PROPOSED ACTION:	Issuance of an Incidental Harassment Authorization to Lamont-Doherty Earth Observatory to Take Marine Mammals by Harassment Incidental to a Marine Geophysical Survey in the Atlantic Ocean Offshore North Carolina, September through October, 2014.
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:	Jeannine Cody National Marine Fisheries Service Office of Protected Resources Permits and Conservation Division 1315 East West Highway Silver Spring, MD 20910 301-427-8401
LOCATION:	The Atlantic Ocean, approximately 17 to 422 kilometers (10 to 262 miles off the coast of Cape Hatteras, North Carolina.
ABSTRACT:	This Environmental Assessment analyzes the environmental impacts of the National Marine Fisheries Service, Office of Protected Resources proposal to issue an Incidental Harassment Authorization to Lamont-Doherty Earth Observatory, for the taking, by Level B harassment, of small numbers of marine mammals, incidental to a marine geophysical survey in the Atlantic Ocean, September - October, 2014.
DATE:	September 2014

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LIST OF ABBREVIATIONS OR ACRONYMS

2-D	two dimensional
ACRC	U.S. Navy's Atlantic City Range Complex
ADCP	acoustic Doppler current profiler
Authorization	Incidental Harassment Authorization
BOEM	Bureau of Ocean Energy and Management
CFR	Code of Federal Regulations
CHSRA	Cape Hatteras Special Research Area
Commission	Marine Mammal Commission
CZMA	Coastal Zone Management Act (16 U.S.C. §§ 1451 *et seq*.)
dB	decibel
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ENAM	East North America Margin
ESA	Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq*.)
EEZ	Exclusive Economic Zone
EZ	exclusion zone
FONSI	Finding of No Significant Impact
FR	*Federal Register*
ft	feet
Hz	hertz
IHA	Incidental Harassment Authorization
ITA	Incidental Take Authorization
ITS	Incidental Take Statement
kHz	kilohertz
km	kilometer
km^2	square kilometer
m	meter
mi	mile
mi^2	square mile
MMPA	Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1631 *et seq*.)
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
µPa	micropascal
NAO	NOAA Administrative Order
NEPA	National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq*.)
NNCE	Northern North Carolina Estuarine stock of bottlenose dolphins
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NSF	National Science Foundation
OMB	Office of Management and Budget
Opinion	Biological Opinion
SNCE	Southern North Carolina Estuarine stock of bottlenose dolphins
UME	Unusual Mortality Event
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey

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. The incidental take of a marine mammal falls under four categories: mortality, serious injury, injury, or harassment. 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. The National Marine Fisheries Service, Office of Protected Resources, Permits and Conservation Division (NMFS, hereinafter, we) may authorize the incidental taking of small numbers of marine mammals by harassment upon the request of a U.S. citizen provided we follow certain statutory and regulatory procedures and make determinations. We discuss this exception in more detail in section 1.2.

Lamont-Doherty Earth Observatory of Columbia University (Lamont-Doherty) has requested an Incidental Harassment Authorization (Authorization) to take marine mammals, by harassment incidental to conducting a marine geophysical (seismic) survey in the Atlantic Ocean off the coast of Cape Hatteras, North Carolina. In response to their request, we propose to issue an Authorization to Lamont-Doherty under Section 101(a)(5)(D) of the MMPA, which would allow them to take small numbers of marine mammals, incidental to the conduct of their activities, September through October, 2014. We do not have the authority to permit, authorize, or prohibit Lamont-Doherty's research seismic activities under Section 101(a)(5)(D) of the MMPA, as that authority lies with the National Science Foundation (Foundation).

Our proposed issuance of an Authorization to Lamont-Doherty is a major federal action 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 our proposed action on the human environment.

This Environmental Assessment (EA) addresses the potential environmental impacts of the following choices available to us under section 101(a)(5)(D) of the MMPA, namely:

- Issue the proposed Authorization to Lamont-Doherty for take, by Level B harassment, of marine mammals during the seismic survey, taking into account the prescribed means of take, mitigation measures, and monitoring requirements;
- Do not issue the proposed Authorization to Lamont-Doherty, in which case, for the purposes of NEPA analysis only, we assume that the proposed activities would proceed and cause incidental take without the mitigation and monitoring measures prescribed in the proposed Authorization[1]; or

[1] The National Science Foundation's EA, *Draft Environmental Assessment of a Marine Geophysical Survey by the R/V Marcus G. Langseth in the Atlantic Ocean off Cape Hatteras, September-October 2014*, states that Lamont-Doherty would not conduct the proposed survey without an Incidental Harassment Authorization.

- Issue the proposed Authorization to Lamont-Doherty for take, by Level B harassment, of marine mammals during the seismic survey by incorporating additional required mitigation measures in addition to Lamont-Doherty's or our proposed mitigation and monitoring measures.

1.1.1 BACKGROUND ON THE LAMONT-DOHERTY'S MMPA APPLICATION

Lamont-Doherty proposes to use the R/V *Marcus G. Langseth* (*Langseth*) to collect and analyze data on the mid-Atlantic coast of the East North America Margin (ENAM). The two-dimensional (2-D) seismic survey would cover a portion of the rifted margin of the eastern U.S. and the results would allow scientists to investigate how the continental crust stretched and separated during the opening of the Atlantic Ocean and understand magnetism's role during the continental breakup. The proposed seismic survey is purely scientific in nature and not related to oil and natural gas exploration on the outer continental shelf of the Atlantic Ocean.

The Foundation, which owns and operates the *Langseth* under a cooperative agreement with Lamont-Doherty, supports basic scientific research in the mathematical, physical, medical, biological, social, and other sciences pursuant to the National Science Foundation Act of 1950, (Public Law 810507, as amended). The Foundation considers proposals submitted by organizations and makes contracts and/or other arrangements (*i.e.*, grants, loans, and other forms of assistance) to support research activities. In 2013, a Foundation-expert panel recommended a research proposal titled, *Collaborative Research: A community seismic experiment targeting the pre-, syn-, and post-rift evolution of the Mid Atlantic US margin*, (Award #1348454) for funding and ship time on the *Langseth*. As the federal action agency for this award, the Foundation has funded the proposed seismic survey in the Atlantic Ocean, September through October, 2014 as a part of the NSF Act of 1950.

Acoustic stimuli generated by the seismic airgun array have the potential to cause behavioral disturbances to marine mammals in the proposed project area. We describe the Foundation-supported seismic survey in more detail in section 2.2.

1.1.2 MARINE MAMMALS IN THE ACTION AREA

There are 33 marine mammal species with confirmed or potential occurrence in the proposed action area (Tables 1a, b, and c). Of the species listed in Tables 1a, b, and c, 31 species would most likely be harassed incidental to conducting the seismic survey. (See Table 6 in section 3.2.1 Affected Environment, Marine Mammals).

Table 1(a) – Mysticetes with possible/confirmed occurrence in the proposed activity area.

Mysticetes		
1	**North Atlantic right whale***	*Eubalaena glacialis*
2	**Humpback whale***	*Megaptera novaeangliae*
3	Minke whale	*Balaenoptera acutorostrata*
4	**Sei whale***	*Balaenoptera borealis*
5	**Fin whale***	*Balaenoptera physalus*
6	**Blue whale***	*Balaenoptera musculus*
7	Bryde's whale	*Balaenoptera edeni*

* Listed as threatened or endangered under the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 *et seq*.).

Table 1(b) – Odontocetes with possible/confirmed occurrence in the proposed activity area.

