PROPOSED ACTION:	Issuance of an Incidental Harassment Authorization to the Scripps Institution of Oceanography to Take Marine Mammals by Harassment Incidental to a Low-Energy Marine Geophysical Survey in the Southwest Pacific Ocean, East of New Zealand, May to July 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 Southwest Pacific Ocean in the Exclusive Economic Zone, outside of territorial water, off the east coast of New Zealand (located between approximately 38.5 to 42.5º South, and between 174 to 180º East)
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 Scripps Institution of Oceanography for the taking, by Level B harassment, of small numbers of marine mammals, incidental to conducting a low-energy marine geophysical survey in the Southwest Pacific Ocean, East of New Zealand, May to June 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
PSO	Protected Species Observer
Revelle	R/V *Roger Revelle*

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 Scripps Institution of Oceanography (SIO), 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 Exclusive Economic Zone (EEZ) of New Zealand in the Southwest Pacific Ocean, May through June 2015. We do not have the authority to permit, authorize, or prohibit SIO's low-energy seismic survey in the Southwest Pacific Ocean, East of New Zealand.

Our proposed action results from SIO's request for an authorization to take marine mammals, by harassment, incidental to conducting a low-energy marine seismic survey in the Southwest Pacific Ocean, East of New Zealand. SIO'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 Scripps Institution of Oceanography to Take Marine Mammals by Harassment Incidental to a Low-Energy Marine Geophysical Survey in the Southwest Pacific Ocean, East of New Zealand, May to June 2015*, focuses primarily on the environmental effects of authorizing the take of marine mammals incidental to SIO's activities.

To evaluate the effects of conducting the low-energy marine geophysical (seismic) survey in the Southwest Pacific Ocean, East of New Zealand during a period between May and June 2015, the NSF and SIO have prepared an *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* (LGL, 2014) (available at: http://www.nmfs.noaa.gov/pr/permits/incidental/research/scripps_2015_scripps_dea.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* (80 FR 15060, March 20, 2015; [NMFS, 2015]) (available at: http://www.gpo.gov/fdsys/pkg/FR-2015-03-20/pdf/2015-06261.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 SIO'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 whether or not to issue 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 SIO 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 SIO'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 of the proposed IHA in the *Federal Register* (80 FR 15060, March 20, 2015) 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' low-energy 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 SIO 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 SIO for the low-energy seismic survey. Because we do not have the authority to permit, authorize, or prohibit the seismic survey activities themselves, SIO 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 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

SIO'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 SIO 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 Southwest Pacific Ocean, East of New Zealand, May to June 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 SIO 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 Exclusive Economic Zone of New Zealand in the Southwest Pacific Ocean, May through June 2015. We do not have the authority to permit, authorize, or prohibit SIO's low-energy seismic survey in the Southwest Pacific Ocean, East of New Zealand.

Our proposed action is triggered by SIO's request for an IHA to take marine mammals incidental to conducting the proposed low-energy marine seismic survey in the Exclusive Economic Zone of New Zealand in the Southwest Pacific Ocean. SIO'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. SIO therefore requires 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 SIO 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 Scripps Institution of Oceanography to Take Marine Mammals by Harassment Incidental to a Low-Energy Marine Geophysical Survey in the Southwest Pacific Ocean, East of New Zealand, May to June 2015*, addresses the potential environmental impacts of two choices available under section 101(a)(5)(D) of the MMPA, namely:

- Issue the IHA to SIO 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 SIO, 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

SIO proposes to use the R/V *Roger Revelle* (*Revelle*), a 83 meter (m) (272.3 feet [ft]) research vessel owned by the U.S. Navy and operated by SIO, to use conventional seismic methodology to perform marine-based studies in the Southwest Pacific Ocean, East of New Zealand. Heat flow and seismic reflection data would be collected offshore the northern and southern Hikurangi margin in New Zealand, to develop a process-based understanding of the thermal structure of the subduction zone. The northern area is underlain by an aseismic creep-dominated subduction interface and is the site of repeated shallow (<15 km depth) slow slip earthquakes. The southern field area contrasts strongly, with deep (>30 km) slow slip earthquakes undip inferred to be associated with interseismic coupling on the plate interface, similar to Cascadia. Acquisition of approximately 15 high-resolution transects would increase the number of available heat flow measurements from this continental margin by 2 orders of magnitude. Using sediment seismic velocities and thermal conductivities obtained from this experiment, heat-flow coverage would be expanded using regional observations of hydrate-related bottom simulating horizons. The project addresses fundamental questions about seismicity and deformation processes on a subduction plate interface, and how they may be linked to hydrologic and geodynamic processes. Students training would cover a range of techniques, from marine data collection and analysis to numerical modeling. Results of the study would be incorporated in university courses as well as included in community science outreach efforts (see Figures 1 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 2014, a NSF-expert panel recommended a collaborative research proposal titled, *The Thermal Regime of the Hikurangi Subduction Zone and Shallow Slow Slip Events, New Zealand* (Award #1355878) for funding and ship time on the *Revelle*. As the federal action agency, NSF has funded SIO and Oregon State University's proposed low-energy seismic survey in the Southwest Pacific Ocean, East of New Zealand, May through June 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 December 15, 2014, we received an application from SIO, 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*)
- Bryde's whale (B. *edeni*)
- Antarctic minke whale (*B. bonaerensis*)
- Minke whale (*B. acutorostrata*)
- Humpback whale (*Megaptera novaeangliae*)
- Pygmy right whale (*Caperea marginata*)
- Southern right whale (*Eubalaena australis*)

Odontocetes
- Andrew's beaked whale (*Mesoplodon bowdoini*)
- Blainville's baked whale (*Mesoplodon densirostris*)
- Bottlenose dolphin (*Tursiop truncatus*)
- Cuvier's beaked whale (*Ziphius cavirostris*)

- Dusky dolphin (*Lagenorhynchus obscurus*)
- False killer whale (*Pseudorca crassidens*)
- Gray's beaked whale (Mesoplodon grayii)
- Hector's beaked whale (*Mesoplodon hectori*)
- Hector's dolphin (*Cephalorhynchus hectori*)
- Hourglass dolphin (*Lagenorhynchus cruciger*)
- Killer whale (*Orcinus orca*)
- Long-finned pilot whale (*Globicephala melas*)
- Maui's dolphin (*Cephalorhynchus hectori maui*)
- Pygmy sperm whale (*Kogia breviceps*)
- Shepherd's beaked whale (*Tasmacetus shepherdi*)
- Short-beaked common dolphin (*Delphinus delphis*)
- Short-finned pilot whale (*Globicephala macrorhynchus*)
- Southern bottlenose whale (*Hyperoodon planifrons*)
- Southern right whale dolphin (*Delphinus delphis*)
- Sperm whale (*Physeter macrocephalus*)
- Spade-toothed beaked whale (*Mesoplodon traversii*)
- Strap-toothed beaked whale (*Mesoplodon layardii*)

Pinnipeds

- New Zealand fur seal (*Arctocephalus forsteri*)
- 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 SIO is to authorize (pursuant to the MMPA) SIO's request to take marine mammals incidental to SIO'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 December 15, 2014, SIO submitted an IHA application demonstrating both the need and potential eligibility for issuance of an IHA in connection with the low-energy 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 SIO's IHA 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. We are thus developing and analyzing alternatives of developing and issuing an IHA for the specified activity in the IHA application. We 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 Exclusive Economic Zone of New Zealand in the Southwest Pacific Ocean 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 SIO's 2014 *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* (LGL, 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 low-energy seismic 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 and draft EA during the corresponding NEPA review process.

On March 20, 2015, we published a notice of the proposed IHA with our preliminary determinations in the *Federal Register* (80 FR 15060). 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 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 Scripps Institution of Oceanography to Take Maine Mammals by Harassment Incidental to a Low-Energy Marine Geophysical Survey in the Southwest Pacific Ocean, East of New Zealand, May to June 2015*, incorporates by reference and relies on SIO's December 2014 IHA application, our notice of the proposed IHA (80 FR 15060, March 20, 2015), and their environmental analyses to avoid duplication of analysis and unnecessary length.

Our notice of the proposed IHA (80 FR 15060, March 20, 2015) 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 SIO to incidentally harass by Level B harassment only, 35 species of marine mammals during the proposed 27-operational-day, low-energy seismic survey. Within the notice of the proposed IHA (80 FR 15060, March 20, 2015), 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 impact of conducting the proposed survey in the Exclusive Economic Zone of New Zealand of the Southwest Pacific Ocean, from May through June 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, both of which would be insignificant.

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

NSF, which funds, and SIO, which operates the project and research vessel that would serve as the operational platform for the seismic survey, directed LGL Limited, Environmental Research Associates to prepare an environmental analysis, titled *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* (LGL, 2014), to meet their requirements under Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*, for NSF and SIO'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 SIO'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 SIO's 2014 *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand,*

May to June 2015, prepared by LGL Limited, Environmental Research Associates (LGL, 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 SIO's 2014 environmental analysis (LGL, 2014) contains a description of NSF and SIO's proposed low-energy seismic survey, proposed monitoring and mitigation measures, (Section II); and a discussion of the affected environment and environmental analysis (Section III and IV) (LGL, 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 Southwest Pacific Ocean, East of New Zealand 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 SIO's analyses conclude that with incorporation of monitoring and mitigation measures proposed by NSF and SIO, 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 SIO 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 SIO'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 are 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 (80 FR 15060, March 20, 2015). 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 (80 FR 15060, March 20, 2015), 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 (80 FR 15060, March 20, 2015) 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.

This process would serve 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 and SIO's analysis on our website at: http://www.nmfs.noaa.gov/pr/permits/incidental/research/scripps_2015_scripps_dea.pdf concurrently with the release of our *Federal Register* notice requesting comments on the proposed IHA (80 FR 15060, March 20, 2015). 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 (80 FR 15060, March 20, 2015), the documents it references, and the public comments provided in response.

