (77 FR 49922; August 17, 2012) included a discussion of the effects of airguns on marine mammals, which is not repeated here. That discussion did not take into consideration the monitoring and mitigation measures proposed by ION and those that will be required by NMFS. No instances of serious injury or mortality are expected as a result of ION's activities given the strong likelihood that marine mammals (especially migrating bowheads) would avoid the approaching airguns (or vessel) before being exposed to levels high enough for them to be seriously injured or killed.

Potential Effects From Icebreaking on Marine Mammals

Icebreaking would be carried out for the ION's proposed in-ice seismic survey activities in the Beaufort and Chukchi Seas. Acoustic source modeling and propagation of the icebreaker were provided in the Notice of Proposed IHA (77 FR 49922; August 17, 2012). The source levels of the icebreaker are much lower than those of the airguns. Although they are non-impulse sounds and are treated differently from airgun pulses when the Level B behavioral harassment is considered, the 120 dB re 1 μPa radii from icebreaking activities are still smaller than the 160 dB re 1 μPa radii. Therefore, the zone of influence from the airgun arrays essentially covers the area that would be ensonified by icebreaking activities during the survey, except for vessel transiting. The potential effects of icebreaking to marine mammals are discussed in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012) and are not repeated here.

Anticipated Effects on Habitat

The primary potential impacts to marine mammals and other marine species are associated with elevated sound levels produced by airguns and other active acoustic sources, noise generated from icebreaking, and breaking of ice during the seismic survey. However, other potential impacts to the surrounding habitat from physical disturbance are also possible. Major potential anticipated effects on habitat from ION's proposed in-ice seismic survey include impacts on prey species (fish and other marine species that serve as marine mammal food) and physical environment (the destroy of ice layers) and are discussed in detail in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012) and are not repeated here.

Potential Impacts on Availability of Affected Species or Stock for Taking for Subsistence Uses

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.''

Seismic surveys and associated icebreaking operations have the potential to impact marine mammals hunted by Native Alaskans. In the case of cetaceans, the most common reaction to anthropogenic sounds (as noted previously in this document) is avoidance of the ensonified area. In the case of bowhead whales, this often means that the animals could divert from their normal migratory path by up to several kilometers. Additionally, general vessel presence in the vicinity of traditional hunting areas could negatively impact a hunt.

In the case of subsistence hunts for bowhead whales in the Beaufort and Chukchi Seas, there could be an adverse impact on the hunt if the whales were deflected seaward (further from shore) in traditional hunting areas. The impact would be that whaling crews would have to travel greater distances to intercept westward migrating whales, thereby creating a safety hazard for whaling crews and/or limiting chances of successfully striking and landing bowheads. Native knowledge indicates that bowhead whales become increasingly ''skittish'' in the presence of seismic noise. Whales are more wary around the hunters and tend to expose a much smaller portion of their back when surfacing (which makes harvesting more difficult). Additionally, natives report that bowheads exhibit angry behaviors in the presence of seismic, such as tail-slapping, which translate to danger for nearby subsistence harvesters.

However, due to its proposed time and location, ION's proposed in-ice seismic survey in the Beaufort and Chukchi Seas would be unlikely to result in the aforementioned impacts. As discussed in detail in the **Federal Register** for the proposed IHA (77 FR 49922; August 17, 2012), the only potential impacts on subsistence use of marine mammals from ION's proposed icebreaking seismic survey during October—December period are the fall bowhead hunt and ringed seal harvest. Nevertheless, the proposed seismic survey is expected to occur in waters far offshore from the regular seal hunting areas, and ION indicates it would elect to operate at the eastern end of the survey area until fall whaling in the Beaufort Sea near Barrow is finished, thus reducing the likelihood of interfering with subsistence use of marine mammals in the vicinity of the project area.

Finally, ION has signed a Conflict Avoidance Agreement (CAA), and prepared a Plan of Cooperation (POC) under 50 CFR 216.104 to address potential impacts on subsistence hunting activities. The CAA identifies those measures will be taken to minimize adverse impacts of the planned activities on subsistence harvesting. ION met with the AEWC and communities' Whaling Captains' Associations as part of the CAA development, and established avoidance guidelines and other mitigation measures to be followed where the activities may have an impact on subsistence.

Mitigation Measures

Any incidental take authorization (ITA) under Section 101(a)(5)(D) of the MMPA, must prescribe where applicable, 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.

For ION's in-ice seismic survey in the Beaufort and Chukchi Seas, NMFS is requiring ION to implement the following mitigation measures to minimize the potential impacts to marine mammals in the project vicinity

as a result of the marine seismic survey activities.

The mitigation measures are divided into the following major groups: (1) Establishing exclusion and disturbance zones, (2) Vessel speed or course alteration, (3) Ramp up procedures (4) Power down procedures, and (5) Shutdown procedures. The primary purpose of these mitigation measures is to detect marine mammals within, or about to enter designated exclusion zones and to initiate immediate shutdown or power down of the airgun(s).

(1) Exclusion Zones

Under current NMFS guidelines, ''exclusion zones'' for marine mammals around industrial sound sources are customarily defined as the distances within which received sound levels are ≥180 dB re 1 μPa (rms) for cetaceans and ≥190 dB re 1 μPa (rms) for pinnipeds. These criteria are based on an assumption that sound energy at lower received levels will not injure these animals or impair their hearing abilities but that higher received levels might have some such effects. Disturbance or behavioral effects to marine mammals from underwater sound may occur after exposure to sound at distances greater than the exclusion zone (Richardson *et al.,* 1995).

Received sound levels were modeled for the full 26 airgun, 4,450 in^3 array in relation to distance and direction from the source (Zykov *et al.,* 2010). Based on the model results, Table 1 in this document shows the distances from the airguns where ION predicts that received sound levels will drop below 190, 180, and 160 dB re 1 μPa (rms). A single 70-in^3 airgun would be used during turns or if a power down of the full array is necessary due to the presence of a marine mammal within or about to enter the applicable exclusion zone of the full airgun array. To model the source level of the 70-in^3 airgun, ION used the measurements of a 30-in^3 airgun. Underwater sound propagation of a 30-in^3 airgun was measured in <100 m (328 ft) of water near Harrison Bay in 2007, and results were reported in Funk *et al.* (2008). The constant term of the resulting equation was increased by 2.45 dB based on the difference between the volume of the two airguns [2.45 = 20Log(70/30) − (⅓)]. The 190 and 180 dB (rms) distances for the 70-in^3 airgun from the adjusted equation, 19 m (62 ft) and 86 m (282 ft) respectively, would be used as the exclusion zones around the single 70 in^3 airgun in all water depths until results from field measurements are available.

An acoustics contractor would perform the direct measurements of the received levels of underwater sound versus distance and direction from the energy source arrays using calibrated hydrophones (see below ''Sound Source Verification'' in the ''Monitoring and Reporting Measures'' section). The acoustic data would be analyzed as quickly and as reasonably practicable in the field and used to verify (and if necessary adjust) the size of the exclusion zones. The field report will be made available to NMFS and the Protected Species Observers (PSOs) within 120 hrs of completing the measurements. The mitigation measures to be implemented at the 190 and 180 dB (rms) sound levels would include power downs and shut downs as described below.

TABLE 1—MARINE MAMMAL EXCLUSION ZONES FROM THE 26 AIRGUN, 4,450-IN^3 ARRAY, FOR SPECIFIC CATEGORIES BASED ON THE WATER DEPTH

rms (dB re. 1 μPa)	Exclusion and disturbance zones (meters)		
	Depth less than 100 m	Depth 100 m–1,000 m	Depth more than 1,000 m
190	600	180	180
180	2,850	660	580
160	27,800	42,200	31,600

(2) Speed or Course Alteration

If a marine mammal (in water) is detected outside the exclusion zone and, based on its position and the relative motion, is likely to enter the exclusion zone, the vessel's speed and/or direct course shall be changed in a manner that also minimizes the effect on the planned objectives when such a maneuver is safe.

Another measure proposes to avoid concentrations or groups of whales by all vessels in transit under the direction of ION. Operators of vessels should, at all times, conduct their activities at the maximum distance possible from such concentrations of whales.

All vessels during transit shall be operated at speeds necessary to ensure no physical contact with whales occurs. If any barge or transit vessel approaches within 1.6 km (1 mi) of observed bowhead whales, the vessel operator shall take reasonable precautions to avoid potential interaction with the bowhead whales by taking one or more of the following actions, as appropriate:

(A) Reducing vessel speed to less than 5 knots within 300 yards (900 feet or 274 m) of the whale(s);

(B) Steering around the whale(s) if possible;

(C) Operating the vessel(s) in such a way as to avoid separating members of a group of whales from other members of the group;

(D) Operating the vessel(s) to avoid causing a whale to make multiple changes in direction; and

(E) Checking the waters immediately adjacent to the vessel(s) to ensure that no whales will be injured when the propellers are engaged.

When weather conditions require, such as when visibility drops, adjust vessel speed accordingly to avoid the likelihood of injury to whales.

In the event that any aircraft (such as helicopters) are used to support the planned survey, the proposed mitigation measures below would apply:

(A) Under no circumstances, other than an emergency, shall aircraft be operated at an altitude lower than 1,000 feet above sea level (ASL) when within 0.3 mile (0.5 km) of groups of whales.

(B) Helicopters shall not hover or circle above or within 0.3 mile (0.5 km) of groups of whales.

(3) Ramp Ups

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 airguns firing until the full volume is achieved. The purpose of a ramp up is to ''warn'' marine mammals 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 proposed seismic survey program, the seismic operator will ramp up the airgun arrays slowly. Full ramp ups (*i.e.,* from a cold start after a shut down or when no airguns have been

firing) will begin by firing a single airgun in the array. A full ramp up, following a cold start, can be applied if the exclusion zone has been free of marine mammals for a consecutive 30-minute period. The entire exclusion zone must have been visible during these 30 minutes. If the entire exclusion zone is not visible, then ramp up from a cold start cannot begin.

Ramp up procedures from a cold start shall be delayed if a marine mammal is sighted within the exclusion zone during the 30-minute period prior to the ramp up. The delay shall last until the marine mammal(s) has been observed to leave the exclusion zone or until the animal(s) is not sighted for at least 15 or 30 minutes. The 15 minutes applies to small odontocetes and pinnipeds, while a 30 minute observation period applies to baleen whales and large toothed whales.

A ramp up, following a shutdown, can be initiated if the marine mammal(s) for which the shutdown occurred has been observed to leave the exclusion zone or until the animal(s) is not sighted for at least 15 minutes (small odontocetes and pinnipeds) or 30 minutes (baleen whales and large toothed whales).

If, for any reason, electrical power to the airgun array has been discontinued for a period of 10 minutes or more, ramp-up procedures shall be implemented. Only if the PSO watch has been suspended, a 30-minute clearance of the exclusion zone is required prior to commencing ramp-up. Discontinuation of airgun activity for less than 10 minutes does not require a ramp-up.

The seismic operator and PSOs shall maintain records of the times when ramp-ups start and when the airgun arrays reach full power.

During turns and transit between seismic transects, the 70 in^3 mitigation gun will remain operational. The ramp up procedure will still be followed when increasing the source levels from one airgun to the full array. PSOs will be on duty whenever the airguns are firing during daylight and during the 30 minute periods prior to full ramp ups. Daylight will occur for ~11 hours/day at the start of the survey in mid-October diminishing to ~3 hours/day in mid-November.

(4) Power Down Procedures

A power down involves decreasing the number of airguns in use such that the radii of the 190 and 180 dB re 1 μPa (rms) zones are decreased to the extent that observed marine mammals are not in the applicable exclusion zone. A power down may also occur when the vessel is moving from one seismic line to another. During a power down, only one airgun is operated. The continued operation of one airgun is intended to (a) alert marine mammals to the presence of the seismic vessel in the area, and (b) retain the option of initiating a ramp up to full array under poor visibility conditions. In contrast, a shutdown is when all airgun activity is suspended (see next section).

If a marine mammal is detected outside the exclusion zone but is likely to enter the exclusion zone, and if the vessel's speed and/or course cannot be changed to avoid having the mammal enter the exclusion zone, the airguns may (as an alternative to a complete shutdown) be powered down before the mammal is within the exclusion zone. Likewise, if a mammal is already within the exclusion zone when first detected, the airguns will be powered down immediately if this is a reasonable alternative to a complete shutdown. During a power down of the array, the number of guns operating will be reduced to a single 70 in^3 airgun. The pre-season estimates of the 190 dB re 1 μPa (rms) and 180 dB re 1 μPa (rms) exclusion zones around the power down source are 19 m (62 ft) and 86 m (282 ft), respectively. The 70 in^3 airgun power down source will be measured during acoustic sound source measurements conducted at the start of seismic operations. If a marine mammal is detected within or near the applicable exclusion zone around the single 70 in^3 airgun, it too will be deactivated, resulting in a complete shutdown (see next subsection).