Odontocetes		
1	**Sperm whale***	*Physeter macrocephalus*
2	Dwarf sperm whale	*Kogia sima*
3	Pygmy sperm whale	*K. breviceps*
4	Blainville's beaked whale	*Mesoplodon densirostris*
5	Cuvier's beaked whale	*Ziphius cavirostris*
6	Gervais' beaked whale	*M. europaeus*
7	True's beaked whale	*M. mirus*
8	Rough-toothed dolphin	*Steno bredanensis*
9	Bottlenose dolphin	*Tursiops truncatus*
10	Pantropical spotted dolphin	*Stenella attenuate*
11	Atlantic spotted dolphin	*S. frontalis*
12	Spinner dolphin	*S. longirostris*
13	Striped dolphin	*S. coeruleoalba*
14	Clymene dolphin	*S. clymene*
15	Short-beaked common dolphin	*Delphinus delphis*
16	Atlantic white-sided-dolphin	*Lagenorhynchus acutus*
17	Fraser's dolphin	*Lagenodelphis hosei*
18	Risso's dolphin	*Grampus griseus*
19	Melon-headed whale	*Peponocephala electra*
20	False killer whale	*Pseudorca crassidens*
21	Pygmy killer whale	*Feresa attenuate*
22	Killer whale	*Orcinus orca*
23	Long-finned pilot whale	*Globicephala melas*
24	Short-finned pilot whale	*G. macrorhynchus*
25	Harbor porpoise	*Phocoena phocoena*

* Listed as threatened or endangered under the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq*.).

Table 1(c) – Pinnipeds with possible/confirmed occurrence in the proposed activity area.

Pinnipeds		
1	Harbor seal	*Phoca vitulina*

1.1.3 Species Not Considered Due to Rarity in the Action Area

We do not consider the following species in this EA because their range does not overlap with the survey area or they are rarely present in the proposed survey area (NSF, 2014; Waring et al., 2014). Therefore, take is unlikely for these species.

Table 2 – Species with rare or uncommon occurrence in the proposed activity area.

Species Not Considered Further in this EA		
1	Beluga whale	*Delphinapterus leucas*
2	Gray seal	*Halichoerus grypus*
3	Hooded seal	*Cystophora cristata*
4	Harp seal	*Pagophilus groenlandicus*
5	West Indian manatee[1]	*Trichechus manatus*

[1] This species is under the jurisdiction of the U.S. Fish and Wildlife Service.

1.2 PURPOSE AND NEED

The MMPA prohibits "takes" of marine mammals with only a few specific exceptions. The applicable exception in this case is an exemption for incidental take of marine mammals in section 101(a)(5)(D) of the MMPA.

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 U.S. 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 authorization to the public for review.

We have issued regulations to implement the Incidental Take Authorization provisions of the MMPA (50 CFR § 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 authorizations. All applicants must comply with the regulations at 50 CFR § 216.104 and submit applications requesting incidental take according to the provisions of the MMPA.

Purpose: The primary purpose of our proposed action is to authorize the take of marine mammals incidental to Lamont-Doherty's proposed seismic survey. The Authorization would exempt Lamont-Doherty from the take prohibitions contained in the MMPA.

To authorize the take of small numbers of marine mammals, we must evaluate the best available information to determine whether the take would have a negligible impact on the affected marine mammal species or stock (*i.e*., the population level) and have an unmitigable impact on the availability of the affected species or stock for certain subsistence uses.

In addition, we must prescribe, where applicable, the permissible methods of taking and other means of effecting the least practicable adverse impact on the marine mammal species or stocks and their habitat (*i.e*., mitigation), paying particular attention to rookeries, mating grounds, and other areas of similar significance. Our duty under this *least practicable adverse impact* standard is to prescribe mitigation reasonably designed to minimize, to the extent practicable, any adverse population level impacts, as well as habitat impacts. While one can minimize population-level impacts only by reducing impacts on individual marine mammals, not all take translates to population-level impacts. Thus, our objective under the *least practicable adverse impact* standard is to design mitigation targeting those impacts on individual marine mammals that would most likely to lead to adverse population-level effects (78 FR at 78113 and 78135, 2013c).

If appropriate, we must also prescribe the means of effecting the least practicable impact on the availability of the species or stocks of marine mammals for subsistence uses. Authorizations 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 or stock.

Need: On February 26, 2014, Lamont-Doherty submitted an adequate and complete application demonstrating both the need and potential eligibility for issuance of an Authorization in connection with the activities described in section 1.1.1. We now have a corresponding duty to determine whether and how we can authorize take by Level B harassment incidental to the activities described in Lamont-Doherty's application. Our responsibilities under section

101(a)(5)(D) of the MMPA and its implementing regulations establish and frame the need for this proposed action.

Any alternatives considered under NEPA must meet the agency's statutory and regulatory requirements. Our described purpose and need guide us in developing reasonable alternatives for consideration, including alternative means of mitigating potential adverse effects.

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 fully or partially funded, regulated, conducted, authorized, or approved by a federal agency. Because our proposed issuance of an Authorization would allow for the taking of marine mammals consistent with provisions under the MMPA, we consider this as a major federal action subject to NEPA.

Under the requirements of NAO 216-6 section 6.03(f)(2)(b) for incidental harassment authorizations, we prepared this EA to determine whether the direct, indirect, and cumulative impacts related to the proposed issuance of an Authorization for incidental take of marine mammals during the conduct of Lamont-Doherty's proposed seismic survey activities could 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 Authorization.

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 alternatives considered in this EA on the relevant requirements in section 101(a)(5)(D) of the MMPA. Thus, our authority under the MMPA bounds the scope of our alternatives. We conclude that this analysis–combined with the analyses in the following documents–fully describes the potential impacts associated with the proposed seismic survey program, including any required mitigation and monitoring measures.

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

- our notice of the proposed Authorization in the *Federal Register* (79 FR 44549, July 31, 2014);
- *Request by Lamont-Doherty Earth Observatory for an Incidental Harassment Authorization to Allow the Incidental Take of Marine Mammals during a Marine Geophysical Survey by the R/V Marcus G. Langseth in the Atlantic Ocean off Cape Hatteras, September–October 2014* (LGL, 2014);
- *Environmental Assessment of a Marine Geophysical Survey by the R/V Marcus G. Langseth in the Atlantic Ocean off Cape Hatteras, September-October 2014* (NSF, 2014);
- *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

- *Record of Decision for Marine Seismic Research Funded by the National Science Foundation. June, 2012* (NSF, 2012).

MMPA Application and Notice of the Proposed IHA

The CEQ regulations (40 CFR § 1502.25) encourage federal agencies to integrate NEPA's environmental review process with other environmental review laws. We rely substantially on the public process for developing proposed Authorizations and evaluating 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 Authorization during the corresponding NEPA review process.

On July 31, 2014, we published a notice of a proposed Authorization in the *Federal Register* (79 FR 44549) which included the following:

- A detailed description of the proposed action and an assessment of the potential impacts on marine mammals and their habitat;
- Plans for Lamont-Doherty's mitigation and monitoring measures to avoid and minimize potential adverse impacts to marine mammals and their habitat and proposed reporting requirements; and
- Our preliminary findings under the MMPA.

We considered Lamont-Doherty's proposed seismic survey and associated mitigation and monitoring measures and preliminarily determined that the proposed seismic survey in the Atlantic Ocean, September through October, 2014, would result, at worst, in a modification in behavior and/or low-level physiological effects (Level B harassment) of certain species of marine mammals. In addition, we determined that the proposed activity would not have an unmitigable adverse impact on the availability of marine mammals for subsistence uses. The notice afforded the public a 30-day comment period on our proposed MMPA Authorization.