1.3.4 RELEVANT COMMENTS ON NSF AND SIO'S ANALYSIS

The NSF did not release their Draft Environmental Analysis to the public, as the document was prepared pursuant to Executive Order 12114 and public comment is not required. As such, they received no public comments. However, NMFS posted NSF and SIO's analysis on our website at http://www.nmfs.noaa.gov/pr/permits/incidental/research/scripps_2015_scripps_dea.pdf concurrently with the release of our *Federal Register* notice requesting comments on the proposed IHA (80 FR 15060, March 20, 2015). We evaluated 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

NAO 216-6 established NOAA procedures for complying with NEPA and the implementing NEPA 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 for our issuance of an IHA, as well as comment on the activities described in SIO's IHA application and in the *Federal Register* notice of the proposed IHA. The CEQ regulations further encourage agencies to integrate the NEPA review process with review under other environmental statutes. Consistent with agency practice, we integrated our NEPA review and preparation of the Draft EA with the public process required by the MMPA for the proposed issuance of an IHA.

The Draft EA and *Federal Register* notice of the proposed IHA, combined with our preliminary determinations, 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.

During the 30-day public comment period in the notice of the proposed IHA (80 FR 15060, March 20, 2015) we received comments from one individual and the Marine Mammal Commission (Commission). Public comments on the notice of the proposed IHA postmarked by March 20, 2015, 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 our authorizing potential take of marine mammals incidental to NSF and SIO's action are summarized here:

On April 1, 2015, we received comments from the Commission on the notice of the proposed IHA (80 FR 15060, March 20, 2015). 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 NMFS 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 SIO 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 SIO, NSF, ASC, L-DEO, USGS, or any other relevant entity.
- The potential to take Arnoux's and pygmy beaked whales and Risso's dolphins exists (ranges that may potentially occur in the Southwest Pacific Ocean and/or are in the stranding record) and recommends that NMFS include those species in the IHA and authorize the associated takes based on group size.
- Consult with SIO and other relevant entities (*e.g.*, NSF, ASC, L-DEO, and USGS) 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 appropriate estimates of g(0) and f(0) values derived from PSO data collected during seismic surveys.

On April 11, 2015, we received comments from Dr. Elisabeth Slooten of Otago University on the notice of the proposed IHA (80 FR 15060, March 20, 2015).

We briefly summarize Dr. Elisabeth Slooten's comments here. Generally she recommended that we:

- Require a dedicated marine mammal survey in New Zealand waters (*i.e.*, no current regional population estimates exist for New Zealand waters) before the low-energy seismic survey to assess the number of marine mammals that could be potentially affected and population-level impact could be assessed.
- In the absence of scientifically robust marine mammal data, SIO and NMFS have used anecdotal information from various sources that are not applicable to New Zealand waters.
- The use of alternative technologies should be further discussed (*e.g.*, commercial viability, purpose, financial cost, environmental impacts, etc.) before the proposed low-energy seismic survey.
- Clarify the probability and effectiveness of using PSOs for detecting marine mammals in the proposed action area, especially when considering the distances which noise from the airgun array propagates.
- Describe the effectiveness and biological meaningful reductions in environmental impact of mitigation measures (*e.g.*, ramp-up, shut-down) and support using scientific evidence.
- Require shut-downs of the airgun array and other sound sources during poor visibility and/or nighttime conditions.
- Require the use of a towed passive acoustic monitoring (PAM) system.

- Consider the potential risk factors of a vessel moving from deep water towards a shallower coastal area, and the ship using a multi-beam echosounder and sub-bottom profiler in addition to airguns, based on the stranding of beaked whales during a NSF-funded seismic survey in 2002.

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 SIO 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 *Revelle*, 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 SIO 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 would conclude with a single Biological Opinion for NSF's Division of Ocean Sciences and NMFS's Office of Protected Resources, Permits and Conservation Division for the low-energy seismic survey and associated IHA in May 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 SIO's 2014 *Environmental Analysis of a Low-Energy Marine Geopohysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* (LGL, 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 SIO'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

[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.

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;
- 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 SIO'S PROPOSED LOW-ENERGY SEISMIC SURVEY

SIO plans to conduct a low-energy seismic survey in the Southwest Pacific Ocean, at three sites off the east coast of New Zealand, from May to June 2015 (see Figures 1). 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; and collecting heat-flow measurements from the seafloor using various methods and equipment. The research would be conducted by Oregon State University. SIO plans to use one source vessel, the *Revelle*, and a seismic airgun array to collect seismic data in the Southwest Pacific Ocean at three sites off the southwest coast of North Island and northeast coast of South Island, New Zealand. The *Revelle* is a research vessel owned by the U.S. Navy and operated by SIO of the University of California San Diego. SIO plans to use conventional low-energy, seismic methodology to perform marine-based studies in the Southwest Pacific Ocean. The studies would involve a low-energy seismic survey, and heat-flow measurements from the seafloor to meet a number of research goals. In addition to the planned operations of the seismic airgun array and hydrophone streamer, SIO intends to operate two additional acoustical data acquisition systems - a multi-beam echosounder and sub-bottom profiler continuously throughout the low-energy seismic survey.

The proposed surveys would allow the development of a process-based understanding of the thermal structure of the Hikurangi subduction zone, and the expansion of this understanding by using regional observations of gas hydrate-related bottom simulating reflections. To achieve the proposed project's goals, the Principal Investigators propose to collect low-energy, high-resolution and multi-channel system profiles, and heat-flow measurements along transects seaward and landward of the Hikurangi deformation front. Heat-flow measurements would be made in well-characterized sites increasing the number of publicly available heat-flow and thermal conductivity measurements from this continental margin by two orders of magnitude. Seismic survey data would be used to produce

sediment structural maps and seismic velocities to achieve the project objectives.

The low-energy seismic survey would be collected in a total of 9 grids of intersecting lines of two sizes (see Figure 1 of the IHA application) at exact locations to be determined in the field. The water depths would be very similar to those at the nominal survey locations shown in Figure 1 of the IHA application. The northern and middle sites off the North Island are the primary study areas, and the southern site off the South Island is a contingency area that would only be surveyed if time permits. SIO's calculations assume that 7 grids at the primary areas and two grids at the southern site would be surveyed. The total trackline distance of the low-energy seismic survey would be approximately 1,250 km, almost all in water depths greater than 1,000 m.

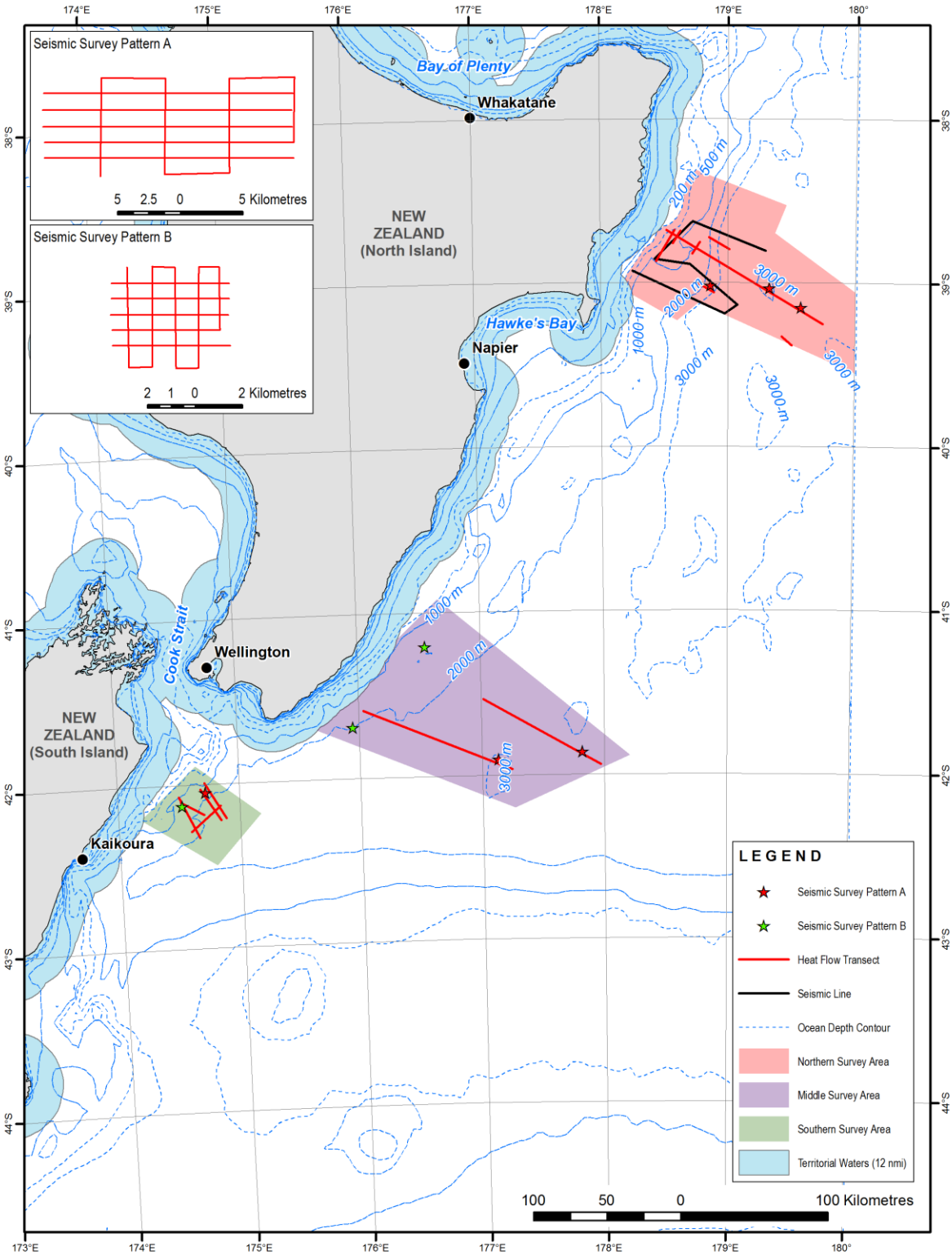

Figure 1. Locations of the proposed low-energy seismic survey and heat-flow probe measurement sites in the Southwest Pacific Ocean, East of New Zealand study area.