Marine mammals hauled out on ice may enter the water when approached closely by a vessel. If a marine mammal on ice is detected by PSOs within the exclusion zones, it will be watched carefully in case it enters the water. In the event the animal does enter the water and is within an applicable exclusion zone of the airguns during seismic operations, a power down or shut-down will immediately be initiated. If the animal does not enter the water, it will not be exposed to sounds at received levels for which mitigation is required; therefore, no mitigation measures will be implemented.

Following a power down, operation of the full airgun array will not resume until the marine mammal has cleared the exclusion zone. The animal will be considered to have cleared the exclusion zone if it:

- Is visually observed to have left the exclusion zone, or
- Has not been seen within the zone for 15 min in the case of pinnipeds (excluding walruses) or small odontocetes, or
- Has not been seen within the zone for 30 min in the case of mysticetes or large odontocetes.

(5) Shutdown Procedures

The operating airgun(s) will be shut down completely if a marine mammal approaches or enters the then-applicable exclusion zone and a power down is not practical or adequate to reduce exposure to less than 190 or 180 dB re 1 μPa (rms). The operating airgun(s) will also be shut down completely if a marine mammal approaches or enters the estimated exclusion zone around the reduced source (one 70 in^3 airgun) that will be used during a power down.

Airgun activity will not resume until the marine mammal has cleared the exclusion zone. The animal will be considered to have cleared the exclusion zone if it is visually observed to have left the exclusion zone, or if it has not been seen within the zone for 15 min (pinnipeds and small odontocetes) or 30 min (mysticetes and large odontocetes). Ramp up procedures will be followed during resumption of full seismic operations after a shutdown of the airgun array.

In addition, a single airgun (also referred to as the ''mitigation gun'' in past IHAs) shall not be kept firing for long periods of time during darkness or other periods of poor visibility when seismic surveys are not ongoing, with the exception of turns when starting a new trackline, or short transits or maintenance with a duration of less than one hour.

Finally, if a pinniped is sighted hauled out on ice within the underwater exclusion zone (received level 190 dB re 1 μPa (rms)), it will be watched carefully by the PSOs. Even though the pinniped may not be exposed to in-air noise levels that could be considered a take, the presence of the seismic vessel could prompt the animal to slip into the water, and thus be exposed to a high intensity sound field as a result. Therefore, the airgun should be powered down or shutdown immediately if thepinniped enters the water.

Mitigation Measures for Subsistence Activities

(1) Subsistence Mitigation Measures

Since ION's proposed October—December in-ice seismic survey in the Beaufort and Chukchi Seas is unlikely to result in adverse impacts to subsistence users due to its proposed time and location, no specific mitigation measures are proposed other than those general mitigation measures discussed above.

(2) Plan of Cooperation (POC) and Conflict Avoidance Agreement (CAA)

Regulations at 50 CFR 216.104(a)(12) require IHA applicants for activities that take place in Arctic waters to provide a POC 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.

ION has signed a Conflict Avoidance Agreement (CAA) with the Alaska Eskimo Whaling Commission (AEWC) and communities' Whaling Captains' Associations for the proposed 2012 in-ice seismic survey. The main purpose of the CAA is to provide (1) equipment and procedures for communications between subsistence participants and industry participants; (2) avoidance guidelines and other mitigation measures to be followed by the industry participants working in or transiting in the vicinity of active subsistence hunters, in areas where subsistence hunters anticipate hunting, or in areas that are in sufficient proximity to areas expected to be used for subsistence hunting that the planned activities could potentially adversely affect the subsistence bowhead whale hunt through effects on bowhead whales; and (3) measures to be taken in the event of an emergency occurring during the term of the CAA.

The CAA states that all vessels (operated by ION) shall report to the appropriate Communication Center (Com-Center) at least once every six hours commencing with a call at approximately 06:00 hours. The appropriate Com-Center shall be notified if there is any significant change in plans, such as an unannounced start-up of operations or significant deviations from announced course, and such Com-Center shall notify all whalers of such changes.

The CAA further states that each Com-Center shall have an Inupiat operator (''Com-Center operator'') on duty 24 hours per day during the 2012 subsistence bowhead whale hunt.

In addition, ION has developed a ''Plan of Cooperation'' (POC) for the 2012 seismic survey in the Beaufort and Chukchi Seas in consultation with representatives of Barrow, Nuiqsut, Kaktovik, and Wainwright and subsistence users within these communities. NMFS received the final POC on August 13, 2012. The final POC is posted on NMFS Web site at *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications.*

Mitigation Conclusions

NMFS has carefully evaluated these mitigation measures and considered a range of other measures in the context of ensuring that NMFS prescribes the means of effecting the least practicable impact on the affected marine mammal species and stocks and their habitat. Our evaluation of potential 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 measure is 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.

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

Monitoring and Reporting Measures

Any ITA issued under Section 101(a)(5)(D) of the MMPA is required to prescribe, where applicable, ''requirements pertaining to the monitoring and reporting of such taking.'' The MMPA implementing regulations at 50 CFR 216.104(a)(13) state that requests for ITAs must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area.

(1) Protected Species Observers (PSOs)

Vessel-based monitoring for marine mammals shall be performed by trained PSOs throughout the period of survey activities, supplemented by the officers on duty, to comply with expected provisions in the IHA. The observers shall monitor the occurrence and behavior of marine mammals near the survey vessels during all daylight periods. PSO duties include watching for and identifying marine mammals; recording their numbers, distances, and reactions to the survey operations; and documenting ''take by harassment'' as defined by NMFS.

A. Number of Observers

A sufficient number of PSOs shall be required onboard the survey vessel to meet the following criteria:

- 100% monitoring coverage during all periods of survey operations in daylight;
- Maximum of 4 consecutive hours on watch per PSO; and
- Maximum of ~12 hours of watch time per day per PSO.

An experienced field crew leader shall supervise the PSO team onboard the survey vessels. ION's proposed survey will occur in October–December when the number of hours of daylight is significantly reduced, and thus will require fewer PSOs to be aboard the survey vessel than required for surveys conducted during the open water season with nearly 24 hrs of daylight. PSOs aboard the icebreaker operating 0.5–1 km (0.31–0.62 mi) ahead of the survey vessel will provide early detection of marine mammals along the survey track. Three PSOs will be stationed aboard the icebreaker *Polar Prince* to take advantage of this forward operating platform and provide advance notice of marine mammals to the PSO on the survey vessel. Three PSOs will be stationed aboard the survey vessel *Geo Arctic* to monitor the exclusion zones centered on the airguns and to request mitigation actions when necessary.

B. Observer Qualifications and Training

Crew leaders and most other biologists serving as observers shall be individuals with recent experience as observers during one or more seismic monitoring projects in Alaska, the Canadian Beaufort Sea, or other offshore areas.

Biologist-observers shall have previous marine mammal observation experience, and field crew leaders will be highly experienced with previous vessel-based marine mammal monitoring and mitigation projects. Résumés for all individuals shall be provided to NMFS for review and acceptance of their qualifications. Inupiat observers will be experienced in the region, familiar with the marine mammals of the area, and complete an approved observer training course designed to familiarize individuals with monitoring and data collection procedures. A PSO handbook, adapted for the specifics of the planned survey program, will be prepared and distributed beforehand to all PSOs.

Biologist-observers and Inupiat observers shall also complete a two or three-day training and refresher session together on marine mammal monitoring, to be conducted shortly before the anticipated start of the seismic survey. When possible, experienced observers shall be paired with inexperienced observers. The training session(s) shall be conducted by qualified marine

mammalogists with extensive crew-leader experience during previous vessel-based seismic monitoring programs.

Primary objectives of the training include:

- Review of the marine mammal monitoring plan for this project, including any amendments specified by NMFS in the IHA;
- Review of marine mammal sighting, identification, and distance estimation methods using visual aids;
- Review of operation of specialized equipment (reticle binoculars, night vision devices (NVDs), and GPS system);
- Review of, and classroom practice with, data recording and data entry systems, including procedures for recording data on marine mammal sightings, monitoring operations, environmental conditions, and entry error control. These procedures will be implemented through use of a customized computer database and laptop computers;
- Review of the specific tasks of the Inupiat Communicator; and
- Exam to ensure all observers can correctly identify marine mammals and record sightings.

C. PSO Handbook

A PSOs' Handbook will be prepared for ION's monitoring program. Handbooks contain maps, illustrations, and photographs, as well as text, and are intended to provide guidance and reference information to trained individuals who will participate as PSOs. The following topics will be covered in the PSO Handbook for the ION project:

- Summary overview descriptions of the project, marine mammals and underwater noise, the marine mammal monitoring program (vessel-based, aerial, acoustic measurements), the NMFS' IHA (if issued) and other regulations/permits/agencies, the Marine Mammal Protection Act;
- Monitoring and mitigation objectives and procedures, initial exclusion zones;
- Responsibilities of staff and crew regarding the marine mammal monitoring plan;
- Instructions for ship crew regarding the marine mammal monitoring plan;
- Data recording procedures: codes and coding instructions, common coding mistakes, electronic database; navigational, marine physical, field data sheet;
- List of species that might be encountered: identification cues, natural history information;
- Use of specialized field equipment (reticle binoculars, NVDs, forward-looking infrared (FLIR) system);
- Reticle binocular distance scale;
- Table of wind speed, Beaufort wind force, and sea state codes;
- Data storage and backup procedures;
- Safety precautions while onboard;
- Crew and/or personnel discord; conflict resolution among PSOs and crew;
- Drug and alcohol policy and testing;
- Scheduling of cruises and watches;
- Communication availability and procedures;
- List of field gear that will be provided;
- Suggested list of personal items to pack;
- Suggested literature, or literature cited; and
- Copies of the NMFS IHA and USFWS LOA.

(2) Monitoring Methodology

A. General Monitoring Methodology

The observer(s) will watch for marine mammals from the best available vantage point on the survey vessels, typically the bridge. The observer(s) will scan systematically with the unaided eye and 7×50 reticle binoculars, supplemented during good visibility conditions with 20×60 image-stabilized Zeiss Binoculars or Fujinon 25×150 ''Big-eye'' binoculars, a thermal imaging (FLIR) camera, and night-vision equipment when needed (see below). Personnel on the bridge shall assist the marine mammal observer(s) in watching for marine mammals.

Information to be recorded by observers shall include the same types of information that were recorded during recent monitoring programs associated with Industry activity in the Arctic (*e.g.,* Ireland *et al.,* 2009). When a mammal sighting is made, the following information about the sighting shall be recorded:

- Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if determinable), bearing and distance from observer, apparent reaction to activities (*e.g.,* none, avoidance, approach, etc.), closest point of approach, and pace;
- Additional details for any unidentified marine mammal or unknown observed;
- Time, location, speed, and activity of the vessel, sea state, ice cover, visibility, and sun glare; and
- The positions of other vessel(s) in the vicinity of the observer location.

The ship's position, speed of the vessel, water depth, sea state, ice cover, visibility, airgun status (ramp up, mitigation gun, or full array), and sun glare shall 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.

Distances to nearby marine mammals will be estimated with binoculars containing a reticle to measure the vertical angle of the line of sight to the animal relative to the horizon. Observers may use a laser rangefinder to test and improve their abilities for visually estimating distances to objects in the water. However, previous experience has shown that a Class 1 eye-safe device was not able to measure distances to seals more than about 70 m (230 ft) away. The device was very useful in improving the distance estimation abilities of the observers at distances up to about 600 m (1,968 ft), the maximum range at which the device could measure distances to highly reflective objects such as other vessels. Humans observing objects of more-or-less known size via a standard observation protocol, in this case from a standard height above water, quickly become able to estimate distances within about ±20% when given immediate feedback about actual distances during training.

When a marine mammal is seen within the exclusion zone applicable to that species, the geophysical crew shall be notified immediately so that mitigation measures required by the IHA (if issued) can be implemented. It is expected that the airgun array will be shut down within several seconds, often before the next shot would be fired, and almost always before more than one additional shot is fired. The protected species observer shall then maintain a watch to determine when the mammal(s) appear to be outside the exclusion zone such that airgun operations can resume.

ION will provide or arrange for the following specialized field equipment for use by the onboard PSOs: 7×50 reticle binoculars, Big-eye binoculars or high power image-stabilized binoculars, GPS unit, laptop computers, night vision binoculars, digital still and possibly digital video cameras in addition to the above mentioned FLIR camera system (see below).

B. Monitoring at Night and in Poor Visibility

Night-vision equipment (Generation 3 binocular image intensifiers, or equivalent units) will be available for use when/if needed. Past experience with NVDs in the Beaufort Sea and elsewhere has indicated that NVDs are

not nearly as effective as visual observation during daylight hours (*e.g.,* Harris *et al.,* 1997, 1998; Moulton and Lawson, 2002). A FLIR camera system mounted on a high point near the bow of the icebreaker will also be available to assist with detecting the presence of seals and polar bears on ice and, perhaps also in the water, ahead of the airgun array. The FLIR system detects thermal contrasts and its ability to sense these differences is not dependent on daylight.

Additional details regarding the monitoring protocol during NVD and FLIR system use has been developed in order to collect data in a standardized manner such that the effectiveness of the two devices can be analyzed and compared.