1.3.2 Scope of Environmental Analysis

Given the limited scope of the decision for which we are responsible, this EA intends to provide more focused information on the primary issues and impacts of environmental concern related specifically to our proposed issuance of the Authorization. This EA does not further evaluate effects to the elements of the human environment listed in Table 3 because environmental reviews for Lamont-Doherty's seismic survey, incorporated by reference (NSF, 2011, 2012, 2014), have evaluated the effects of their activities on other elements of the human environment.

The Foundation's EA for this activity (NSF, 2014); their *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* (hereafter refered as the PEIS, NSF, 2011); and Record of Decision (NSF, 2012) concluded that the impact of the action:

- would have minor and transitory effects on the marine environment or marine resources;
- would not significantly impact marine invertebrate populations, recreational and commercial fisheries, seabirds, and associated Essential Fish Habitat;
- would not significantly impact archaeological and traditional cultural resources; and
- would not significantly impact recreational dive sites and shipwrecks.

Table 3 – Components of the human environment not affected by our issuance of an Authorization.

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

In addition, previous environmental reviews for similar Authorizations for seismic survey activities in the Atlantic Ocean, incorporated by reference, have shown that our limited action would not affect those components of the human environment listed in Table 3. They include:

- *Environmental Assessment for the Issuance of an Incidental Harassment Authorization to Lamont-Doherty Earth Observatory to Take Marine Mammals by Harassment Incidental to a Marine Geophysical Survey in the Atlantic Ocean, April - June, 2013* (NMFS, 2013a);
- *Environmental Assessment: Issuance of an Incidental Harassment Authorization to Lamont-Doherty Earth Observatory to Take Marine Mammals by Harassment Incidental to a Marine Geophysical Survey in the Northeast Atlantic Ocean, June to July 2013* (NMFS, 2013b); and
- *Environmental Assessment on the Issuance of an Incidental Harassment Authorization to Lamont Doherty Earth Observatory to Take Marine Mammals by Harassment Incidental to a Marine Geophysical Survey in the Northwest Atlantic Ocean, June – August, 2014* (NMFS, 2014b).

In each case, we concluded that the proposed issuance of an Authorization for each seismic survey would not significantly affect the quality of the human environment and issued findings of no significant impact (FONSI).

1.3.3 Integrating NEPA Review with Other Environmental Reviews

NAO 216-6 established agency 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 requested comments on the potential environmental impacts described in Lamont-Doherty's MMPA application and in the *Federal Register* notice of the proposed Authorization (79 FR 44549, July 31, 2014). The CEQ regulations further encourage agencies to integrate the NEPA review process with review under the environmental statutes. Consistent with agency practice, we integrated our NEPA review and preparation of this EA with the public process required by the MMPA for the proposed issuance of an Authorization.

The *Federal Register* notice of the proposed Authorization, 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.

The *Federal Register* notice of the proposed Authorization summarized our proposed action and any potential impacts to marine mammals and their habitat, and included a statement that we would evaluate the Foundation's draft EA (NSF, 2014) and determine whether or not to adopt it or prepare a separate NEPA analysis and incorporate relevant portions of the Foundation's draft EA by reference. We invited interested parties to submit written comments concerning the application and our preliminary analyses and findings including those relevant for consideration in the EA. The public comment period for the notice of the proposed Authorization began on July 31, 2014 and ended on September 2, 2014. The Foundation will finalize their EA at the conclusion of environmental reviews conducted under various statutes, including the MMPA and ESA.

We posted Lamont-Doherty's application on our website concurrently with the release of the *Federal Register* notice of the proposed Authorization. We base this EA on the information included in our *Federal Register* notice, the documents it references, and the public comments provided in response. At the conclusion of this process, we will post the final EA, and, if appropriate, FONSI, on the same website.

1.3.4 RELEVANT COMMENTS ON OUR *FEDERAL REGISTER* NOTICE

During the 30-day public comment period on the notice of the proposed Authorization, we received comment letters from the following individuals or groups (Tables 4a and 4b).

Table 4a – Federal, state, or municipal agencies who submitted comments on our proposed action.

Federal / State / Municipal Agencies	
U.S. Marine Mammal Commission	Town of Nags Head, NC
	Town of Kill Devil Hills, NC

Table 4b – Organizations and individuals who submitted comments on our proposed action.

Organizations and Private Citizens	
William McLellan	Meira Warshauer
Dr. D. Ann Pabst	Linda Ward
Jeff Oden	Bonnie Monteleone
Bonnie Monteleone	Marcus Langseth Science Oversight Committee
Ginger Taylor	Natural Resources Defense Council
Anonymous commenter	Center for Biological Diversity
Allen and Kathy Fitz	

The substantive public comments related to the potential environmental impacts associated with our action of issuing an Authorization for Lamont-Doherty's action include:

- Establishing larger exclusion zones for species of concern;
- Evaluating impacts to North Atlantic Right whales, beaked whales, and other species of concern;

- Ensuring that take remains below estimates by limiting Lamont-Doherty to both the specified tracklines and the specified number of line-kilometers, and requiring Lamont-Doherty to cease operations when they complete the authorized number of tracklines;
- Requiring Lamont-Doherty to use lowest practicable source level for the survey;
- Evaluating the potential impacts on marine species from sound-producing sources other than airguns and requiring Lamont-Doherty to use another type of multi-beam echosounder;
- Considering the use of alternate technologies for seismic airgun testing;
- Extending the post-shutdown monitoring for large and beaked whales from 30 minutes to 60 minutes or greater to minimize impacts;
- Considering time-area restrictions or closure for areas such as the Cape Hatteras Special Research Area (CHSRA);
- Suspending activities at night;
- Enhancing the visual monitoring program with additional technologies (e.g., hydrophone buoys, aerial surveys, shore-based and small-vessel monitoring;
- Coordinating and notifying the regional stranding networks;
- Reconsidering acoustic thresholds;
- Ensuring adequate consideration of cumulative effects; and
- Re-evaluating our preliminary determinations for negligible impact and small numbers.

The Marine Mammal Commission (Commission) provides comments on all proposed incidental take authorizations as part of their established role under the MMPA (§ 202 (a)(2)). The Commission submitted the following recommendations:

- Require Lamont-Doherty to use site-specific sound modeling to verify, refine, and if needed, recalculate exclusion zone distances and take estimates;
- Require Lamont-Doherty to power down the airgun array when concentrations of six or more humpback, sei, fin, blue, and/or sperm whales are within the 160-dB buffer zone.
- Prohibit Lamont-Doherty from operating the multi-beam echosounder, sub-bottom profiler, and acoustic Doppler current profiler during transit;
- Prohibit Lamont-Doherty from engaging in any contingency activities (*e.g.*, repeating tracklines over what we proposed in the notice of proposed Authorization);
- Revise take estimates for harbor seals, spinner dolphins, Fraser's dolphins, melon-headed whales, pygmy killer whales, false killer whales, killer whales, Northern North Carolina Estuarine (NNCE) stock and Southern North Carolina Estuarine (SNCE) stock of bottlenose dolphins, based on presence in the area or average group size; and
- Consult with the Foundation and Lamont-Doherty to develop, validate, and implement a monitoring program that provides a scientifically sound, reasonably accurate assessment of the types of marine mammal takes and the actual numbers of marine mammals taken.

We fully considered all of the public comments, including any pertinent and substantive information, as part of our MMPA and NEPA decision-making process and crafted our proposed final Authorization and this EA accordingly. We have also provided responses to the public comments in the *Federal Register* notice announcing our final decision on the proposed issuance of the Authorization.

