PROPOSED ACTION:	Issuance of an Incidental Harassment Authorization to the National Science Foundation and Antarctic Support Contract to Take Marine Mammals by Harassment Incidental to a Low-Energy Marine Geophysical Survey in the Ross Sea, January to April 2015.
TYPE OF STATEMENT:	Environmental Assessment
LEAD AGENCY:	U.S. Department of Commerce, National Oceanic and Atmospheric Administration National Marine Fisheries Service
RESPONSIBLE OFFICIAL:	Donna S. Wieting, Director, Office of Protected Resources, National Marine Fisheries Service
FOR FURTHER INFORMATION:	Howard Goldstein National Marine Fisheries Service Office of Protected Resources, Permits and Conservation Division 1315 East West Highway Silver Spring, MD 20910 301-427-8401
LOCATION:	Selected regions of the Ross Sea (located north of the Ross Ice Shelf) in International Waters (i.e., high seas) with a focus on the Whales Deep Basin trough (encompassing the region between 76 to 78º South, and between 165 to 170º West)
ABSTRACT:	This Environmental Assessment analyzes the environmental impacts of the National Marine Fisheries Service, Office of Protected Resources, Permits and Conservation Division's proposal to issue an Incidental Harassment Authorization to the National Science Foundation and Antarctic Support Contract for the taking, by Level B harassment, of small numbers of marine mammals, incidental to conducting a low-energy marine geophysical survey in the Ross Sea, January to February 2015.

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LIST OF ABBREVIATIONS OR ACRONYMS

AEP	auditory evoked potential
ASC	Antarctic Support Contract
BiOp	Biological Opinion
CFR	Code of Federal Regulations
Commission	Marine Mammal Commission
dB	decibel
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*)
FONSI	Finding of No Significant Impact
FR	*Federal Register*
ft	feet
IEE/EA	Initial Environmental Evaluation/Environmental Assessment
IHA	Incidental Harassment Authorization
ITA	Incidental Take Authorization
ITS	Incidental Take Statement
km	kilometer
km/hr	kilometer per hour
kts	knots
m	meter
mi	mile
mph	miles per hour
MMPA	Mammal Protection Act of 1972, as amended (16 U.S.C. 1631 *et seq.*)
µPa	microPascal
nmi	nautical miles
Palmer	RVIB *Nathaniel B. Palmer*
PSO	Protected Species Observer

EXECUTIVE SUMMARY

The National Marine Fisheries Service (NMFS), Office of Protected Resources, Permits and Conservation Division has prepared this Environmental Assessment (EA) pursuant to the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. §§ 4321 *et seq*.), the Council on Environmental Quality (CEQ) regulations in 40 CFR §§ 1500-1508, and NOAA Administrative Order 216-6.

ES.1 Description of the Proposed Action

We (National Marine Fisheries Service, Office of Protected Resources, Permits and Conservation Division) propose to issue an Incidental Harassment Authorization (IHA) to the National Science Foundation (NSF) and Antarctic Support Contract (ASC), under the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. §§ 1631 *et seq*.) for the incidental taking of small numbers of marine mammals, incidental to the conduct of a low-energy marine geophysical (seismic) survey in the International Waters (i.e., high seas) in the Ross Sea, January through February 2015. We do not have the authority to permit, authorize, or prohibit NSF and ASC's low-energy seismic survey in the Ross Sea.

Our proposed action results from NSF and ASC's request for an authorization to take marine mammals, by harassment, incidental to conducting a low-energy marine seismic survey in the Ross Sea. NSF and ASC's low-energy seismic survey activities, which have the potential to cause marine mammals to be behaviorally disturbed, warrant an incidental take authorization from us under section 101(a)(5)(D) of the MMPA.

ES.2 Scope of this Environmental Assessment

This EA, titled *Environmental Assessment on the Issuance of an Incidental Harassment Authorization to the National Science Foundation and Antarctic Support Contract to Take Marine Mammals by Harassment Incidental to a Low-Energy Marine Geophysical Survey in the Ross Sea, January to February 2015*, focuses primarily on the environmental effects of authorizing the take of marine mammals incidental to NSF and ASC's activities.

To evaluate the effects of conducting the low-energy marine geophysical (seismic) survey in the Ross Sea during a period between January and February 2015, the NSF and ASC have prepared an *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* (AECOM, 2014) (available at: http://www.nmfs.noaa.gov/pr/permits/incidental_take_pdfs/nsf_asc_rosssea_2015_draftieeea.pdf). We do not duplicate their analysis; rather we incorporate it by reference as explained further in this document. NSF's 2014 analysis tiers to the 2011 *Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey* (NSF/USGS PEIS) (NSF, 2011) (available at: http://www.nsf.gov/geo/oce/envcomp/usgs-nsf-marine-seismic-research/nsf-usgs-final-eis-oeis_3june2011.pdf), which considers all impacts of conducting a low-energy seismic survey. We incorporate the 2011 NMFS/USGS PEIS by reference. Last, we published a notice of the proposed IHA in the *Federal Register* (79 FR 68512, November 17, 2014; [NMFS, 2014]) (available at: http://www.gpo.gov/fdsys/pkg/FR-2014-11-17/pdf/2014-26915.pdf), which provided a

detailed description of the proposed low-energy seismic survey and environmental information and issues related to it. We also incorporate this notice by reference.

We have prepared this EA to assist in determining whether the direct, indirect, and cumulative impacts related to our proposed issuance of an IHA under the MMPA for NSF and ASC's low-energy seismic survey is likely to result in significant impacts to the human environment. This EA is intended to inform our decision on issuing the IHA. While the focus of this EA is on the effects caused by the proposed issuance of an IHA, in combining this analysis with the analyses in the previously referenced documents, we have considered all impacts associated with the underlying action which is the full suite of activities conducted by NSF and ASC for their proposed low-energy seismic survey. We anticipate the issuance of an IHA to result in the take of small numbers of marine mammals in a specific geographic region incidental to NSF and ASC's specified activities.

Our NEPA analysis further evaluates effects to marine mammals and their habitat due to the specific scope of the decision for which we are responsible (i.e., whether or not to issue the IHA, which includes prescribed means of incidental take, mitigation measures, and monitoring requirements). Our review of public comments submitted in response to our notice for the proposed IHA in the *Federal Register* (79 FR 68512, November 17, 2014) did not reveal additional environmental impacts or issues requiring analysis in this EA.

ES.3 Alternatives

Our Proposed Action (Preferred Alternative) represents the authorization of take incidental to the applicants' seismic survey, along with required monitoring and mitigation measures for marine mammals that would minimize potential adverse environmental impacts. The proposed IHA includes prescribed means of incidental take, mitigation and monitoring measures, and reporting requirements.

For the No Action Alternative, we would not issue an IHA to NSF and ASC for the taking, by Level B harassment, of small numbers of marine mammals, incidental to the low-energy seismic survey.

- The No Action Alternative also includes the full suite of activities conducted by NSF and ASC for the low-energy seismic survey. Because we do not have the authority to permit, authorize, or prohibit the seismic survey activities themselves, NSF and ASC may decide to: (1) continue with the seismic survey with the inclusion of mitigation and monitoring measures sufficient to preclude any incidental take of marine mammals; (2) continue the seismic survey and be in violation of the MMPA if take of marine mammals occurs; or (3) choose not to conduct the low-energy seismic survey.
- For purposes of this NEPA analysis, however, we have focused on the potential environmental effects that could arise without the mitigation and monitoring measures for marine mammals prescribed in the IHA, in order to sharply compare and contrast alternatives.

ES.4 Environmental Impacts of the Proposed Action

NSF and ASC's proposed low-energy seismic survey activities would involve active acoustics that have the potential to cause marine mammals to be behaviorally disturbed.

- The impacts of the seismic survey on marine mammals are specifically related to acoustic activities, and these are expected to be temporary in nature, negligible, and would not result in substantial impacts to marine mammals or to their role in the ecosystem.

- The action alternative includes a suite of mitigation measures intended to minimize potential adverse interactions with marine mammals and their habitat. We acknowledge that the incidental take authorized by the IHA would potentially result in insignificant, unavoidable adverse impacts. However, we believe that the issuance of an IHA would not result in significant cumulative effects on marine mammal species or their habitats.

The analysis in this EA, including the documents we incorporate by reference, serve as the basis for determining whether our issuance of an IHA to NSF and ASC for the taking, by Level B harassment, of small numbers of marine mammals, incidental to the conduct of the low-energy marine seismic survey in the Ross Sea, January to February 2015, would result in significant impacts to the human environment.

CHAPTER 1 – INTRODUCTION AND PURPOSE AND NEED

1.1 DESCRIPTION OF PROPOSED ACTION

The Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. 1631 *et seq*.) prohibits the incidental taking of marine mammals. For a marine mammal to be incidentally taken, it is either killed, injured, or harassed. The MMPA defines harassment as any act of pursuit, torment, or annoyance which: (1) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (2) 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). There are exceptions to the MMPA's prohibition on take, such as the authority at issue here for us to authorize the incidental taking of small numbers of marine mammals by harassment upon the request of a U.S. citizen, provided certain statutory and regulatory procedures are met and determinations made. We describe this exception set forth in the MMPA at section 101(a)(5)(D) in more detail in Section 1.2.

We (NMFS, Office of Protected Resources, Permits and Conservation Division) propose to issue an IHA to NSF and ASC under the MMPA for the taking of small numbers of marine mammals, incidental to the conduct of a low-energy marine geophysical (seismic) survey in the International Waters in the Ross Sea, January through February 2015. We do not have the authority to permit, authorize, or prohibit NSF and ASC's low-energy seismic survey in the Ross Sea.

Our proposed action is triggered by NSF and ASC's request for an IHA to take marine mammals incidental to conducting the proposed low-energy marine seismic survey in the International Waters in the Ross Sea. NSF and ASC's seismic survey activities have the potential to cause marine mammals to be behaviorally disturbed by exposing them to elevated levels of sound which, as we have explained, is anticipated to result in take that would otherwise be prohibited by the MMPA. NSF and ASC therefore require an IHA for incidental take and have requested that we provide it through the issuance of an IHA under section 101(a)(5)(D) of the MMPA. Our proposed issuance of an IHA to NSF and ASC is a federal action that requires environmental review under the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq*.), the Council on Environmental Quality (CEQ) regulations in 40 CFR §§ 1500-1508, and NOAA Administrative Order (NAO) 216-6. Thus, we are required to analyze the effects of the action on the human environment and determine whether they are significant, such that preparation of an Environmental Impact Statement (EIS) is necessary.

This EA, titled *Environmental Assessment on the Issuance of an Incidental Harassment Authorization to the National Science Foundation and the Antarctic Support Contract to Take Marine Mammals by Harassment Incidental to a Low-Energy Marine Geophysical Survey in the Ross Sea, January to February 2015*, addresses the potential environmental impacts of two choices available under section 101(a)(5)(D) of the MMPA, namely:

- Issue the IHA to NSF and ASC for Level B harassment take of marine mammals under the MMPA during the low-energy seismic survey, taking into account the prescribed means of take, mitigation measures, and monitoring requirements required in the IHA; or
- Not issue an IHA to NSF and ASC, in which case, for the purposes of NEPA analysis only, we assume the activities would proceed and cause incidental take without the mitigation and monitoring measures prescribed in the IHA.

We have identified one action alternative as reasonable and, along with the No Action Alternative, have carried two alternatives forward for evaluation in this EA.

1.1.1 Background on the Applicant's MMPA Application

NSF and ASC propose to use the RVIB *Nathaniel B. Palmer* (*Palmer*), a 94 meter (m) (308.5 feet [ft]) research vessel owned by Edison Chouest Offshore, Inc. and operated by NSF and ASC (under a long-term charter with Edison Chouest Offshore, Inc.), to use conventional seismic methodology to perform marine-based studies in the Ross Sea. These studies would include evaluation of the timing and duration of two grounding events (i.e., advances of grounded ice) to the outer and middle shelf of the Whales Deep Basin, a West Antarctic Ice Sheet paleo ice stream trough in the eastern Ross Sea (see Figures 1 and 2 of the IHA application).

NSF supports basic scientific research in the mathematical, physical, medical, biological, social, and other sciences pursuant to the National Science Foundation Act of 1950, as amended (NSF Act; 42 U.S.C. 1861-75). NSF considers proposals submitted by organizations and makes contracts and/or other arrangements (i.e., grants, loans, and other forms of assistance) to support research activities. In 2013, a NSF-expert panel recommended a collaborative research proposal titled, *Timing and Duration of the LGM and Post-LGM Grounding Events in Whales Deep Paleo Ice Stream, Eastern Ross Sea Middle Continental Shelf* (Award Bart #1246357) for funding and ship time on the *Palmer*. As the federal action agency, NSF has funded ASC and Louisiana State University's proposed low-energy seismic survey in the Ross Sea, January through February 2015, under the NSF Act of 1950. We describe the NSF-supported low-energy seismic survey in more detail in Section 2.2.

1.1.2 Marine Mammals in the Action Area

On July 15, 2014, we received an application from NSF and ASC, which reflected updates to the mitigation zones (for safety), incidental take requests for marine mammals, and information on marine protected areas. Marine mammals under our jurisdiction that could be adversely affected by the proposed low-energy seismic survey include:

Mysticetes
- Blue whale (*Balaenoptera musculus*)
- Fin whale (*B. physalus*)
- Sei whale (*B. borealis*)
- Antarctic minke whale (*B. bonaerensis*)
- Minke whale (*B. acutorostrata*)
- Humpback whale (*Megaptera novaeangliae*)
- Southern right whale (*Eubalaena australis*)

Odontocetes
- Arnoux's beaked whale (*Berardius arnuxii*)
- Hourglass dolphin (*Lagenorhynchus cruciger*)
- Killer whale (*Orcinus orca*)
- Long-finned pilot whale (*Globicephala melas*)
- Sperm whale (*Physeter macrocephalus*)
- Southern bottlenose whale (*Hyperoodon planifrons*)
- Strap-toothed beaked whale (*Mesoplodon layardii*)

Pinnipeds
- Crabeater seal (*Lobodon carcinophaga*)
- Leopard seal (*Hydrurga leptonyx*)
- Ross seal (*Ommatophoca rossii*)
- Weddell seal (*Leptonychotes weddellii*)
- Southern elephant seal (*Mirounga leonina*)

1.2 BACKGROUND FOR PURPOSE AND NEED

The MMPA and Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 *et seq.*) prohibit "takes" of marine mammals and of threatened and endangered species, respectively, with only a few specific exceptions. The applicable exceptions in this case are an exemption for incidental take of marine mammals in sections 101(a)(5)(D) of the MMPA and 7(o)(2) of the ESA.

Section 101(a)(5)(D) of the MMPA directs the Secretary of Commerce (Secretary) to authorize, upon request, the incidental, but not intentional, taking of small numbers of marine mammals of a species or population stock, by United States citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region, if we make certain findings and provide a notice of a proposed IHA to the public for review. Entities seeking to obtain authorization for the incidental take of marine mammals under our jurisdiction must submit such a request (in the form of an application) to us. Section 101(a)(5)(D) of the MMPA also establishes a 45-day time limit for our review of the application for an IHA followed by a 30-day public notice and comment period on any proposed authorization for the incidental harassment of small numbers of marine mammals. Within 45 days of the close of the public comment period, we must either issue or deny the IHA.