B. (1) FLIR and NVD Monitoring

The infrared system is able to detect differences in the surface temperature of objects making it potentially useful during both daylight and darkness periods. NVDs, or light intensifiers, amplify low levels of ambient light from moonlight or sky glow light in order to provide an image to the user. Both technologies have the potential to improve monitoring and mitigation efforts in darkness. However, they remain relatively unproven in regards to their effectiveness under the conditions and it the manner of use planned for this survey. The protocols for FLIR and NVD use and data collection described below are intended to collect the necessary data in order to evaluate the ability of these technologies to aid in the detection of marine mammals from a vessel.

- All PSOs shall monitor for marine mammals according to the procedures outlined in the PSO handbook.
- One PSO shall be responsible for monitoring the FLIR system (IR–PSO) during most darkness and twilight periods. The on-duty IR–PSO shall monitor the IR display and alternate between the two search methods described below. If a second PSO is on watch, they shall scan the same area as the FLIR using the NVDs for comparison. The two PSOs shall coordinate what area is currently being scanned.
- The IR–PSO should rotate between the search methods (see below) every 30 minutes in the following routine:
  - 00:00–00:30: Method I
  - 00:30–01:00: Method II, Port side
  - 01:00–01:30: Method I
  - 01:30–02:00: Method II, Starboard side

B. (2) FLIR Search Methods

The FLIR system consists of a camera that will be mounted on high point in front of the vessel. The camera is connected to a joystick control unit (JCU) and a display monitor that will be located on the bridge of the vessel. The IR–PSO shall manually control the view that is displayed by adjusting the pan (360° continuous pan) and tilt (+/− 90° tilt) settings using the JCU. The FLIR manufacturer has indicated that they have tested the FLIR unit (model M626L) to − 25 °C (− 13 °F), but expect that it will operate at colder temperatures. During the time of the proposed seismic survey, the average minimum temperatures at Prudhoe Bay in October and November are +10 °F and − 10 °F, respectively. Colder temperatures are certainly likely at times, but overall the temperatures should generally be within the operational range of the equipment.

As noted above, two different search methods shall be implemented for FLIR monitoring and results from the two will be compared. The first method involves a back-and-forth panning motion and the second utilizes the FLIR unit focused on a fixed swath ahead and to one side of the vessel track:

Method I: Set the horizontal tilt of the camera to an angle that provides an adequate view out in front of the vessel and also provides good resolution to potential targets (this will likely mean that the lower portion of the view displayed on the monitor is of an area relatively close to the vessel (<100 m [328 ft]) while the middle and upper portions of the view are at greater distances (500–2,000 m [1,640–6,562 ft]). Pan back and forth across the forward 180° of the vessels heading at a slow-scanning rate of approximately 1–2°/sec, as one would with binoculars. This method is intended to replicate the type of observations conducted using binoculars and cover a relatively wider swatch compared to Method II. It should produce sightings data that can be analyzed using line-transect methodologies to estimate marine mammal densities in the survey area.

Method II: Set the horizontal tilt of the camera to an angle that provides an adequate view out in front of the vessel (similar or identical to the above), and then set the camera at a fixed position that creates a swath of view off the bow and to one side of the vessel (see Figure 1 of ION's monitoring plan). This method essentially establishes a fixed-strip width that is intended to produce sightings data that can be analyzed using strip-transect methodologies to estimate marine mammal densities.

B. (3) NVD Methods

The NVDs are goggles worn by the observer and are to be used in a similar fashion as binoculars. When observing in conjunction with the FLIR system, the objective will be to replicate the monitoring methodology being employed by the FLIR system. Method I requires a full 180° scan (or as large of a range as possible from the observer's location) with the NVDs, and Method II requires a focused scan of the ~60° swath being monitored by the FLIR system.

C. Field Data-Recording, Verification, Handling, and Security

The observers shall record their observations onto datasheets or directly into handheld computers. During periods between watches and periods when operations are suspended, those data shall be entered into a laptop computer running a custom computer database. The accuracy of the data entry shall be verified in the field by computerized validity checks as the data are entered, and by subsequent manual checking of the database printouts. These procedures will allow initial summaries of data to be prepared during and shortly after the field season, and shall facilitate transfer of the data to statistical, graphical or other programs for further processing. Quality control of the data will be facilitated by (1) the start-of-season training session, (2) subsequent supervision by the onboard field crew leader, and (3) ongoing data checks during the field season.

The data shall be backed up regularly onto CDs and/or USB disks, and stored at separate locations on the vessel. If possible, data sheets will be photocopied daily during the field season. Data shall be secured further by having data sheets and backup data CDs carried back to the Anchorage office during crew rotations.

In addition to routine PSO duties, observers shall use Traditional Knowledge and Natural History datasheets to record observations that are not captured by the sighting or effort data. Copies of these records will be available to observers for reference if they wish to prepare a statement about their observations. If prepared, this statement would be included in the 90-day and final reports documenting the monitoring work.

D. Effort and Sightings Data Collection Methods

Observation effort data shall be designed to capture the amount of PSO effort itself, environmental conditions

that impact an observer's ability to detect marine mammals, and the equipment and method of monitoring being employed. These data shall be collected every 30 minutes or when an effort variable changes (*e.g.,* change in the equipment or method being used to monitor, on/off-signing PSO, etc.), and shall be linked to sightings data. Effort and sightings data forms are the same forms used during other marine mammal monitoring in the open water season, but additional fields have been included to capture information specific to monitoring in darkness and to more accurately describe the observation conditions. The additional fields include the following.

- Observation Method: FLIR, NVD, spotlight, eye (naked eye or regular binoculars), or multiple methods. This data is collected every 30 minutes with the Observer Effort form and with every sighting.
- Cloud Cover: Percentage. This can impact lighting conditions and reflectivity.
- Precipitation Type: Fog, rain, snow, or none.
- Precipitation Reduced Visibility: Confirms whether or not visibility is reduced due to precipitation. This will be compared to the visibility distance (# km) to determine when visibility is reduced due to lighting conditions versus precipitation.
- Daylight Amount: Daylight, twilight, dark. The addition of the twilight field has been included to record observation periods where the sun has set and observation distances may be reduced due to lack of light.
- Light Intensity: Recorded in footcandles (fc) using an incident light meter. This procedure was added to quantify the available light during twilight and darkness periods and may allow for light-intensity bins to be used during analysis.

Analysis of the sightings data shall include comparisons of nighttime (FLIR and NVD) sighting rates to daylight sighting rates. FLIR and NVD analysis will be independent of each other and according to method (I or II) used. Comparison of NVD and FLIR sighting rates will allow for a comparison of marine mammal detection ability of the two methods. However, results and analyses could be limited if relatively few sightings are recorded during the survey.

(3) Acoustic Monitoring Plan

A. Sound Source Measurements

As described above, received sound levels were modeled for the full 26 airgun, 4,450 in^3 array in relation to distance and direction from the source (Zykov *et al.,* 2010). These modeled distances will be used as temporary exclusion zones until measurements of the airgun sound source are conducted. The measurements shall be made at the beginning of the field season, and the measured radii shall be used for the remainder of the survey period. An acoustics contractor with experience in the Arctic conducting similar measurements in recent years will use their equipment to record and analyze the underwater sounds and write the summary reports as described below.

The objectives of the sound source measurements planned for 2012 in the Beaufort Sea will be (1) to measure the distances in potentially ice covered waters in the broadside and endfire directions at which broadband received levels reach 190, 180, 170, 160, and 120 dB re 1 μPa (rms) for the energy source array combinations that may be used during the survey activities, and (2) measure the sounds produced by the icebreaker and seismic vessel as they travel through sea ice. Conducting the sound source and vessel measurements in ice-covered waters using bottom founded recorders creates a risk of not being able to retrieve the recorders and analyze the data until the following year. If the acoustic recorders are not deployed or are unable to be recovered because of too much sea ice, ION shall use measurements of the same airgun source taken in the Canadian Beaufort Sea in 2010, along with sound velocity measurements taken in the Alaskan Beaufort Sea at the start of the 2012 survey to update the propagation model and estimate new exclusion zones. These modeled results shall then be used for mitigation purposes during the remainder of the survey.

The airgun configurations measured shall include at least the full 26 airgun array and the single 70 in^3 mitigation airgun that will be used during power downs. The measurements of airgun array sounds will be made by an acoustics contractor at the beginning of the survey and the distances to the various radii will be reported as soon as possible after recovery of the equipment. The primary area of concern will be the 190 and 180 dB re 1 μPa (rms) exclusion zones for pinnipeds and cetaceans, respectively, and the 160 dB re 1 μPa Level B harassment (for impulsive sources) radii. In addition to reporting the radii of specific regulatory concern, nominal distances to other sound isopleths down to 120 dB re 1 μPa (rms) shall be reported in increments of 10 dB.

Data shall be previewed in the field immediately after download from the hydrophone instruments. An initial sound source analysis shall be supplied to NMFS and the airgun operators within 120 hours of completion of the measurements. The report shall indicate the distances to sound levels based on fits of empirical transmission loss formulae to data in the endfire and broadside directions. A more detailed report will be issued to NMFS as part of the 90-day report following completion of the acoustic program.

B. Seismic Hydrophone Streamer Recordings of Vessel Sounds

Although some measurements of icebreaking sounds have previously been reported, acoustic data on vessels traveling through relatively light ice conditions, as will be the case during the proposed survey, are not available. In order to gather additional information on the sounds produced by this type of icebreaking, ION proposes to use the hydrophones in the seismic streamer on a routine basis throughout the survey. Once every hour the airguns would not be fired at 2 consecutive intervals (one seismic pulse interval is typically ~18 seconds, so there will be ~54 seconds between seismic pulses at this time) and instead a period of background sounds would be recorded, including the sounds generated by the vessels. Over the course of the survey this should generate as many as 750 records of vessel sounds traveling through various ice conditions (from open water to 100% cover juvenile first year ice or lighter multi-year ice). The acoustic data during each sampling period from each hydrophone along the 9 km (5.6 mi) streamer would be analyzed and used to estimate the propagation loss of the vessel sounds. The acoustic data received from the hydrophone streamer would be recorded at an effective bandwidth of 0–400 Hz. In order to estimate sound energy over a larger range of frequencies (broadband), results from previous measurements of icebreakers could be generalized and added to the data collected during this project.

C. Over-Winter Acoustic Recorders

In order to collect additional data on the propagation of sounds produced by icebreaking and seismic airguns in ice-covered waters, as well as on vocalizing marine mammals, ION intends to collaborate with other Industry operators to deploy acoustic recorders in the Alaskan Beaufort Sea in fall 2012, to be retrieved during the 2013 open-water season.

During winter 2011–2012, AURAL acoustic recorders were deployed at or near each of the 5 acoustic array sites

established by Shell for monitoring the fall bowhead whale migration through the Beaufort Sea, as well as one site near the shelf break in the central Alaskan Beaufort Sea. These recorders will be retrieved in July 2012, when Shell deploys Directional Autonomous Seafloor Acoustic Recorders (DASARs) at 5 array locations. When the DASAR arrays are retrieved in early October, ION intends to coordinate with Shell to re-deploy the 6 AURAL recorders to the same locations used during the 2011–2012 winter. Redeploying the recorders in the same locations will provide comparable data from a year with little to no offshore industrial activity (2011) to a year with more offshore industrial activity (2012). Acoustic data from the over-winter recorders will be analyzed to address the following objectives:

- Characterize the sounds and propagation distances produced by ION's source vessel, icebreaker, and airguns on and to the edge of the U.S. Beaufort Sea shelf,
- Characterize ambient sounds and marine mammal calls during October and November to assess the relative effect of ION's seismic survey on the background conditions, and to characterize marine mammal calling behavior, and
- Characterize ambient sound and enumerate marine mammal calls through acoustic sampling of the environment form December 2012 through July 2013, when little or no anthropogenic sounds are expected.

Monitoring Plan Peer Review

The MMPA requires that monitoring plans be independently peer reviewed ''where the proposed activity may affect the availability of a species or stock for taking for subsistence uses'' (16 U.S.C. 1371(a)(5)(D)(ii)(III)). Regarding this requirement, NMFS' implementing regulations state, ''Upon receipt of a complete monitoring plan, and at its discretion, [NMFS] will either submit the plan to members of a peer review panel for review or within 60 days of receipt of the proposed monitoring plan, schedule a workshop to review the plan'' (50 CFR 216.108(d)).

NMFS convened independent peer review panels to review ION's mitigation and monitoring plan in its IHA applications submitted in 2010 and 2011 for taking marine mammals incidental to the proposed seismic survey in the Beaufort and Chukchi Seas, during 2010 and 2011. The panels met on March 25 and 26, 2010, and on March 9, 2011, and provided their final report to NMFS on April 22, 2010 and on April 27, 2011, respectively. The full panel reports can be viewed at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications.*

ION's proposed 2012 action is essentially the same as described in its 2010 and 2011 IHA applications. NMFS worked with ION in 2010 and 2011 to address the peer review panels' recommendations on its 2010 and 2011 4MPs. Since ION's 2012 4MP addressed all issues raised during the 2010 and 2011 peer reviews and incorporated all of NMFS' requested changes, NMFS decided it was not necessary to conduct a peer-review of ION's 2012 4MP. All actions based on the 2010 and 2011 panel review are discussed in the **Federal Register** notice for the proposed IHA (77 FR 49922; August 17, 2012), and is not repeated here.