2.2.1 SPECIFIED TIME AND SPECIFIED AREA

SIO's proposed project and survey sites are located off the southeast coast of North Island and northeast coast of the South Island, New Zealand in selected regions of the Southwest Pacific Ocean. The proposed survey sites are located between approximately 38.5 to 42.5º South and approximately 174 to 180º East off the east coast of New Zealand, in the EEZ of New Zealand and outside of territorial waters (see Figure 1 of the IHA application). Water depths in the study area are between approximately 200 to 3,000 m (656.2 to 9,842.5 ft). The proposed low-energy seismic survey would be collected in a total of nine grids of intersecting lines of two sizes (see Figure 1 of the IHA application) at exact locations to be determined in the field during May to June 2015. Figure 1 also illustrates the general bathymetry of the proposed study area. The proposed low-energy seismic survey would be within an area of approximately 1,154 km^2 (1,336.5 nmi^2). This estimate is based on the maximum number of kilometers for the low-energy seismic survey (1,250 km) multiplied by the area ensonified around the planned tracklines (0.6 km x 2 in intermediate water depths and 0.4 km x 2 in deep water depths). The ensonified area is based on the predicted rms radii (m) based on modeling and empirical measurements (assuming 100% use of the two 45 in^3 GI airguns in 100 to 1,000 m or greater than 1,000 m water depths), which was calculated to be 600 m (1,968.5 ft) or 400 m (1,312.3 ft).

The *Revelle* is expected to depart from Auckland, New Zealand on approximately May 18, 2015 and arrive at Napier, New Zealand on approximately June 18, 2015. Airgun operations would take approximately 135 hours in total, and the remainder of the time would be spent in transit and collecting heat-flow measurements. Research operations would be over a span of 27 days (from approximately May 18 to June 18, 2015). The total distance the *Revelle* would travel in the region to conduct the proposed research activities (*i.e.*, seismic survey, bathymetry survey, and transit to heat-flow measurement locations) represents approximately 2,000 km (1,079.9 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 May 18, 2015 to July 30, 2015.

2.2.2 SEISMIC ACQUISITION AND ACTIVE ACOUSTIC OPERATIONS

NSF and SIO's analysis titled, *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015*, (LGL, 2014); SIO's IHA application; and our notice of the proposed IHA (80 FR 15060, March 20, 2015) 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 *Revelle*, which would deploy a two Sercel Generator Injector (GI) airgun array (each with a discharge volume of 45 cubic inch [in^3], in one string, with a total volume of 90 in^3) as an energy source at a tow depth of up to 2 m (6.6 ft) below the surface. The airguns in the array would be spaced approximately 8 m (26.2 ft) apart and 21 m (68.9 ft) astern of the vessel. The receiving system would consist of one 600 m (1,968.5 ft) long, 48-channel, hydrophone streamer(s) towed behind the vessel. Data acquisition is planned along a series of predetermined lines, almost all (approximately 95%) 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 would receive the returning acoustic signals and transfer the data to the onboard processing system. The low-energy seismic surveys would be conducted while the heat-flow probe is being recharged. All planned seismic data acquisition activities would be conducted by technicians provided by SIO, 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 Investigators are Dr. R. N. Harris and Dr. A. Trehu of the Oregon State University.

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 a maximum of approximately 360 shots per hour. The airguns would operate continuously for no more than 72 hours based on operational constraints. The cumulative duration of airgun operations will not exceed 135 hours. The relatively short, 48-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 *Revelle* are 224.6 decibels (dB) re 1 μPam (peak) or 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). 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 20 millisecond) pulse sound is emitted; the airguns would be silent during the intervening periods. The dominant frequency components range from 0 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 1,250 km (674.9 nmi) of transect lines (including turns) in the study area in the Southwest Pacific Ocean, East of New Zealand. The *Revelle* 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 SIO's estimated take calculations, 25% has been added for those additional operations.

The *Revelle* would also operate a multi-beam echosounder 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. These sound sources would be operated continuously from the *Revelle* throughout the cruise. The nominal source levels for the multi-beam echosounder and sub-bottom profiler are 242 dB re 1 μPa,.

2.2.3 Bathymetric Survey Description and Deployment

Along with the low-energy airgun operations, two additional geophysical (detailed swath bathymetry) measurements focused on a specific study area within the Southwest Pacific Ocean would be made using hull-mounted sonar system instruments from the *Revelle* for operational

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

and navigational purposes. The ocean floor would be mapped with the Kongsberg EM 122 multi-beam echosounder and a Knudsen Chirp 3260 sub-bottom profiler. 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). In cases where higher resolution bathymetric data is sought, the average speed may be as low as 5 knots (9.3 km/hr). These sound sources would be operated continuously from the *Revelle* throughout the cruise. Operating characteristics for the instruments to be used are described below.

Multi-Beam Echosounder (Kongsberg EM 122) – The hull-mounted multi-beam sonar would be operated continuously during the cruise to map the ocean floor. This instrument operates at a frequency of 19.5 to 13 (usually12) kHz, and his hull-mounted. The transmitting beamwidth is 1 or 2º fore to aft and 150º athwartship (cross-track). The estimated maximum source energy level of 242 dB re 1μPa (rms). Each 'ping' of eight (in water greater than 1,000 m or four (in water less than 1,000 m) successive fan-shaped transmissions, each ensonifying a sector that extends 1º fore to aft. Continuous-wave signals increase from 2 to 15 milliseconds (ms) in water depths up to 2,600 m (8,530 ft), and FM chirp signals up to 100 ms long would be used in water greater than 2,600 m. The successive transmission span an overall cross-track angular extent of about 150º, with 2 ms gaps between the pings for successive sectors.

Sub-Bottom Profiler (Knudsen 3260) - The *Revelle* would operate a Knudsen 3260 sub-bottom profiler continuously throughout the cruise simultaneously to map and provide information about the seafloor sedimentary features and bottom topography that is mapped simultaneously with the multi-beam echosounder. The beam of the sub-bottom profiler is transmitted as a 27º cone, which is directed downward by a 3.5 kHz transducer in the hull of the *Revelle*. The nomical power output is 10 kilowatt (kW), but the actual maximum radiated power is 3 kW or 222 dB (rms). The ping duration is up to 64 ms, and the ping interval is 1 second. A common mode of operation is a broadcast five pulses at 1 second intervals followed by a 5 second pulse. The sub-bottom profiler is capable of reaching depths of 10,000 m (32,808.4 ft).

Acoustic Locator (Pinger) – A pinger would be deployed with certain instruments and equipment (*e.g.*, heat-flow probe) so these devices can be located in the even they become detached from their lines. The pinger used in the heat-flwo measurement activities is the Datasonics model BFP-312HP. A pinger typically operates at a frequency of 32.8 kHz, generates a 5 ms pulse per second (10 pulses over a 10 second period), and has an acoustical output of 210 dB re 1 μPa (rms). The pinger would be used during heat-flow measurement operations only. It will operate continuously during each heat-flow probe deployment. Each heat-flow probe measurement lasts approximately 24 hours.

2.2.4 Heat-Flow Probe Description and Deployment

Heat-flow measurements would be made using a "violin-bow" probe with 11 thermistors that provides real time (analog) telemetry of the thermal gradient and in-situ thermal conductivity. The heat-flow probe to be used on the Revelle consists of a lance 6 centimeter (cm) (2.4 in) in diameter and 3.5 m (11.5 ft) long, a sensor tube housing thermistors and heater wires, and a 560 kg (1,234.6 lb) weight stand. The probe is lowered to the bottom, and a 12 kHz pinger attached to the wire approximately 50 m (164 ft) above the instrument monitors the distance between the probe and bottom. The probe is driven into the sediment by gravity, and temperatures within the sediment are measured with equally spaced thermistors. On completion of a measurement, the instrument is hoisted 100 to 500 m (328.1 to 1,640.4 ft) above the sediment, the ship is

maneuvered to a new position, and the process is repeated. Heat-flow measurements can generally be made at a rate of 1 to 2 hours per measurement, approximately 15 minutes for the actual measurement and 45 to 90 minutes to reposition the ship and probe. Internal power allows 20 to 24 measurements during a single lowering of the tool, with profiles lasting as long as 48 hours. Heat-flow measurements would have a nominal spacing of 0.5 to 1 km (0.3 to 0.5 nmi), which would be decreased in areas of significant basement relief or of large changes in gradient. Heat flow transect locations are shown in Figure 1 of the IHA application, and details of the probe and its deployment are given in Section (f) of the IHA application. In total, approximately 200 heat-flow measurements would be made.

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 May to July 2015) to SIO allowing the incidental take, by Level B harassment, of 35 species of marine mammals during the approximately 27-operational-day, low-energy seismic survey subject to the mandatory mitigation and monitoring measures and reporting requirements set forth in the proposed IHA, if issued.

NSF and SIO's analyses and our *Federal Register* notice requesting comments on the proposed IHA (80 FR 15060, March 20, 2015) 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 SIO'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 SIO's action would have a negligible impact on the affected species or stocks (80 FR 15060, March 20, 2015).

We have not altered the mitigation, monitoring and reporting requirements to be included in the proposed 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 SIO 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, SIO and/or its designees have 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 SIO'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).

SIO 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 (90 in^3), based upon the modeled radii in their IHA application and shown here in Table 2.

Table 2. Predicted and modeled (two 45 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 and deep water during the proposed low-energy seismic survey in the Southwest Pacific Ocean, East of New Zealand, during May through June 2015.