In the case of a federal action that may affect marine mammal species listed as threatened or endangered under the ESA, the action agency responsible for funding, authorizing or carrying out the action must consult with NMFS under section 7 of the ESA to ensure that its action is not likely to jeopardize a listed species or result in the adverse modification or destruction of any designated critical habitat. The section 7 consultation process for this action is described in Section 1.4.1. Consultation is completed when NMFS issues a Biological Opinion (BiOp). The BiOp includes, among other things, an Incidental Take Statement (ITS), which must specify measures the Secretary considers necessary or appropriate to minimize the impact of such take. Any incidental take that occurs consistent with the terms and conditions in the ITS is not considered prohibited take under the ESA and is thus exempted.

We have promulgated regulations to implement the permit provisions of the MMPA (50 CFR Part 216) and have produced Office of Management and Budget (OMB)-approved application instructions (OMB Number 0648-0151) that prescribe the procedures necessary to apply for permits. All applicants must comply with these regulations and application instructions in addition to the provisions of the MMPA. Applications for an IHA must be submitted according to regulations at 50 CFR § 216.104.

1.2.1 PURPOSE OF ACTION

The primary purpose of our proposed action, the issuance of an IHA to NSF and ASC is to authorize (pursuant to the MMPA) NSF and ASC's request to take marine mammals incidental to NSF and ASC's proposed activities. To authorize the take of small numbers of marine mammals in accordance with section 101(a)(5)(D) of the MMPA, we must evaluate the best available scientific information to determine whether the take would have a negligible impact on marine mammals or stocks and have an unmitigable impact on the availability of affected marine mammal species for subsistence use. We cannot issue an IHA if it would result in more than a negligible impact on marine mammals or stocks or result in an unmitigable impact on subsistence. We must also set forth the permissible methods of taking and other means of effecting the least practicable impact on the species or stocks of marine mammals and their habitat (i.e. mitigation), paying particular attention to rookeries, mating grounds, and areas of

similar significance. If appropriate, we must prescribe the means of effecting the least practicable impact on the availability of the species or stocks of marine mammals for subsistence uses. IHAs must also include requirements or conditions pertaining to the monitoring and reporting of such taking, in large part to better understand the effects of such taking on the species. A proposed IHA must be published in the *Federal Register* for public notice and comment.

1.2.2 NEED FOR ACTION

As noted above this section, the MMPA establishes a general prohibition on the take of marine mammals, including take by Level B (behavioral) harassment. The MMPA establishes a process discussed in Section 1.2.1, by which individuals engaged in specified activities within a specified geographic area may request an IHA for the incidental take of small numbers of marine mammals.

On July 15, 2014, NSF and ASC submitted an IHA application demonstrating both the need and potential eligibility for issuance of an IHA in connection with the seismic survey described in Section 1.1.1. NMFS needs to review the IHA application to determine if the action proposed is consistent with applicable statutes and regulations. We now have a corresponding duty to determine whether and how we can fashion an IHA authorizing take by Level B harassment incidental to the activities described in NSF and ASC's application. The need for this action is therefore established and framed by the MMPA and our responsibilities under section 101(a)(5)(D) of the MMPA, its implementing regulations, and other applicable requirements which will influence our decision making, such as section 7 of the ESA, which is discussed in more detail below this section. In order for an alternative to be considered reasonable, it must meet the statutory and regulatory requirements. The previously mentioned purpose and need guide us in developing reasonable alternatives for consideration, including alternative means of mitigating potential adverse effects. We are thus developing and analyzing alternatives of developing and issuing an IHA, not alternative means of the applicant carrying out the underlying activities described in its application. We do recognize, though, that mitigation measures developed and included in a final IHA might affect those activities.

1.3 THE ENVIRONMENTAL REVIEW PROCESS

NEPA compliance is necessary for all "major" federal actions with the potential to significantly affect the quality of the human environment. Major federal actions include activities that are fully or partially funded, regulated, conducted, or approved by a federal agency. Because our issuance of an IHA would allow for the taking of marine mammals consistent with provisions under the MMPA and incidental to the applicant's activities, we consider this a federal action subject to NEPA.

We prepared this EA to determine whether the direct, indirect and cumulative impacts related to our issuance of the IHA for incidental take of marine mammals under the MMPA during the low-energy seismic survey in the International Waters in the Ross Sea are likely to be significant. If we deem the potential impacts to be not significant, this analysis, in combination with other analyses incorporated by reference, may support the issuance of a Finding of No Significant Impact (FONSI) for the proposed IHA.

1.3.1 Laws, Regulations, or Other NEPA Analyses Influencing the EA's Scope

We have based the scope of the proposed action and nature of the two alternatives (i.e., whether or not to issue the IHA, including prescribed means of take, mitigation measures, and monitoring requirements) considered in this EA on the relevant requirements in section 101(a)(5)(D) of the MMPA. The scope of our analysis is thus bounded by our decision-making discussed in Section 1.3.2. We believe this analysis, when combined with the analysis in NSF and ASC's 2014 *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* (AECOM, 2014), and their 2011 *Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey* (NSF/USGS, 2011) fully evaluate the impacts associated with this survey, with planned mitigation and monitoring for marine mammals in place.

MMPA Application and Notice of the Proposed IHA

The MMPA and its implementing regulations governing the issuance of an IHA (50 CFR § 216.107) require that upon receipt of an adequate and complete application for an IHA, we must publish a notice of preliminary determinations and a proposed IHA in the *Federal Register* (FR) within 45 days.

The regulations published by the Council on Environmental Quality (CEQ regulations) (40 CFR §1502.25) encourage federal agencies to integrate NEPA's environmental review process with other environmental reviews under other laws. We rely substantially on the public process for developing proposed IHAs under the MMPA and its implementing regulations, to develop and evaluate relevant environmental information and provide a meaningful opportunity for public participation as we develop corresponding EAs. We fully consider public comments received in response to our publication of the notice of proposed IHA during the corresponding NEPA review process.

On November 17, 2014, we published a notice of the proposed IHA with our preliminary determinations in the *Federal Register* (79 FR 68512). The notice included a detailed description of the proposed action, resulting from the MMPA consultation process; consideration of environmental issues and impacts of relevance related to the issuance of an IHA; and potential mitigation and monitoring measures to avoid and minimize potential adverse impacts to marine mammals and their habitats. We explained in that notice that we would use it to provide all relevant environmental information to the public and to solicit the public's comments on the potential environmental effects related to the proposed issuance of the IHA and issues for consideration in this EA.

This EA, titled *Environmental Assessment on the Issuance of an Incidental Harassment Authorization to the National Science Foundation and Antarctic Support Contract to Take Maine Mammals by Harassment Incidental to a Low-Energy Marine Geophysical Survey in the Ross Sea, January to February 2015*, incorporates by reference and relies on NSF and ASC's July 2014 IHA application, our notice of the proposed IHA (79 FR 68512, November 17, 2014), and their environmental analyses to avoid duplication of analysis and unnecessary length.

Our notice of the proposed IHA (79 FR 68512, November 17, 2014) included a detailed description of the proposed project, an assessment of the potential impacts on marine mammals,

mitigation and monitoring measures, reporting requirements planned for this project, and preliminary determinations required by the MMPA. The notice provided information on our proposal to issue an IHA to NSF and ASC to incidentally harass by Level B harassment only, 18 species of marine mammals during the proposed 30-operational-day, low-energy seismic survey. Within the notice of the proposed IHA (79 FR 68512, November 17, 2014), we considered the applicants' proposed action and their proposed mitigation and monitoring measures to effect the least practicable impact on marine mammals including: (1) vessel-based visual monitoring; (2) proposed exclusion zones; (3) shut-down procedures; (4) ramp-up procedures; and (5) speed and course alterations. We preliminarily determined, based on implementation of the required mitigation and monitoring measures, that the proposed survey in the International Waters of the Ross Sea, from January through February 2015, would result, at worst, in a modification in behavior and/or low-level physiological effects (Level B harassment) of certain species of marine mammals, and would have a negligible impact on those affected species or stocks.

PROPOSING FEDERAL AGENCY'S NEPA ANALYSIS ON THE PROPOSED SEISMIC SURVEY AND ISSUANCE OF AN ASSOCIATED IHA

NSF, which funds, and ASC, which operates the project and research vessel that would serve as the operational platform for the seismic survey, directed AECOM to prepare an environmental analysis, titled *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* (AECOM, 2014), to meet their requirements under Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*, for NSF and ASC's proposed federal action. NSF and ASC's 2014 analysis tiers to the *2011 Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey* (NSF, 2011) and the corresponding Record of Decision.

After conducting an independent review of the information and analyses for sufficiency and adequacy, we incorporate by reference the relevant analyses of NSF and ASC's proposed action and discussions of the affected environment and environmental consequences within the following documents, per 40 CFR 1502.21 and NAO 216-6 § 5.09(d):

- NSF and ASC's 2014 *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea*, prepared by AECOM (AECOM, 2014); and
- NSF's 2011 *Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey* (NSF, 2011).

NSF and ASC's 2014 environmental analysis (AECOM, 2014) contains a description of NSF and ASC's proposed low-energy seismic survey, proposed monitoring and mitigation measures, and icebreaking (Section II); and a discussion of the affected environment and environmental analysis (Section III and IV) (AECOM, 2014). The NSF/USGS 2011 PEIS (NSF, 2011) also considers, in a qualitative way (Section 2.3.1.2), the affected environment and environmental consequences of conducting a low-energy seismic survey in the Ross Sea including impacts on biota (Section 3.3), marine invertebrates (Section 3.3.1), fish (Section 3.3.2), sea turtles (Section 3.3.3), seabirds (Section 3.3.4), and marine mammals (Section 3.3.6); and physical disturbances,

planned releases, and accidental releases (Sections 4.2, 4.3, and 4.4). In summary, NSF and ASC's analyses conclude that with incorporation of monitoring and mitigation measures proposed by NSF and ASC, the potential impacts of the proposed action to marine mammals would be limited to localized changes in behavior and distribution near the seismic vessel and would qualify as Level B harassment under the MMPA. NSF and ASC did not identify any significant environmental issues or impacts.

1.3.2 Scope of Environmental Analysis

Given the limited scope of the decision for which we are responsible (i.e., whether or not to issue the IHA which includes prescribed means of take, mitigation measures and monitoring requirements), this EA (relying on the environmental review and analyses performed by NSF, the IHA application and the notice of proposed IHA collectively incorporated by reference herein) is intended to provide more focused information on the primary issues and impacts of environmental concern related specifically to our issuance of the IHA authorizing the take of marine mammals incidental to NSF and ASC's activities and the mitigation measures to minimize the effects of that take. For these reasons, this EA does not further evaluate effects to the elements of the human environment listed in Table 1 because these other elements will not be affected by our action.

Table 1. Components of the human environment not requiring further evaluation.

Biological	Physical	Socioeconomic / Cultural
Non-listed Fish	Air Quality	Commercial Fishing
Non-listed Invertebrates	Essential Fish Habitat	Military Activities
Non-listed Sea Turtles	Geography	Oil and Gas Activities
Amphibians	Land Use	Recreational Fishing
Humans	Oceanography	Shipping and Boating
Non-Indigenous Species	State Marine Protected Areas	National Historic Preservation Sites
Seabirds	Federal Marine Protected Areas	National Trails and Nationwide Inventory of Rivers
	National Estuarine Research Reserves	Low Income Populations
	National Marine Sanctuaries	Minority Populations
	Park Land	Indigenous Cultural Resources
	Prime Farmlands	Public Health and Safety
	Wetlands	Historic and Cultural Resources
	Wild and Scenic Rivers	
	Ecologically Critical Areas	

1.3.3 NEPA Public Scoping Summary

NAO 216-6 established agency procedures for complying with NEPA and the NEPA implementing regulations issued by the CEQ. Consistent with the intent of NEPA and the clear direction in NAO 216-6 to involve the public in NEPA decision-making, we released a Draft EA for public comment on the potential environmental impacts of our issuance of an IHA, as well as comment on the activities described in the MMPA IHA application and in the *Federal Register* notice of the proposed IHA (79 FR 68512, November 17, 2014). The CEQ regulations further encourage agencies to integrate the NEPA review process with review under the environmental

statutes. Consistent with agency practice we integrated our NEPA review and preparation of this EA with the public process required by the MMPA for issuance of an IHA.

The Draft EA and *Federal Register* notice of the proposed IHA with our preliminary determinations (79 FR 68512, November 17, 2014), supporting analyses, and corresponding public comment period are instrumental in providing the public with information on relevant environmental issues and offering the public a meaningful opportunity to provide comments to us for consideration in both the MMPA and NEPA decision-making processes.

The *Federal Register* notice of the proposed IHA (79 FR 68512, November 17, 2014) summarized our purpose and need; included a statement that we would prepare an EA for the proposed action; and invited interested parties to submit written comments concerning the application and our preliminary analyses and findings, including those relevant to consideration in the EA. The notice of the proposed IHA was available for public review and comment from November 17 to December 17, 2014.

This process serves the public participation function for this EA in terms of scoping for the action and providing the public a meaningful opportunity to participate in the environmental decision-making process. In addition, we posted NSF's analysis on our website at: http://www.nmfs.noaa.gov/pr/permits/incidental/ concurrently with the release of our *Federal Register* notice requesting comments on the proposed IHA (79 FR 68512, November 17, 2014). This EA does not expand the scope of environmental issues and impacts for consideration and is based primarily on the information included in our *Federal Register* notice (79 FR 68512, November 17, 2014), the documents it references, and the public comments provided in response. At the conclusion of this process, we will post the final EA, and, if appropriate, the FONSI, on the same website.

1.3.4 Relevant Comments on NSF and ASC's Analysis

NSF and ASC have followed the public review and comment system established under the Antarctic Conservation Act. Specifically, per 45 CFR 641.17c and Appendix 1, Article 6 of the Madrid Protocol under the Antarctic Treaty, the Environmental Office, Division of Polar Programs, shall make the list and copies of final IEE/EAs available to the public upon request. An annual list of IEE/EAs and a description of any decisions taken in consequence thereof shall be circulated to all Antarctic Treaty Parties in April, annually, as required using the Electronic Information Exchange System (http://www.ats.aq/e/ie.htm). The NSF and ASC IEE/EA will therefore be submitted to the Treaty Parties this coming April. NMFS posted NSF and ASC's analysis on our website at: http://www.nmfs.noaa.gov/pr/permits/incidental/ concurrently with the release of our *Federal Register* notice requesting comments on the proposed IHA (79 FR 68512, November 17, 2014). We will evaluate and address relevant public comments that we received in response to the notice of the proposed IHA in Chapters 2, 3, and 4 of this EA. We will also address them in the *Federal Register* notice announcing issuance of the IHA, should we determine to issue the IHA.

1.3.5 Relevant Comments on our Federal Register Notice and Draft Environmental Assessment

During the 30-day public comment period in the notice of the proposed IHA (79 FR 68512, November 17, 2014) we received comments from one individual and the Marine Mammal Commission (Commission). Public comments on the notice of the proposed IHA postmarked by

December 17, 2014, are a part of the public record and are available on our website. One member of the public (a private citizen) raised concern over the effects on the low-energy seismic survey in general, but we have determined based on the best available scientific literature, the limited duration of the project, and the low-level effects to marine mammals, that our IHA would not result in significant impacts on the human environment. The comments related to the potential impacts associated with out authorizing potential take of marine mammals incidental to NSF and ASC's action summarized here:

On December 8, 2014, we received comments from the Commission on the notice of the proposed IHA (79 FR 68512, November 17, 2014). The Commission provides comments on all proposed ITAs as part of its established role under the MMPA (MMPA § 202 (a)(2); 16 U.S.C. 1402(a)(2))).