Reporting Measures

(1) SSV Report

A report on the preliminary results of the acoustic verification measurements, including as a minimum the measured 190-, 180-, 160-, and 120-dB re 1 μPa (rms) radii of the airgun arrays shall be submitted within 120 hr after collection and analysis of those measurements at the start of the field season. This report shall specify the distances of the exclusion zones that were adopted for the marine survey activities.

(2) Field Reports

Throughout the survey program, the observers shall prepare a report each day or at such other intervals as the IHA may specify (if issued), or ION may require summarizing the recent results of the monitoring program. The field reports shall summarize the species and numbers of marine mammals sighted. These reports shall be provided to NMFS and to the survey operators.

(3) Technical Reports

The results of the vessel-based monitoring, including estimates of ''take by harassment'', shall be presented in the 90-day and final technical reports. Reporting shall address the requirements established by NMFS in the IHA. The technical report shall include:

(a) Summaries of monitoring effort: total hours, total distances, and distribution of marine mammals through the study period accounting for sea state and other factors affecting visibility and detectability of marine mammals;

(b) Methods, results, and interpretation pertaining to all acoustic characterization work and vessel-based monitoring;

(c) Analyses of the effects of various factors influencing detectability of marine mammals including sea state, number of observers, and fog/glare;

(d) Species composition, occurrence, and distribution of marine mammal sightings including date, water depth, numbers, age/size/gender categories, group sizes, and ice cover; and

(e) Analyses of the effects of survey operations:

- Sighting rates of marine mammals during periods with and without airgun activities (and other variables that could affect detectability);
- Initial sighting distances versus airgun activity state;
- Closest point of approach versus airgun activity state;
- Observed behaviors and types of movements versus airgun activity state;
- Numbers of sightings/individuals seen versus airgun activity state;
- Distribution around the survey vessel versus airgun activity state; and
- Estimates of ''take by harassment''.

(4) Notification of Injured or Dead Marine Mammals

In addition to the reporting measures proposed by ION, NMFS will require that ION notify NMFS' Office of Protected Resources and NMFS' Stranding Network of sighting an injured or dead marine mammal in the vicinity of marine survey operations. Depending on the circumstance of the incident, ION shall take one of the following reporting protocols when an injured or dead marine mammal is discovered in the vicinity of the action area.

(a) In the unanticipated event that survey operations clearly cause the take of a marine mammal in a manner prohibited by this Authorization, such as an injury, serious injury or mortality (*e.g.,* ship-strike, gear interaction, and/or entanglement), ION shall immediately cease survey operations and immediately report the incident to the Supervisor of Incidental Take Program, Permits and Conservation Division, Office of Protected Resources, NMFS, and the Alaska Regional Stranding Coordinators. The report must include the following information:

(i) Time, date, and location (latitude/longitude) of the incident;

(ii) The name and type of vessel involved;

(iii) The vessel's speed during and leading up to the incident;

(iv) Description of the incident;

(v) Status of all sound source use in the 24 hours preceding the incident;

(vi) Water depth;

(vii) Environmental conditions (*e.g.,* wind speed and direction, Beaufort sea state, cloud cover, and visibility);

(viii) Description of marine mammal observations in the 24 hours preceding the incident;

(ix) Species identification or description of the animal(s) involved;

(x) The fate of the animal(s); and

(xi) Photographs or video footage of the animal (if equipment is available).

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

(b) In the event that ION 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), ION will immediately report the incident to the Supervisor of the Incidental Take Program, Permits and Conservation Division, Office of Protected Resources, NMFS, and the Alaska Regional Stranding Coordinators. The report must include the same information identified above. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with ION to determine whether modifications in the activities are appropriate.

(c) In the event that ION 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 activities authorized in the IHA (if issued) (*e.g.,* previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), ION shall report the incident to the Supervisor of the Incidental Take Program, Permits and Conservation Division, Office of Protected Resources, NMFS, and the Alaska Regional Stranding Coordinators, within 24 hours of the discovery. ION shall provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network. ION can continue its operations under such a case.

Estimated Take by Incidental Harassment

Except with respect to certain activities not pertinent here (military readiness activities), 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]. For the most part, only take by Level B behavioral harassment is anticipated as a result of the proposed marine seismic survey. However, NMFS has determined that Level A takes of a few individuals of marine mammals could occur if the animals are unable to bedetected within the exclusion zones for a prolonged period of time. Although NMFS believes this is not likely, NMFS is proposing to authorize limited takes from Level A harassment. Anticipated impacts to marine mammals are associated with noise propagation from the seismic airgun(s) and the icebreaking used during the seismic survey.

The full suite of potential impacts to marine mammals was described in detail in the ''Potential Effects of the Specified Activity on Marine Mammals'' section found earlier in this document. The potential effects of sound from the proposed marine survey programs might include one or more of the following: tolerance; masking of natural sounds; behavioral disturbance; non-auditory physical effects; and, at least in theory, temporary or permanent hearing impairment (Richardson *et al.* 1995). As discussed earlier in this document, the most common impact will likely be from behavioral disturbance, including avoidance of the ensonified area or changes in speed, direction, and/or diving profile of the animal.

NMFS uses the 160 dB and 120 dB re 1 μPa (rms) isopleths to indicate the onset of Level B harassment by seismic airgun impulses and by icebreaking noises, respectively. ION provided calculations for the 160-dB and 120-dB isopleths produced by these active acoustic sources and then used those isopleths to estimate takes by harassment. NMFS used the calculations to make preliminary findings under the MMPA. ION provided a full description of the methodology used to estimate takes by harassment in its IHA application (see **ADDRESSES**), which is also described in the following sections.

ION has requested an authorization to take ten marine mammal species by Level B harassment. These ten marine mammal species are: beluga whale, harbor porpoise, bowhead whale, gray whale, humpback whale, minke whale, bearded seal, ringed seal, spotted seal, and ribbon seal. However, NMFS does not anticipate that humpback whales are likely to be encountered during the season of ION's icebreaking seismic survey. Therefore, NMFS determined that only nine of the species could be affected and potentially taken by harassment. In addition, although unlikely, NMFS determined that Level A takes of beluga whales, bowhead whales, and ringed seals could also occur, as the proposed monitoring and mitigation measures may not be 100% effective due to ice coverage and extended periods of darkness. Regardless, our analysis has led us to conclude that marine mammals will likely avoid the sound source thereby minimizing the probability of exposure at a level that would equate to Level A harassment.

Basis for Estimating ''Take by Harassment''

As stated previously, it is current NMFS practice to estimate take by Level A harassment for received levels above 180 dB re 1 μPa (rms) for cetaceans and 190 dB re 1 μPa (rms) for pinnipeds, and take by Level B harassment for all marine mammals under NMFS jurisdiction by impulse sounds at a received level above 160 dB re 1 μPa (rms) and by non-impulse sounds at a received level above 120 dB re 1 μPa (rms). However, not all animals are equally affected by the same received noise levels and, as described earlier, in most cases marine mammals are not likely to be taken by Level A harassment (injury) when exposed to received levels higher than 180 dB for a brief period of time.

For behavioral harassment, marine mammals will likely not show strong reactions (and in some cases any reaction) until sounds are much stronger than 160 or 120 dB (for impulse and continuous sounds, respectively). Southall *et al.* (2007) provide a severity scale for ranking observed behavioral responses of both free-ranging marine mammals and laboratory subjects to various types of anthropogenic sound (see Table 4 in Southall *et al.* (2007)). Tables 7, 9, and 11 in Southall *et al.* (2007) outline the numbers of low-frequency cetaceans, mid-frequency cetaceans, and pinnipeds in water, respectively, reported as having behavioral responses to multi-pulses in 10-dB received level increments. These tables illustrate that the more severe reactions did not occur until sounds were much higher than 160 dB re 1 μPa (rms).

Anticipated takes would include ''takes by harassment'' involving temporary changes in behavior (Level B harassment) and TTS (Level B harassment). NMFS does not consider injury (Level A harassment) to be likely, however, due to the limited

effectiveness of monitoring and mitigation measures for animals undetected under the ice and/or during the long periods of darkness, a small amount of Level A harassment takes are also proposed to be authorized. The sections below describe methods used to estimate ''take by harassment'' and present estimates of the numbers of marine mammals that might be affected during the proposed seismic survey in the U.S. Beaufort Sea. The estimates are based on data obtained during marine mammal surveys in the Beaufort Sea and on estimates of the sizes of the areas where effects could potentially occur. In some cases, these estimates were made from data collected from regions and habitats that differed from the proposed project area. Adjustments to reported population or density estimates were made on a case by case basis to account for differences between the source data and the available information on the distribution and abundance of the species in the project area. This section provides estimates of the number of potential ''exposures'' to impulsive sound levels ≥160 dB re 1 μPa (rms), non-pulse sound levels ≥120 dB (rms) from icebreaking, and also includes estimates of exposures to ≥180 dB (rms) for cetaceans and ≥190 dB (rms) for seals.

Although several systematic surveys of marine mammals have been conducted in the southern Beaufort Sea during spring and summer, few data (systematic or otherwise) are available on the distribution and numbers of marine mammals during the early winter period of this survey, particularly in the northern Beaufort Sea. The main sources of distributional and numerical data used in deriving the estimates are described in the next subsection. There is some uncertainty about how representative those data are and the assumptions used below to estimate the potential ''take by harassment''. However, the approach used here is accepted by NMFS as the best available at this time. That is, we calculated the estimated take by multiplying the ensonified area by the density of marine mammals. The following estimates are based on a consideration of the number of marine mammals that might be disturbed appreciably by ~7,250 line kilometers (4,505 line miles) of seismic surveys across the Beaufort Sea and, to a lesser extent, the northern Chukchi Sea.

Marine Mammal Density Estimates

This section describes the estimated densities of marine mammals that may occur in the survey area. The area of water that may be ensonified to various levels is described below. Although a marine mammal may be exposed to icebreaking sounds ≥120 dB (rms) or airgun sounds ≥160 dB (rms), this does not mean that every individual exposed at these levels will *actually* exhibit a disruption of behavioral patterns in response to the sound source. Not all animals react to sounds at this low level, and many will not show strong reactions (and in some cases any reaction) until sounds are much stronger. There are several variables that determine whether or not an individual animal will exhibit a response to the sound, such as the age of the animal, previous exposure to this type of anthropogenic sound, habituation, etc.

The survey has been designed to minimize interactions with marine mammals by planning to conduct the work at times and in areas where the relative density of marine mammals is expected to be quite low. The survey will begin in offshore waters (>1,000 m [3,281 ft] deep) of the eastern U.S. Beaufort Sea (east survey area) in mid-October. Weather and ice permitting, the waters <1,000 m (3,281 ft) deep will not be surveyed until mid-October and thereafter, in order to avoid migrating bowhead whales. The western U.S. Beaufort Sea and north-eastern Chukchi Sea (west survey area) is not expected to be surveyed until late October through December.

Separate densities were calculated for habitats specific to cetaceans and pinnipeds. For cetaceans, densities were estimated for areas of water depth <200 m (656 ft), 200–1,000 m (656–3,281 ft), and >1,000 m (3,281 ft), which approximately correspond to the continental shelf, the continental slope, and the abyssal plain, respectively. Separate densities of both cetacean and pinnipeds were also estimated for the east and west survey areas within each water depth category. However, pinniped densities in the west survey area and <200 m (656 ft) water depth category were further sub-divided into <35 m (115 ft) and 35–200 m (115–656 ft) depth categories. This was done because the west survey area is not expected to be surveyed until November–December, and based on historic sea ice data (NOAA National Ice Center, available online at *www.natice.noaa.gov*), it is expected that substantial amounts of sea ice, including shorefast ice, will be present in the west survey area at that time. Past studies have found that seal densities in ice-covered areas of the Beaufort Sea are different where water depths are <35 m (115 ft) and >35 m (Moulton *et al.,* 2002; Frost *et al.,* 2004); therefore, densities were calculated separately for these water depths. The north-eastern Chukchi Sea is composed of mostly continental shelf waters between 30 m (98 ft) and 200 m (656 ft) in depth, so only a single density estimate for each marine mammal species was used in that area. Since most marine mammals will be continuing their southerly migration in November and early December, the same density estimates for continental shelf waters in the west survey area of the Beaufort Sea were used in the Chukchi Sea. When the seismic survey area is on the edge of the range of a species at this time of year, it is assumed that the average density along the seismic trackline will be 10% (0.10x) the density determined from available survey data within the main range. Density estimates for the Chukchi Sea during the period of November–December were taken from the west survey density estimates at the appropriate depth.

Detectability bias, quantified in part by f(0), is associated with diminishing sightability with increasing lateral distance from the survey trackline. Availability bias, g(0), refers to the fact that there is <100% probability of sighting an animal that is present along the survey trackline. Some sources used below took account of one or both of these correction factors in reporting densities. When these factors had not been accounted for, the best available correction factors from similar studies and/or species were applied to reported results. Details regarding the application of correction factors are provided below for each species.