Where appropriate, we have modified the proposed Authorization based on public comments. Modifications to the proposed mitigation and/or monitoring measures include:

- Revising the take estimates for harbor seals, spinner dolphins, Fraser's dolphins, melon-headed whales, pygmy killer whales, false killer whales, killer whales, NNCE and SNCE stocks of bottlenose dolphins to account for presence or increases in group size;
- Restricting the operation of the multi-beam echosounder, sub-bottom profiler, and acoustic Doppler current profiler during transit;
- Prohibiting Lamont-Doherty from engaging in any contingency activities;
- Requiring a power down of the airgun array for concentrations of six or more animals are within the 160-dB buffer zone; and
- Extending the post-shutdown monitoring for large and beaked whales from 30 minutes to 60 minutes or greater to minimize impacts.

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. We incorporate those descriptions by reference in this EA and briefly summarize them in this section.

1.4.1 Endangered Species Act

Section 7 of the ESA and implementing regulations at 50 CFR § 402 require consultation with the appropriate federal agency (either NMFS or the U.S. Fish and Wildlife Service) for federal actions that "may affect" a listed species or critical habitat. Our proposed issuance of an Authorization is a federal action subject to the section 7 consultation requirements. Accordingly, we are required to ensure that our action is not likely to jeopardize the continued existence of any threatened or endangered species or result in destruction or adverse modification of critical habitat for such species.

There are six marine mammal species under our jurisdiction listed as endangered under the ESA with confirmed or possible occurrence in the proposed project area: blue, fin, humpback, North Atlantic right, sei, and sperm whales. There is no designated critical habitat for any of the ESA-listed species within the action area; thus, our proposed Authorization would not affect any of these species' critical habitats.

The Foundation requested authorization for the incidental take of three marine mammals listed as endangered under the ESA under our jurisdiction: humpback, fin, and sperm whales. Under section 7 of the ESA, the Foundation, the lead Federal agency which owns and operates the *Langseth*, initiated formal consultation on their action with the National Marine Fisheries Service, Office of Protected Resources, Endangered Species Act Interagency Cooperation Division.

We also initiated formal consultation on our proposed action with the National Marine Fisheries Service, Office of Protected Resources, Endangered Species Act Interagency Cooperation Division. For the proposed Authorization, NMFS reviewed Lamont-Doherty's take estimates for listed species under the ESA presented in Table 3 of their application (LGL, 2014). Based on the best available information, we requested consultation on the issuance of incidental take for additional listed species (i.e., blue, sei, and North Atlantic right whales) in addition to the Foundation's original incidental take request.

The formal consultation under section 7 of the ESA will conclude with a single Biological Opinion for the National Science Foundation's Division of Ocean Sciences and to the National

Marine Fisheries Service's Office of Protected Resources, Permits and Conservation Division for the seismic survey and proposed Authorization under the MMPA.

1.4.2 MARINE MAMMAL PROTECTION ACT

We discuss the MMPA and its provisions that pertain to the proposed action described within section 1.2.

1.4.3 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

Under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA; 16 U.S.C. 1801 *et seq*.), Federal agencies are required to consult with the Secretary of Commerce with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency which may adversely affect essential fish habitat (EFH) identified under the MSFCMA.

Table 4 (pages 38-39) of the Foundation's draft EA (NSF, 2014) identifies marine species with EFH overlapping the proposed survey area. As the federal action agency funding Lamont-Doherty's activities, the Foundation would consult with NMFS' Southeast Regional Office on EFH.

We determined that mitigation and monitoring measures required by the Authorization for the action would not result in adverse effects to EFH. Thus, the proposed issuance of an Authorization for the taking of marine mammals, incidental to Lamont-Doherty's seismic survey would not impact EFH and would not require an EFH consultation.

1.4.4 COASTAL ZONE MANAGEMENT ACT

Congress enacted the Coastal Zone Management Act (CZMA) (16 U.S.C. §§ 1451 *et seq*.) to encourage states to manage land and water uses that may affect coastal uses and resources. Once state coastal management programs and the policies within them receive federal approval from NOAA, federal agency activities that may have reasonably foreseeable effects on coastal uses or resources are required to be consistent with those enforceable policies.

North Carolina has not requested approval from NOAA's Office of Ocean and Coastal Resource Management (OCRM) to review the proposed Authorization as an unlisted activity. As the federal action agency funding Lamont-Doherty's activities, the Foundation would consult with North Carolina. The state of North Carolina evaluated the proposed project for consistency with their coastal management program and submitted their consistency concurrence to the Foundation on September 8, 2014. The determination requests the Foundation to abide by mitigation measures for marine mammals, including; conducting 60 minutes of visible monitoring for marine mammals prior to starting the airguns; using a passive acoustic monitoring system; and having at least two protected species visual observers on watch during daylight hours. The Foundation has agreed to follow, to the maximum extent practicable, that state's mitigation measures.

CHAPTER 2 – ALTERNATIVES

2.1 INTRODUCTION

The NEPA and the implementing CEQ regulations (40 CFR §§ 1500-1508) require consideration of alternatives to proposed major 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 No Action Alternative. This provides a baseline analysis against which we can compare the other alternatives.

To warrant detailed evaluation as a reasonable alternative, an alternative must meet our purpose and need. In this case, and as we previously explained, an alternative meets the purpose and need if it satisfies the requirements under section 101(a)(5)(D) the MMPA. We evaluated each potential alternative against these criteria; identified two action alternatives along with the No Action Alternative; and carried these forward for evaluation in this EA.

Alternatives 1 and 3 include a suite of mitigation measures intended to minimize any potential adverse effects to marine mammals. This chapter describes both alternatives and compares them in terms of their environmental impacts and their achievement of objectives.

2.2 DESCRIPTION OF LAMONT-DOHERTY'S PROPOSED ACTIVITIES

We presented a general overview of Lamont-Doherty's proposed 2-D seismic survey operations in our *Federal Register* notice of the proposed Authorization (79 FR 44549, July 31, 2014). Also, the Lamont-Doherty's application and addendum (LGL, 2014) and the Foundation's draft EA (NSF, 2014), describe the survey protocols. We incorporate those descriptions by reference in this EA and briefly summarize them here.