We briefly summarize the Commission's comments here. Generally, the Commission recommended that we:

- Adjust density estimates used to estimate the numbers of potential takes by incorporating some measure of uncertainty when available density data originate from other geographical areas and temporal scales and that it formulate a policy or other guidance setting forth a consistent approach for how applicants should incorporate uncertainty in density estimates.
- Follow a consistent approach in assessing the potential for taking by Level B harassment from exposure to specific type of sound sources (e.g., echosounders, sub-bottom profilers, side-scan sonar, and fish-finding sonar) by all applicants who propose to use them. In addition, despite repeated recommendations from the Commission that it do so, NMFS has yet to develop a clear policy setting forth more explicit criteria and/or threshold for making small numbers and negligible impact determinations.
- Estimate exclusion and buffer zones using either empirical measurements from the particular survey site or a model that accounts for the conditions in the proposed survey area because L-DEO has failed to verify the applicability of its model to conditions outside the Gulf of Mexico. The model should incorporate site-specific environmental and operational parameters (including sound speed profiles, bathymetry, and bottom characteristics).
- Require NSF and ASC to have L-DEO re-estimate the proposed exclusion and buffer zones and associated takes of marine mammals using site-specific environmental (including sound speed profiles, bathymetry, and sediment characteristics at a minimum) and operational (including number/type of airguns, tow depth) parameters for the proposed IHA; and impose the same requirements for all future IHAs submitted by NSF, ASC, L-DEO, USGS, SIO, or any other relevant entity.
- Consult with NSF, ASC, and other relevant entities (e.g., L-DEO, USGS, SIO) to develop, validate, and implement a monitoring program that provides a scientifically sound reasonably accurate assessment of the types of marine mammal and reliable estimates of the numbers of marine mammals taken by incorporating applicable g(0) and f(0) values.

We have considered the comments regarding monitoring and mitigation measures within the context of the MMPA requirement to effect the least practicable impact to marine mammals and their habitats. We have developed responses to specific comments related to the incidental harassment of marine mammals, and we will provide those responses in the *Federal Register* notice announcing issuance of the IHA; and address them in Chapters 2, 3, and 4 of this EA. We fully considered the Commission's comments in preparing the final IHA and this EA.

1.4 OTHER PERMITS, LICENSES, OR CONSULTATION REQUIREMENTS

This section summarizes federal, state, and local permits, licenses, approvals, and consultation requirements necessary to implement the proposed action.

1.4.1 U.S. ENDANGERED SPECIES ACT OF 1973

Section 7 of the ESA requires consultation for actions funded, authorized or carried out by federal agencies (i.e., federal actions) that may affect a species listed as threatened or endangered or that may affect designated critical habitat under the ESA. The regulations at 50 CFR Part 402 specify the requirements for these consultations with NMFS.

NSF and ASC have requested authorization for the incidental take of the following marine mammals that are listed as endangered under the ESA under our jurisdiction: the blue, fin, sei, humpback, southern right, and sperm whales. Under section 7 of the ESA, NSF, as the lead federal agency which funds the *Palmer*, has engaged in a formal consultation with the NMFS, Office of Protected Resources, Endangered Species Act Interagency Cooperation Division, on this proposed low-energy seismic survey.

Likewise, our proposed issuance of an IHA is an interrelated federal action that is also subject to the requirements of section 7 of the ESA. As a result, we are required to ensure that the action of our issuance of an IHA to NSF and ASC is not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of critical habitat for these species. In order for us to authorize the incidental take of blue, fin, sei, humpback, southern right, and sperm whales, we have also engaged in a formal consultation with the Office of Protected Resources, Endangered Species Act Interagency Cooperation Division.

The formal consultation under section 7 of the ESA will conclude with a single Biological Opinion for NSF's Division of Polar Programs and NMFS's Office of Protected Resources, Permits and Conservation Division for the low-energy seismic survey and associated IHA in January 2015.

1.4.2 E.O. 12114: ENVIRONMENTAL EFFECTS ABROAD OF MAJOR FEDERAL ACTIONS.

The requirements for Executive Order (E.O.) 12114 are discussed in NSF and ASC's 2014 *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* (AECOM, 2014) and their 2011 *Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey* (NSF, 2011). We have incorporated both documents by reference in this EA.

Briefly, the provisions of E.O. 12114 apply to major federal actions that occur or have effects outside of U.S. territories (the United States, its territories, and possessions). Accordingly, NSF prepares environmental analyses for major federal actions which could have environmental impacts anywhere beyond the territorial jurisdiction of the United States. NOAA, as a matter of

policy, prepares NEPA analyses for proposed major federal actions occurring within its territorial waters, the U.S. EEZ, the high seas, and the EEZs of foreign nations.

CHAPTER 2 – ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 INTRODUCTION

The NEPA and the implementing CEQ regulations (40 CFR §§ 1500-1508) require consideration of alternatives to proposed federal actions, and NAO 216-6 provides agency policy and guidance on the consideration of alternatives to our proposed action. An EA must consider all reasonable alternatives, including the preferred action. It must also consider the no action alternative, even if it does not meet the stated purpose and need, so as to provide a baseline analysis against which we can compare the action alternative.

To warrant detailed evaluation as a reasonable alternative, an alternative must meet our purpose and need. In this case, as we previously explained, an alternative will only meet the purpose and need if it satisfies the requirements under section 101(a)(5)(D) the MMPA (see Chapter 1), which serves as the alternative's only screening criterion. We evaluated each potential alternative against this criterion. Based on this evaluation, we have identified one action alternative as reasonable and, along with the No Action Alternative, have carried two alternatives forward for evaluation in this EA.[1]

We did not carry forward alternatives that we considered not reasonable for detailed evaluation in this EA. Section 2.3.4 presents alternatives considered but eliminated from further review. The action alternative includes a suite of mitigation measures intended to minimize potentially adverse interactions with marine mammals. This chapter describes both alternatives and compares them in terms of their environmental impacts and their achievement of objectives.

As described in Section 1.2.1, we must prescribe the means of effecting the least practicable impact on the species or stocks of marine mammals and their habitat. In order to do so, we must consider NSF and ASC's proposed mitigation measures, as well as other potential measures, and assess the benefit of the considered measures to the potentially affected species or stocks and their habitat. Our evaluation of potential measures includes consideration of the following factors in relation to one another: (1) the manner in which, and the degree to which, the successful implementation of the measure is expected to minimize adverse impacts to marine mammals; (2) the proven or likely efficacy of the specific measure to minimize adverse impacts as planned; and (3) the practicability of the measure for applicant implementation.

Any additional mitigation measure proposed by us beyond what the applicant proposes should be able to or have a reasonable likelihood of accomplishing or contributing to the accomplishment of one or more of the following goals:

- Avoidance or minimization of marine mammal injury, serious injury, or death wherever possible;

[1] For instances involving federal decisions on proposals for projects, the single action alternative would consider the effects of permitting the proposed activity which would be compared to the "No action" alternative. In this case, under the No Action Alternative, the proposed activity (i.e., issuing the IHA with mitigation, monitoring, and reporting requirements) would not take place, and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity (NEPA; Section 1502.14(d)). 40 CFR Sec. 1508.23 states that if an agency subject to NEPA has a goal and is actively preparing to make a decision on one or more alternative means of accomplishing that goal, the effects can be meaningfully evaluated.

- A reduction in the numbers of marine mammals taken (total number or number at biologically important time or location);
- A reduction in the number of times individual marine mammals are taken (total number or number at biologically important time or location);
- A reduction in the intensity of the anticipated takes (either total number or number at biologically important time or location);
- Avoidance or minimization of adverse effects to marine mammal habitat, paying special attention to the food base; activities that block or limit passage to or from biologically important areas; permanent destruction of habitat; or temporary destruction/disturbance of habitat during a biologically important time; and
- For monitoring directly related to mitigation, an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation.

2.2 DESCRIPTION OF NSF AND ASC'S PROPOSED LOW-ENERGY SEISMIC SURVEY

NSF and ASC plan to conduct a low-energy seismic survey in the Ross Sea from January to February 2015 (see Figures 1 and 2). In addition to the low-energy seismic survey, scientific research activities would include conducting a bathymetric profile survey of the seafloor using transducer based instruments such as a multi-beam echosounder, and sub-bottom profiler; acquiring bottom imaging using underwater camera systems, and collecting approximately 32 core samples from the seafloor using various methods and equipment. The research would be conducted by Louisiana State University. NSF and ASC plan to use one source vessel, the *Palmer*, and a seismic airgun array to collect seismic data in the Ross Sea. The vessel would be operated by ASC, which operates the United States Antarctic Program under contract to NSF. NSF and ASC plan to use conventional low-energy, seismic methodology to perform marine-based studies in the Ross Sea, including evaluation of the timing and duration of two grounding events (i.e., advances of grounded ice) to the outer and middle shelf of the Whales Deep Basin, a West Antarctic Ice Sheet paleo ice stream trough in the eastern Ross Sea. The studies would involve a low-energy seismic survey, acquiring core samples from the seafloor, and performing radiocarbon dating of benthic foraminifera to meet a number of research goals. In addition to the planned operations of the seismic airgun array and hydrophone streamer(s), NSF and ASC intend to operate a single-beam echosounder, multi-beam echosounder, ADCP, and sub-bottom profiler continuously throughout the survey.

Grounding events in the Whales Deep Basin are represented by seismically resolvable Grounding Zone Wedges. During the proposed activities in the Ross Sea, researchers would acquire additional seismic data and multi-beam bathymetry and imaging to precisely define the depositional and erosional limits of the outer and middle shelf Grounding Zone Wedges. The proposed collection of benthic samples and resulting analyses would test the hypothesis and counter hypothesis regarding the West Antarctic Ice Sheet retreat as it relates to the Whales Deep Basin paleo ice stream through: (1) radiocarbon dating in situ benthic foraminifera isolated from diamict deposited on the Grounding Zone Wedges foreset; (2) ramped pyrolysis of acid insoluble organic isolated from diatom ooze overlying Grounding Zone Wedges diamict; (3) calculating the duration of the two grounding events; and (4) extracting pore-water from the Grounding Zone Wedges diamict to determine salinity and $\delta^{18}O$ values to test a numerical model prediction regarding the West Antarctic Ice Sheet retreat.

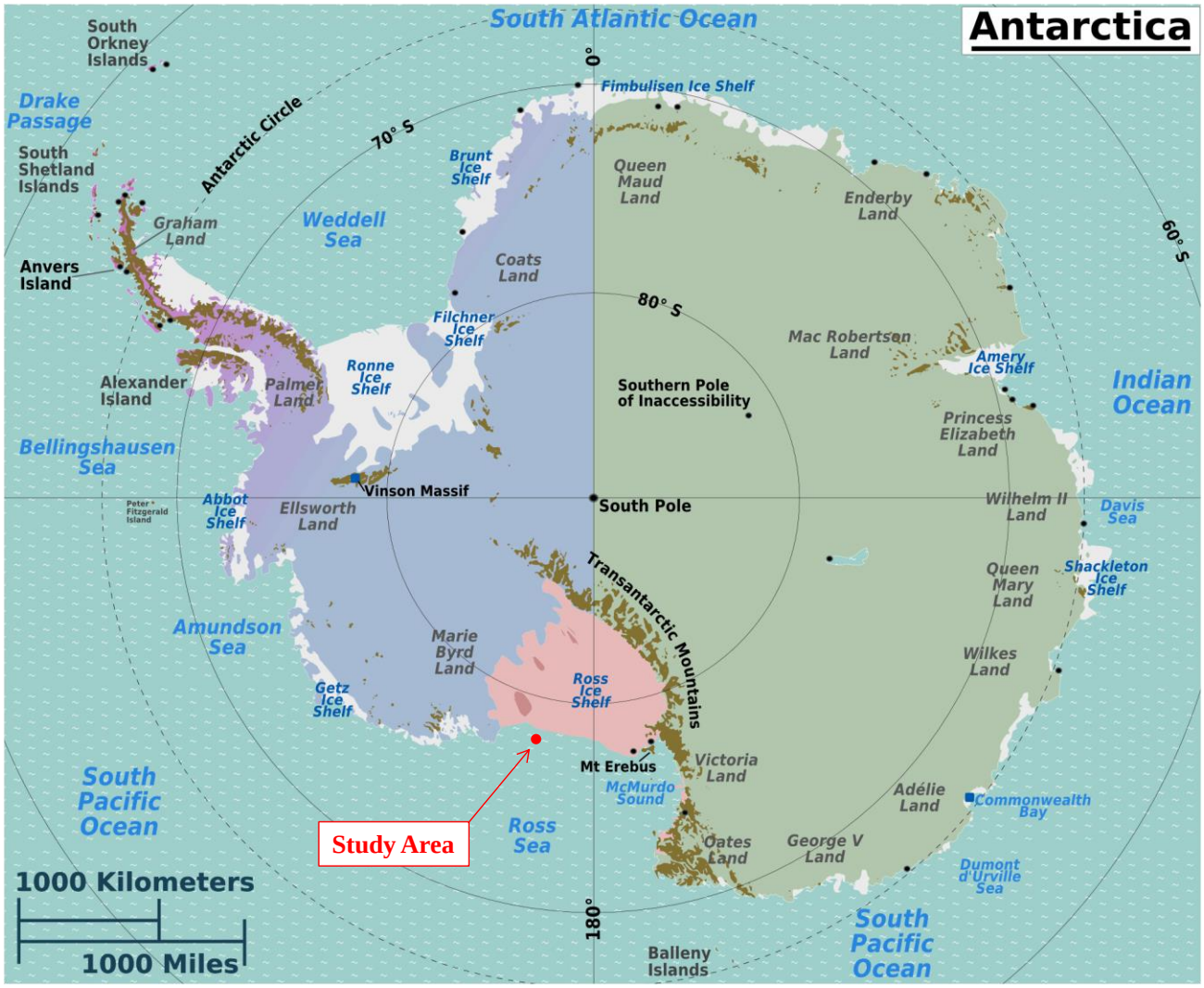

Figure 1. Ross Sea study area.