(1) Cetaceans

Beluga Whales: Beluga density estimates were calculated based on aerial survey data collected in October in the eastern Alaskan Beaufort Sea by the NMML (as part of the Bowhead Whale Aerial Survey Project (BWASP) program funded by BOEM) in 2007–2010. They reported 31 sightings of 66 individual whales during 1,597 km (992 mi) of on-transect effort over waters 200–2,000 m (656–6,562 ft) deep. An f(0) value of 2.326 was applied and it was calculated using beluga whale sightings data collected in the Canadian Beaufort Sea (Innes *et al.* 2002). A g(0) value of 0.419 was used that represents a combination of ga(0) = 0.55 (Innes *et al.,* 2002) and gd(0) = 0.762 (Harwood *et al.,* 1996). The resulting density estimate (0.1169 individuals/km^2; Table 2 in this document) was applied to areas of 200–1,000 m (656 –3,281 ft). There were 3 sightings of 4 individual beluga whales during 7,482 km (4,649 mi) of on-transect effort over waters 0–200 m (0–656 ft) deep during this same time

period. Using the same f(0) and g(0) values from above, the resulting density estimate for continental shelf waters (0–200 m deep) is 0.0015 individuals/km² (Table 2 in this document). The density estimate for waters >1000 m (3,281 ft) deep was estimated as 40% of the 200–1,000 m (656–3,281 ft) density based on the relative number of sightings in the two water depth categories. For all water depth and survey area categories, the maximum beluga density estimates represent the mean estimates multiplied by four to allow for chance encounters with unexpected large groups of animals or overall higher densities than expected.

Beluga density estimates for the west survey area, which is planned to be surveyed beginning in November, represent the east survey area estimates multiplied by 0.1 because the Beaufort Sea and north-eastern Chukchi Sea is believed to be at the edge of the species' range in November–December. Belugas typically migrate into the Bering Sea for the winter (Allen and Angliss, 2011) and are not expected to be present in the study area in high numbers in November–December. Satellite tagging data support this and indicate belugas migrate out of the Beaufort Sea in the October–November period (Suydam *et al.,* 2005).

Bowhead Whales: Bowhead whale density estimates were calculated based on aerial survey data collected in the Beaufort Sea as part of the BWASP program funded by BOEM. The average density estimate was based on surveys in October 2007–2010 and the maximum density estimate was based on surveys conducted in October 1997–2004. The earlier data were used to calculate the maximum estimate because they include some years of unusually high numbers of bowhead sightings in the western Alaskan Beaufort Sea at that time of year. The 2007–2010 data included 25 on-transect sightings collected during 7,482 km (4,649 mi) of effort over waters 0–200 m (0–656 ft) deep in the eastern Alaskan Beaufort Sea. The 1997–2004 data included 147 on-transect sightings of 472 individual whales collected during 20,340 km (12,639 mi) of effort over waters 0–200 m (0–656 ft) deep in the eastern Alaskan Beaufort Sea. An f(0) correction factor of 2.33 used in the density calculation was the result of a weighted average of the f(0) values applied to each of the flights (Richardson and Thomson, 2002). The multiplication of ga(0) = 0.144 and gd(0) = 0.505 correction factors reported in Richardson and Thomson (2002) gave the g(0) value of 0.0727 used in the density calculation. The resulting density estimates (0.0942 whales/km² and 0.3719 whales/km²) represent the average and maximum densities, respectively for October for areas of <200 m (656 ft) water depth, and are referred to below as the reference density for bowhead whales.

Because bowhead whale density is typically higher in continental shelf waters of the Beaufort Sea in early October, the survey has been planned to start in the eastern U.S. Beaufort Sea in waters deeper than 1,000 m (3,281 ft; ice conditions permitting), where bowhead density is expected to be much lower. Survey activity in shallower waters will proceed from east to west starting later in October as bowhead whales migrate west out of the Beaufort Sea. The nearshore lines in the east survey area will be surveyed during late October. Bowhead density in the east survey area in waters <200 m (656 ft) deep was estimated by taking ten percent of the reference density above (Table 2 in this document). This adjustment was based on data from Miller *et al.* (2002) that showed a ~90% decrease in bowhead whale abundance in the eastern Alaskan Beaufort Sea from early to late October.

Bowhead whale densities in intermediate (200–1,000 m [656–3,281 ft]) and deep (>1,000 m [3,281 ft]) water depths in the east survey area are expected to be quite low. Ninety-seven percent of sightings recorded by MMS aerial surveys 1997–2004 occurred in areas of water depth <200 m (656 ft) (Treacy, 1998, 2000, 2002a, 2000b; Monnett and Treacy, 2005). Therefore, density estimates for areas of water depth 200–1,000 m (656–3,281 ft) were estimated to be ~3% of the values for areas with depth <200 m (656 ft). This is further supported by Mate *et al.* (2000), who found that 87% of locations from satellite-tagged bowhead whales occurred in areas of water depth <100 m (328 ft). In areas with water depth >1,000 m (3,281 ft), ~4,225 km (2,625 mi) of aerial survey effort occurred during October 1997–2004; however, no bowhead sightings were recorded. The effort occurred over eight years, so it is unlikely that this result would have been influenced by ice cover or another single environmental variable that might have affected whale distribution in a given year. Therefore, a minimal density estimate (0.0001 whales/km²) was used for areas with water depth >1,000 m (3,281 ft).

Several sources were used to estimate bowhead whale density in the west survey area, including the north-eastern Chukchi Sea, which is expected to be surveyed beginning in late October or early November. Mate *et al.* (2000) found that satellite-tagged bowhead whales in the Beaufort Sea travelled at an average rate of 88 km (55 mi) per day. At that rate, an individual whale could travel across the extent of the east survey area in four days and across the entire east-west extent of the survey area in ten days, if it did not stop to feed during its migration, as bowhead whales have been observed to do earlier in the year (Christie *et al.,* 2010). Also, Miller *et al.* (2002) presented a 10-day moving average of bowhead whale abundance in the eastern Beaufort Sea using data from 1979–2000 that showed a decrease of ~90% from early to late October. Based on these data, it is expected that almost all whales that had been in the east survey area during early October would likely have migrated beyond the survey areas by November–December. In addition, kernel density estimates and animal tracklines generated from satellite-tagged bowhead whales, along with acoustic monitoring data, suggest that few bowhead whales are present in the proposed survey area in November (near Point Barrow), and no whales were present in December (ADFG, 2010; Moore *et al.,* 2010). Therefore, density estimates for the <200 m (656 ft) and 200–1,000 m (656–3,281 ft) water depth categories in the west survey area were estimated to be one tenth of those estimates for the east survey area. Minimal density estimates (0.0001 whales/km²) were used for areas of water depth >1,000 m (3,281 ft).

Other Cetaceans: Other cetacean species are not expected to be present in the area at the time of the planned survey. These species, including humpback and fin whales, typically migrate during autumn and are expected to be south of the proposed survey area by the October–December period. Gray whales have been detected near Point Barrow during the period of the proposed project, and even throughout the winter (Moore *et al.,* 2006; Stafford *et al.,* 2007). Authorization for minimal takes of other cetacean species that are known to occur in the Beaufort Sea during the summer have been requested in case of a chance encounter of a few remaining individuals.

TABLE 2—EXPECTED DENSITIES OF CETACEANS IN THE ARCTIC OCEAN IN OCTOBER–DECEMBER BY WATER DEPTH AND SURVEY AREA

Species	<200 m	200–1,000 m	>1,000 m
Beaufort East Survey Area			
Beluga whale	0.0015	0.1169	0.0468
Harbor porpoise	0.0001	0.0001	0.0001
Bowhead whale	0.0094	0.0028	0.0001
Gray whale	0.0001	0.0001	0.0001
Minke whale	0.0001	0.0001	0.0001
Beaufort West Survey Area			
Beluga whale	0.0002	0.0117	0.0047
Harbor porpoise	0.0001	0.0001	0.0001
Bowhead whale	0.0009	0.0003	0.0001
Gray whale	0.0001	0.0001	0.0001
Minke whale	0.0001	0.0001	0.0001
Chukchi Survey Area			
Beluga whale	0.0002	.....	.....
Harbor porpoise	0.0001	.....	.....
Bowhead whale	0.0009	.....	.....
Gray whale	0.0001	.....	.....
Minke whale	0.0001	.....	.....

(2) Pinnipeds

In polar regions, most pinnipeds are associated with sea ice, and typical census methods involve counting pinnipeds when they are hauled out on ice. In the Beaufort Sea, surveys typically occur in spring when ringed seals emerge from their lairs (Frost *et al.,* 2004). Depending on the species and study, a correction factor for the proportion of animals hauled out at any one time may or may not have been applied (depending on whether an appropriate correction factor was available for the particular species and area). By applying a correction factor, the total density of the pinniped species in an area can be estimated. Only the animals in water would be exposed to the pulsed sounds from the airguns; however, densities that are presented generally represent either only the animals on the ice or all animals in the area. Therefore, only a fraction of the pinnipeds present in areas where ice is present (and of sufficient thickness to support hauled-out animals) would be exposed to seismic sounds during the proposed seismic survey. Individuals hauled out on ice in close proximity to the vessels are likely to enter the water as a reaction to the passing vessels, and the proportion that remain on the ice will likely increase with distance from the vessels.

Ringed Seals: Ringed seal density for the east survey area for waters <1000 m (3,281 ft) deep was estimated using vessel-based data collected in the Beaufort Sea during autumn (Sep–Oct) 2006–2008 and reported by Savarese *et al.* (2010; Table 3 in this document). Correction factors for sightability and availability were used when the authors calculated the estimates, so no further adjustments were required. For the east survey area for waters >1000 m (3,281 ft) deep, few data on seal distribution are available. Harwood *et al.* (2005) recorded a ringed seal sighting in the Beaufort Sea in an area where water depth was >1,000 m (3,281 ft) in September–October 2002 during an oceanographic cruise. It is therefore possible that ringed seals would occur in those areas, and their presence would likely be associated with ephemeral prey resources. If a relatively warm surface eddy formed that concentrated prey in offshore areas at depths that would be possible for ringed seals to access, it is possible that seals would be attracted to it. A warm eddy was found in the northern Beaufort Sea in October 2002 in an area where water depth was >1,000 m (3,281 ft) (Crawford, 2010), so it is possible that such an oceanographic feature might develop again and attract seals offshore. However, it is unclear whether such a feature would attract many seals, especially since the marine mammal observers present on the ship in 2002 did not observe very many seals associated with the offshore eddy. In the absence of standardized survey data from deep-water areas, but with available data suggesting densities are likely to be quite low, minimal density estimates (0.0001 seals/km^2) were used in areas where water depth is >1,000 m (3,281 ft). For all water depth categories in the east survey area, the maximum ringed seal density was assumed to be the mean estimate multiplied by four to allow for chance encounters with unexpected large groups of animals or overall higher densities than expected.

Habitat zones and associated densities were defined differently in the west survey area, which will be surveyed in November–December, because more ice is expected to be encountered at that time than in October (NOAA National Ice Center: *www.natice.noaa.gov*). The density estimates for the west survey area were calculated using aerial survey data collected by Frost *et al.* (2004) in the Alaskan Beaufort Sea during the spring. A g(0) correction factor of 0.60 from tagging data reported by Bengtson *et al.* (2005) was used to adjust all density estimates from Frost *et al.* (2004) described below. Seal distribution and density in spring, prior to breakup, are thought to reflect distribution patterns established earlier in the year (*i.e.,* during the winter months; Frost *et al.,* 2004). Density estimates were highest (1.00–1.33 seals/km^2) in areas of water depth 3–35 m (10–115 ft), and decreased (0–0.77 seals/km^2) in water >35 m (115 ft) deep. The mean density estimate used for areas with water depth <35 m (Table 4 in this document) was estimated using an average of the pack ice estimates modeled by Frost *et al.* (2004). The maximum estimate for the same area is the maximum observed density for areas of water depth 3–35 m (10–115 ft) in Frost *et al.* (2004). The mean density estimate used for areas with 35–200 m (115–656 ft) water depth is the modeled value for water depth >35 m (115 ft) from Frost *et al.* (2004). The maximum estimate is the maximum observed density for areas with >35 m (115 ft) water depth in Frost *et al.* (2004). Because ringed seal density tends to decrease with increasing water depth (Moulton *et al.,* 2002; Frost *et al.,* 2004), ringed seal density was estimated to be minimal in areas of >200 m (656 ft) water depth.

In the Chukchi Sea, ringed seal densities were taken from offshore aerial surveys of the pack ice zone conducted in spring 1999 and 2000 (Bengtson *et al.,* 2005). The average density from those two years (weighted by survey effort) was 0.4892 seals/km^2. This value served as the average density while the highest density from the two years, (0.8100 seals/km^2 in 1999) was used as the maximum density.