Source and Total Volume	Tow Depth (m)	Water Depth (m)	Predicted RMS Radii Distances[1] (m)		
			160 dB	180 dB	190 dB
Two 45 in^3 GI Airguns (90 in^3)	2	Intermediate (100 to 1,000)	600 (1,968.5 ft)	100 (328.1 ft)	15 (49.2 ft) *100 (328 ft) be used for pinnipeds as described in NSF/USGS PEIS*
Two 45 in^3 GI Airguns (90 in^3)	2	Deep (>1,000)	400 (1,312.3 ft)	100 (328.1 ft)	10 (32.8 ft) *100 would be used for pinnipeds as described in NSF/USGS PEIS*

Based on the NSF/USGS PEIS and Record of Decision, for situations which incidental take of marine mammals is anticipated, SIO has proposed exclusion zones of 100 m for cetaceans and pinnipeds for all low-energy acoustic sources in water depths greater than 100 m.

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. SIO 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: SIO 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. SIO 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: SIO 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, L-DEO, NSF and ASC 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, SIO 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, SIO would place at least two PSOs aboard the *Revelle* 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 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. SIO would use the data to estimate numbers of animals potentially 'taken' by harassment (as defined in the MMPA).

REPORTING MEASURES

SIO 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), SIO shall immediately cease the specified activities and immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources. SIO may not resume activities until we are able to review the circumstances of the prohibited take.

2.3.2 ALTERNATIVE 2 – NO ACTION

We are required to evaluate the No Action Alternative, per CEQ NEPA regulations (C.F.R. § 1502.14). The No Action Alternative serves as a baseline to compare the impacts of the Proposed Action.

Under the No Action Alternative, we would not issue an IHA to SIO for the taking, by Level B harassment, of small numbers of marine mammals, incidental to the conduct of a low-energy seismic survey in the EEZ of New Zealand in the Southwest Pacific Ocean, May through June 2015. For the purposes of this EA, NMFS assumes under the No Action Alternative that SIO would conduct the proposed low-energy seismic survey without an exemption from the MMPA against the take of marine mammals. NMFS also assumes that SIO 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.

Under the No Action alternative, we have also considered that we would not issue an IHA to SIO as well as NSF and SIO would not conduct the low-energy seismic survey in the EEZ of New Zealand in the Southwest Pacific Ocean, May through June 2015. A complete description of NSF and SIO's No Action alternative is in NSF and SIO's 2014 *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* (LGL, 2014). NSF and SIO considered the effects of the low-energy seismic survey not going forward and we incorporate that description by reference.

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 SIO 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 and SIO, in its 2014 *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* (LGL, 2014), considered and rejected an alternative of conducting the project at another time, alternative location, and use of alternative technologies.

The proposed dates for the cruise (May through June 2015) are the most suitable dates that would best meet the applicant's objectives, from a logistical perspective, for SIO, and the *Revelle* and its crew. Because the proposed dates for the cruise (27 operational days in May to June 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. Alternative technologies to the use of airguns were investigated to conduct marine geophysical research, and at the present time, these technologies are still not feasible, commercially viable, or appropriate to meet NSF and SIO's purpose and need.

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 SIO's 2014 *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* (LGL, 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 study area is located in one province of one biome of Longhurst's (2007) pelagic biogeography: the South Subtropical Convergence Province (SSTC) of the Antarctic Westerly Winds Biome. The SSTC, lying between 35 to 45º South, is characterized by a sharp decrease in the westerly winds of the Southern Ocean and strong downwelling. Through one or more of several different mechanisms, biomass of chlorophyll is enhanced in this province. The SSTC must contain a relatively high biomass of small fish and squid, because it supports concentrations of large pelagic fish such as mackerel (*Trachurus picturatus murphyi*) and southern blue fin tuna (*Thunnus maccoyi*), which leaves the SSTC only to enter warmer water to breed.

More information on the physical conditions and marine mammal habitat in the Southwest Pacific Ocean study area can be found in NSF and SIO's *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* (available at: http://www.nmfs.noaa.gov/pr/permits/incidental/research/scripps_2015_scripps_dea.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 35 species of marine mammals under our jurisdiction that may occur in the proposed survey area, including 9 mysticetes (baleen whales), 24 odontocetes (toothed whales, dolphins, and porpoises), and 2 pinnipeds (seals and sea lions), during May through June 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 SIO's *Environmental Analysis of a Low-Energy Marine Geophysical by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* (available at: http://www.nmfs.noaa.gov/pr/permits/incidental/research/scripps_2015_scripps_dea.pdf), which we incorporate here by reference.

We presented this information earlier in Section 1.1.2 in this EA and in Table 3 in the *Federal Register* notice requesting comments on the proposed IHA (80 FR 15060, March 20, 2015), and we incorporate those descriptions by reference here. Table 3 (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 Southwest Pacific Ocean, East of New Zealand.

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 3 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 has a cosmopolitan distribution, but tends to be mostly pelagic, only occurring nearshore to feed and possibly breed (Jefferson *et al.*, 2008). Three subspecies of blue whales are recognized: *B. m. musculus* in the Northern Hemisphere, *B. m. intermedia* (true blue whale) in the Antarctic, and *B. m. brevicauda* (pygmy blue whale) in the sub-Antarctic zone of the southern Indian Ocean and the southwestern Pacific Ocean (Sears and Perrin, 2009). The pygmy and Antarctic blue whale occur in New Zealand (Branch *et al*., 2007). 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 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. Most pygmy blue whales do not migrate south during summer; however, Antarctic blue whales are typically found south of 55º South during summer, although some are known not to migrate (Branch *et al*., 2007).

Blue whales have been sighted throughout New Zealand waters year-round, with most sightings reported for the South Taranaki Bight and the east coast of Northland (Berkenbusch *et al*., 2013; Torres, 2013). Most sightings off the east coast, including at East Cape and Bay of Plenty, occurred during spring and summer (Clement, 2010; Berkenbusch *et al*., 2013). Fall sightings are made in Cook Strait, South Taranaki Bight, and offshore from Banks Peninsula (Berkenbusch *et al*., 2013; Olson *et al*., 2013; Torres, 2013). Sightings have been made near the proposed northern and middle study areas off North Island, as well as near the southern area off South Island during summer (Berkenbusch *et al*., 2013; Torres 2013; Torres *et al*., 2013b). One blue whale was sighted on the Chatham Rise south of the study area during fall (Torres *et al*., 2013b).

Blue whale vocalizations specific to New Zealand waters were detected within 2 km (1.1 nmi) from Great Barrier Island, northern New Zealand, from June to December 1997; Southern Ocean blue whale songs were detected further offshore during May to July (McDonald, 2006). Blue whale vocalizations were also detected within the southern study area off the northeastern South Island during March 2013 (Miller *et al*., 2013).

The South Taranaki Bight, between North and South Island, appears to be a foraging area for blue whales, as upwelling in this area likely concentrates their euphausiid prey (Torres, 2013). There are likely other feeding areas in New Zealand for blue whales (Olson *et al*., 2013). There have been 20 strandings of blue whales on the New Zealand coast (Torres, 2013), including at

least three strandings of pygmy blue whales (Berkenbusch *et al*., 2013). One blue whale stranding was reported for Hawke's Bay, several were reported in the South Taranaki Bight/Book Strait area, and the remainder were spread out along the rest of the coastline (Torres, 2013).

Fin whale – The fin whale occurs in all major oceans; however, its overall range and distribution is not well known (Jefferson *et al*., 2008). 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. In the Southern Hemisphere, fin whales are usually distributed south of 50º South in the austral summer, and they migrate northward to breed in the winter (Gambell, 1985). 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. 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.

Numerous sightings of fin whales have been made in New Zealand waters, mostly during spring and summer, although records exist throughout the year (Baker, 1999; Clement, 2010; Berkenbusch *et al*., 2013). The majority of sightings are for the east coast of North Island in shelf waters, including the Hauraki Gulf, Bay of Plenty, and East Cape (Clement, 2010; Berkenbusch *et al*., 2013), although sightings have also been recorded for the east coast of South Island, Cook Strait, and the west coast of New Zealand (Berkenbusch *et al*., 2013). Some of the sightings have occurred in and near the proposed study areas off North and South Island. Fall sightings have been reported for East Cape and Banks Peninsula, as well as other areas around New Zealand (Berkenbusch *et al*., 2013). Distant fin whale vocalizations were detected off Great Barrier Island, northern New Zealand, during June to September 1997 (McDonald, 2006). At least 13 fin whale stranding have been reported for New Zealand, including stranding in Hawke's Bay, Bay of Plenty, and Cook Strait (Brabyn, 1991).

Sei whale – The sei whale occurs in all ocean basins (Horwood, 2009). It undertakes season migrations to feed in sub-polar latitudes during summer, returning to lower latitudes during winter to calve (Horwood, 2009). In the South Pacific, sei whales typically concentrate between the sub-tropical and Antarctic convergences during the summer (Horwood, 2009). Numerous sightings of sei whales have been made in New Zealand waters (Baker, 1999; Clement, 2010; Berkenbusch *et al*., 2013; Torres *et al*., 2013b). Although most sightings have been made during October to April (Clement, 2010), there are records of this species throughout the year, including May and June (Berkenbusch *et al*., 2013). The majority of sightings are for the east coast of North Island in shelf waters, including the Hauraki Gulf, Bay of Plenty, and East Cape (Clement, 2010; Berkenbusch *et al*., 2013); nonetheless, sightings have also been recorded for the east coast of South Island, Cook Strait, Stewart Island, the west coast of New Zealand, and the Chatham Islands (Berkenbusch *et al*., 2013). Large groups (greater than 100 whales) and single sei whales have been reported for Bay of Plenty and the Hawke's Bay area (Clement, 2010). Some of the sightings have occurred in and near the proposed study areas off North and South Island. Fall sightings have reported for East Cape and eastern Cook Strait, as well as other areas around New Zealand (Berkenbusch *et al*., 2013). In addition, at least eight sightings have been reported for New Zealand, including strandings in the Bay of Plenty and Cook Strait (Brabyn, 1991).