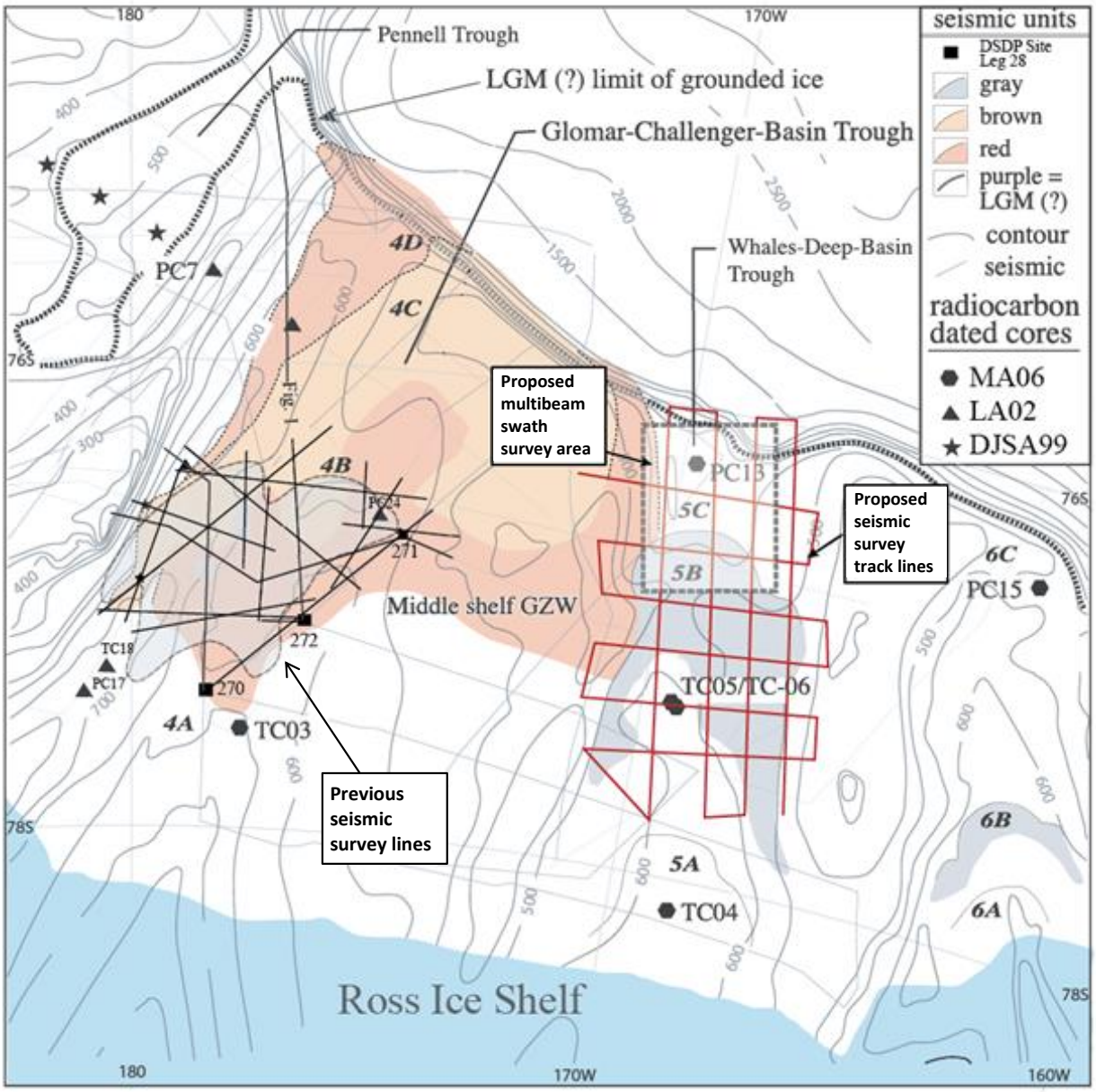

Figure 2. Proposed tracklines for the low-energy seismic survey in the Ross Sea.

2.2.1 Specified Time and Specified Area

NSF and ASC's proposed project and survey sites are located in selected regions of the Ross Sea (located north of the Ross Ice Shelf) and focus on the Whales Deep Basin trough (encompassing the region between 76 to 78º South and between 165 to 170º West (see Figure 2 of the IHA application). Figure 2 also illustrates the general bathymetry of the proposed study area and previously collected data with respect to seismic units and dated cores. The proposed low-energy seismic survey would be conducted in International Waters. Figure 2 of the IHA application illustrates the general bathymetry of the proposed study area near the Ross Ice Shelf. Water depths in the survey area are between 100 to 1,000 m. The proposed low-energy seismic

survey would be within an area of approximately 3,882 km^2 (1,131.8 nmi^2). This estimate is based on the maximum number of kilometers for the low-energy seismic survey (1,750 km) multiplied by the area ensonified around the planned tracklines (1.109 km x 2). The ensonified area is based on the predicted rms radii (m) based on modeling and empirical measurements (assuming 100% use of the two 105 in^3 GI airguns in 100 to 1,000 m water depths), which was calculated to be 1,109 m (3,638.5 ft) (see Appendix B of the IHA application).

If icebreaking is required during the course of the research activities in the Antarctica region, it is expected to occur on a limited basis. The research activities and associated contingencies are designed to avoid areas of heavy ice condition, and the Ross Sea region is typically clear during the January to February time period due to a large polynya routinely forms in front of the Ross Ice Shelf. Researchers would work to minimize time spent breaking ice. The proposed science operations are most difficult to conduct in icy conditions because the ice noise degrades the quality of the geophysical and ADCP data. Also, time spent breaking ice takes away from time supporting research. Logistically, if the vessel were in heavy ice conditions, researchers would not tow the airgun array and streamer, as this would likely damage equipment and generate noise interference. It is possible that the low-energy seismic survey can be performed in low ice conditions of the *Palmer* could generate an open path behind the vessel.

Because the *Palmer* is not rated routinely break multi-year ice, operations would generally avoid transiting through older ice (i.e., 2 years or older, thicker than 1 m). If sea ice is encountered during the cruise, it is anticipated the *Palmer* would proceed primarily through one year sea ice, and possibly some new, very thin ice, and would follow leads wherever possible. Satellite imagery from the Ross Sea region (http://www.iup.physik.uni-bremen.de:8084/ssmis/) documents that sea ice is at its minimum extent during the month of February. Based on the ship's speed of 5 knots under moderate ice conditions, 500 km represents approximately 54 hours of icebreaking operations. It is noted that typical transit through areas of primarily open water containing brash or pancake ice are not considered icebreaking for the purposes of this assessment.

The *Palmer* is expected to depart from McMurdo Station on approximately January 24, 2015 and arrive at Hobart, Australia on approximately March 20, 2015. Research operations would be over a span of 27 days (from approximately January 24 to February 26, 2015). At the end of the proposed research operations, the Palmer would resume other operational activities, and transit to Hobart, Australia. The total distance the *Palmer* would travel in the region to conduct the proposed research activities (i.e., seismic survey, bathymetry survey, transit to coring locations and McMurdo Station) represents approximately 12,000 km (6,479.5 nmi). Some minor deviation from this schedule is possible, depending on logistics and weather (i.e., the cruise may depart earlier or be extended due to poor weather; there could be additional days of airgun operations if collected data are deemed to be of substandard quality). Therefore, we propose to issue an IHA that is effective from January 24, 2015 to April 9, 2015.

2.2.2 Seismic Acquisition and Active Acoustic Operations

NSF and ASC's analysis titled, *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea*, (AECOM, 2014); NSF and ASC's IHA application; and our notice of the proposed IHA (79 FR 68512, November 17, 2014) describe the survey protocols in detail. We incorporate those descriptions by reference in this EA and briefly summarize them here.

The proposed low-energy seismic survey will involve one source vessel, the *Palmer*, which would deploy a two Sercel Generator Injector (GI) airgun array (each with a discharge volume of 105 cubic inch [in^3], in one string, with a total volume of 210 in^3) as an energy source at a tow depth of up to 3 to 4 m (9.8 to 13.1 ft) below the surface. A third airgun would serve as a "hot spare" to be used as a back-up in the event that one of the two operating airguns malfunctions. The airguns in the array would be spaced approximately 3 m (9.8 ft) apart and 15 to 40 m (49.2 to 131.2 ft) astern of the vessel. The receiving system would consist of one or two 100 m (328.1 ft) long, 24-channel, solid-state hydrophone streamer(s) towed behind the vessel. Data acquisition is planned along a series of predetermined lines, all of which would be in water depths greater than 1,000 m. As the GI airguns are towed along the survey lines, the hydrophone streamer(s) would receive the returning acoustic signals and transfer the data to the onboard processing system. All planned seismic data acquisition activities would be conducted by technicians provided by NSF and ASC, with onboard assistance by the scientists who have proposed the study. The vessel would be self-contained, and the crew would live aboard the vessel for the entire cruise. The Principal Investigator is Dr. Philip Bart of the Louisiana State University (Baton Rouge).

The weather, sea, and ice conditions would be closely monitored, including the presence of pack ice that could hinder operation of the airgun array and streamer(s) as well as conditions that could limit visibility. If situations are encountered which pose a risk to the equipment, impede data collection, or require the vessel to stop forward progress, the equipment would be shut-down and retrieved until conditions improve. In general, the airgun array and streamer(s) could be retrieved in less than 30 minutes.

During the low-energy seismic survey, the vessel would attempt to maintain a constant cruise speed of approximately 5 knots (9 km/hr). There would be between 360 and 720 shots per hour (distributed over the 9 km distance), and the relative linear distance between shots would be between 15 and 30 m (49.2 to 98.4 ft). The airguns would operate continuously for no more than 100 hours based on operational constraints. The cumulative duration of airgun operations will not exceed 200 hours. The relatively short, 24-channel hydrophone streamer would provide operational flexibility to allow the low-energy seismic survey to proceed along the designated cruise tracklines. The design of the seismic equipment is to achieve high-resolution images with the ability to correlate to the ultra-high frequency sub-bottom profiling data and provide cross-sectional views to pair with the seafloor bathymetry.

The nominal source levels of the airgun array on the *Palmer* are 224.6 to 229.8 decibels (dB) re 1 μPa (peak to peak) and the root mean square (rms) value for a given airgun pulse is typically 16 dB re 1 μPa lower than the peak-to-peak value (Greene, 1997). The specific source output for the two airgun array is 234.1 dB (0 to peak) and 239.8 dB (peak-peak). However, the difference between rms and peak or peak-to-peak values for a given pulse depends on the frequency content and duration of the pulse, among other factors[2]. During firing, a brief (approximately 0.3

[2] Sound pressure is the sound force per unit area, and is usually measured in micropascals (μPa), where 1 pascal (Pa) is the pressure resulting from a force of one newton exerted over an area of one square meter. Sound pressure level (SPL) is expressed as the ratio of a measured sound pressure and a reference level. The commonly used reference pressure level in underwater acoustics is 1 μPa, and the units for SPLs are dB re: 1 μPa. SPL (in decibels [dB]) = 20 log (pressure/reference pressure). SPL is an instantaneous measurement and can be expressed as the peak, the peak-peak (p-p), or the root mean square (rms). Root mean square, which is the square root of the arithmetic average of the squared instantaneous pressure values, is typically used in discussions of the effects of sounds on vertebrates and all references to

second) pulse sound is emitted; the airguns would be silent during the intervening periods. The dominant frequency components range from 2 to 188 Hertz (Hz).

The proposed study (e.g., equipment testing, startup, line changes, repeat coverage of any areas, and equipment recovery) would consist of approximately 1,750 km (944.9 nmi) of transect lines (including turns) in the study area in the Ross Sea. The *Palmer* may conduct additional airgun operations in the study area associated with turns, airgun testing, and repeat coverage of any areas where the initial data quality is sub-standard. In NSF and ASC's estimated take calculations, 25% has been added for those additional operations. The portion of the cruise planned for after the low-energy seismic survey in the Ross Sea is not associated with the project, it is associated with McMurdo Station support and would occur regardless of the low-energy seismic survey (i.e., no science activities would be conducted). In addition, the Palmer would transit approximately 3,980 km (2,149 nmi) to Australia after the planned support activities for McMurdo Station.

The *Palmer* would also operate a single-beam and multi-beam echosounder, ADCP, and a sub-bottom profiler concurrently during airgun operations to map characteristics of the ocean floor and to provide information about the sedimentary features and bottom topography. This sound source would be operated continuously from the *Palmer* throughout the cruise between the first and last survey sites. The nominal source levels for the single-beam echosounder and multi-beam echosounder, ADCP, and sub-bottom profiler are 242 dB re 1 μPa, 223.6 dB re 1 μPa and 222 dB re 1 μPa, respectively.

2.2.3 Core Sampling Description and Deployment

The primary sampling goals involve the acquisition of sediment cores for analysis. The coring locations would be determined using data generated by the low-energy seismic survey. It is anticipated that cores would be advanced at a total of 32 coring locations using several different types of equipment designed to meet research specific objectives. Proposed sediment coring activities include: box coring at 3 locations, gravity coring at 3 locations, jumbo piston coring at 4 locations, Kasten coring at 11 locations, and standard piston coring at 11 locations. The proposed coring activities are summarized in Table 2 (see below). The small diameter coring devices would collect sediment from the seafloor at 32 sample locations. At each sampling location up to 176 cm^2 (27.3 in^2) of seafloor would be disturbed by deployment of the coring devices yielding a cumulative total of approximately 0.6 m^2 (6.5 ft^2) disturbance during the proposed project (see Figure 2 of the IHA application).

Table 2. Proposed coring activities in the Ross Sea.

Sampling Device	Core Diameter (cm)	Core Length	Number of Cores
Box Core (Rectangular Profile)	10	0.5	3
Gravity Core	7.5	3	3
Jumbo Piston Core	12.7	12	4
Kasten Core	15	6	11
Standard Piston Core	8.9	9	11

From the sediment cores, the in situ foraminifera and ramped pyrolysis radiocarbon data would be used to conduct a detailed comparison of acid insoluble organic versus foraminifera radiocarbon

SPL in this document refer to the root mean square unless otherwise noted. SPL does not take the duration of a sound into account.

dates. The grounding-event duration data generate would provide a test of the two radiocarbon dating strategies. Resolving which of the two interpretations of how near-surface sedimentology and stratigraphy of Glomar Challenger Basin Grounding Zone Wedges stratigraphy in easter Ross Sea relates to post-Last Glacial Maximum grounding-line migration is the goal of the proposed research; determining which of the strategies is more accurate and/or what offsets exist between the two dating strategies used to support these interpretations is important because constraining the timing of recent grounding events is essential to predict what factors might cause the current stability (i.e., a pause in grounding-line migration) to end with additional West Antarctic Ice Sheet retreat.

2.2.4 Bathymetric Survey Description and Deployment

Along with the low-energy airgun operations, other additional geophysical (detailed swath bathymetry) measurements focused on a specific study area within the Ross Sea would be made using hull-mounted sonar system instruments. The proposed bathymetric researcher would bisect approximately 8,300 km^2 (2,419.9 nmi^2) in the Ross Sea Region (see Figure 2 of the IHA application). In addition, several other transducer-based instruments onboard the vessel would be operated continuously during the cruise for operational and navigational purposes. During bathymetric survey operations, when the vessel is not towing seismic equipment, its average speed would be approximately 10.1 kts (18.8 km/hr). Operating characteristics for the instruments to be used are described below.

Single-Beam Echosounder (Knudsen 3260) – The hull-mounted CHIRP sonar would be operated continuously during all phases of the cruise. This instrument is operated at 12 kHz for bottom-tracking purposes or at 3.5 kHz in the sub-bottom profiling mode. The sonar emits energy in a 30º beam from the bottom of the ship.

Single-Beam Echosounder (Bathy 2000) – The hull-mounted sonar characteristics of the Bathy 2000 are similar to the Knudsen 3260. Only one hull-mounted echosounder can be operated at a time, and this source would be operated instead of the Knudsen 3260 only if needed (i.e., only one would be in continuous operation during the cruise). The specific model to be used is expected to be selected by the scientific researchers and was the preferred instrument for many previous low-energy seismic surveys on the *Palmer*.