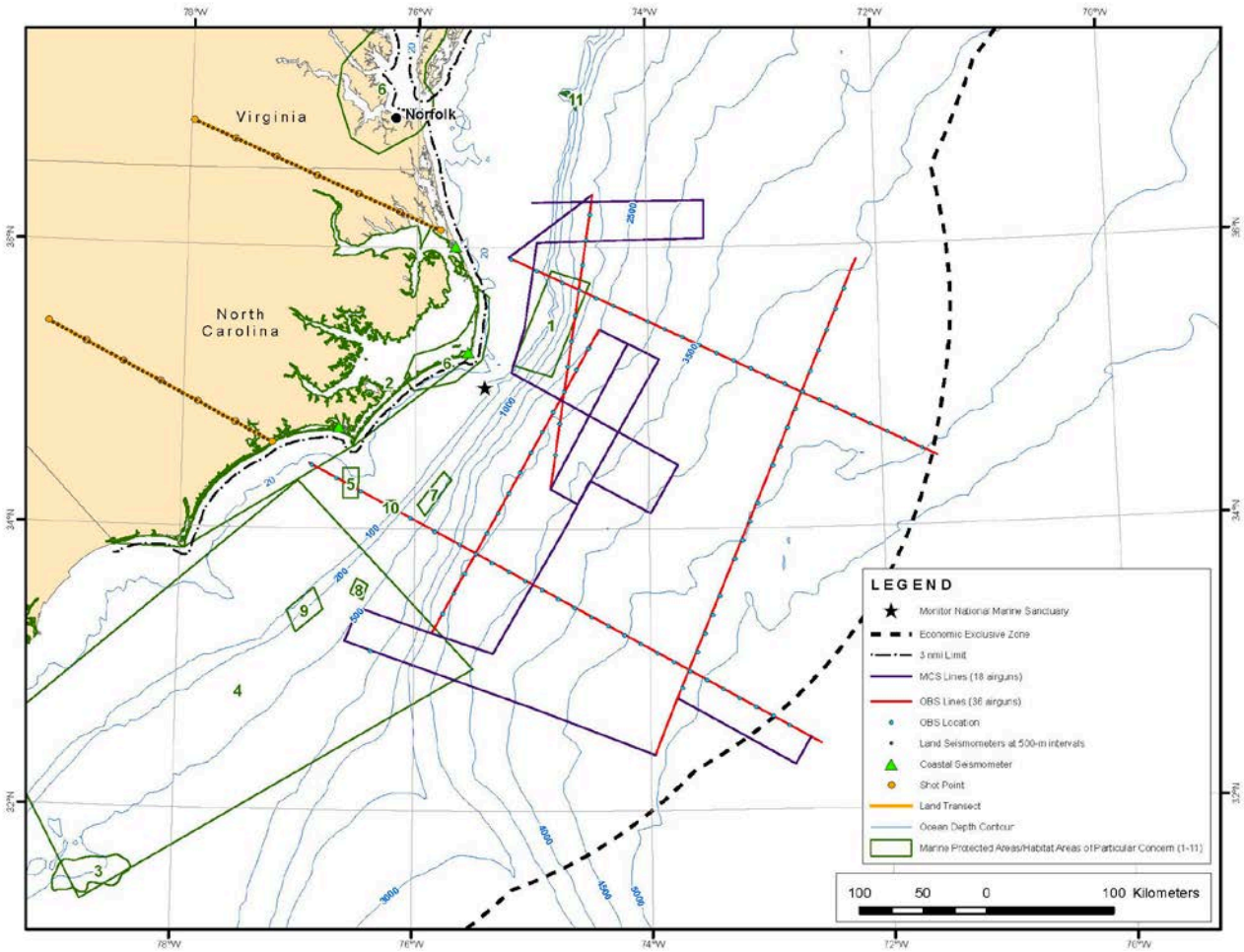
2.2.1 SPECIFIED TIME AND SPECIFIED AREA

Lamont-Doherty proposes to conduct the seismic survey from the period of September 15 through October 31, 2014. The proposed study would include approximately 792 hours of airgun operations (i.e., a 24-hour operation over 33 days). Lamont-Doherty would not conduct the proposed survey after October 31, 2014 to avoid exposing North Atlantic right whales to sound at the beginning of their migration season.

Lamont-Doherty proposes to conduct the seismic survey in the Atlantic Ocean, approximately 17 to 422 kilometers (km) (10 to 262 miles (mi)) off the coast of Cape Hatteras, NC between approximately 32-37° N and approximately 71.5-77° W (Figure 1).

Water depths in the survey area are approximately 20 to 5,300 m (66 feet (ft) to 3.3 mi). They would conduct the proposed survey outside of North Carolina state waters, within the U.S. Exclusive Economic Zone, and partly in international waters.

Figure 1 – Proposed location of the seismic survey in the Atlantic Ocean off the coast of North Carolina during September through October, 2014.



2.2.2 2-D SEISMIC SURVEY OPERATIONS

Source Vessel: The *Langseth* is 71.5 m (235 ft) long vessel with a gross tonnage of 3,834 pounds. The vessel's speed during operations would be approximately 4.5 knots (kt) (8.3 km/hour (hr); 5.1 miles per hour (mph)). It has an observation tower that is 21.5 m (71 ft) above sea level providing protected species observers an unobstructed view around the entire vessel.

Transit: The *Langseth* would depart from Norfolk, VA and transit for approximately one day to the proposed survey area. Setup, deployment, and streamer ballasting would occur over approximately three days and seismic acquisition would take approximately 33 days. At the conclusion of the proposed survey, the *Langseth* would take approximately one day to retrieve gear and would return to Norfolk, VA.

Transects: The proposed survey would cover approximately 5,185 km (3,221 mi) of transect lines (approximately 3,425 km for the multi-channel seismic and approximately 1,760 km for the seismometer acquisition operations) within the survey area. This represents a 1,165 km (723 mi) (reduction in transect lines from Lamont-Doherty's original proposal that totaled 6,350 km (3,946 mi) of transect lines within the survey area.

Seismic Airguns: During the survey, the *Langseth* crew would deploy a four-string array consisting of 36 airguns with a total discharge volume of approximately 6,600 cubic inches (in^3), or a two-string array consisting of 18 airguns with a total discharge volume of 3,300 in^3 as an energy source. The *Langseth* would tow the four-string array at a depth of approximately 9 m (30 ft) and would tow the two-string array at a depth of 6 m (20 ft). The shot interval during seismometer acquisition would be approximately 65 seconds every 150 m (492 ft) and 22 seconds every 50 m (164 ft) during multi-channel acquisition operations. During acquisition, the airguns will emit a brief (approximately 0.1 second) pulse of sound and during the intervening periods of operations, the airguns are silent.

Hydrophones and Ocean Bottom Seismometers: The receiving system would consist of one 8-km (5-mi) hydrophone streamer which would receive the returning acoustic signals and transfer the data to the on-board processing system. In addition to the hydrophone, the study would also use approximately 94 seismometers placed on the seafloor to record the returning acoustic signals from the airgun array internally for later analysis.

Multibeam Echosounder: The *Langseth* will operate a Kongsberg EM 122 multibeam echosounder only during airgun operations to map characteristics of the ocean floor. The hull-mounted echosounder emits brief pulses of sound (also called a ping) (10.5 to 13.0 kilohertz (kHz) in a fan-shaped beam that extends downward and to the sides of the ship. The nominal source level for the multibeam echosounder is 242 dB re: 1 μPa.

Sub-bottom Profiler: The *Langseth* will also operate a Knudsen Chirp 3260 sub-bottom profiler only during airgun operations to provide information about the sedimentary features and bottom topography. The hull-mounted profiler emits a ping with a dominant frequency component at 3.5 kHz. The nominal source level for the profiler is 204 dB re: 1 μPa.

Acoustic Doppler Current Profiler: Lamont-Doherty would measure currents only during airgun operations using a Teledyne OS75 75-kilohertz (kHz) acoustic Doppler current profiler (ADCP). The ADCP's configuration consists of a 4-beam phased array with a beam angle of 30°. The source level is proprietary information but has a maximum acoustic source level of 224 dB re: 1 μPa.

Support Vessels: Lamont-Doherty would use two support vessels for the proposed survey. The first support vessel, the R/V *Endeavor* (*Endeavor*) has a length of 56.4 m (184 ft), a beam of 10.1 m (33 ft), and a maximum draft of 5.6 m (18.3 ft). The *Endeavor* crew would deploy and retrieve the seismometers one-by-one from the stern of the vessel while onboard protected species observers monitor for marine mammals and recommend ceasing deploying or recovering the seismometers to avoid potential entanglement with marine mammals. Lamont-Doherty would use a second vessel to prevent the *Langseth's* streamer entangling with fixed fishing gear. The vessel would be a multi-purpose offshore utility vessel similar to the *Northstar Commander*, which is 28 m (91.9 ft) long with a beam of 8 m (26.2 ft) and a draft of 2.6 m (8.5 ft).