Other Seal Species: Other seal species are expected to be less frequent in the study area during the period of this survey. Bearded and spotted seals would be present in the area during summer, and possibly ribbon seals as well, but they generally migrate into the southern Chukchi and Bering seas during fall (Allen and Angliss, 2011). Few satellite-tagging studies have been conducted on these species in the Beaufort Sea, winter surveys have not been conducted, and a few bearded seals have been reported over the continental shelf in spring prior to general breakup. However, three bearded seals tracked in 2009 moved south into the Bering Sea along the continental shelf by November (Cameron and Boveng, 2009). It is possible that some individuals, bearded seals in particular, may be present in the survey area. In the absence of better information from the published literature or other sources that would indicate significant numbers of any of these species might be present, minimal density estimates were used for all areas and water depth categories for these species, with the estimates for bearded seals assumed to be slightly higher than those for spotted and ribbon seals (Tables 3 and 4 in this document).

TABLE 3—EXPECTED DENSITIES (#/KM^2) OF PINNIPEDS IN THE EAST SURVEY AREA OF THE U.S. BEAUFORT SEA IN OCTOBER.

Species	<200 m	200–1,000 m	>1,000 m
Ringed seal	0.0840	0.0840	0.0004
Bearded seal	0.0004	0.0004	0.0004
Spotted seal	0.0001	0.0001	0.0001
Ribbon seal	0.0001	0.0001	0.0001

TABLE 4—EXPECTED DENSITIES (#/KM^2) OF PINNIPEDS IN THE BEAUFORT WEST AND CHUKCHI SURVEY AREAS OF THE ARCTIC OCEAN IN NOVEMBER-DECEMBER.

Species	<35 m	35–200 m	>200 m
Beaufort West			
Ringed seal	1.9375	1.0000	0.0004
Bearded seal	0.0004	0.0004	0.0004
Spotted seal	0.0001	0.0001	0.0001
Ribbon seal	0.0001	0.0001	0.0001
Chukchi Sea			
Ringed seal	.....	0.4892	.....
Bearded seal	.....	0.0004	.....
Spotted seal	.....	0.0001	.....
Ribbon seal	.....	0.0001	.....

Potential Number of Takes by Level B Behavioral Harassment

Numbers of marine mammals that might be present and potentially taken are estimated below based on available data about mammal distribution and densities at different locations and times of the year as described above.

The number of individuals of each species potentially exposed to received levels ≥120 dB re 1 μPa (rms) or ≥160 dB re 1 μPa (rms), depending on the type of activity occurring, within each portion of the survey area (east and west) and water depth category was estimated by multiplying:

- The anticipated area to be ensonified to ≥120 dB re 1 μPa (rms) or ≥160 dB re 1 μPa (rms) in each portion of the survey area (east and west) and water depth category, by
- The expected species density in that time and location.

Some of the animals estimated to be exposed, particularly migrating bowhead whales, might show avoidance reactions before being exposed to ≥160 dB re 1 μPa (rms). Thus, these calculations actually estimate the number of individuals potentially exposed to ≥160 dB (rms) that would occur if there were no avoidance of the area ensonified to that level.

(1) Potential Number of Takes by Seismic Airguns at Received Levels ≥160 dB

The area of water potentially exposed to received levels of airgun sounds ≥160 dB (rms) was calculated by using a GIS to buffer the planned survey tracklines within each water depth category by the associated modeled ≥160 dB (rms) distances. The expected sound propagation from the airgun array was modeled by JASCO Applied Research (Zykov *et al.,* 2010) and is expected to vary with water depth. Survey tracklines falling within the <100 m (328 ft), 100–1,000 m (328–3,281 ft), and >1,000 m (3,281 ft) water depth categories were buffered by distances of 27.8 km (17.3 mi), 42.2 km (26.2 mi), and 31.6 km (19.6 mi), respectively. The total area of water that would be exposed to sound >160 dB (rms) on one or more occasions is estimated to be 209,752 km^2. A breakdown by water depth classes used in association with density estimates is presented in Table 5 in this document and Figure 2 of the IHA application.

Based on the operational plans and marine mammal densities described above, the estimates of marine mammals potentially exposed to sounds ≥160 dB (rms) are presented in Table 5 in this document. For species likely to be present, the requested numbers are calculated as described above. For less common species, estimates were set to minimal numbers to allow for chance encounters. Discussion of the number of potential exposures is summarized by species in the following subsections.

It is likely that some members of one endangered cetacean species (bowhead whale) will be exposed to received

sound levels ≥160 dB (rms) unless bowheads avoid the survey vessel before the received levels reach 160 dB (rms). However, the late autumn timing and the design of the proposed survey will minimize the number of bowheads and other cetaceans that may be exposed to seismic sounds generated by this survey. The best estimates of the number of whales potentially exposed to ≥160 dB (rms) are 282 and 4,315 for bowheads and belugas, respectively (Table 5).

The ringed seal is the most widespread and abundant pinniped species in ice-covered Arctic waters, and there is a great deal of variation in estimates of population size and distribution of these marine mammals. Ringed seals account for the vast majority of marine mammals expected to be encountered, and hence exposed to airgun sounds with received levels >160 dB (rms) during the proposed marine survey. Our analysis, based on our use of summer/fall density data, resulted in an overestimation of take of ringed seals (approximately 60,293 ringed seals may be exposed to marine survey sounds with received levels >160 dB (rms)) if they do not avoid the sound source. Other pinniped species are not expected to be present in the proposed survey area in more than minimal numbers in October-December; however, ION is requesting authorization for a small number of harassment ''takes'' of species that occur in the area during the summer months in case a few individuals are encountered (Table 5 in this document).

It should be noted that there is no evidence that most seals exposed to airgun pulses with received levels 160 dB re 1 μPa (rms) are disturbed appreciably, and even at a received level of 180 dB (rms) disturbance is not conspicuous (Harris *et al.,* 2001; Moulton and Lawson, 2002). Therefore, for seals, the estimates of numbers exposed to ≥160 dB re 1 μPa (rms) greatly exceed the numbers of seals that will actually be disturbed in any major or (presumably) biologically significant manner.

TABLE 5—ESTIMATES OF THE POSSIBLE NUMBERS OF MARINE MAMMALS EXPOSED TO ≥160 DB RE 1 μPA (RMS) DURING ION'S PROPOSED SEISMIC PROGRAM IN THE BEAUFORT AND CHUKCHI SEAS, OCTOBER–DECEMBER 2012

Cetaceans	Water depth			Total
	<200 m	200–1,000 m	>1,000 m	
Beluga whale	43	1,195	3,077	4,215
Harbor porpoise	9	2	10	21
Bowhead whale	269	3	10	282
Gray whale	9	2	10	21
Minke whale	9	2	10	21
Pinnipeds (Beaufort East)	**Water depth**			**Total**
	<35 m	35–200 m	>200 m	
Ringed seal	1,794	805	25	2,624
Bearded seal	9	4	25	38
Spotted seal	2	1	6	9
Ribbon seal	2	1	6	9
Pinnipeds (Beaufort West & Chukchi Sea)	**<35 m**	**35–200 m**	**>200 m**	**Total**
Ringed seal	16,969	40,682	18	57,669
Bearded seal	4	25	18	47
Spotted seal	1	6	5	12
Ribbon seal	1	6	5	12

(2) Potential Number of Takes by Icebreaking at Received Levels ≥120 dB

As discussed above, based on available information regarding sounds produced by icebreaking in various ice regimes and the expected ice conditions during the proposed survey, vessel sounds generated during ice breaking are likely to have source levels between 175 and 185 dB re 1 μPa-m. As described above, we have assumed that seismic survey activity will occur along all of the planned tracklines shown in Figure 1 of ION's IHA application. Therefore, received levels ≥160 dB radius of 26.7–42.2 km (16.6–26.2 mi; depending on water depth) to each side of all of the survey lines was applied for the calculation. Assuming a source level of 185 dB re 1 μPa-m and using the 15logR for calculating spreading loss of acoustic intensity, icebreaking sounds may be ≥120 dB out to a maximum distance of ~21.6 km (13.4 mi). Thus, all sounds produced by icebreaking are expected to diminish below 120 dB re 1 μPa within the zone where we assume mammals will be exposed to ≥160 dB (rms) from seismic sounds. Exposures of marine mammals to icebreaking sounds with received levels ≥120 dB would effectively duplicate or ''double-count'' animals already included in the estimates of exposure to strong (≥160 dB) airgun sounds. The planned survey lines cover a large extent of the U.S. Beaufort Sea, and seismic survey activity along all those lines has been assumed in the estimation of takes. Any non-seismic periods, when only icebreaking might occur, would therefore result in fewer exposures than estimated from seismic activities.

If refueling of the *Geo Arctic* is required during the survey and the *Polar Prince* transits to and from Canadian waters to acquire additional fuel for itself, an additional ~200 km (124 mi) of transit may occur. Most of this transit would likely occur through ice in offshore waters >200 m (656 ft) in depth. For estimation purposes we have assumed 25% of the transit will occur in 200–1,000 m (656–3,281 ft) of water and the remaining 75% will occur in >1000 m (3,281 ft) of water. This results in an estimated ~2,160 km^2 of water in areas 200–1,000 m (656–3,281 ft) deep and 6,487 km^2 in waters >1,000 m (3,281 ft) deep being ensonified to ≥120 dB by icebreaking sounds. Using the density estimates for the east survey

area shown in Tables 2 and 3, the estimated exposures of cetaceans and pinnipeds are shown in Table 6 here.

TABLE 6—ESTIMATES OF THE POSSIBLE NUMBERS OF MARINE MAMMALS EXPOSED TO ≥120 DB RE 1 μPA (RMS) DURING ICEBREAKING ACTIVITIES ASSOCIATED WITH THE PREFERRED ALTERNATIVE FOR REFUELING DURING ION'S PROPOSED SEISMIC PROGRAM IN THE BEAUFORT SEA, OCTOBER–DECEMBER 2012

Species	Water depth		Total
	200–1,000 m	>1,000 m	
Beluga whale	253	320	573
Harbor porpoise	0	1	1
Bowhead whale	1	1	2
Gray whale	0	1	1
Minke whale	0	1	1
Ringed seal	181	3	184
Bearded seal	1	3	4
Spotted seal	0	1	1
Ribbon seal	0	1	1

If the *Polar Prince* cannot return to port via Canadian waters, then a transit of ~600 km (373 mi) from east to west across the U.S. Beaufort would be necessary. Again, it is expected that most of this transit would likely occur in offshore waters >200 m (656 ft) in depth. For estimation purposes we have assumed 25% of the transit will occur in 200–1,000 m (656–3,281 ft) of water and the remaining 75% will occur in >1,000 m (3,281 ft) of water. This results in an estimated ~3,240 km^2 of water in areas 200–1,000 m (656–3,281 ft) deep and 9,720 km^2 in waters >1,000 m (3,281 ft) deep being ensonified to ≥120 dB by icebreaking sounds within each half of the U.S. Beaufort Sea, for a total of 25,920 km^2 ensonified across the entire U.S. Beaufort Sea. Using the density estimates in Tables 2–3, estimated exposures of cetaceans and pinnipeds are shown in Table 7 here.

TABLE 7—ESTIMATES OF THE POSSIBLE NUMBERS OF MARINE MAMMALS EXPOSED TO ≥120 DB RE 1 μPA (RMS) DURING ICEBREAKING ACTIVITIES ASSOCIATED WITH THE SECONDARY ALTERNATIVE FOR REFUELING DURING ION'S PROPOSED SEISMIC PROGRAM IN THE BEAUFORT AND CHUKCHI SEAS, OCTOBER–DECEMBER 2012

Species	Water depth		Total
	200–1,000 m	>1,000 m	
Beluga whale	417	500	917
Harbor porpoise	0	2	2
Bowhead whale	1	2	3
Gray whale	0	2	2
Minke whale	0	2	2
Ringed seal	273	8	281
Bearded seal	2	8	10
Spotted seal	0	2	2
Ribbon seal	0	2	2

Potential Number of Takes by Level B TTS and Level A Harassment

In the past, because of the likelihood that that individuals will avoid exposure at received levels and lengths of time associated with PTS, and because of the anticipated effectiveness of mitigation in the daytime and in open water, applicants have not requested authorization for Level A harassment of marine mammals. However, as noted previously, due to the more limited effectiveness of monitoring and mitigation measures for animals under ice cover and during long lowlight hours, but still considering the likelihood that most individuals will avoid exposure at higher levels and the lower densities of some species, NMFS is proposing to authorize takes of a small number of marine mammals by PTS (Level A harassment or injury) when exposed to received noise levels above 180 and 190 dB re 1 μPa (rms) for prolonged period, although this is unlikely to occur.

The methods used below for estimating the number of individuals potentially exposed to sounds >180 or >190 dB re 1 μPa (rms), which are based on over-estimated densities and do not consider avoidance or mitigation are therefore corrected to account for avoidance and mitigation to estimate a more reasonable number that could incur PTS (Level A take) although, for reasons described here and further below, NMFS does not anticipate that marine mammals will be injured or harmed by the proposed project.