Multi-Beam Sonar (Simrad EM120) – The hull-mounted multi-beam sonar would be operated continuously during the cruise. This instrument operates at a frequency of 12 kHz, has an estimated maximum source energy level of 242 dB re 1μPa (rms), and emits a very narrow (<2º) beam fore to aft and 150º in cross-track. The multi-beam system emits a series of nine consecutive 15 ms pulses.

Acoustic Doppler Current Profiler (ADCP Teledyne RDI VM-150) – The hull-mounted ADCP would be operated continuously throughout the cruise. The ADCP operates at a frequency of 150 kHz with an estimated acoustic output level at the source of 223.6 dB re 1μPa (rms). Sound energy from the ADCP is emitted as a 30º conically-shaped beam.

Acoustic Doppler Current Profiler (ADCP Ocean Surveyor OS-38) – The characteristics of this backup hull-mounted ADCP unit are similar to the Teledyne VM-150 and would be continuously operated.

Acoustic Locator (Pinger) – A pinger would be deployed with certain instruments (e.g., camera) and equipment (e.g., corers) so these devices can be located in the even they become detached from their lines. A pinger typically operates at a frequency of 12 kHz, generates a 5 ms pulse per second, and has an acoustical output of 162 dB re 1 µPa (rms). A maximum total of 32 coring samples would be obtained using these devices and ranging from 1.5 to 3 hours per sample and require approximately 62 hours per sample. Therefore, it is estimated that the pinger would operate a total of 62 hours.

Passive Instruments – During the low-energy seismic survey in the Ross Sea, underwater imagery would be obtained through deployment of a benthos bottom camera and towing benthic camera system (during the coring activities). In addition, numerous (approximately 50) expendable bathythermograph (XBTs) probes would also be released (and none would be recovered) over the course of the cruise to obtain temperature data necessary to calculate sound velocity profiles used by the multi-beam sonar.

2.2.4 Icebreaking Activities

Icebreaking is considered by NMFS to be a continuous sound and NMFS estimates that harassment occurs when marine mammals are exposed to continuous sounds at a received sound level of 120 dB SPL or above. Potential takes of marine mammals may ensue from icebreaking activity in which the *Palmer* is expected to engage in Antarctic waters (i.e., along the Ross Sea region, between 76 to 78º South, between 165 to 170º West). While breaking ice, the noise from the ship, including impact with ice, engine noise, and propeller cavitation, would exceed 120 dB (rms) continuously. If icebreaking does occur in Antarctic waters, NMFS, NSF and ASC expect it would occur on a limited basis during transit and non-seismic operations to gain access to coring or other sampling locations and not during seismic airgun operations. The research activities and associated contingencies are designed to avoid areas of heavy sea ice condition, and the Ross Sea region is typically clear during the January to February time period. If the *Palmer* breaks ice during transit within the Antarctic waters (within the Ross Sea or other areas of the Southern Ocean), airgun operations would not be conducted concurrently.

In 2008, acousticians from Scripps Institution of Oceanography Marine Physical Laboratory and University of New Hampshire Center for Coastal and Ocean Mapping conducted measurements of SPLs of the U.S. Coast Guard Cutter (USCGC) *Healy* icebreaking under various conditions (Roth and Schmidt, 2010). The results indicated that the highest mean SPL (185 dB) was measured at survey speeds of 4 to 4.5 kts in conditions of 5/10 ice and greater. Mean SPL under conditions where the ship was breaking heavy ice by backing and ramming was actually lower (180 dB). In addition, when backing and ramming, the vessel is essentially stationary, so the ensonified area is limited for a short period (on the order of minutes to tens of minutes) to the immediate vicinity of the vessel until the ship breaks free and once again makes headway.

The 120 dB received sound level radius around the *Healy* while icebreaking was estimated by researchers (USGS, 2010). Using a practical spreading model, a source level of 185 dB decays to 120 dB in about 21.54 km (11.6 nmi). This model is corroborated by Roth and Schmidt (2010). Therefore, as the ship travels through the ice, a swath 43.08 km (23.3 nmi ft) wide would be subject to sound levels greater than or equal to 120 dB. This results in potential exposure of 21, 540 km^2 (6,280.1 nmi^2) to sounds greater than or equal to 120 dB from icebreaking.

Data characterizing the sound levels generated by icebreaking activities conducted by the *Palmer* are not available; therefore, data for noise generating from an icebreaking vessel such as the USCGC *Healy* would be used as a proxy. It is noted that the *Palmer* is a smaller vessel and has less icebreaking capability than the U.S. Coast Guard's other polar icebreakers, being only capable of breaking ice up to 1 m thick at speeds of 3 kts (5.6 km/hr or 3 nmi). Therefore, the sound levels that may be generated by the *Palmer* are expected to be lower than the conservative levels estimated and measured for the USCGC *Healy*. Researchers would work to minimize time spent breaking ice as science operations are more difficult to conduct in icy conditions since the ice noise degrades the quality of the seismic and ADCP data and time spent breaking ice takes away from time supporting scientific research. Logistically, if the vessel were in heavy ice conditions, researchers would not tow the airgun array and streamer, as this would likely damage equipment and generate noisy data. It is possible that the low-energy seismic survey can be performed in low ice conditions if the *Palmer* could generate an open path behind the vessel.

Because the *Palmer* is not rated to break multi-year ice routinely, operations generally avoid transiting through older ice (i.e., 2 years or older, thicker than 1 m). If sea ice is encountered during the cruise, it is anticipated the *Palmer* would proceed primarily through one year sea ice, and possibly some new, very thin ice, and would follow leads wherever possible. Based on historical sea ice extent and the proposed cruise tracklines, it is estimated by NSF and ASC that the *Palmer* may actively break up ice to a distance of 500 km (270 nmi). Based on a ship's speed of 5 kts under moderate ice conditions, this distance represents approximately 54 hours of icebreaking operations. It is noted that typical transit through areas primarily open water and containing brash ice or pancake ice would not be considered icebreaking.

2.3 DESCRIPTION OF ALTERNATIVES

2.3.1 ALTERNATIVE 1 – ISSUANCE OF AN AUTHORIZATION WITH MITIGATION MEASURES

The Proposed Action constitutes Alternative 1 and is the Preferred Alternative. Under this alternative, we would issue an IHA (valid from January to April 2015) to NSF and ASC allowing the incidental take, by Level B harassment, of 18 species of marine mammals during the approximately 30-operational-day, low-energy seismic survey subject to the mandatory mitigation and monitoring measures and reporting requirements described in this alternative.

NSF and ASC's analyses and our *Federal Register* notice requesting comments on the proposed IHA (79 FR 68512, November 17, 2014) analyzed the potential impacts of this alternative in detail. We incorporate those analyses by reference in this EA and briefly summarize the mitigation and monitoring measures and reporting requirements likely to be incorporated in the final IHA, if issued, in the following sections.

We preliminarily determined, under section 101(a)(5)(D) of the MMPA that the measures included in the proposed IHA were sufficient to reduce the effects of NSF and ASC's activity on marine mammals to the level of least practicable impact. In addition, we preliminarily determined that the taking of small numbers of marine mammals incidental to NSF and ASC's action would have a negligible impact on the affected species or stocks (79 FR 68512, November 17, 2014).

We have not altered the mitigation, monitoring and reporting requirements to be included in the final IHA; nor have we received any information that would cause us to change our negligible impact or small numbers determinations. Accordingly, this Preferred Alternative (Issuance of an IHA with Mitigation Measures) would satisfy the purpose and need of our proposed action under the MMPA (issuance of an IHA, along with required mitigation measures and monitoring), and would enable us, NSF, and ASC to comply with the statutory and regulatory requirements of the MMPA and ESA.

MITIGATION AND MONITORING MEASURES

To reduce the potential for disturbance from acoustic stimuli associated with the activities, NSF and ASC proposed to implement the following monitoring and mitigation measures for marine mammals:

(1) establishment of exclusion zones to avoid injury to marine mammals and visual monitoring of the exclusion zones by Protected Species Observers (PSOs);
(2) shut-down procedures when PSOs detect marine mammals within or about to enter the exclusion zones while the airgun array is operating;
(3) ramp-up procedures; and
(4) speed or course alterations to avoid marine mammals entering the exclusion zone(s).

Proposed Buffer and Exclusion Zones: We have established various threshold criteria for injury and harassment that may result from exposure to acoustic stimuli. These thresholds are expressed as the root mean square (rms) of all sound amplitudes measured over the duration of an impulse with a base unit of decibels referenced to one micropascal (re 1 µPa [rms]); the relevant thresholds for NSF and ASC's action are 190 dB re 1 µPa (rms) for potential injury to pinnipeds; 180 dB re 1 µPa (rms) for potential injury to cetaceans; and 160 dB re 1 µPa (rms) for potential Level B (behavioral) harassment from pulsed sounds (e.g., airguns). The relevant thresholds for NSF and ASC's action are 120 dB re 1 µPa (rms) for potential Level B (behavioral) harassment from continuous sounds (e.g., icebreaking).

NSF and ASC will establish a 160, 180, and 190 dB re 1 µPa (rms) buffer and exclusion zone for marine mammals, cetaceans, and pinnipeds, respectively, before starting the two-GI airgun array (210 in^3), based upon the modeled radii in their IHA application and shown here in Table 3. NSF and ASC will also establish a 120 dB re 1 µPa (rms) buffer zone for marine mammals before beginning icebreaking activities. Using a practical spreading model based on a source level of 185 dB, the predicted buffer zone for icebreaking activities is 21.54 km (11.6 nmi).

Table 3. Predicted and modeled (two 105 in^3 GI airgun array) distances by L-DEO to which sound levels greater than or equal to 160, 180, and 190 dB re 1 µPa could be received in intermediate water during the proposed low-energy seismic survey in the Ross Sea of the Southern Ocean, during January through February 2015.

Source and Total Volume	Tow Depth (m)	Water Depth (m)	Predicted RMS Radii Distances[1] (m)		
			160 dB	180 dB	190 dB
Two 105 in^3 GI Airguns (210 in^3)	3 to 4	Intermediate (100 to 1,000)	1,109 (3,638.5 ft)	111 (364.2 ft)	36 (118.1 ft) *100 (328 ft) be used for pinnipeds *

Based on the NSF/USGS PEIS and Record of Decision, for situations which incidental take of marine mammals is anticipated, NSF and ASC have proposed exclusion zones of 100 m for cetaceans and pinnipeds for all low-energy acoustic sources in water depths greater than 100 m. However, NMFS has proposed to require exclusion zones of 111 m for cetaceans and 100 m for pinnipeds based on the predicted and modeled values by L-DEO and to be more protective for marine mammals.

NMFS has determined that for acoustic effects, using acoustic thresholds in combination with corresponding exclusion zones is an effective way to consistently apply measures to avoid or minimize the impacts of an action. NSF and ASC use the thresholds to establish a mitigation shut-down or exclusion zone, i.e., if an animal enters or is about to enter an area calculated to be ensonified above the level of an established threshold, a sound source is shut-down.

Shut-Down Procedures: NSF and ASC would shut-down the operating airgun(s) if they see a marine mammal within or approaching the exclusion zone for the single or two airguns. NSF and ASC would not resume airgun activity until the marine mammal(s) has cleared the exclusion zone, or until the PSO is confident that the animal has left the vicinity of the vessel.

Ramp-Up Procedures: NSF and ASC would initiate a ramp-up procedure, beginning with a single airgun in the array and then adding the second airgun after five minutes, when beginning operations and after a specified period (approximately 15 minutes) of non-active airgun operations when a shut-down has exceeded that period. SIO, USGS, and L-DEO have used similar periods during previous low-energy seismic surveys.

Speed and/or Course Alteration: If a marine mammal is detected outside the applicable exclusion zone and, based on its position and the relative direction of travel, is likely to enter the exclusion zone, NSF and ASC would consider changes of the vessel's speed and/or direct course, if this does not compromise operational safety. This would be done if operationally practicable, while minimizing the effect on the planned science objectives. For marine seismic surveys using large streamer arrays, course alterations are not typically possible. After any such speed and/or course alteration is begun, the marine mammal activities and movements relative to the seismic vessel will be closely monitored to ensure the marine mammal does not approach within the exclusion zone. If the marine mammal appears likely to enter the exclusion zone, further mitigation actions would be taken, including further course alterations or shut-down of the airgun(s).

Visual Monitoring: During airgun operations, NSF would place at least two PSOs aboard the *Palmer* for the duration of the cruise. One PSO would watch for marine mammals near the vessel during daytime airgun operations (from nautical twilight-dawn to nautical twilight-dusk) and during any ramp-ups at night. At least one visual PSO will be on watch during meal times and restroom breaks and the PSO shifts would last no longer than four hours at a time.

PSOs would record data to estimate the numbers of marine mammals exposed to various received sound levels and to document reactions or lack thereof. PSOs would also observe during daytime periods when the seismic system is not operating and/or icebreaking is occurring for comparison of sighting rates and behavior with versus without airgun operations. They would also provide information needed to order a shut-down of the seismic source when a marine mammal is within or near the exclusion zone. NSF and ASC would use the data to estimate numbers of animals potentially 'taken' by harassment (as defined in the MMPA).

REPORTING MEASURES

NSF and ASC would submit a comprehensive report to NMFS and the NSF within 90 days after the end of the cruise. The report would describe the operations that were conducted and sightings of marine mammals near the operations. The report would provide full documentation of methods, results, and interpretation pertaining to all monitoring. The 90-day report would summarize the dates and locations of seismic operations, and all marine mammal sightings (i.e., dates, times, locations, activities, and associated seismic survey and icebreaking activities). The report would also include estimates of the number and nature of exposures that could result in takes of marine mammals by harassment or in other ways.

In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by the IHA (if issued), such as an injury (Level A harassment), serious injury or mortality (e.g., ship-strike, gear interaction, and/or entanglement), NSF and ASC shall immediately cease the specified activities and immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources. NSF and ASC may not resume activities until we are able to review the circumstances of the prohibited take.

2.3.2 ALTERNATIVE 2 – NO ACTION

Under the No Action Alternative, we would not issue an IHA to NSF and ASC. For the purposes of this EA, NMFS assumes under the No Action Alternative that NSF and ASC would conduct the proposed low-energy seismic survey without an exemption from the MMPA against the take of marine mammals. NMFS also assumes that NSF and ASC will conduct the low-energy seismic survey in the absence of the protective monitoring and mitigation measures for marine mammals that would be required by the IHA.

2.3.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

We also considered an alternative whereby we issue the IHA for another time. However, this alternative failed to meet the statutory and regulatory requirements of the MMPA for an IHA, as NSF and ASC did not request nor submit an IHA application (i.e., under the MMPA the Secretary shall issue an IHA upon request) to conduct the seismic survey at an alternate time. Further, NSF, in its 2014 *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* (AECOM, 2014), considered and rejected an alternative of conducting the project at another time.

The proposed dates for the cruise (January through February 2015) are the most suitable dates that would best meet the applicant's objectives, from a logistical perspective, for NSF and ASC, and the *Palmer* and its crew. Because the proposed dates for the cruise (27 operational days in January to February 2015) are the dates when the personnel and equipment essential to meet the overall project objectives are available, we did not consider this alternative further.

The potential environmental impacts of this alternative would be similar to the impacts of the proposed action (Alternative 1).