Ballast Water Requirements: The proposed seismic research would not result in discharges of any pollutants or non-indigenous species or into ocean waters. The operation of the Langseth would only result in discharges incidental to normal operations of a surface vessel (NSF, 2011).

2.2.2 APPROACH TO DEVELOPING MITIGATION EXCLUSION ZONES

Lamont-Doherty's application (LGL, 2014) and Appendix A in the Foundation's draft EA (NSF, 2014), describe the approach to establishing mitigation exclusion zones in detail. We incorporate those descriptions by reference in this EA and briefly summarize them here.

In summary, Lamont-Doherty acquired sound propagation measurements for several array configurations at shallow- and deep-water depths during acoustic verification studies conducted in the northern Gulf of Mexico in 2003 (Tolstoy et al., 2004) and in 2007 and 2008 (Tolstoy et al., 2009). Based on the empirical data from those studies, Lamont-Doherty developed a sound propagation modeling approach[2] that conservatively predicts received sound levels as a function of distance from a particular airgun array configuration in deep water (Diebold et al., 2010).

In 2010, Lamont-Doherty assessed the accuracy of their modeling approach by comparing the sound levels of the field measurements in the Gulf of Mexico study to their model predictions (Diebold, et al., 2010). They reported that the observed sound levels from the field measurements fell almost entirely below the predicted mitigation radii curve for deep water (Diebold, et al., 2010). Based on this information, Lamont-Doherty has shown that their model can reliably estimate mitigation radii in deep water. We acknowledge that Lamont-Doherty based their modeling approach on the environmental variability present in the Gulf of Mexico, but the model has limited ability to capture the variability resulting from site-specific factors present in the marine environment offshore North Carolina.

Lamont-Doherty used a similar process to develop mitigation radii (i.e., exclusion and buffer zones) for a shallow-water seismic survey in the northeast Pacific Ocean offshore Washington in 2012. Lamont-Doherty conducted a shallow-water survey using an airgun configuration that was similar or larger to the discharge volumes proposed for this survey in shallow-water survey (i.e., 3,300 or 6,600 in^3) and recorded the received sound levels on the shelf and slope off Washington using the *Langseth's* 8-km hydrophone streamer. Crone et al. (2013) analyzed those received sound levels from the 2012 survey and reported that the actual distances for the exclusion and buffer zones were two to three times smaller than what Lamont-Doherty's modeling approach predicted. While the results confirm bathymetry's role in sound propagation, Crone et al. (2013) confirmed that the empirical measurements from the Gulf of Mexico calibration survey (the same measurements used to inform Lamont-Doherty's modeling approach for this survey in shallow water) overestimated the size of the exclusion and buffer zones for the shallow-water 2012 survey off Washington and were thus precautionary, in that particular case, for effecting the least practicable impact marine mammals.

The comparisons of Lamont-Doherty's model results and the field data collected in the Gulf of Mexico and Washington illustrate a degree of conservativeness built into Lamont-Doherty's model for deep water, which we would expect to offset some of the limited ability of the model to capture the variability resulting from site-specific factors, especially in shallow water. However, in the interest of additional protection, we have required more conservative and

[2] The modeling approach uses ray tracing (*i.e.*, a graphical representation of the effects of refracting sound waves) for the direct wave traveling from the array to the receiver and its associated source ghost (reflection at the air-water interface in the vicinity of the array), in a constant-velocity half-space (infinite homogeneous ocean layer, unbounded by a seafloor).

precautionary mitigation and monitoring measures within this Authorization. Following our consideration of those conservative factors, we have included an additional layer of conservativeness by increasing the 180-dB and 190-dB exclusion zones for the shallow-water portions of this survey by a factor of 50 percent (approximately a 3-dB difference) to be precautionary and to account for sound levels falling well below the estimated radii. Thus, enlarging the exclusion zones within the shallow-water portions of the survey should be able to account for any environmental variability within the study area in addition to the other conservative factors that we have considered in estimating the exclusion zones.

Table 5 in this EA shows the original and revised predicted distances that Lamont-Doherty would use to establish exclusion and buffer zones for mitigation.

Table 5 –Modeled exclusion zones (EZ) for marine mammals in the survey area.

Source and Volume (in^3)	Tow Depth (m)	Water Depth (m)	Predicted RMS Distances[1] (m)				
			190 dB with Buffer	190 dB	180 dB with Buffer	180 dB	160 dB
Single Bolt airgun (40 in^3)	6 or 9	< 100 100-1,000 > 1,000	37[3] - -	27[3] - -	121[3] 100 100	86[3] 100 100	938[3] 582[2] 388[1]
18-Airgun array (3,300 in^3)	6	< 100 100-1,000 > 1,000	436[4] - -	294[4] - -	1,628[4] - -	1,097[4] 675[2] 450[1]	15,280[4] 5,640[2] 3,760[1]
36-Airgun array (6,600 in^3)	9	< 100 100-1,000 > 1,000	877[3] - -	645[3] - -	2,838[3] - -	2,060[3] 1,391[2] 927[1]	22,600[3] 8,670[2] 5,780[1]

[1] Based on Lamont-Doherty modeling results.
[2] Predicted distances based on model results with a 1.5 correction factor between deep and intermediate water depths.
[3] Predicted distances based on empirically-derived measurements in the Gulf of Mexico with scaling factor applied to account for differences in tow depth.
[4] Predicted distances based on empirically-derived measurements in the Gulf of Mexico.

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 propose to issue an Authorization (valid from September through October 2014) to Lamont-Doherty allowing the incidental take, by Level B harassment, of 31 species of marine mammals subject to the mandatory mitigation and monitoring measures and reporting requirements set forth in the proposed Authorization, along with any additions based on consideration of public comments.

MITIGATION MEASURES

As described in Section 1.2, we must prescribe the means of effecting the least practicable adverse impact on the species or stocks of marine mammals and their habitat. In order to do so, we must consider Lamont-Doherty's proposed mitigation measures, as well as other potential measures, and assess how such measures could benefit the 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, we expect the successful implementation of the measure to minimize adverse impacts to marine mammals; (2)

the proven or likely efficacy of the specific measure to minimize adverse impacts as planned; and (3) the practicability of the measure for applicant implementation.

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

- Avoidance or minimization of marine mammal injury, serious injury, or death wherever possible;
- 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 the activity takes individual marine mammals (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.

To reduce the potential for disturbance from acoustic stimuli associated with the activities, Lamont-Doherty has agreed to implement the following monitoring and mitigation measures for marine mammals. These include:

1) Utilize NMFS-qualified, vessel-based Protected Species Observers (PSOs) to visually watch for and monitor marine mammals near the seismic source vessel during daytime operations (from nautical twilight-dawn to nautical twilight-dusk) and before and during start-ups of sound sources day or night. Two PSOs would observe the exclusion and disturbance zones. When practicable, as an additional means of visual observation, the *Langseth's* vessel crew may also assist in detecting marine mammals.

2) Establish a 177 dB re: 1 µPa and 187 dB re: 1 µPa exclusion zone (EZ) for marine mammals for the shallow-water portion of the survey before the full array (either 3,300 or 6,600 in^3) or a single airgun (40 in^3) is in operation (Table 5).

3) Visually observe the entire extent of the EZ (177 dB re: 1 µPa for cetaceans and 187 dB re: 1 µPa for pinnipeds) using NMFS-qualified PSOs, for at least 30 minutes (min) prior to starting the airgun array (day or night).