Humpback whale – The humpback whale is found throughout all of the world's oceans (Jefferson *et al*., 2008). Although considered to be mainly a coastal species, humpback whales often traverse oceanic areas while migrating (Jefferson *et al*., 2008). Humpbacks migrate from winter breeding areas in the tropics to temperate or polar feeding areas in the summer (Jefferson *et al*., 2008). In the South Pacific Ocean, there are several distinct winter breeding grounds, including eastern Australia and Oceania (Anderson *et al*., 2010; Garrigue *et al*., 2011). Whales from Oceania migrate past New Zealand to Antarctica summer feeding areas (Constantine *et al*., 2007; Garrigue *et al*., 2000, 2010). The northern migration along the New Zealand coast occurs between May and August, with a peak in late June to mid-July; the southern migration occurs from September to December, with a peak in late Octobver to late November (Dawbin, 1956). Dawbin (1956) suggested that northern migrating humpback whales travel along the east coast of South Island and then move along the east coast of North Island or through Cook Strait and up the west coast of North Island; smaller numbers migrate around southwestern South Island. Most southern migrating whales travel along the west coast of New Zealand, whereas some migrate along the east coast of North Island south to East Cape before moving to offshore waters (Dawbin, 1956). Clement (2010) also noted that humpback whales likely use East Cape to navigate along the east coast of New Zealand during the northern and southern migrations. Large numbers of humpback whales were taken around New Zealand during the commercial whaling era, and the recovery of humpbacks in those waters has been slow (Gibbs and Childerhouse 2000; Constantine *et al*., 2007).

Southern right whale – The southern right whale occurs throughout the Southern Hemisphere between approximately 20 and 60º South (Kenney, 2009). Right whales used to widely distributed throughout the New Zealand waters (Stewart and Todd, 2001), but they were decimated by commercial whaling operations (Carroll *et al*., 2014). Numbers of right whales using the waters near the sub-Antarctic Auckland Islands have been increasing, and these islands appear to be primary wintering/calving areas for this species in New Zealand (Patenaude and Baker, 2001), particularly Port Ross (Carroll *et al*., 2011a). Southern right whales are also known to winter at sub-Antarctic Campbell Island (Steward and Todd, 2001), as well as mainland New Zealand (Patenaude, 2003). Movement of whales between the islands, as well as between the islands and the mainland (*e.g.*, Patenaude *et al*., 2001; Childerhouse *et al*., 2010; Carroll *et al*., 2011b), suggests that right whales in New Zealand comprise a single stock (Carroll *et al*., 2011b). The population size in New Zelaand was estimated at 2,619 individuals (Carroll *et al*., 2013).

Southern right whales calve in nearshore coastal waters during the winter and typically migrate to offshore feeding grounds during summer (Patenaude, 2003). The Chatham Rise area is thought to be an important feeding area for right whales (Torres *et al*., 2013a). Based on a re-analysis of historical and other documents, Richards (2002) suggested that right whales arrived at South Island from sub-Antarctic waters during May and occurred in nearshore waters along the coast of New Zealand to calve. By October, whales had moved northward into offshore waters east of the Kermadec Islands, between 173 and 165º West, and 30 and 37º South, or over the northern half of the Louisville Ridge. During November, there was a marked shift southward and eastward, reaching 50º South around January. Clement (2010) noted that southern right whales likely use East Cape to navigate along the east coast of New Zealand during the northern and southern migrations.

Habitat use modeling for New Zealand by Torres *et al*. (2013c) showed that the proposed study areas have low habitat suitability for the southern right whale; sheltered coastal areas had the highest habitat suitability, at least during winter. Torres *et al*. (2013a,d) reported that southern right whale presence increases in water temperatures 7 to 13º Celsius, with closer proximity to the subtropical front, and a mixed layer depth of less than 100 m.

Sperm whale – Sperm whales have an extensive worldwide distribution which is linked to social structure: mixed groups of adults and females and juveniles of both sexes generally occur in tropical and subtropical waters, whereas adult males are commonly found or in same-sex aggregations, often occurring in higher latitudes outside the breeding season (Best, 1979; Rice, 1989). Females typically inhabit waters greater than 1,000 m deep and latitudes greater than 40º (Rice, 1989). Torres *et al*. (2013a) found that sperm whale distribution is associated with proximity to geomorphologic featurs, as well as surface temperature.

Sperm whales are widely distributed throughout New Zealand waters, occurring in offshore and nearshore regions, with decreasing abundance away from New Zealand towards the centra South Pacific Ocean (Gaskin, 1973). Year-round sightings of sperm whales have been made throughout New Zealand waters, both close to shore and offshore (Berkenbusch *et al*., 2013; Torres *et al*., 2013b). Clement (2010) noted that male and female sper whales likely migrate through the Hawke's Bay area during summer and fall. An aggregation of sperm whales is known to occur off Kaikoura Peninsula, on the northeastern coast of South Island; this area is almost exclusively used by males on a year-round basis (Lettevall *et al*., 2002; Richter *et al*., 2003). Letteval *et al*. (2002) reported that 192 sperm whales used the area off Kaikoura Penensula over the source of 1990 to 2001. Some individuals spend several weeks or months in the area at a time, revisiting the location over several seasons; some other individuals are only seen once and are considered transients (Jaquet *et al*., 2000; Letteval *et al*., 2002). The mean residency times of sperm whales in the area was 42 days, and the mean number of whales in the area at any one time was 13.8 (Lettevall *et al*., 2002). More recently, Sagnol *et al*. (2014) reported a mean of four sperm whales were present in the area at any one time.

Childerhouse *et al*. (1995) noted that 60 to 108 whales may be present off Kaikoura in any season. Whale sin that area are seen closer to shore in the winter than in summer, possible because of changes in the distribution of their prey (Jaquet *et al*., 2000; Richter *et al*., 2003). During summer, almost all sightings are made in waters deep than 1,000 m, whereas during winter, sperm whale distribution is more diffuse, with more whales seen south of Kaikoura, over the Conway Trench and in waters 500 to 1,000 m deep (Jaquet *et al*., 2000; Richter *et al*., 2003).

Sperm whale sightings have been reported throughout the year in and near the proposed northern and middle study areas, as well as the southern study area (Clement, 2010; Berkenbusch *et al*., 2013; Torres *et al*., 2013b). There have been at least 211 strandings reported for New Zealand (Berkenbusch *et al*., 2013), including along the coast of East Cape, and in Hawke's Bay and Cook Strait (Brabyn, 1991). 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.

Table 3. 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 Southwest Pacific Ocean, East of New Zealand. (See text and Table 2 in SIO's IHA application for further details.)

Species	Habitat	Occurrence	Range	Population Estimate	ESA[1]	MMPA[2]
Mysticetes						
Southern right whale (*Eubalaena australis*)	Coastal, shelf, pelagic	Common	Circumpolar 20 to 55º South	8,000[3] to 15,000[4] - Worldwide 12,000[12] – Southern Hemisphere 2,700[12] – Sub-Antarctic New Zealand	EN	D
Pygmy right whale (*Caperea marginata*)	Pelagic and coastal	Rare	Circumpolar 30 to 55º South	NA	NL	NC
Humpback whale (*Megaptera novaeangliae*)	Pelagic, nearshore waters, and banks	Common	Cosmopolitan Migratory	35,000 to 42,000[3,12] – Southern Hemisphere	EN	D
Minke whale (*Balaenoptera acutorostrata* including dwarf sub-species)	Pelagic and coastal	Uncommon	Circumpolar – Southern Hemisphere to 65º South	720,0000 to 750,000[12,14,15] – Southern Hemisphere	NL	NC
Antarctic minke whale (*Balaenoptera bonaerensis*)	Pelagic, ice floes, coastal	Uncommon	7º South to ice edge (usually 20 to 65º South)	720,000 to 750,000[12,14,15] – Southern Hemisphere	NL	NC
Bryde's whale (*Balaenoptera edeni*)	Pelagic and coastal	Rare	Circumglobal - Tropical and Subtropical Zones	At least 30,000 to 40,000[3] - Worldwide 21,000[12] – Northwestern Pacific Ocean 48,109[13]	NL	NC
Sei whale (*Balaenoptera borealis*)	Primarily offshore, pelagic	Uncommon	Migratory, Feeding Concentration 40 to 50º South	80,000[3] – Worldwide 10,000[14] – South of Antarctic Convergence	EN	D
Fin whale (*Balaenoptera physalus*)	Continental slope, pelagic	Uncommon	Cosmopolitan, Migratory	140,000[3] - Worldwide 15,000[14] – South of Antarctic Convergence	EN	D