CHAPTER 3 – AFFECTED ENVIRONMENT

This chapter describes existing conditions in the project area. Complete descriptions of the physical, biological, and social environment of the action area are in NSF and ASC's 2014 *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* (AECOM, 2014) and their 2011 *Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey* (NSF, 2011). We incorporate those descriptions by reference and briefly summarize or supplement the relevant sections for marine mammals in the following subchapters.

3.1 PHYSICAL ENVIRONMENT

We are required to consider impacts to the physical environment under NOAA NAO 216-6. As discussed in Chapter 1, our proposed action and alternatives relate only to the authorization of incidental take of marine mammals and not to the physical environment. Certain aspects of the physical environment are not relevant to our proposed action (see subchapter 1.3.2 - Scope of Environmental Analysis). Because of the requirements of NAO 261-6, we briefly summarize the physical components of the environment here.

3.1.1 MARINE MAMMAL HABITAT

The proposed action area is in International Waters of the Ross Sea. The Ross Sea lies to the north of Earth's largest ice shelf, the Ross Ice Shelf, which covers an area of 520,000 km^2 (151,607.7 nmi^2), with an average thickness of 370 m (1,213.9 ft). The Ross Sea stretches between Cape Adare to the west and Cape Colbeck to the east. The outer portion of the Ross Ice Shelf floats on seawater that is modified during its transit beneath the shelf, and the mixes and exchanges with waters to the north over the continental shelf. The continental shelf north of the Ross Ice Shelf covers an area of 466,000 km^2 (135,863.9 nmi^2), with an average depth of approximately 530 m (1,738.9 ft), and the shelf break occurs at approximately 700 m (2,296.6 ft) depth. However, of importance to the biota, small portions of the Ross Sea are shallower than 200 m (656.2 ft). Numerous troughs running roughly in a north-south direction, carved by ice streamers during past glacial periods, traverse the shelf. These troughs, and the intervening banks, influence regional circulation, sedimentation, and biogeochemical and biological processes. Unlike other Antarctic continental shelves, the northwest portion of the Ross Sea shelf was not glaciated during the previous glacial maxima, which is an important characteristics with regard to the composition of regional biota.

The Ross Sea is the most southerly oceanic water body in the world, extending to about 78º South, where it meets the Ross Ice Shelf. Sea water circulates freely under the shelf. The presence of a 1,000 km (540 nmi) wide and deep continental shelf contrasts to most other areas of the Antarctic coastline, where the shelf is either narrow or absent. Strongly localized but large-scale glacial action in the past has given rise to a very irregular topography with the seafloor typically covered with glacial sediments of silt, sand, gravel, and scattered erratic boulders. A conspicuous feature of the Ross Sea is a relatively narrow ridge, a vast terminal moraine, running northwest of Cape Colbeck to the Pennell Bank. This ridge was formed by a grounded ice sheet from a former period of glaciation.

Sea ice extends during the austral winter to cover up to 85% of the Ross Sea. There is considerable year-to-year variation in the extent of this ice, largely due to climatic variation.

Large polynyas (areas of combined open water and thin ice surrounded by sea and/or land and ice) are a feature of the Ross Sea and play an important role in many natural processes, including heat transfer from ocean to atmosphere and phytoplankton production.

Three main oceanic frontal zones occur within the Ross Sea region; the Antarctic Convergence, Antarctic Divergence and Antarctic Slope Front. Frontal zones separate water masses of different temperature and salinity and exhibit marked biological and physical changes. The interchange of these water masses, especially at the Antarctic Divergence, provides the minerals and nutrients fundamental to marine biological production.

The Ross Sea polynya contains the most productive and spatially extensive phytoplankton bloom in the entire Southern Ocean and in mid-winter covers an area of 27,000 km^2 (7,871.9 nmi^2). The Ross Sea is characterize by high levels of phytoplankton primary production in the spring and summer. The production of zooplankton (secondary producers) is similar to that found in other comparable areas of the Southern Ocean, although the distribution of euphausiids (krill) does differ.

The Ross Sea is biologically active and diverse with production phytoplankton, zooplankton, including krill populations, whales returning to feed from breeding areas in the north, as well as seal colonies, fish, and flying seabirds. The seafloor in the Ross Sea is also known to contain diverse benthic communities.

More information on the physical conditions and marine mammal habitat in the Ross Sea study areas can be found in NSF's *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* (available at: http://www.nmfs.noaa.gov/pr/permits/incidental_take_pdfs/nsf_asc_rosssea_2015_draftieeea.pdf), which we incorporate here by reference.

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 MARINE MAMMALS

We provide information on the occurrence, distribution, population size, and conservation status for each of the 18 species of marine mammals under our jurisdiction that may occur in the proposed survey area, including 6 mysticetes (baleen whales), 7 odontocetes (toothed whales, dolphins, and porpoises), and 5 pinnipeds (seals and sea lions), during January through February 2015. More information on the status, abundance, and seasonal distribution of the stocks or species of marine mammals likely to be affected by the proposed activities can be found in NSF and ASC's *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* (available at: http://www.nmfs.noaa.gov/pr/permits/incidental_take_pdfs/nsf_asc_rosssea_2015_draftieeea.pdf), which we incorporate here by reference.

We presented this information earlier in Section 1.1.2 in this EA and in Table 4 in the *Federal Register* notice requesting comments on the proposed IHA (79 FR 68512, November 17, 2014), and we incorporate those descriptions by reference here. Table 4 (see below) presents information on the habitat, regional abundance, and conservation and population status of marine mammals that may occur in or near the proposed low-energy seismic survey in the Ross Sea.

All of the marine mammals are protected under the MMPA, and several of these species are listed as endangered under the ESA, and thus depleted under the MMPA, including the blue, fin, humpback, sei, southern right, and sperm whales (see Table 4 below). More information on the blue, fin, humpback, sei, southern right, and sperm whales in the proposed study area can be found below:

Blue whale – The blue whale is considered relatively rare in the Southern Ocean and Southern Hemisphere, with an abundance estimate of approximately 1,700 animals (Sears and Perrin, 2009). The population structure in the Southern Ocean is not well understood. Blue whales arrive in the Antarctic feeding grounds each austral summer, and some probably migrate past 60º South during early austral summer (October to November). Visual and acoustic surveys conducted by the IWC in Antarctic waters recorded 710 blue whale calls in January 2002 and 2,559 calls in February 2002. During two separate surveys, 24 (Ensor et al., 2003) and 30 (Smith, Jr. et al., 2012) individuals were observed in the Ross Sea. Blue whales begin migrating north out of the Antarctic to winter breeding grounds earlier than fin and sei whales. The Antarctic blue whale occurs as a subspecies in the Antarctic (*B. musculus intermedia*), mainly in relatively high latitudes south of the Antarctic Convergence and close to the ice edge. The pygmy blue whale (*B. musculus brevicauda*) is also found in the Southern Hemisphere, typically north of the Antarctic Convergence, approximately 55º South.

Fin whale – Northern and southern fin whale populations are distinct, and are sometimes recognized as different sub-species (Aguilar, 2009). Fin whales migrate in the open oceans and their winter breeding areas are mostly uncertain Fin whales likely migrate south beyond 60º South during early to mid-austral summer, arriving on more southern feeding grounds after blue whales. The distribution of fin whales during the austral summer ranges from 40 to 60º South in the southern Indian and South Atlantic Oceans and 50 to 60º South in the South Pacific Ocean. Approximately 200 fin whales have been observed in the Ross Sea (Pinkerton et al., n.d.; Ensor et al., 2013). The New Zealand stock summers from 170º East to 145º West. Fin whales migrate north before the end of austral summer toward breeding grounds in and around the Fiji Sea.

Humpback whale – Southern hemisphere humpback whales typically feed near 60º South and between 120º East and 110º West during austral summer (December to March). Two separate surveys recorded 150 (Pinkerton et al., n.d.) and 27 (Ensore et al., 2003) animals. It is estimated that fewer than 5% (150 animals) of the Southern Ocean population (3,000 animals) are present in the Ross Sea for only two months per year (Pinkerton et al., n.d.). The current population in the Scotia Sea and Antarctic Peninsula region (CCAMLR survey area) was estimated to be approximately 9,484 animals (Reilly et al., 2004). However, a small number of late- or early-migrating whales may pass further south of the area during early or late austral summer, based on the species' typical migration patterns. Animals using this region are likely part of the Area V stock that breeds in and around French Polynesia, the Cook Islands, and Tonga. Humpbacks that winter off New Calcedonia and Tonga are estimated to number only in the few hundreds.

Sei whale – Sei whales are generally not found north of 30º South in the southern hemisphere and could visit the proposed study area in the Southern Ocean during the austral summer (Reeves et al., 1999). Their main summer feeding concentration occurs between 40 and 50º South. Populations of sei whales, like other rorquals, may seasonally migrate toward the lower latitudes during the winter and higher latitudes during the summer. No breeding grounds have been identified for sei whales anywhere in its range; however, calving is thought to occur from September to March. The population in the Southern Ocean has not been estimated but remains

greatly depleted. The population in the Ross Sea is estimated to be around 100 animals (Pinkerton et al., n.d.).

Sperm whale – Sperm whales, consisting of solitary males and mixed sex/age classes, are likely to occur in the Southern Ocean during the austral summer. Young calves could also be present during summer. A single group of four sperm whales was sighted in February 2005 during an NSF-funded SIO academic seismic survey in the southwest Pacific Ocean. Female and immature sperm whales generally occur at tropical and temperate latitudes of 50º North to 50º South, while solitary adult males are found to 75º North and 75º South. Home ranges of individual females span distances up to 1,000 km (540 nmi); however, some females travel several thousand miles across large parts of an ocean basin. Sperm whales generally occur in waters greater than 180 m (590 ft) deep; waters in the sub-Antarctic to the Antarctic coastal shelf are greater than 1,000 m (3,280 ft) deep. Populations of sperm whales in the Ross Sea are estimated to range between 88 (Ensor et al., 2003) and 800 (Pinkerton et al., n.d.) animals.

Table 4. The habitat, regional abundance, and conservation status of marine mammals that may occur in or near the proposed low-energy seismic survey area in the Antarctic area of the Ross Sea. (See text and Table 4 in NSF and ASC's IHA application for further details.)

Species	Habitat	Occurrence	Range	Population Estimate	ESA[1]	MMPA[2]
Mysticetes						
Southern right whale (*Eubalaena australis*)	Coastal, pelagic	Rare	Circumpolar 20 to 55º South	8,000[3] to 15,000[4]	EN	D
Humpback whale (*Megaptera novaeangliae*)	Pelagic, nearshore waters, and banks	Common	Cosmopolitan	35,000 to 40,000[3] - Worldwide 9,484[5] – Scotia Sea and Antarctica Peninsula	EN	D
Minke whale (*Balaenoptera acutorostrata* including dwarf sub-species)	Pelagic and coastal	Common	Circumpolar – Southern Hemisphere to 65º South	NA	NL	NC
Antarctic minke whale (*Balaenoptera bonaerensis*)	Pelagic, ice floes	Common	7º South to ice edge (usually 20 to 65º South)	Several 100,000[3] - Worldwide 18,125[5] - Scotia Sea and Antarctica Peninsula	NL	NC
Sei whale (*Balaenoptera borealis*)	Primarily offshore, pelagic	Uncommon	Migratory, Feeding Concentration 40 to 50º South	80,000[3] - Worldwide	EN	D
Fin whale (*Balaenoptera physalus*)	Continental slope, pelagic	Common	Cosmopolitan, Migratory	140,000[3] - Worldwide 4,672[5] - Scotia Sea and Antarctica Peninsula	EN	D
Blue whale (*Balaenoptera musculus*; including pygmy	Pelagic, shelf, coastal	Uncommon	Migratory Pygmy blue whale – North of Antarctic	8,000 to 9,000[3] - Worldwide 1,700[6] - Southern Ocean	EN	D

blue whale [*Balaenoptera musculus brevicauda*])			Convergence 55º South			
Odontocetes						
Sperm whale (*Physeter macrocephalus*)	Pelagic, deep sea	Common	Cosmopolitan, Migratory	360,000[3] – Worldwide 9,500[3] - Antarctic	EN	D
Arnoux's beaked whale (*Berardius arnuxii*)	Pelagic	Common	Circumpolar in Southern Hemisphere, 24 to 78º South	NA	NL	NC
Cuvier's beaked whale (*Ziphius cavirostris*)	Pelagic	Rare	Cosmopolitan	NA	NL	NC
Southern bottlenose whale (*Hyperoodon planifrons*)	Pelagic	Common	Circumpolar - 30º South to ice edge	500,000[3] – South of Antarctic Convergence	NL	NC
Gray's beaked whale (*Mesoplodon grayi*)	Pelagic	Rare	30º South to Antarctic waters	NA	NL	NC
Hector's beaked whale (*Mesoplodon hectori*)	Pelagic	Rare	Circumpolar - cool temperate waters of Southern Hemisphere	NA	NL	NC
Spade-toothed beaked whale (*Mesoplodon traversii*)	Pelagic	Rare	Circumantarctic	NA	NL	NC
Strap-toothed beaked whale (*Mesoplodon layardii*)	Pelagic	Common	30º South to Antarctic Convergence	NA	NL	NC
Killer whale (*Orcinus orca*)	Pelagic, shelf, coastal, pack ice	Common	Cosmopolitan	80,000[3] – South of Antarctic Convergence 25,000[7] - Southern Ocean	NL	NC
Long-finned pilot whale (*Globicephala melas*)	Pelagic, shelf, coastal	Common	Circumpolar - 19 to 68º South in Southern Hemisphere	200,000[3,8] – South of Antarctic Convergence	NL	NC
Southern right whale dolphin (*Lissodelphis peronii*)	Pelagic	Rare	12 to 65º South	NA	NL	NC
Hourglass dolphin (*Lagenorhynchus cruciger*)	Pelagic, ice edge	Common	33º South to pack ice	144,000[3] – South of Antarctic Convergence	NL	NC
Spectacled porpoise (*Phocoena dioptrica*)	Coastal, pelagic	Rare	Circumpolar – Southern Hemisphere	NA	NL	NC

Pinnipeds						
Crabeater seal (*Lobodon carcinophaga*)	Coastal, pack ice	Common	Circumpolar - Antarctic	5,000,000 to 15,000,000[3,9] - Worldwide	NL	NC
Leopard seal (*Hydrurga leptonyx*)	Pack ice, sub-Antarctic islands	Common	Sub-Antarctic islands to pack ice	220,000 to 440,000[3,10] - Worldwide	NL	NC
Ross seal (*Ommatophoca rossii*)	Pack ice, smooth ice floes, pelagic	Common	Circumpolar - Antarctic	130,000[3] 20,000 to 220,000[14] - Worldwide	NL	NC
Weddell seal (*Leptonychotes weddellii*)	Fast ice, pack ice, sub-Antarctic islands	Common	Circumpolar – Southern Hemisphere	500,000 to 1,000,000[3,11] - Worldwide	NL	NC
Southern elephant seal (*Mirounga leonina*)	Coastal, pelagic, sub-Antarctic waters	Uncommon	Circumpolar - Antarctic Convergence to pack ice	640,000[12] to 650,000[3] - Worldwide 470,000 – South Georgia Island[14]	NL	NC
Antarctic fur seal (*Arctocephalus gazella*)	Shelf, rocky habitats	Rare	Sub-Antarctic islands to pack ice edge	1,600,000[13] to 3,000,000[3] - Worldwide	NL	NC
Subantarctic fur seal (*Arctocephalus tropicalis*)	Shelf, rocky habitats	Rare	Subtropical front to sub-Antarctic islands and Antarctica	Greater than 310,000[3] - Worldwide	NL	NC

NA = Not available or not assessed.
[1] U.S. Endangered Species Act: EN = Endangered, T = Threatened, DL = Delisted, NL = Not listed.
[2] U.S. Marine Mammal Protection Act: D = Depleted, S = Strategic, NC = Not Classified.
[3] Jefferson et al., 2008.
[4] Kenney, 2009.
[5] Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) survey area (Reilly et al., 2004)
[6] Sears and Perrin, 2009.
[7] Ford, 2009.
[8] Olson, 2009.
[9] Bengston, 2009.
[10] Rogers, 2009.
[11] Thomas and Terhune, 2009.
[12] Hindell and Perrin, 2009.
[13] Arnould, 2009.
[14] Academic Press, 2009.