4) Implement a ramp-up procedure when initiating the seismic operations or any time after the entire array has been shut down for more than 8 minutes, which means start the smallest sound source first and add sound sources in a sequence such that the source level of the array shall increase in steps not exceeding approximately 6 dB per 5-minute period. During ramp-up, the PSOs would monitor the EZ, and if they sight marine mammals, they would implement a power-down or shutdown as though the full array were operational. Therefore, initiation of ramp-up procedures from shutdown requires that the PSOs visually observe the full EZ described in Measures 2 and 3.

5) Power-down or shutdown the sound source(s) if a PSO detects a marine mammal that is within, approaches, or enters the applicable EZ. A shutdown means that the crew shuts down all operating sound sources (i.e., turned off). A power-down means reducing the number of operating sound sources to a single operating 40 in^3 airgun, which reduces the EZ to the degree that the animal(s) is no longer within or about to enter it.

6) Set the shot interval for the single operating 40 in^3 airgun to one shot per minute.

7) Following a power-down, the *Langseth* crew would not resume full airgun activity until the marine mammal has cleared the 177- or 187-dB exclusion zone. The observers would consider the animal to have cleared the exclusion zone if:
   a. the observer has visually observed the animal leave the exclusion zone; or
   b. an observer has not sighted the animal within the exclusion zone for 15 minutes for species with shorter dive durations (*i.e.*, small odontocetes); or 30 minutes has passed for mysticetes and large odontocetes (including pygmy sperm, dwarf sperm, and killer whales); and 60 minutes has passed for sperm and beaked whales which can have longer dive durations..

8) Following a power-down, the *Langseth* crew would resume operating the airguns at full power after for 15 minutes for species with shorter dive durations (*i.e.*, small odontocetes); or 30 minutes has passed for mysticetes and large odontocetes (including pygmy sperm, dwarf sperm, and killer whales); and 60 minutes has passed for sperm and beaked whales which can have longer dive durations..

9) Considering the conservation status of North Atlantic right whales, the *Langseth* crew will be required to shut down the airgun(s) immediately in the unlikely event that observers detect this species, regardless of the distance from the vessel. The *Langseth* would only begin ramp-up if observers have not seen a North Atlantic right whale for 30 minutes.

10) Following a shutdown for more than 8 minutes and subsequent animal departure, survey operations may resume following ramp-up procedures described in Measure 4.

11) The seismic survey may continue into night and low-light hours if such segment(s) of the survey is initiated when the entire applicable EZs can be effectively monitored visually (*i.e.*, PSO(s) must be able to see the extent of the entire applicable EZ).

12) No initiation of survey operations involving the use of sound sources is permitted from a shutdown position at night or during low-light hours (such as in dense fog or heavy rain) unless at least one airgun (40-in^3 or similar) has been operating during the interruption of seismic survey operations. Given these provisions, it is likely that the vessel's crew would not ramp up the airgun array from a complete shutdown at night or in thick fog, because the outer part of the EZ would not be visible during those conditions.

13) Alter speed or course during seismic operations if a marine mammal, based on its position and relative motion, appears likely to enter the relevant EZ. If speed or course alteration is not safe or practicable, or if after implementing an alteration the marine mammal still appears likely to enter the EZ, further mitigation measures, such as a power-down or shutdown, shall be taken.

14) Power down of the airgun array for concentrations of six or more animals are within the 160-dB buffer zone and avoid concentrations of humpback , sei, fin, blue, and/or sperm whales (if possible (i.e., exposing concentrations of animals to 160 dB re: 1 μPa). For purposes of the survey, a concentration or group of whales will consist of six or more individuals visually sighted that do not appear to be traveling (*e.g.*, feeding, socializing, etc.).

15) Restrict the operation of the multi-beam echosounder, sub-bottom profiler, and acoustic Doppler current profiler during transit; and

16) Prohibit Lamont-Doherty from engaging in any contingency activities.

MONITORING MEASURES

Lamont-Doherty proposes to sponsor marine mammal monitoring during the present project, in order to implement the mitigation measures that require real-time monitoring and to satisfy the monitoring requirements of the Authorization. Lamont-Doherty understands that we would review the monitoring plan and may require refinements to the plan.

The Authorization would require Lamont-Doherty to use a passive acoustic monitoring (PAM) system, to the maximum extent practicable, to detect, and allow some localization of marine mammals around the *Langseth* during all airgun operations and during most periods when airguns are not operating. When the PAM operator detects an animal, he/she must notify the PSO immediately of a vocalizing marine mammal so the *Langseth* crew can initiate a power-down or shut-down, if required.

REPORTING MEASURES

Lamont-Doherty would submit a report to us and the Foundation within 90 days after the end of the cruise. The report would describe the operations 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 report must contain and summarize the following information:

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

In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by the Authorization, such as an injury (Level A harassment), serious injury, or mortality (*e.g.*, ship-strike, gear interaction, and/or entanglement), Lamont-Doherty would immediately cease the specified activities and immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, her designees,

and the Southeast Regional Stranding Coordinator. Lamont-Doherty may not resume activities until we are able to review the circumstances of the prohibited take. The report must include the following information:

1) Time, date, and location (latitude/longitude) of the incident;
2) The *Langseth's* speed during and leading up to the incident;
3) Description of the incident;
4) Status of all sound source use in the 24 hours preceding the incident;
5) Water depth;
6) Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility);
7) A description of marine mammal observations in the 24 hours preceding the incident;
8) Species identification or description of the animal(s) involved;
9) The fate of the animal(s); and
10) Photographs or video footage of the animal (if equipment is available).

In the event that Lamont-Doherty discovers an injured or dead marine mammal, and the PSO determines that the cause of the injury or death is unknown and the death is relatively recent (*i.e.*, in less than a moderate state of decomposition as we describe in the next paragraph), Lamont-Doherty will immediately report the incident to the Incidental Take Program Supervisor, Permits and Conservation Division, Office of Protected Resources, NMFS, her designees, and the Southeast Regional Stranding Coordinator. The report must include the same information identified in the paragraph above this section. Activities may continue while we review the circumstances of the incident. We would work with Lamont-Doherty to determine whether modifications in the activities are appropriate.

In the event that Lamont-Doherty discovers an injured or dead marine mammal, and the lead visual observer determines that the injury or death is not associated with or related to the authorized activities (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), Lamont-Doherty would report the incident to the Incidental Take Program Supervisor, Permits and Conservation Division, Office of Protected Resources, NMFS, her designees, and the and the Southeast Regional Stranding Coordinator within 24 hours of the discovery. Lamont-Doherty would provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS. Activities may continue while we review the circumstances of the incident.

TAKE ESTIMATES

Lamont-Doherty modeled the number of different individuals that could be exposed to airgun sounds with received levels greater than or equal to 160 dB re: 1 µPa on one or more occasions by multiplying the total marine area that would be within the 160-dB radius around the operating seismic source on at least one occasion (3,425 km^2 which does not include contingency for repeating tracklines) along with the expected density of animals in the area.

Based on public comments received on the *Federal Register* notice of proposed Authorization, we re-evaluated the mitigation and monitoring proposed for incorporation in the Authorization. We determined—based on the best available information—that the revised mitigation measures and revised take estimates are presently the most feasible and effective measures for

implementation (Wright, 2014). Thus, this Preferred Alternative would satisfy the purpose and need of our proposed action under the MMPA–issuance of an Authorization, along with required mitigation measures and monitoring that meets the standards set forth in section 101(a)(5)(D) of the MMPA and the implementing regulations.