Only two cetacean species, beluga and bowhead, may be present in the Alaskan Beaufort Sea late in the survey period or where extensive ice cover is present. Gray whale vocalizations have been recorded throughout one winter (2003–2004) in the western Alaskan Beaufort Sea near Pt. Barrow (Moore *et al.* 2006). However, the presence of gray whales in October and November in the Alaskan Beaufort Sea does not appear to be a regular occurrence or involve a significant number of animals when it does occur. NMFS therefore does not anticipate exposures of cetacean species, other than belugas or bowheads, to received sound levels ≥180 dB during periods of ION's in-ice seismic survey.

Beluga whales have shown avoidance of icebreaking sounds at relatively low

received levels. In the Canadian Arctic, belugas showed initial avoidance of icebreaking sounds at received levels from 94–105 dB in the 20—1,000 Hz band, although some animals returned to the same location within 1–2 days and tolerated noise levels as high as 120 dB in that band (Finley *et al.,* 1990). Playback experiments of icebreaker sounds resulted in 35% of beluga groups showing avoidance at received levels between 78–84 dB in the 1/3-octave band centered at 5,000 Hz, or 8–14 dB above ambient levels (Richardson *et al.,* 1995b). Based on these results, it was estimated that reactions by belugas to an actual icebreaker would likely occur at ~10 km (6.2 mi) under similar conditions. Erbe and Farmer (2000) estimated that zones of disturbance from icebreaking sounds could extend 19–46 km (12–28.6 mi) depending on various factors. Erbe and Farmer (2000) also estimated that a beluga whale would have to remain within 2 km (1.2 mi) of an icebreaker backing and ramming for over 20 min to incur small TTS (4.8 dB), and within 120 m for over 30 min to incur more significant TTS (12–18 dB). Therefore, we expect that the probability of a beluga whale to experience TTS is extremely low.

Aerial and vessel based monitoring of seismic surveys in the central Beaufort Sea showed significant avoidance of active airguns by belugas. Results of the aerial monitoring suggested an area of avoidance out to 10–20 km (6.2–12.4 mi) around an active seismic source with higher than expected sighting rates observed at distances 20–30 km (12.4–18.6 mi) from the source (Miller *et al.* 1999; 2005). The nearest aerial ''transect'' beluga sighting during seismic activity was at a distance of 7.8 km (4.8 mi). Only seven beluga sightings were recorded from the survey vessel during the entire study, three of which occurred during airgun activity. Two of the seismic period sightings were made at the beginning of active airgun periods and the other was during seismic testing of a limited number of guns. These sightings occurred at distances between 1.54 km and 2.51 km from the vessel. Similarly, few beluga whales were observed near seismic surveys in the Alaskan Beaufort Sea in 1996–1998 (Richardson 1999), although the beluga migration corridor is typically well offshore of where most of the seismic survey occurred. Observers on seismic and associated support vessels operating in the Alaskan Beaufort Sea during 2006–2008 seasons reported no beluga sightings during seismic or non-seismic periods, suggesting avoidance of both seismic and vessel sounds (Savarese *et al.,* 2010). No mitigation measures during seismic operations (power down or shut down of airgun arrays) have been required as a result of beluga sightings during surveys in the Chukchi or Beaufort seas in 2006–2009 (Ireland *et al.,* 2007a, 2007b; Patterson *et al.,* 2007, Funk *et al.,* 2008, Ireland *et al.,* 2009b, Reiser *et al.,* 2010).

Based on the reported avoidance of vessel, icebreaking, and seismic sounds by beluga whales, and the low and seasonally decreasing density during the time of the proposed survey, the likelihood of beluga whales occurring within the ≥180 dB zone during the proposed project is extremely low. A cautionary estimate that assumes 10% of belugas will show no avoidance of the 180 dB zone results in an estimate of 23 beluga whales exposed to sounds ≥180 dB (based on the densities described above and the area of water that may be ensonified to ≥180 dB) during the proposed project.

Bowhead whales have shown similar avoidance of vessel and seismic sounds. Less information is available regarding avoidance of icebreaking sounds; however, avoidance of the overall activity was noted during intensive icebreaking around drill sites in the Alaskan Beaufort Sea in 1992. Migrating bowhead whales appeared to avoid the area of drilling and icebreaking by ~25 km (15.5 mi) (Brewer *et al.,* 1993). Also, monitoring of drilling activities in a previous year, during which much less icebreaking occurred, showed avoidance by migrating bowheads out to ~20 km (12.4 mi). Therefore, the relative influence of icebreaking versus drilling sounds is difficult to determine.

Similarly, migrating bowheads avoided the area within ~20 km (12.4 mi) of nearshore seismic surveys, and showed less avoidance extending to ~30 km (18.6 mi) (Miller *et al.,* 1999). Only 1 bowhead was observed from the survey vessel during the three seasons (1996–1998) when seismic surveys continued into September. Bowheads not actively engaged in migration have shown less avoidance of seismic operations. During seismic surveys in the Canadian Beaufort Sea in late August and early September bowhead whales appeared to avoid an area within ~2 km (1.2 mi) of airgun activity (Miller and Davis, 2002) and sightings from the survey vessel itself were common (Miller *et al.,* 2005). Vessel based sightings showed a statistically significant difference of ~600 m (1,969 ft) in the mean sighting distances of bowheads (relative to the survey vessel) between periods with and without airgun activity. This, along with significantly lower sighting rates of bowhead whales during periods of airgun activity, suggests that bowheads still avoided close approach to the area of seismic operation (Miller and Davis, 2002). Results from vessel-based and aerial monitoring in the Alaskan Beaufort Sea during 2006–2008 were similar to those described above (Funk *et al.,* 2010). Sighting rates from seismic vessels were significantly lower during airgun activity than during non-seismic periods. Support vessels reported 12 sightings of bowhead whales in areas where received levels from seismic were ≥160 dB (Savarese *et al.,* 2010). Aerial surveys reported bowhead whales feeding in areas where received levels of seismic sounds were up to 160 dB. Bowheads were not observed in locations with higher received levels (Christie *et al.,* 2010). Based on four direct approach experiments in northern Alaskan waters, Ljungblad *et al.* (1988) reported total avoidance of seismic sounds at received sound levels of 152, 165, 178, and 165 dB.

The available information summarized above suggests that bowhead whales are very likely to avoid areas where received levels are ≥180 dB re 1 μPa (rms). Again, making a cautionary assumption that as many as 10% of bowheads may not avoid the 180 dB zone around the airguns, we calculate that 6 individuals could be exposed to ≥180 dB (based on the densities described above and the area of water that may be ensonified to ≥180 dB). During seismic surveys in the Alaskan Beaufort Sea in 2007 and 2008, 5 power downs of the full airgun array were made due to sightings of bowhead or unidentified mysticete whales (8 total individuals) within the ≥180 dB exclusion zone. These sightings occurred during >8000 km (4,971 mi) of survey effort in good conditions plus additional effort in poor conditions (Savarese *et al.,* 2010), resulting in an estimated 0.625 sightings within the 180 dB distance per 1,000 km (620 mi) of seismic activity. Even without allowance for the reduced densities likely to be encountered in October and especially November, or for the fact that observers will be on duty during all daylight hours and will call for mitigation actions if whales are sighted within or near the 180 dB distance, this rate would suggest that fewer than 8 bowheads may occur within the ≥180 dB zone during the proposed survey.

For seals (principally ringed seals), the proportion exhibiting avoidance is lower than for cetaceans, and thus the received level at which avoidance becomes evident is higher. However, some survey results have shown a statistically significant avoidance of the

190 dB re 1 μPa (rms) zone, and an assumption that numbers exposed to ≥190 dB could be calculated from ''non-seismic'' density data is not inappropriate. Using similar reasoning as described above for cetaceans, we have limited these estimates to ringed seals as the presence of other pinniped species is very unlikely during the times and locations when exposures to ≥190 dB may have an increased likelihood of occurrence.

Monitoring work in the Alaskan Beaufort Sea during 1996–2001 provided considerable information regarding the behavior of seals exposed to seismic pulses (Harris *et al.,* 2001; Moulton and Lawson, 2002). The combined results suggest that some seals avoid the immediate area around seismic vessels. In most survey years, ringed seal sightings averaged somewhat farther away from the seismic vessel when the airguns were operating than when they were not (Moulton and Lawson, 2002). Also, seal sighting rates at the water surface were lower during airgun array operations than during no-airgun periods in each survey year except 1997. However, the avoidance movements were relatively small, on the order of 100 m (328 ft) to (at most) 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.

During more recent seismic surveys in the Arctic (2006–2009), Reiser *et al.* (2009) also reported a tendency for localized avoidance of areas immediately around the seismic source vessel along with coincident increased sighting rates at support vessels operating 1–2 km (0.62–1.2 mi) away. However, pinnipeds were sighted within the 190 dB zone around the operating airguns more frequently than were cetaceans within the 180 dB zone. Assuming that 25% of the ringed seals encountered may not avoid the 190 dB zone as the airguns approach, we calculate that ~277 individuals could be exposed to ≥190 dB (based on the densities described above and the area of water that may be ensonified to ≥190 dB). As an alternative estimate, during the same >8,000 km (4,971 mi) of monitoring effort in the Alaskan Beaufort Sea reported above regarding bowhead whales, 42 observations of seals within the 190 dB zone caused power downs of the airguns. This was ~5.25 power downs per 1,000 km (620 mi) of seismic survey effort. Even without allowance for the reduced densities of seals likely to be encountered in October–November or for the fact that observers will be on duty during all daylight hours and will call for mitigation actions if necessary, this rate would suggest that as many as 38 seals may occur within the ≥190 dB zone during the proposed survey.

However, as stated earlier, in most circumstances marine mammals would avoid areas where intense noise could cause injury, including PTS. Although approximately 23 beluga whales, 8 bowhead whales, and 38 seals (presumably all ringed seals) could theoretically be exposed to received levels above 180 dB re 1 μPa (for whales) and 190 dB re 1 μPa (for seals), most of them are likely to avoid areas of intense noise and would not incur TTS or PTS (injury). In the unlikely case a small number of individuals animals did not avoid the intense noise, then TTS or even PTS could occur. Assuming that 10% of the individuals that were initially exposed to received levels above 180 dB re 1 μPa (for beluga and bowhead whales) and 190 dB re 1 μPa (for ringed seals) do not vacate the area, and subsequent exposure leads to some degree of PTS, then approximately 3 beluga whales, 1 bowhead whale, and 4 ringed seals could be taken by Level A harassment. However, NMFS considers this estimate to be very conservative as explained above.

Estimated Take Conclusions

Cetaceans—Effects on cetaceans are generally expected to be restricted to avoidance of an area around the seismic survey and short-term changes in behavior, falling within the MMPA definition of ''Level B harassment,'' and possibly mild TTS (Level B harassment), or PTS (Level A harassment), though the latter is not likely.

Using the 160 dB (for pulse) and 120 dB (for non-pulse) criteria, the average estimates of the numbers of individual cetaceans exposed to sounds >160 dB and 120 dB re 1 μPa (rms) represent varying proportions of the populations of each species in the Beaufort Sea and adjacent waters. For species listed as ''endangered'' under the ESA, the estimates include approximately 284 bowheads. This number is approximately 1.86% of the Bering-Chukchi-Beaufort population of >15,233 assuming 3.4% annual population growth from the 2001 estimate of >10,545 animals (Zeh and Punt 2005). For other cetaceans that might occur in the vicinity of the marine seismic survey in the Chukchi Sea, they also represent a very small proportion of their respective populations. The average estimates of the number of beluga whales, harbor porpoises, gray whales, and minke whales that might be exposed to >160 dB and 120 dB re 1 μPa (rms) are 5,232, 23, 23, and 23, when the secondary alternative for refueling is being considered. These numbers represent 13.33%, 0.05%, 0.12%, and 1.87% of these species' respective populations in the proposed action area. If ION selects the preferred alternative for refueling, the estimated takes for beluga would be reduced to 4,888 animals, or 12.45% of the population, which are still based on overestimated densities of these animals for the winter season.

Seals—A few seal species are likely to be encountered in the study area, but ringed seal is by far the most abundant in this area. The average estimates of the numbers of individuals exposed to sounds at received levels >160 dB and 120 dB re 1 μPa (rms) during the proposed icebreaking seismic survey are as follows: ringed seals (60,574), bearded seals (95), spotted seals (23), and ribbon seals (23), when the secondary alternative for refueling is being considered. These numbers represent 24.33%, 0.04%, 0.04%, and 0.05% of Alaska stocks of ringed, bearded, spotted, and ribbon seals. If ION selects the preferred alternative for refueling, the estimated takes for ringed, bearded, spotted, and ribbon seals would drop to 60,477, 89, 22, and 22, respectively, which in turn represent 24.29%, 0.04%, 0.04%, 0.04% of Alaska stocks of these species, based on overestimated densities of these animals for the winter season.

Negligible Impact and Small Numbers Analysis and Determination

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.'' In making a negligible impact determination, NMFS considers a variety of factors, including but not limited to: (1) The number of anticipated mortalities; (2) the number and nature of anticipated injuries; (3) the number, nature, intensity, and duration of Level B harassment; and (4) the context in which the takes occur.