3.2.2 PROTECTED SPECIES (OTHER THAN MARINE MAMMALS)

More information on five species of ESA-listed sea turtles (i.e., leatherback [*Dermochelys coriacea*], green [*Chelonia mydas*], loggerhead [*Caretta caretta*], hawksbill [*Eretmochelys imbricata*], and olive ridley [*Lepidochelys olivacea*]), six seabird families (i.e., albatrosses, petrels/shearwaters, diving petrels, gannets/boobies, gulls, and terns/noddies), and three species of penguin (i.e., Adellie penguin [*Pygoscelis adeliae*], chinstrap [*Pygoscelis antarcticus*], and Emperor penguin [*Aptenodytes forsteri*]), that could occur in the sub-Antarctic area can be found in Section 3 of NSF and ASC's *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* (available at:

http://www.nmfs.noaa.gov/pr/permits/incidental_take_pdfs/nsf_asc_rosssea_2015_draftieeea.pdf), which we incorporate here by reference. The limited available data indicate that sea turtles hear airgun sounds and sometimes exhibit localized avoidance; however, none are expected to occur in the proposed action area where airgun operations activities and icebreaking activities are planned. No effects are anticipated to the seabird species from the airgun array and icebreaking activities during the low-energy seismic survey.

CHAPTER 4 – ENVIRONMENTAL CONSEQUENCES

This chapter of the EA analyzes the impacts of the two alternatives (i.e., whether or not to issue the IHA which includes prescribed means of incidental take, mitigation measures, and monitoring requirements for marine mammals only) and addresses the potential direct, indirect, and cumulative impacts of our issuance of an IHA for Level B harassment take of marine mammals during the seismic survey. NSF and ASC's analyses (i.e., the 2014 *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* [AECOM, 2014] and their 2011 *Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey* [NSF, 2011]) and our *Federal Register* notice requesting comments on the proposed IHA (79 FR 68512, November 17, 2014) facilitate an analysis of the direct, indirect, and cumulative effects of our proposed issuance of an IHA.

The following definitions will be used to characterize the nature of the various impacts evaluated with this EA:

- *Short-term or long-term impacts*. These characteristics are determined on a case-by-case basis and do not refer to any rigid time period. In general, short-term impacts are those that would occur only with respect to a particular activity or for a finite period. Long-term impacts are those that are more likely to be persistent and chronic.
- *Direct or indirect impacts*. A direct impact is caused by a proposed action and occurs contemporaneously at or near the location of the action. An indirect impact is caused by a proposed action and might occur later in time or be farther removed in distance but still be a reasonably foreseeable outcome of the action. For example, a direct impact of erosion on a stream might include sediment-laden waters in the vicinity of the action, whereas an indirect impact of the same erosion might lead to lack of spawning and result in lowered reproduction rates of indigenous fish downstream.
- *Minor, moderate, or major impacts*. These relative terms are used to characterize the magnitude of an impact. Minor impacts are generally those that might be perceptible but, in their context, are not amenable to measurement because of their relatively minor character. Moderate impacts are those that are more perceptible and, typically, more amenable to quantification or measurement. Major impacts are those that, in their context and due to their intensity (severity), have the potential to meet the thresholds for significance set forth in CEQ regulations (40 CFR 1508.27) and, thus, warrant heightened attention and examination for potential means for mitigation to fulfill the requirements of NEPA.
- *Adverse or beneficial impacts*. An adverse impact is one having adverse, unfavorable, or undesirable outcomes on the man-made or natural environment. A beneficial impact is one having positive outcomes on the man-made or natural environment. A single act might result in adverse impacts on one environmental resource and beneficial impacts on another resource.
- *Cumulative impacts*. CEQ regulations implementing NEPA define cumulative impacts as the "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." (40 CFR 1508.7) Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time within a geographic area.

4.1 EFFECTS OF ALTERNATIVE 1 – ISSUANCE OF AN IHA WITH MITIGATION

Alternative 1 is the Preferred Alternative, under which we would issue an IHA to NSF and ASC for the taking, by Level B harassment, of small numbers of marine mammals, incidental to the conduct of a low-energy seismic survey in International Waters in the Ross Sea, January through February 2015. We would incorporate the mitigation and monitoring measures and reporting requirements described in Chapter 2.

NSF and ASC's 2014 *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* (AECOM, 2014), their 2011 *Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey* (NSF, 2011), and our *Federal Register* notice requesting comments on the proposed IHA (79 FR 68512, November 17, 2014) describe the potential effects of airgun sounds, and single-beam echosounder, multi-beam echosounder, ADCP and sub-bottom profiler signals as well as icebreaking activities on marine mammals. We incorporate those descriptions by reference and briefly summarize or supplement the relevant sections in the following subchapters.

4.1.1 IMPACTS TO MARINE MAMMAL HABITAT

Our proposed action would have no additive or incremental effect on the physical environment beyond those resulting from the cruise itself and evaluated in the referenced documents.

The effects of one seismic source vessel would not result in substantial damage to ocean and coastal habitats that might constitute marine mammal habitats. The seismic survey will not result in any permanent impact on habitats used by the marine mammals in the survey area, including the food sources they use (i.e., fish and invertebrates), as this impact is temporary and reversible. The main impact associated with the activity will be temporarily elevated noise levels and the associated direct effects on marine mammals. The issuance of an IHA would not affect physical habitat features, such as substrates and water quality. NMFS included a discussion of the potential effects of this action on marine mammal habitats in the notice of the proposed IHA (79 FR 68512, November 17, 2014), and that discussion is incorporated here by reference.

4.1.2 IMPACTS TO MARINE MAMMALS

The impacts of the low-energy seismic survey on marine mammals are specifically related to acoustic activities. We expect that impacts to marine mammals that could be encountered within the survey area would be limited to temporary behavioral responses (such as brief masking of natural sounds) and temporary changes in animal distribution. We interpret these effects on marine mammals as falling, at most, within the MMPA definition of Level B (behavioral) harassment for those species managed by us. NMFS included a discussion of the potential effects of this action on marine mammals in the notice of the proposed IHA (79 FR 68512, November 17, 2014), and that discussion is incorporated here by reference. This discussion includes the effects of sound from airguns as well as additional sound sources (i.e., single beam echosounder, multi-beam echosounder, ADCP, and sub-bottom profiler) on mysticetes, odontocetes, and pinnipeds, including tolerance, masking, behavioral disturbance, hearing impairment, and other non-auditory physical effects.

Under Alternative 1 – Preferred Alternative, we would authorize the incidental, Level B harassment only, in the form of temporary behavioral disturbance, of 18 species of cetaceans and

pinnipeds and expect no long-term or substantial adverse effects on marine mammals, their habitats, or their role in the environment.

NSF and ASC proposed a number of monitoring and mitigation measures for marine mammals as part of its IHA application. In analyzing the effects of the Preferred Alternative, we conclude that the IHA's requirement of the following monitoring and mitigation measures would minimize and/or avoid impacts to marine mammals:

(1) establishment of exclusion zones to avoid injury to marine mammals and visual monitoring of the exclusion zones by Protected Species Observers (PSOs);
(2) shut-down procedures when PSOs detect marine mammals within or about to enter the exclusion zones while the airgun is operating;
(3) ramp-up procedures; and
(4) speed or course alterations to avoid marine mammals entering the exclusion zone(s).

In NSF and ASC's IHA application, they did not request authorization to take marine mammals by Level A harassment because their environmental analyses indicate that marine mammals would not be exposed to levels of sound likely to result in Level A harassment (we refer the reader to Appendix B of NSF and ASC's NEPA document titled 2011 *Final Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research funded by the National Science Foundation or Conducted by the U.S. Geological Survey* [NSF, 2011]). Consequently, NSF and ASC's request for take by Level A harassment is zero animals for any species.

We do not anticipate that take by injury (Level A harassment), serious injury, or mortalities would occur, nor would we authorize take by injury, serious injury, or mortality, and we expect that harassment takes should be at the lowest level practicable, due to the incorporation of the mitigation measures proposed in NSF and ASC's IHA application.

Survey Timing: We expect the activity to result in limited temporary behavioral responses (such as brief masking of natural sounds) and temporary changes in animal distribution. There are no known biologically important events (e.g., calving, feeding, etc.) in the survey area during this time.

Acoustic Thresholds: We have determined that for acoustic effects, using acoustic thresholds in combination with corresponding buffer and exclusion zones is an effective way to consistently apply measures to avoid or minimize the impacts of an action. NSF and ASC would use the thresholds to establish a mitigation shut-down or exclusion zone for potential acoustic injury and behavioral disturbance (i.e., if an animal is about to enter or enters an area calculated to be ensonified above the level of an established threshold, a sound source is shut-down).

Vessel Strikes: The potential for striking marine mammals is a concern with vessel traffic. The probability of a ship strike resulting in an injury or mortality of an animal has been associated with ship speed; it is highly unlikely that the proposed low-energy seismic survey would result in a serious injury or mortality to any marine mammal as a result of vessel strike, given the *Palmer's* slow survey speed (approximately 9.3 kilometers/hour (km/hr); 5 knots [kts]). NSF and ASC have not requested authorization for take of marine mammals that might occur incidental to vessel ship strike while transiting to and from the survey site. However, the probability of marine mammal interactions occurring during transit to and from the survey area is

unlikely, due to the *Palmer's* slow cruising speed which is approximately 18.7 to 26.9 km/hr (10.1 to 14.5 kts), which is generally below the speed at which studies have noted reported increases of marine mammal injury or death (Laist, Knowlton, Mead, Collet, & Podesta, 2001).

Estimated Take of Marine Mammals by Level B Incidental Harassment: NSF and ASC have requested take by Level B harassment as a result of their proposed low-energy marine seismic survey. Acoustic stimuli (i.e., increased underwater sound) generated during the operation of the seismic airgun array are expected to result in the behavioral disturbance of marine mammals. Take is not expected to result from the use of the single-beam echosounder, multi-beam echosounder, ADCP, and sub-bottom profiler, as the brief exposure of marine mammals to one pulse, or small number of signals, to be generated by these instruments in this particular case is not likely to result in the harassment of marine mammals.

As mentioned previously, we estimate that 18 species of marine mammals under our jurisdiction could be potentially affected by Level B harassment over the course of the proposed IHA. For each species, these take numbers are small relative to the regional or overall population size (all estimates are less than or equal to 16 percent). Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (i.e., 24-hour cycle). Behavioral reactions to noise exposure (such as disruption of critical life functions, displacement, or avoidance of important habitat) are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall et al., 2007). While we anticipate that the seismic operations would occur on consecutive days, the estimated duration of the survey would last no more than 27 operational days. Additionally, the low-energy seismic survey would be increasing sound levels in the marine environment in a relatively small area surrounding the vessel (compared to the range of the animals), which is constantly travelling over distances, so most animals may only be exposed to and harassed by sound for short periods (i.e., less than day).

Table 5 outlines the number of requested Level B harassment takes that are anticipated as a result of these activities and the regional or overall population estimates for the marine mammal species that may be taken by Level B harassment.

Table 5. Estimates of the densities and possible numbers of marine mammal species that might be exposed to sound levels greater than or equal to 120 dB re 1 µPa (rms) (icebreaking) and greater than or equal to 160 dB re 1 µPa (airgun operations) during the proposed low-energy seismic survey in the Ross Sea, during January through February 2015.

Species	Density (# of animals/km^2)[1]	Calculated Take from Seismic Airgun Operations (i.e., Estimated Number of Individuals Exposed to Sound Levels ≥ 160 dB re 1 µPa)[2]	Calculated Take from Icebreaking Operations (i.e., Estimated Number of Individuals Exposed to Sound Levels ≥ 120 dB re 1 µPa)[2]	Total Requested Take Authorization	Abundance[3]	Approximate Percentage of Population Estimate (Requested Take)[4]	Population Trend[5]
Mysticetes							
Southern right whale	NA	0	0	0	8,000 to 15,000	NA	Increasing at 7 to 8% per year
Humpback whale	0.0306570	120	661	937	35,000 to 40,000 – Worldwide 9,484 – Scotia Sea and Antarctica Peninsula	0.03 – Worldwide 9.88 – Scotia Sea and Antarctic Peninsula	Increasing
Antarctic minke whale	0.0845595	329	1,822	2,151	Several 100,000 – Worldwide 18,125 – Scotia Sea and Antarctica Peninsula	11.87 – Scotia Sea and Antarctica Peninsula	Stable
Minke whale (including dwarf minke whale sub-species)	0.08455	329	1,822	2,151	NA	NA	NA
Sei whale	0.0046340	18	100	118	80,000 - Worldwide	0.15	NA
Fin whale	0.0306570	120	661	781	140,000 – Worldwide 4,672 – Scotia Sea and Antarctica Peninsula	0.56 - Worldwide 16.72 – Scotia Sea and Antarctica Peninsula	NA

Blue whale	0.0065132	26	141	167	8,000 to 9,000 – Worldwide 1,700 – Southern Ocean	2.09 – Worldwide 9.82 – Southern Ocean	NA
Odontocetes							
Sperm whale	0.0098821	39	213	252	360,000 – Worldwide 9,500 - Antarctic	0.07 – Worldwide 2.65 - Antarctic	NA
Arnoux's beaked whale	0.0134420	53	290	343	NA	NA	NA
Strap-toothed beaked whale	0.0044919	18	97	115	NA	NA	NA
Southern bottlenose whale	0.0117912	46	254	300	50,000 – South of Antarctic Convergence	0.6	NA
Killer whale	0.0208872	82	450	532	80,000 – South of Antarctic Convergence 25,000 – Southern Ocean	0.67 – South of Antarctic Convergence 2.13 – Southern Ocean	NA
Long-finned pilot whale	0.0399777	156	862	1,018	200,000 – South of Antarctic Convergence	0.51	NA
Hourglass dolphin	0.0189782	74	409	483	144,000 – South of Antarctic Convergence	0.34	NA
Pinnipeds							
Crabeater seal	0.6800000	2,640	14,648	17,288	5,000,000 to 15,000,000 - Worldwide	0.35	Increasing
Leopard seal	0.0266700	104	575	679	220,000 to 440,000 - Worldwide	0.31	NA
Ross seal	0.0166700	65	360	425	130,000 20,000 to 220,000 - Worldwide	2.13	NA
Weddell seal	0.1066700	415	2,298	2,713	500,000 to 1,000,000 - Worldwide	0.54	NA
Southern elephant seal	0.0001300	1	3	4	640,000 to 650,000 – Worldwide; 470,000 – South Georgia Island	<0.01 – Worldwide or South Georgia Island	Increasing, decreasing, or stable depending on breeding population

NA = Not available or not assessed.
[1] Densities based on sightings from IWC SOWER Report 2002, NMSDD, or State of the Ross Sea Region (NZAI, 2001) data.
[2] Calculated take is estimated density (reported density times correction factor) multiplied by the area ensonified to 160 dB (rms) around the planned seismic lines, increased by 25% for contingency.
[3] Calculated take is estimated density (reported density times correction factor) multiplied by the area ensonified to 120 dB (rms) around the planned transit lines where icebreaking activities may occur.
[3] See population estimates for marine mammal species in Table 4 (above).
[4] Total requested authorized takes expressed as percentages of the species or regional populations.
[5] Jefferson et al. (2008).