Blue whale (*Balaenoptera musculus*; including pygmy blue whale [*Balaenoptera musculus brevicauda*])	Pelagic, shelf, coastal	Uncommon	Migratory Pygmy blue whale – North of Antarctic Convergence 55º South	8,000 to 9,000[3] - Worldwide 2,300[12] – True Southern Hemisphere 1,500[14] - Pygmy	EN	D
Odontocetes						
Sperm whale (*Physeter macrocephalus*)	Pelagic, deep sea	Common	Cosmopolitan, Migratory	360,000[3] – Worldwide 30,000[13] – South of Antarctic Convergence	EN	D
Dwarf sperm whale (*Kogia sima*)	Shelf, Pelagic	Vagrant	Circumglobal – Tropical and Temperate Zones	NA	NL	NC
Pygmy sperm whale (*Kogia breviceps*)	Shelf, Pelagic	Uncommon	Circumglobal – Temperate Zones	NA	NL	NC
Arnoux's beaked whale (*Berardius arnuxii*)	Pelagic	Vagrant	Circumpolar in Southern Hemisphere, 24 to 78º South	NA	NL	NC
Cuvier's beaked whale (*Ziphius cavirostris*)	Pelagic	Uncommon	Cosmopolitan	600,000[14,16]	NL	NC
Southern bottlenose whale (*Hyperoodon planifrons*)	Pelagic	Rare	Circumpolar - 30º South to ice edge	500,000[3] – South of Antarctic Convergence 600,000[14,16]	NL	NC
Shepherd's beaked whale (*Tasmacetus shepherdi*)	Pelagic	Rare	Circumpolar – Cold temperate waters Southern Hemisphere	600,000[14,16]	NL	NC
Andrew's beaked whale (*Mesoplodon bowdoini*)	Pelagic	Rare	Circumpolar – temperate waters of Southern Hemisphere, 32 to 55º South	600,000[14,16]	NL	NC
Blainville's beaked whale (*Mesoplodon densirostris*)	Pelagic	Rare	Circumglobal – tropical and temperate waters	600,000[14,16]	NL	NC
Ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*)	Pelagic	Vagrant	Tropical and Temperate waters – Indo-Pacific Ocean	NA	NL	NC
Gray's beaked whale (*Mesoplodon grayi*)	Pelagic	Common	30º South to Antarctic waters	600,000[14,16]	NL	NC

Hector's beaked whale (*Mesoplodon hectori*)	Pelagic	Rare	Circumpolar - cool temperate waters of Southern Hemisphere	600,000[14,16]	NL	NC
Hubb's beaked whale (*Mesoplodon carlhubbsi*)	Pelagic	Vagrant	North Pacific Ocean	NA	NL	NC
Pygmy beaked whale (*Mesoplodon peruvianis*)	Pelagic	Vagrant	28º North to 30º South in Pacific Ocean	NA	NL	NC
Spade-toothed beaked whale (*Mesoplodon traversii*)	Pelagic	Rare	Circumantarctic	600,000[14,16]	NL	NC
Strap-toothed beaked whale (*Mesoplodon layardii*)	Pelagic	Uncommon	30º South to Antarctic Convergence	600,000[14,16]	NL	NC
True's beaked whale (*Mesoplodon mirus*)	Pelagic	Vagrant	Anti-tropical in Northern and Southern Hemisphere	NA	NL	NC
Killer whale (*Orcinus orca*)	Pelagic, shelf, coastal, pack ice	Common	Cosmopolitan	80,000[3] – South of Antarctic Convergence	NL	NC
False killer whale (*Pseudorca crassidens*)	Pelagic, shelf, coastal	Uncommon	Circumglobal – tropical and warmer temperate water	NA	NL	NC
Long-finned pilot whale (*Globicephala melas*)	Pelagic, shelf, coastal	Common	Circumpolar - 19 to 68º South in Southern Hemisphere	200,000[3,5,14] – South of Antarctic Convergence	NL	NC
Short-finned pilot whale (*Globicephala macrocephalus*)	Pelagic, shelf, coastal	Uncommon	Circumglobal – 50º North to 40º South	At least 600,000[3] - Worldwide	NL	NC
Melon-headed whale (*Peponocephala electra*)	Pelagic, shelf, coastal	Vagrant	Circumglocal - 40º North to 35º South	45,000[3] – Eastern Tropical Pacific Ocean	NL	NC
Bottlenose dolphin (*Tursiops truncatus*)	Coastal, shelf, offshore	Common	45º North to 45º South	At least 614,000[3] - Worldwide	NL	NC
Dusky dolphin (*Lagenorhynchus obscurus*)	Shelf, slope	Common	Temperate waters - Southern Hemisphere	12,000 to 20,000[17] – New Zealand	NL	NC
Fraser's dolphin (*Lagenodelphis hosei*)	Pelagic	Vagrant	Pantropical – 30º North to 30º South	289,000[3] – Eastern Tropical Pacific Ocean	NL	NC
Hector's dolphin (*Cephalorhynchus*	Nearshore	Rare	Shallow coastal waters - New	7,400[17] 55[19] – Maui's	NL	NC

hectori; including Maui's dolphin subspecies [*C. h. maui*])			Zealand (Maui's dolpin – west North Island)			
Hourglass dolphin (*Lagenorhynchus cruciger*)	Pelagic, ice edge	Uncommon	33º South to pack ice	144,000[3] to 150,000[14] – South of Antarctic Convergence	NL	NC
Pantropical spotted dolphin (*Stenella attenuata*)	Coastal, shelf, slope	Vagrant	Circumglobal - 40º North to 40º South	At least 2,000,000[3] - Worldwide	NL	NC
Spinner dolphin (*Stenella longirostris*)	Mainly nearshore	Vagrant	Circumglobal - 40º North to 40º South	At least 1,200,000[3] - Worldwide	NL	NC
Striped dolphin (*Stenella coeruleoalba*)	Off continental shelf, convergence zones, upwelling	Vagrant	Circumglobal – 50 to 40 South	At least 1,100,000[3] - Worldwide	NL	NC
Risso's dolphin (*Grampus griseus*)	Slope, Pelagic	Vagrant	Circumglobal – Tropical and Temperate waters	At least 330,000[3] – Worldwide	NL	NC
Rough-toothed dolphin (*Steno bredanensis*)	Pelagic	Vagrant	Circumglobal - 40º North to 35º South	NA	NL	NC
Short-beaked common dolphin (*Delphinus delphis*)	Pelagic	Common	Circumglobal – tropical and warm temperate waters	At least 3,500,000[3] - Worldwide	NL	NC
Southern right whale dolphin (*Lissodelphis peronii*)	Pelagic	Uncommon	12 to 65º South	NA	NL	NC
Spectacled porpoise (*Phocoena dioptrica*)	Coastal, pelagic	Vagrant	Circumpolar – Southern Hemisphere	NA	NL	NC
Pinnipeds						
Crabeater seal (*Lobodon carcinophaga*)	Coastal, pack ice	Vagrant	Circumpolar - Antarctic	5,000,000 to 15,000,000[3,6] - Worldwide	NL	NC
Leopard seal (*Hydrurga leptonyx*)	Pack ice, sub-Antarctic islands	Vagrant	Sub-Antarctic islands to pack ice	220,000 to 440,000[3,7] – Worldwide	NL	NC
Ross seal (*Ommatophoca rossii*)	Pack ice, smooth ice floes, pelagic	Vagrant	Circumpolar - Antarctic	130,000[3] 20,000 to 220,000[11] – Worldwide	NL	NC
Weddell seal (*Leptonychotes*	Fast ice, pack ice,	Vagrant	Circumpolar – Southern	500,000 to 1,000,000[3,8] –	NL	NC

weddellii)	sub-Antarctic islands		Hemisphere	Worldwide		
Southern elephant seal (*Mirounga leonina*)	Coastal, pelagic, sub-Antarctic waters	Uncommon	Circumpolar - Antarctic Convergence to pack ice	640,000[9] to 650,000[3] - Worldwide 470,000 – South Georgia Island[11] 607,000[17]	NL	NC
Antarctic fur seal (*Arctocephalus gazella*)	Shelf, rocky habitats	Vagrant	Sub-Antarctic islands to pack ice edge	1,600,000[10] to 3,000,000[3] - Worldwide	NL	NC
New Zealand fur seal (*Arctocephalus forsteri*)	Rocky habitats, sub-Antarctic islands	Common	North and South Islands, New Zealand Southern and Western Australia	135,000[3] - Worldwide 50,000 to 100,000[18] – New Zealand	NL	NC
Subantarctic fur seal (*Arctocephalus tropicalis*)	Shelf, rocky habitats	Vagrant	Subtropical front to sub-Antarctic islands and Antarctica	Greater than 310,000[3] - Worldwide	NL	NC
New Zealand sea lion (*Phocarctos hookeri*)	Shelf, rocky habitats	Rare	Sub-Antarctic islands south of New Zealand	12,500[3]	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] Olson, 2009.
[6] Bengston, 2009.
[7] Rogers, 2009.
[8] Thomas and Terhune, 2009.
[9] Hindell and Perrin, 2009.
[10] Arnould, 2009.
[11] Academic Press, 2009.
[12] IWC, 2014.
[13] IWC, 1981.
[14] Boyd, 2002.
[15] Dwarf and Antarctic minke whale combined.
[16] All Antarctic beaked whales combined.
[17] New Zealand Department of Conservation.
[18] Suisted and Neale, 2004.
[19] 95% confidence interval (48 to 69 animals) from Hamner *et al.* 2012, 2013.

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*]), two seabird species (*i.e.*, Chatham petrel [*Pterodroma axillaris*] and magenta petrel [*Pterodroma magentae*]), two shorebirds (New Zealand shore plover [*Thinornis novaeseelandiae*] and black stilt [*Himantopus novaezelandiae*]), and five species of penguin (*i.e.*, southern rockhopper penguin [*Eudyptes chrysocome*], yellow-eyed penguin [*Megadyptes antipodes*], white-flippered penguin [*Eudyptula minor albosignata*],

Fjordland crested penguin [*Eudyptes pachyrhynchus*], and erect-crested penguin [*Eudyptes sclateri*]), that could occur in the proposed study area can be found in Section 3 of SIO's *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand* (available at: http://www.nmfs.noaa.gov/pr/permits/incidental/research/scripps_2015_scripps_dea.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 are planned. No effects are anticipated to the seabird species from the airgun array 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 proposed issuance of an IHA for Level B harassment take of marine mammals during the low-energy seismic survey. NSF and SIO's analyses (*i.e.*, the 2014 *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* [LGL, 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 (80 FR 15060, March 20, 2015) facilitate an analysis of the direct, indirect, and cumulative effects of our proposed issuance of an IHA.

In developing this EA, NMFS adhered to the procedural requirements of NEPA; the Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 CFR 1500-1508), and NOAA's procedures for implementing NEPA (*i.e.*, NOAA Administrative Order 216-6, Environmental Review Procedures for Implementing the National Environmental Policy Act).