Most of the takes from ION's proposed icebreaking seismic surveys are expected to be Level B harassment, *i.e.,* behavioral disturbance with a slight likelihood of mild TTS. However, it is possible that PTS (Level A harassment) given the lowered effectiveness of monitoring measures are during extensive ice coverage and prolonged periods of darkness. Although it is possible that some individual marine mammals may be exposed to sounds from marine survey activities more than

once, this is not expected to happen extensively since both the animals and the survey vessels will be moving constantly in and out of the survey areas. Therefore, the degree of TTS and PTS, if incurred, is expected to be minor (low intensity—a few dBs of loss at certain frequencies), and the TTS is expected to be brief (minutes to hours) before full recovery. No serious injury or mortality is expected as a result of the proposed seismic survey, and neither is proposed to be authorized.

Of the nine marine mammal species likely to occur in the proposed marine survey area, only the bowhead whale is listed as endangered under the ESA. This species is also designated as ''depleted'' under the MMPA. Despite these designations, the Bering-Chukchi-Beaufort stock of bowheads has been increasing at a rate of 3.4 percent annually for nearly a decade (Allen and Angliss, 2010). Additionally, during the 2001 census, 121 calves were counted, which was the highest yet recorded. The calf count provides corroborating evidence for a healthy and increasing population (Allen and Angliss, 2010), even in the face of ongoing industrial activity and subsistence harvest. There is no critical habitat designated in the U.S. Arctic for the bowhead whale. Certain stocks or populations of gray and beluga whales and spotted seals are listed as endangered or are proposed for listing under the ESA; however, none of those stocks or populations occur in the proposed activity area. On December 10, 2010, NMFS published a notice of proposed threatened status for subspecies of the ringed seal (75 FR 77476) and a notice of proposed threatened and not warranted status for subspecies and distinct population segments of the bearded seal (75 FR 77496) in the **Federal Register**. Neither of these two ice seal species is currently considered depleted under the MMPA.

Level B Behavioral Harassment

Most of the bowhead whales encountered during the summer will likely show overt disturbance (avoidance) only if they receive airgun sounds with levels ≥160 dB re 1 μPa (rms). Odontocete reactions to seismic energy pulses are usually assumed to be limited to shorter distances from the airgun(s) than are those of mysticetes, probably in part because odontocete low-frequency hearing is assumed to be less sensitive than that of mysticetes. However, at least when in the Canadian Beaufort Sea in summer, belugas appear to be fairly responsive to seismic energy, with few being sighted within 6–12 mi (10–20 km) of seismic vessels during aerial surveys (Miller *et al.,* 2005). Both belugas and bowhead whales are expected to occur in much smaller numbers in the vicinity of the proposed seismic survey area during the proposed survey. In addition, due to the constant movement of the seismic survey vessel, the duration of the cetaceans' exposure to noise from seismic impulses would be brief. For the same reason, it is unlikely that any individual animal would be exposed to high received levels multiple times.

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,'' with only limited potential occurrences of TTS (Level B harassment) and PTS (Level A harassment).

Furthermore, the estimated numbers of animals potentially exposed to sound levels sufficient to cause appreciable disturbance are small percentages of the population sizes in the Bering-Chukchi-Beaufort seas, as described above.

Finally, as discussed above, since ION is not likely to start its proposed in-ice seismic survey until mid- to late-October when most of the cetaceans (especially bowhead whales) have moved out of the area, the actual take numbers are expected to be much lower.

The many reported cases of apparent tolerance by cetaceans from seismic exploration, vessel traffic, and some other human activities show that co-existence is possible. Mitigation measures such as controlled vessel speed, dedicated PSOs, non-pursuit, and shutdowns or power downs when marine mammals are seen within defined ranges will further reduce short-term reactions and minimize any effects on hearing sensitivity. In all cases, the effects are expected to be short-term, with no lasting biological consequence.

Some individual pinnipeds may be exposed to sound from the proposed marine surveys more than once during the time frame of the project. However, as discussed previously, due to the constant movement of the survey vessel, the probability of an individual pinniped being exposed multiple times is much lower than if the source is stationary. Therefore, NMFS has determined that the pinnipeds' exposure to sounds produced by the proposed marine seismic survey in the Beaufort and Chukchi Seas is mostly expected to result in no more than Level B harassment and is anticipated to have no more than a negligible impact on the animals.

The estimated Level B behavioral takes proposed to be authorized represent up to 12.45% of the Beaufort Sea population of approximately 39,258 beluga whales (Allen and Angliss, 2010), up to 0.04% of Bering Sea stock of approximately 48,215 harbor porpoises, 0.12% of the Eastern North Pacific stock of approximately 19,126 gray whales, 1.86% of the Bering-Chukchi-Beaufort population of 15,233 individuals assuming 3.4 percent annual population growth from the 2001 estimate of 10,545 animals (Zeh and Punt, 2005), and 1.78% of the Alaska stock of approximately 1,233 minke whales. The take estimates presented for ringed, bearded, spotted, and ribbon seals represent up to 24.29, 0.04, 0.04, and 0.04 percent of U.S. Arctic stocks of each species, respectively. These estimates represent the percentage of each species or stock that could be taken by Level B behavioral harassment if each animal is taken only once. Although we have estimated that up to 24.29% of ringed seals could be taken as a result of the proposed seismic survey activity, it is important to note that the population densities for marine mammals within the proposed survey area are overestimates. As explained above, because of the lack of fall/winter data, NMFS and ION had to rely on the summer/fall density data to calculate expected densities of marine mammals and potential take estimates. Our analysis has led us to conclude that in the case of ringed seals (and several other species), the number of ringed seals that would occur in the project area during the proposed survey period is expected to be much lower and thus, far fewer ringed seals are actually expected to be taken as a result of ION's in-ice seismic survey in the Beaufort Sea. Furthermore, it is likely that individual animals could be taken multiple times and be counted as different individuals, thus inflating the percentage of unique individuals that would be affected. Finally, as discussed earlier, the effects to marine mammals that would result from Level B behavioral harassment are expected to be minor and brief, and mostly involve animals temporarily changing their behavior and vacating the proximity of the survey area briefly as the survey vessel and icebreaker approach. Marine mammals are expected to resume their normal activities and reoccupy the area as soon as the vessels move away. Additionally, since the proposed in-ice seismic survey is planned outside the breeding season of marine mammals, no impacts on calves or pups are expected. Further, there is no known marine

mammal feeding activity during the period of ION's in-ice seismic survey activities. Therefore, any effects to marine mammals are not expected to be biologically significant on either the individual or population level for thess species. In addition, the mitigation and monitoring measures (described previously in this document) included in the IHA are expected to further reduce any potential disturbance to marine mammals.

Hearing Impairment (TTS, Level B Harassment, or PTS, Level A Harassment)

Most cetaceans (and particularly Arctic cetaceans) show relatively high levels of avoidance when received sound pulse levels exceed 160 dB re 1 µPa (rms), and it is uncommon to sight Arctic cetaceans within the 180 dB radius, especially for prolonged duration. Results from monitoring programs associated with seismic activities in the Arctic indicate that cetaceans respond in different ways to sound levels lower than 180 dB. These results have been used by agencies to support monitoring requirements within distances where received levels fall below 160 dB and even 120 dB. Thus, very few animals would be exposed to sound levels of 180 dB re 1 µPa (rms) regardless of detectability by PSOs. Avoidance varies among individuals and depends on their activities or reasons for being in the area, and occasionally a few individual Arctic cetaceans will tolerate sound levels above 160 dB. Tolerance of levels above 180 dB is infrequent regardless of the circumstances, and marine mammals exposed to levels this high are expected to avoid the source, thereby minimizing the probability of TTS. Therefore, a calculation of the number of cetaceans potentially exposed to >180 dB that is based simply on density would be a gross overestimate of the actual numbers exposed to 180 dB. Such calculations would be misleading unless avoidance response behaviors were taken into account to estimate what fraction of those originally present within the soon-to-be ensonified to >180 dB zone (as estimated from density) would still be there by the time levels reach 180 dB.

It is estimated that up to 1 bowhead whale and 3 beluga whales could be exposed to received noise levels above 180 dB re 1 µPa (rms), and 4 ringed seals could be exposed to received noise levels above 190 dB re 1 µPa (rms) for durations long enough to cause TTS if the animals are not detected in time to have mitigation measures implemented (or even PTS if such exposures occurred repeatedly). None of the other species are expected to be exposed to received sound levels anticipated to cause TTS or PTS.

Marine mammals that are taken by TTS are expected to receive minor (in the order of several dBs) and brief (minutes to hours) temporary hearing impairment because (1) animals are not likely to remain for prolonged periods within high intensity sound fields, and (2) both the seismic vessel and the animals are constantly moving, and it is unlikely that the animal will be moving along with the vessel during the survey. Although repeated experience to TTS could result in PTS (Level A harassment), for the same reasons discussed above, even if marine mammals experience PTS, the degree of PTS is expected to be mild, resulting in a few dB elevation of hearing threshold. Therefore, even if a few marine mammals receive TTS or PTS, the degree of these effects are expected to be minor and, in the case of TTS, brief, and are not expected to be biologically significant for the population or species.

Effects on Marine Mammal Habitat

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 rates of recruitment or survival of marine mammals in the area. Based on the vast size of the Arctic Ocean where feeding by marine mammals occurs versus the localized area of the marine survey activities, any missed feeding opportunities in the direct project area would be minor based on the fact that other feeding areas exist elsewhere. For bowhead whales, the majority of the population would have migrated past many of the feeding areas of the central Beaufort Sea prior to the initiation of activities by ION.

The effects of icebreaking activity are not expected to result in significant modification to marine mammal habitat. Although it is expected that the ice coverage would be 8/10th to 10/10th, the ice in the proposed project area is loose annual ice during the time of the proposed in-ice seismic survey activity. Therefore, ice floes being broken and pushed aside from the icebreaker are expected to rejoin behind the seismic survey path. In addition, no ice seal lairs are expected during the period of ION's in-ice seismic survey in the Beaufort and Chukchi Seas.

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 mitigation and monitoring measures, NMFS finds that ION's 2012 in-ice seismic survey in the Beaufort and Chukchi Seas may result in the incidental take of small numbers of marine mammals, by Level A and Level B harassment only, and that the taking from the seismic surveys will have a negligible impact on the affected species or stocks.

Unmitigable Adverse Impact Analysis and Determination

NMFS has determined that ION's 2012 in-ice marine seismic survey in the Beaufort and Chukchi Seas will not have an unmitigable adverse impact on the availability of species or stocks for taking for subsistence uses. This determination is supported by information contained in this document and ION's CAA and POC. ION has adopted a spatial and temporal strategy for its Beaufort and Chukchi Seas in-ice seismic survey operation that is intended to avoid subsistence activities. ION plans to start its seismic survey after the fall bowhead harvests have concluded for the communities of Kaktovik and Nuiqsut, and its seismic survey is expected to occur far offshore from regular ringed seal hunts. Although hunting may still be occurring in Barrow, ION has agreed to work in the eastern part of the survey area first so as not to overlap with areas used by hunters in Barrow. The late November bowhead harvests on St. Lawrence Island should not be affected by ION's vessel transits through the Bering Strait, which would not occur until the conclusion of the survey in early to mid-December. No other subsistence activity is expected to occur during ION's proposed seismic survey period.

Based on the measures described in ION's POC and CAA, the proposed mitigation and monitoring measures (described earlier in this document), and the project design itself, NMFS has determined there will not be an unmitigable adverse impact on subsistence uses from ION's icebreaking marine seismic survey in the Beaufort and Chukchi Seas.

Endangered Species Act (ESA)

The bowhead whale is the only marine mammal species currently listed as endangered under the ESA that could occur during ION's proposed in-ice seismic survey period. In addition, there are two marine mammal species that are currently being proposed for listing under the ESA with confirmed occurrence in the proposed project area: ringed and bearded seals. NMFS'

Permits and Conservation Division consulted with NMFS' Alaska Regional Office Division of Protected Resources under section 7 of the ESA on the issuance of an IHA to ION under section 101(a)(5)(D) of the MMPA for this activity. A Biological Opinion was issued on October 17, 2012, which concludes that issuance of the IHA is not likely to jeopardize the continued existence of the ESA-listed marine mammal species and species proposed for ESA-listing. NMFS will issue an Incidental Take Statement under this Biological Opinion which contains reasonable and prudent measures with implementing terms and conditions to minimize the effects of take of listed species.

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 ION to take marine mammals incidental to conducting in-ice seismic survey in the Beaufort and Chukchi Seas during fall/winter 2012. NMFS has finalized the EA and prepared a FONSI for this action. Therefore, preparation of an EIS is not necessary.

Authorization

As a result of these determinations, NMFS has issued an IHA to ION to take marine mammals incidental to its in-ice seismic survey in the Beaufort and Chukchi Seas, Alaska, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Dated: October 17, 2012.

Helen M. Golde,

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

[FR Doc. 2012–26103 Filed 10–23–12; 8:45 am]

BILLING CODE 3510–22–P