We do not expect the activity to adversely affect the species or stocks through effects on annual rates of recruitment or survival for any affected species or stock (i.e., negligible impact). The low-energy seismic survey would not take place in areas of significance for marine mammal feeding, resting, breeding, or calving and would not adversely impact marine mammal habitat.

4.2 EFFECTS OF ALTERNATIVE 2– NO ACTION ALTERNATIVE

Under the No Action Alternative, we would not issue an IHA to NSF and ASC for the taking, by Level B harassment, of small numbers of marine mammals, incidental to the conduct of a low-energy seismic survey in International Waters in the Ross Sea, January through February 2015. As a result, NSF and ASC would not receive an exemption from the MMPA. For the purposes of this EA, NMFS assumes under the No Action Alternative that NSF and ASC would conduct the proposed low-energy seismic survey without an exemption from the MMPA for the take of marine mammals. NMFS also assumes that NSF and ASC will conduct the low-energy seismic survey in the absence of the protective monitoring and mitigation measures for marine mammals that would be required by the IHA.

4.2.1 IMPACTS TO MARINE MAMMALS

Under the No Action Alternative, the cruise would likely result in additional impacts to marine mammals, specifically related to acoustic activities, compared to the Proposed Action, due to the absence of mitigation and monitoring measures required under the IHA.

If the survey proceeded without the protective monitoring and mitigation measures and reporting requirements required by a final IHA under the MMPA, the direct, indirect, or cumulative effects on marine mammals of not issuing the IHA would include the following:

- Incidental take of marine mammals would likely occur at levels we have already identified and evaluated in our *Federal Register* notice on the proposed IHA (79 FR 68512, November 17, 2014) (see Table 5 [above] for the estimated number of individuals and takes authorized by marine mammal species), or at higher levels, due to the lack of mitigation measures required in the IHA. The *Federal Register* notice of the proposed IHA (79 FR 68512, November 17, 2014) has a description of the potential effects on marine mammals from the acoustic stimuli, which includes one or more of the following: tolerance, masking of natural sounds, behavioral disturbance, temporary or permanent hearing impairment, or non-auditory physical or physiological effects; and
- Marine mammals that could be encountered within the survey area could experience acoustic injury, and temporary behavioral responses (such as brief masking of natural sounds), and temporary changes in animal distribution more significant than under the Preferred Alternative, because of the lack mitigation measures required in the IHA (include shut-down when marine mammals are within or about to enter the Level A harassment exclusion zone);

- NMFS would not be able to obtain the monitoring and reporting data needed to assess the anticipated impact of the activity upon the species or stock of marine mammals, assess the anticipated impact of the activity on the availability of the species or stocks of marine mammals for subsistence uses and comply with the MMPA's requirement to increase the knowledge of the species.

4.3 COMPLIANCE WITH NECESSARY LAWS – NECESSARY FEDERAL PERMITS

Under section 7 of the ESA, NSF, on behalf of ASC and Louisiana State University, has initiated and engaged in formal consultation with the NMFS, Office of Protected Resources, Endangered Species Act Interagency Cooperation Division, on this proposed low-energy seismic survey. NMFS (Permits and Conservation Division) also formally consulted with NMFS (Endangered Species Act Interagency Cooperation Division) on the issuance of the IHA under section 101(a)(5)(D) of the MMPA for this activity. Consultation concluded prior to determination on the issuance of the IHA.

The formal consultation under section 7 of the ESA concluded with a single Biological Opinion for NSF's Division of Polar Programs and NMFS's Office of Protected Resources, Permits and Conservation Division, which concluded the proposed actions are not likely to jeopardize the continued existence of listed species and included an Incidental Take Statement incorporating the requirements of the IHA as Terms and Conditions. All parties must comply with the relevant terms and conditions of the ITS corresponding to the Biological Opinion issued to NSF, ASC, and us. NSF and ASC must comply with the mitigation and monitoring requirements included in the IHA in order to be exempted from the prohibition on take of listed endangered marine mammal species otherwise imposed by section 9 of the ESA.

4.4 UNAVOIDABLE ADVERSE IMPACTS

NSF and ASC's 2014 *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* (AECOM, 2014), their 2011 *Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey* (NSF, 2011), and our *Federal Register* notice requesting comments on the proposed IHA (79 FR 68512, November 17, 2014) summarize unavoidable adverse impacts to marine mammals or the populations to which they belong or to their habitats occurring in the survey area. We incorporate those documents by reference.

We acknowledge that the incidental take authorized by the IHA would potentially result in unavoidable adverse impacts. However, we do not expect NSF and ASC's activities to have adverse consequences on the viability of marine mammals in the study area and we do not expect the marine mammal populations in that area to experience reductions in reproduction, numbers, or distribution that might appreciably reduce their likelihood of surviving and recovering in the wild. Numbers of individuals of all species taken by harassment are expected to be small (relative to species or stock abundance), and the seismic survey would have a negligible impact on the affected species or stocks of marine mammals.

4.5 CUMULATIVE EFFECTS

Cumulative effects are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions

regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR §1508.7). Cumulative impacts can result from individually minor but collectively significant actions that take place over a period of time (e.g., in the Ross Sea for 27 operational days).

Impacts to marine mammal populations include the following: past, present, and reasonably foreseeable future commercial whaling; altered prey base and habitat quality as a result of global climate change; past, present, and reasonably foreseeable future predation, exposure to biotoxins and the resulting bioburden; past and future research activities in the area; vessel noise and collisions; and commercial fisheries. These activities account for cumulative impacts to regional and worldwide populations of marine mammals, many of whom are a small fraction of their former abundance and are listed as endangered or threatened under the ESA and depleted under the MMPA.

Marine mammal science suggests that acoustic masking from anthropogenic noise can pose a serious threat to marine mammals, particularly low-frequency specialists such as baleen whales. Low-frequency ocean noise has increased in recent decades, often in habitats with seasonally resident populations of marine mammals, raising concerns that noise chronically influences life histories of individuals and populations (Clark et al., 2009). However, quantifying the biological costs for marine mammals within an ecological framework is a critical missing link to our assessment of cumulative noise impacts in the marine environment and assessing cumulative effects on marine mammals (Clark et al., 2009).

Natural background underwater acoustic sources in Antarctic waters include the movement and grinding of ice floes, grounding of icebergs, wind, waves, precipitation, and earthquakes (SCAR, 2004). The proposed low-energy seismic survey would add another, albeit temporary activity to the marine environment in the Ross Sea, though the proposed low-energy seismic survey would be limited to a small area in the Ross Sea and Southern Ocean for a relatively short period of time.

The NSF and ASC's 2014 *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* (AECOM, 2014) summarizes the potential cumulative effects to marine mammals or the populations to which they belong or on their habitats occurring in the survey area. Our analyses, which incorporate their analyses by reference and briefly summarize them here, focus on the activities that are most likely to impact the marine mammals found in the proposed survey area (i.e., research activities, vessel traffic, and commercial fisheries).

4.5.1 Past, Present, and reasonably Foreseeable Future Seismic Surveys in the Ross Sea and Southern Ocean

Other scientific research activities have been conducted and may be conducted in the foreseeable future in this region. NSF Division of Polar Programs has conducted a low-energy seismic survey for the Antarctic region (in the Dumont d'Urville Sea off the coast of East Antarctica) in January to March 2014 and another was conducted in the Antarctic region (in the Scotia Sea and South Atlantic Ocean) in September to October 2014.

At the present time, the action proponents are not aware of other research activities planned to occur in the proposed action area during the January to February 2015 timeframe, but research activities planned by other entities are possible, although unlikely. The proposed study site is remote and difficult to access; therefore, relatively few activities are conducted in it. The Ross Sea and Southern Ocean region has been studied by several National Antarctic Programs and

numerous research cruises have been conducted by New Zealand, Chilean, Argentine, British, and U.S. Antarctic research teams. Within the larger region of the marine environment, commercial fishing and tourism both occur at very low levels, though if these types of vessels are encountered it is unlikely that the proposed research would impact them. National Antarctic Program research cruises also occur in low numbers. Efforts will be made by NSF and ASC to identify such cruises and coordinate with them to reduce potential impacts.

There are no other seismic surveys with an IHA from us scheduled to occur in International Waters in the Ross Sea, January through April 2015. Therefore, we are unaware of any synergistic impacts to marine resources associated with reasonably foreseeable future actions that may be planned or occur within the same region of influence. The impacts of conducting the low-energy seismic survey on marine mammals are specifically related to acoustic activities, and these are expected to be temporary in nature, negligible, and would not result in substantial impacts to marine mammals or to their role in the ecosystem. We do not expect that the issuance of an IHA would have a significant cumulative effect on the human environment, due to the required mitigation and monitoring measures described in Section 2.3.1.

4.5.2 Vessel Traffic, Vessel Noise, and Collisions

Vessel traffic around the proposed study area in the Ross Sea occurs at very low levels. The total transit distance by NSF and ASC's *Palmer* would be minimal relative to total transit length for vessels operating in the proposed survey area during February to April. We expect that the impacts of the *Palmer's* operations combined with the existing shipping operations would produce insignificant overall effects from ship disturbance on marine mammals.

4.5.3 Fishing

NSF and ASC's 2014 *Initial Environmental Evaluation/Environmental Assessment to Perform Marine Geophysical Survey, Collect Bathymetric Measurements, and Conduct Sediment Coring by the RVIB Nathaniel B. Palmer in the Ross Sea* (AECOM, 2014) describes commercial fisheries operations in the general area of the proposed low-energy seismic survey (Chapter 4). The Antarctic krill fishery may operate within the proposed Antarctic study areas. Many Southern Ocean fisheries are regulated by the Commission for the Conservation of Antarctic Marine Living Resources. The primary contributions of fishing to potential cumulative impacts on marine mammals involve, noise, potential entanglement and the direct and indirect removal of prey items. However, fishing operations at most of the proposed survey sites likely would be limited because of distance from shore. There may be some localized avoidance by marine mammals of fishing vessels near the proposed low-energy seismic survey area. NSF and ASC's operations in the proposed survey area are also limited temporally (duration of 27 operational days), and we expect that the combination of the *Palmer*'s operations with the existing commercial fishing operations would produce an insignificant overall disturbance effect on marine mammals. Proposed airgun operations and icebreaking activities should not impede commercial fishing operations, and the *Palmer* would avoid fishing vessels when towing seismic equipment.

4.5.4 Commercial Whaling

Large whale and pinniped population numbers in the proposed action area have been impacted historically by commercial exploitation, mainly in the form of whaling. The development of steam-powered boats in the late 19th century, coupled with the use of the forward-mounted gun-fired harpoon, made it possible to more efficiently kill and tow ashore the larger baleen whale

species such as blue, fin, and minke whales. Roman and Palumbi (2003) have reported that pre-whaling population estimates for fin and humpback whales were far greater than those previously calculated and 6 to 20 times higher than present-day population estimates. Prior to current prohibitions on whaling, such as the International Whaling Commission's (IWC) moratorium, most large whale species had been depleted to the extent that it was necessary to list them as endangered under the ESA. For instance in the southern hemisphere, commercial whalers took at least 68,000 humpback whales prior to the IWC's ban on humpback whaling in the southern hemisphere in 1966 (Bonner, 1982). As humpback whale catches dropped, blue whale catches began to climb, taking thousands of whales annually from 1914 to 1924 and by the late 1920's, tens of thousands of whale annually (Mizroch et al., 1984b). As catches of blue whales declined, whalers took on average over 20,000 fin whales per year from the mid-1940's through the 1960's (Mizroch et al., 1984a,b). Between 1904 and 1975, over 703,000 fin whales were harvested throughout the Antarctic (IWC, 1990). In the southern hemisphere, whalers then switched to harvesting sei whales in the 1950's and 1960's, as catches of other baleen species diminished, taking more than 20,000 sei whales in 1964 (Mizroch et al., 1984a). Commercial whalers did not take large numbers of Antarctic minke whales until the early 1970s, when stocks of blue, fin, sei, and humpback whales had been depleted. We expect that the impacts of the *Palmer*'s operations combined with the commercial whaling operations would produce insignificant overall effects on marine mammals.

4.5.5 Climate Change

The 2007 Intergovernmental Panel on Climate Change concluded that there is very strong evidence for global warming and associated weather changes and that humans have "very likely" contributed to the problem through burning fossil fuels and adding other "greenhouse gases" to the atmosphere (IPCC, 2007a; 2007b). This study involved numerous models to predict changes in temperature, sea level, ice pack dynamics, and other parameters under a variety of future conditions, including different scenarios for how human populations respond to the implications of the study.

Increased ocean temperatures will reduce oxygen, and atmospheric CO_2 will reduce ocean pH and threaten the health of the marine ecosystem. Ocean circulation patterns will change, with less mixing of cold and warm water in tropical and subtropical areas, affecting the ability of near-surface species to reach nutrients at lower depths (NJCAA, 2014). At more northern latitudes, mixing could actually increase with melting of sea ice, but general ocean warming will alter migration and breeding patterns and push species further northward (NJCAA, 2014).

With the large degree of uncertainty on the impact of climate change to marine mammals in the Scotia Sea and South Atlantic Ocean, we recognize that warming of this region could affect the prey base and habitat quality for marine mammals. Nonetheless, we expect that the low-energy seismic survey and the issuance of the IHA to NSF and ASC would not result in any noticeable contributions to climate change and would not lead to any incremental adverse effects on marine mammals, when combined with the effects of climate change. We expect that the impacts of the Palmer's operations combined with climate change would produce insignificant overall effects on marine mammals.

CHAPTER 5 – LIST OF PREPARERS AND AGENCIES CONSULTED

Agencies Consulted:

Marine Mammal Commission
4340 East West Highway, Room 700
Bethesda, MD 20814

Dr. Polly Penhale
Division of Polar Programs
National Science Foundation
4201 Wilson Boulevard, Suite 725
Arlington, VA 22230

Dr. Ted Doerr
Antarctic Support Contract
7400 South Tucson Way
Centennial, CO 80112-3938

Brian Bloodworth
Endangered Species Act Consultation Biologist
Endangered Species Act Interagency Cooperation Division
Office of Protected Resources
NOAA, National Marine Fisheries Service
1315 East-West Hwy, Suite 13758
Silver Spring, MD 20910

Prepared By:

Howard Goldstein
Fisheries Biologist
Permits and Conservation Division
Office of Protected Resources
NOAA, National Marine Fisheries Service
1315 East-West Hwy, Suite 13140
Silver Spring, MD 20910

CHAPTER 6 – REFERENCES

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