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 SIO for the taking, by Level B harassment, of small numbers of marine mammals, incidental to the conduct of a low-energy seismic survey in the EEZ of New Zealand in the Southwest Pacific Ocean, May through June 2015. We would incorporate the mitigation and monitoring measures and reporting requirements described earlier in this EA into a final IHA.

NSF and SIO's 2014 *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* (LGL, 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 (80 FR 15060, March 20, 2015) describe the potential effects of airgun sounds, and multi-beam echosounder and sub-bottom profiler signals 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 with the required mitigation and monitoring measures 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 (80 FR 15060, March 20, 2015), 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 (80 FR 15060, March 20, 2015), 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.*, multi-beam echosounder 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 35 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.

SIO 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 SIO'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 SIO'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, SIO'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 SIO'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. SIO 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 *Revelle's* slow survey speed (approximately 9.3 kilometers/hour (km/hr); 5 knots [kts]). SIO has 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 *Revelle'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: SIO 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 multi-beam echosounder 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 35 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 1 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 4 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 4. Estimates of the densities and possible numbers of marine mammal species that might be exposed to sound levels greater than or equal to 160 dB re 1 µPa (airgun operations) during the proposed low-energy seismic survey in the Southwest Pacific Ocean, East of New Zealand, during May through June 2015.

Species	Density U.S. West Coast/Southern Ocean/Estimate Used (# of animals/1,000 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]	Total Proposed Take Authorization[3]	Abundance[4]	Approximate Percentage of Population Estimate (Proposed Take)[5]	Population Trend[6]
Mysticetes						
Southern right whale	0.98/NA/0.98	1.13	2	8,000 to 15,000 - Worldwide 12,000 – Southern Hemisphere 2,700 – Sub-Antarctic New Zealand	0.03 – Worldwide 0.02 – Southern Hemisphere 0.07 – Sub-Antarctic New Zealand	Increasing at 7 to 8% per year
Pygmy right whale	0.39/NA/0.39	0.45	2	NA	NA	NA
Humpback whale	0.98/0.25/0.25	0.29	2	35,000 to 42,000 – Southern Hemisphere	<0.01 – Southern Hemisphere	Increasing
Antarctic minke whale	0.59/NA/0.59	0.68	2	720,000 to 750,000 – Southern Hemisphere	<0.01 – Southern Hemisphere	Stable
Minke whale (including dwarf minke whale sub-species)	0.59/NA/0.59	0.68	2	720,000 to 750,000 – Southern Hemisphere	<0.01 – Southern Hemisphere	NA
Bryde's whale	0.20/NA/0.20	0.23	2	At least 30,000 to 40,000 - Worldwide 21,000 –	<0.01 – Worldwide <0.01 – Northwestern Pacific Ocean	NA

				Northwestern Pacific Ocean 48,109	<0.01	
Sei whale	0.59/0.08/0.08	0.09	2	80,000 – Worldwide 10,000 – South of Antarctic Convergence	<0.01 – Worldwide 0.02 – South of Antarctic Convergence	NA
Fin whale	0.59/0.13/0.13	0.15	2	140,000 – Worldwide 15,000 – South of Antarctic Convergence	<0.01 - Worldwide 0.01 – South of Antarctic Convergence	NA
Blue whale	0.59/0.05/0.05	0.06	2	8,000 to 9,000 – Worldwide 2,300 – True Southern Hemisphere 1,500 - Pygmy	0.03 – Worldwide 0,09 – True Southern Hemisphere 0.13 - Pygmy	NA
Odontocetes						
Sperm whale	1.62/1.16/1.16	1.34	10	360,000 – Worldwide 30,000 – South of Antarctic Convergence	<0.01 – Worldwide 0.03 – South of Antarctic Convergence	NA
Pygmy sperm whale	0.97/NA/0.97	1.12	5	NA	NA	NA
Arnoux's beaked whale	NA/NA/NA	NA	8	NA	NA	NA
Cuvier's beaked whale	0.69/NA/0.69	0.80	2	600,000	<0.01	NA
Shepherd's beaked whale	0.46/NA/0.46	0.53	3	600,000	<0.01	NA
Southern bottlenose whale	0.46/NA/0.46	0.53	2	50,000 – South of Antarctic Convergence 600,000	<0.01 – South of Antarctic Convergence <0.01	NA
Andrew's beaked whale	0.46/NA/0.46	0.53	2	600,000	<0.01	NA
Blainville'	0.23/NA/0.23	0.27	2	600,000	<0.01	NA

s beaked whale						
Gray's beaked whale	0.92/NA0.92	1.06	2	600,000	<0.01	NA
Hector's beaked whale	0.46/NA/0.46	0.53	2	600,000	<0..01	NA
Pygmy beaked whale	NA/NA/NA	NA	3	NA	NA	NA
Spade-toothed beaked whale	0.23/NA/0.23	0.27	2	600,000	<0.01	NA
Strap-toothed beaked whale	0.69/NA/0.69	0.80	3	600,000	<0.01	NA
Killer whale	0.45/5.70/5.70	6.58	12	80,000 – South of Antarctic Convergence	0.02 – South of Antarctic Convergence	NA
False killer whale	0.27/NA0.27	0.31	10	NA	NA	NA
Long-finned pilot whale	0.27/6.41/6.41	7.40	20	200,000 – South of Antarctic Convergence	0.01 – South of Antarctic Convergence	NA
Short-finned pilot whale	0.45/NA/0.45	0.52	20	At least 600,000 - Worldwide	<0.01 - Worldwide	NA
Bottlenose dolphin	81.55/NA/81.55	94.11	95	At least 614,000 - Worldwide	0.02 - Worldwide	NA
Dusky dolphin	81.55/NA/81.55	94.11	95	12,000 to 20,000 – New Zealand	0.79 – New Zealand	NA
Hector's dolphin	32.62/NA/32.62	37.64	38	7,400	0.51	Declining
Hourglass dolphin	48.93/NA/48.93	56.47	57	144,000 to 150,000 – South of Antarctic Convergence	0.04 – South of Antarctic Convergence	NA
Risso's dolphin	NA/NA/NA	NA	10	At least 330,000 – Worldwide	<0.01 – Worldwide	NA
Short-beaked common dolphin	163.10/NA/163.10	188.22	189	At least 3,500,000 - Worldwide	<0.01 - Worldwide	NA

Southern right whale dolphin	48.93/NA/48.93	56.46	57	NA	NA	NA
Pinnipeds						
Southern elephant seal	5.11/NA/5.11	5.90	6	640,000 to 650,000 – Worldwide 470,000 – South Georgia Island 607,000	<0.01 – Worldwide or South Georgia Island	Increasing, decreasing, or stable depending on breeding population
New Zealand fur seal	12.79/NA/12.79	14.76	15	135,000 – Worldwide 50,000 to 100,000 – New Zealand	0.01 – Worldwide 0.03 – New Zealand	Increasing

NA = Not available or not assessed.
[1] Densities based on sightings from NMFS SWFSC, IWC, and Bonnell *et al*. (2012) data.
[2] Calculated take is estimated density multiplied by the area ensonified to 160 dB (rms) around the proposed seismic tracklines, increased by 25% for contingency.
[3] Adjusted to account for average group size.
[4] See population estimates for marine mammal species in Table 3 (above).
[5] Total proposed authorized takes expressed as percentages of the species or regional populations.
[6] Jefferson *et al*. (2008).

We do not expect the activity to impact rates of recruitment or survival for any affected species or stock. 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 SIO for the taking, by Level B harassment, of small numbers of marine mammals, incidental to the conduct of a low-energy seismic survey in the EEZ of New Zealand in the Southwest Pacific Ocean, May through June 2015. As a result, SIO would not receive an exemption from the MMPA. For the purposes of this EA, NMFS assumes under the No Action Alternative that SIO would conduct the proposed low-energy seismic survey without an exemption from the MMPA for the take of marine mammals. NMFS also assumes that SIO would 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 (80 FR 15060, March 20, 2015) (see Table 4 [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 (80 FR 15060, March 20, 2015) 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;
- 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.

4.2.2 Impacts to Marine Mammal Habitat

Under the No Action Alternative, the impacts are the same as those described in the Preferred Alternative.

4.3 Compliance with Necessary Laws – Necessary Federal Permits

Under section 7 of the ESA, NSF, on behalf of SIO, 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) would also formally consult 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 would be 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 Ocean Sciences 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 SIO's 2014 *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* (LGL, 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 (80 FR 15060, March 20, 2015) 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 SIO'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 Southwest Pacific Ocean, East of New Zealand, for 27 operational days).

Impacts to marine mammal populations include the following: past, present, and reasonably foreseeable future research activities in the area; 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; vessel noise and collisions; tourism; and commercial fisheries. These activities account for cumulative impacts to regional and worldwide populations of marine mammals, many of which 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 experts now consider acoustic masking from anthropogenic noise as a major threat to marine mammal populations, 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 New Zealand waters include the wind, waves, precipitation, and earthquakes. The proposed low-energy seismic survey would add another, albeit temporary activity to the marine environment in the Southwest Pacific Ocean, though the proposed low-energy seismic survey would be limited to a small area in the Southwest Pacific Ocean, East of New Zealand, for a relatively short period of time.

The NSF and SIO's 2014 *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* (LGL, 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 and industry activities, vessel traffic, tourism, and commercial fisheries).

4.5.1 Past, Present, and Reasonably Foreseeable Future Research Activities in the Southwest Pacific Ocean

Other scientific research activities have been conducted and may be conducted in the foreseeable future in this region. Barnes *et al*. (2010) noted that numerous multi-channel seismic (MCS) surveys have been conducted over the continental shelf and slope of the Hikurangi Margin off the east coast of North Island. More recent MCS surveys that have been conducted include those by the R/V *Tangaroa* off Hawke's Bay and Mahia Peninsula during 1998 to 2004 (*e.g.*, Paquet et al., 2009), the 2001 *Geco Resolution* seismic survey off Hawke's Bay using a 8,238 in^3 airgun array (*e.g.*, Pecher *et al*., 2004), the 2005 M/V *Multiwave* seismic survey along the upper margin off Hawke's Bay that obtained 2,800 km (1,511.9 nmi) of MCS data using a 3,840 to 4,140 in^3 source airgun array (*e.g*., Barker *et al*., 2009), and 710 km (383.4 nmi) of MCS profiles by the R/V *Sonne* in 2007 along the central part of the margin, using a source airgun array of up to 2,080 in^3 (Barnes *et al*., 2010). In addition, 1,350 km (728 nmi) of MCS surveys were conducted in October 2011 off the northern margin (Barnes *et al*., 2011), and during the austral summer of 2009 to 2010, 2,800 km of MCS data were collected in the Pegasus Basin supplemented by ocean bottom seismograph (OBS) data (Henrys *et al*., 2013). Recent multi-beam bathymetry and sidescan sonar surveys have also taken in place in the area (Mountjoy *et al*., 2009; Greinert *et al*., 2010).

The proposed study area is also the focus of a future Integrated Ocean Drilling Program (IODP) drilling transect that would intersect the source area of slow-slip earthquakes. The IODP project would highlight the physics behind the slow slip event processes and improve our understanding of great subduction thrust earthquakes. The project would consist of seven shallow riserless holes to recover sediments, rocks and pore fluids, to collect geophysical logs, and make downhole measurements. Borehole observatories would also be installed in a subset of these boreholes. An OBS project for the area has also been funded. An OBS array was deployed in the austral summer of 2014, and instruments would be retrieved during March to April 2015. The OBS project is part of an onshore and offshore seismic and geodetic study of shallow slow slip events at the Hikurangi subduction margin. In addition, the Hikurangi Trough has also been identified as a new site for research under the Geodynamic Processes at Rifting and Subducting Margins program (GeoPRISMS 2013), with an objective to address the subduction cycles and deformation and could include seismic surveys.

Other scientific research activities may be conducted in this region in the future; however, no other marine seismic surveys are proposed in the region using the *Revelle* in the foreseeable future. At the present time, the proponents of the seismic surveys are not aware of other similar research activities planned to occur in the proposed study area during the May to June 2015 timeframe, but research activities planned by other entities are possible.

There are no other seismic surveys with an IHA from us scheduled to occur in the EEZ of New Zealand or Southwest Pacific Ocean, May through June 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 INDUSTRY ACTIVITIES

In addition to academic seismic surveys, numerous industry seismic surveys for oil and gas development have taken place in the vicinity. Schlumberger Seaco, Inc. conducted a two-dimensional seismic survey in the East Coast and Pegasus Basins off the east coast of the North Island during April to May 2014; the seismic survey used an array of 6,300 in^3 and collected data along 5,000 line km (2,699.8 nmi) (EOS, 2014). The Anadarko New Zealand Company also conducted a seismic survey in the Pegasus Basin during the austral summer of 2014 (ERM, 2014). Both seismic surveys overlapped the proposed middle study area off North Island, and the Anadarko seismic survey also occurred within the proposed southern study area off northeastern South Island. Additionally, numerous other industry seismic surveys have taken place within the waters of New Zealand, including in the Taranaki, Canterbury, and Great South basins (NZDOC, 2014h). Statoil has recently acquired an exploration permit in the Reinga Basin offshore Northland's west coast and plans to conduct a seismic survey there during the austral summer of 2014 to 2015 (Statoil, 2013). The very small energy source that would be used to produce only a negligible increase in sound introduced to the sea by the industry surveys, all of which used much larger sources. We do not expect that the low-energy seismic surey and the issuance of an IHA to SIO would have a significant cumulative effect on the human environment, due to the required mitigation and monitoring measures described in Section 2.3.1.

4.5.3 VESSEL TRAFFIC, VESSEL NOISE, AND COLLISIONS

Vessel traffic in and around the proposed study areas would primarily or possibly exclusively consist of commercial shipping and commercial fishing vessels. Based on data made available through the Automated Mutual-Assistance Vessel Rescue (AMVER) system managed by the U.S. Coast Guard, up to 14 commercial vessels per month passed near the proposed study areas during 2007 to 2013 (2013 data are available for January to June, the most recent data available as of October 2014) (USCG, 2013). Live vessel traffic information is available from Marine Traffic (2014), including vessel names, types, flags, positions, and destinations. Various types of vessels were in the general vicinity of the proposed study areas when Marine Traffic (2014) was accessed on October 23 and 27, 2014, including cargo vessels (10), tankers (2), tugs (3), barge (1), fishing vessel (1), and an unidentified vessel (1). The only vessels with a flag other than New Zealand were seven of the cargo vessels and the tankers.

There are 16 Customs ports in New Zealand, serving recreational, commercial, and cruise vessels (NZCS, 2011). One Customs port, Eastland Port, is in Gisborne, along the western edge of the northern study area. At least 92% of the region's exports leave via Eastland Port, including logs, squash, processed timber products and kiwifruit; other vessels handled at this port include Royal New Zealand Navy ships, cement carriers, fertilizer ships, fishing vessels, cruise ships and recreational boats (Eastland Group, 2010). Otherwise, the nearest Customs ports are in Napier, Wellington, and Picton (northern South Island, 80 km (43.2 nmi) northwest of the southern study area.

There are no precautionary areas (where ships must navigate with particular caution to reduce the risk of maritime casualty and marine pollution) near the proposed study areas (Maritime NZ, 2007). There are also no major liner shipping routes near the survey areas (Melbourne IT, 2014). The majority of vessels accessing east coast New Zealand ports would have origins or destinations either in New Zealand or nearby countries (*e.g.*, Australia, Japan, Korea, Singapore); therefore, the most travelled routes would be within the 12 nmi limit north or south along the coast (ERM, 2014), inshore of the survey transects.

The total transit distance (approximately 2,000 km [1,079.9]) by the *Revelle* would be minimal relative to total transit length for vessels operating in the proposed study area during May to June. Thus, we expect that the impacts from the *Revelle*'s operations combined with the existing shipping operations is expected to produce insignificant overall effects from ship disturbance on marine mammals.

4.5.4 FISHING

SIO's 2014 *Environmental Analysis of a Low-Energy Marine Geophysical Survey by the R/V Roger Revelle in the Southwest Pacific Ocean, East of New Zealand, May to June 2015* (LGL, 2014) describes commercial fisheries operations in the general area of the proposed survey (Chapter 3). The primary contributions of fishing to potential cumulative impacts on marine mammals involve direct and indirect removal of prey items, noise, potential entanglements (Reeves *et al*., 2003). There may be some localized avoidance by marine mammals of fishing vessels near the proposed low-energy seismic survey area. SIO's operations in the proposed study area are also limited temporally (duration of 27 operational days), consisting mostly of transit, and we expect that the combination of the *Revelle*'s operations with the existing commercial fishing operations would produce an insignificant overall disturbance effect on marine mammals. Proposed airgun operations should not impede commercial fishing operations, and the *Revelle* would avoid fishing vessels when towing seismic equipment.

4.5.5 TOURISM

Various companies offer whale and dolphin watching and/or interaction tours around New Zealand, although none were found to be operating in the proposed study areas. The nearest popular whale-watching area is Kaikoura, approximately 35 km (18.9 nmi) southwest of the southern survey area (Richter *et al*. 2006; Lundquist *et al*., 2012). There, dusky dolphins are the primary focus of dolphin-watching and swim-with-dolphin programs, although sperm whales are also viewed (Lundquist *et al*., 2012). Other popular whale watching/interacting tours are based out of Porpoise Bay (southeastern South Island), Doubtful Sound (southwestern South Island), Akoroa Harbour (eastern South Island), Auckland (northwestern North Island), and Bay of Islands and Hauraki Gulf (northeastern North Island; northwest of the northern survey area) (New Zealand Tourism, n.d.; Orams, 2004; Stockin *et al*., 2008). Dolphin watching tours also occur in the Bay of Plenty (Neumann, 2001). Whale watching vessels typically include catamarans (*e.g.*, Whale Watch 2014) or yachts (*e.g.*, Auckland Tourism, 2014), with some tourism companies also employing the use of fixed-wing aircraft (*e.g.*, Wings Over Whales, 2007) or helicopters (Richter *et al*., 2006; Lundquist *et al*., 2012). Flights are typically 30 to 50 minutes in duration, with an average of two to three trips per day (Richter *et al*., 2006). Boat-based tours are offered year-round and typically last for 2.5 to 3 hours, ranging from 3 up to 16 trips per day during the peak summer season (Richter *et al*., 2006). A permit from the New Zealand Department of Commerce is required to conduct commercial whale watching, specifying the focal species and number of trips undertaken per week (Richter *et al*., 2006).

In Hauraki Gulf, two dolphin tourism boats operate throughout the year (Stockin *et al*., 2008). According to Stockin *et al*. (2008), foraging and resting bouts of common dolphins were significantly disrupted by tourism boats, with both types of behaviors decreasing during boat presence. Similar behavioral changes because of tourism operations have been reported for humpback and sperm whales, and dusky, common, Hector's, and bottlenose dolphins. Other effects observed in New Zealand include variations in vocalizations, increase in dive intervals and aerial behavior, horizontal avoidance, increase in speed, and decrease in resting behavior (Stockin *et al*., 2008). Possible effects that tourism may have on marine mammals have also been reported (*e.g.*, Orams, 2004; Richter *et al*., 2006; Lundquist *et al*., 2012).

SIO's airgun operations are not located in areas used for whale-watching activities and are short in duration (approximately 27 operational days), whereas whale watching is ongoing. The combination of the proposed surveys with the existing tourism operations is expected to produce only a negligible increase in overall disturbance effects on marine mammals.

4.5.6 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 Southwest Pacific 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 SIO 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.

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