2.3.2 ALTERNATIVE 2 – NO ACTION ALTERNATIVE

Under the No Action Alternative, Lamont-Doherty could choose not to proceed with their proposed activities or to proceed without an Authorization. If they choose the latter, Lamont-Doherty would not be exempt from the MMPA take prohibitions and would be in violation of the MMPA if take of marine mammals occurs.

For purposes of this EA, we characterize the No Action Alternative as Lamont-Doherty not receiving an Authorization and Lamont-Doherty conducting the 2-D seismic survey program without the protective measures and reporting requirements required by an Authorization under the MMPA. We take this approach to meaningfully evaluate the primary environmental issues—the impact on marine mammals from these activities in the absence of protective measures.

2.3.3 ALTERNATIVE 3 – ISSUANCE OF AUTHORIZATION WITH ADDITIONAL MITIGATION MEASURES

Under Alternative 3, we would issue an Authorization to Lamont-Doherty, allowing the incidental take by Level B harassment only of small numbers of marine mammal species incidental to conducting seismic survey activities in the Atlantic Ocean during the effective period of the Authorization. Alternative 3 would consist of all of the mitigation, monitoring, and reporting measures contained in Alternative 1, including the following additional measures derived from the public comment process on our notice of the proposed Authorization.

(1) **Alternate Survey Areas:** This measure would require Lamont-Doherty to not conduct the survey within the CHSRA to minimize interactions with marine life.

(2) **Operational Restrictions**: This measure would require Lamont-Doherty to suspend their activities in low-light/nighttime conditions and minimize the number of repeated tracklines for the survey.

(3) **Augmented Visual Monitoring**: This measure would require the use of alternative technologies and methods (e.g., hydrophone buoys, aerial surveys, shore-based and small-vessel monitoring) to detect marine mammals beyond the proposed visual and acoustic monitoring.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER CONSIDERATION

We considered whether other alternatives could meet the purpose and need and support the Lamont-Doherty's activities. We considered an alternative that would allow for the issuance of an Authorization with no required mitigation or monitoring but eliminated that Alternative from consideration, as it would not be in compliance with the MMPA and therefore would not meet the purpose and need. For that reason, we do not analyze this alternative further in this document.

CHAPTER 3 – AFFECTED ENVIRONMENT

This chapter describes existing conditions in proposed survey area. Descriptions of the physical and biological environment of the action area are contained in the documents incorporated by reference (see section 1.3.1) and summarized here.

3.1 PHYSICAL ENVIRONMENT

As discussed in Chapter 1, our proposed action and alternatives relate only to the proposed issuance of our 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 section 1.3.2 - Scope of Environmental Analysis). Because of the requirements of NAO 216.6, however, we briefly summarize the physical components of the environment here.

The continental shelf off the U.S. east coast is very narrow off Cape Hatteras, broadening to form the mid-Atlantic Bight to the north and the Florida-Hatteras Shelf to the south. South of Cape Hatteras, the shelf gives way to the relatively steep Florida-Hatteras Slope at 100–500 m depths, the Blake Plateau, 700−1000 m deep and extending approximately 300 to 500 km offshore, and the Blake Escarpment, which slopes steeply to the abyssal plain at 400–5000 m. North of Cape Hatteras, the continental slope is steep from 200 to 2000 m deep extending less than 200 m offshore, then sloping gradually to 5000-m depth (NSF, 2014).

The water off the U.S. east coast consists of three water masses: coastal or shelf waters, slope waters, and the Gulf Stream. Coastal waters off Canada, which originate mostly in the Labrador Sea, move southward over the continental shelf until they reach Cape Hatteras, where they are entrained between the Gulf Stream and slope waters (NSF, 2014).

3.1.1 MARINE MAMMAL HABITAT

We presented information on marine mammal habitat and the potential impacts to marine mammal habitat in our notice of the proposed Authorization. Also, the Foundation presented more detailed information on the physical and oceanographic aspects of the North Carolina environment in their draft EA (NSF, 2014).

The Cape Hatteras Research Area (CHSRA) is a special research area offshore of Cape Hatteras, North Carolina designated by NMFS under the Pelagic Longline Take Reduction Plan (50 CFR 229.36). The research conducted within the CHSRS results in a better understanding the nature of marine mammal interactions incidental to the commercial pelagic longline fishery. The goal is to reduce serious injuries and mortalities of pilot whales and Risso's dolphins resulting from interactions with pelagic longline gear. The CHSRA designation relates specifically to commercial longline fishing and regulatory and non-regulatory measures to reduce marine mammal and other species bycatch from that fishery. It does not, however, include restrictions on other activities including navigation through the area (BOEM, 2014).

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 MARINE MAMMALS

We provide information on the occurrence of marine mammals with possible or confirmed occurrence in the survey area in section 1.1.2 of this EA (Tables 1a, b, and c). The marine mammals most likely to be present in the action area are in Table 6.

The *Federal Register* notice on the proposed Authorization provided information on the stock, regulatory status, abundance, occurrence, seasonality, and hearing ability of the marine mammals in the action area. Lamont-Doherty's application and the Foundation's EA also provided distribution, life history, and population size information for marine mammals within the action area. We incorporate those descriptions by reference and briefly summarize the information in Table 6.

Table 6 – Marine mammals most likely to be harassed incidental to Lamont-Doherty's survey.

Species	Stock Name	Regulatory Status[1, 2]	Stock/Species Abundance[3]	Range	Seasonal Occurrence
North Atlantic right whale	Western Atlantic	MMPA - D ESA – EN	455	Coastal/shelf	Uncommon
Humpback whale	Gulf of Maine	MMPA - D ESA – EN	823	Pelagic	Uncommon
Minke whale	Canadian East Coast	MMPA - D ESA – NL	20,741	Coastal/shelf	Uncommon
Sei whale	Nova Scotia	MMPA - D ESA – EN	357	Offshore	Rare
Fin whale	Western North Atlantic	MMPA - D ESA – EN	3,522	Pelagic	Rare
Blue whale	Western North Atlantic	MMPA - D ESA – EN	440[4]	Coastal/pelagic	Rare
Bryde's whale	NA	MMPA - D ESA – NL	11,523[5]	Shelf/pelagic	Uncommon
Sperm whale	Nova Scotia	MMPA - D ESA – EN	2,288	Pelagic	Common
Dwarf sperm whale	Western North Atlantic	MMPA - NC ESA – NL	3,785	Off Shelf	Uncommon
Pygmy sperm whale	Western North Atlantic	MMPA - NC ESA – NL	3,785	Off Shelf	Uncommon
Blainville's beaked whale	Western North Atlantic	MMPA - NC ESA – NL	7,092	Pelagic	Rare
Cuvier's beaked whale	Western North Atlantic	MMPA - NC ESA – NL	6,532	Pelagic	Uncommon
Gervais' beaked whale	Western North Atlantic	MMPA - NC ESA – NL	7,092	Pelagic	Rare
True's beaked whale	Western North Atlantic	MMPA - NC ESA – NL	7,092	Pelagic	Rare
Rough-toothed dolphin	Western North Atlantic	MMPA - NC ESA – NL	271	Pelagic	Uncommon
Bottlenose dolphin	Western North Atlantic Offshore	MMPA - NC ESA – NL	77,532	Pelagic	Common
	Western North Atlantic Southern Migratory Coastal	MMPA – D, S ESA – NL	9,173	Coastal	Common
	WNA Southern NC Estuarine System	MMPA – D, S ESA – NL	188	Coastal	Common
	WNA Northern NC Estuarine System	MMPA – D, S ESA – NL	950	Coastal	Common
Pantropical spotted dolphin	Western North Atlantic	MMPA - NC ESA – NL	3,333	Pelagic	Common
Atlantic spotted dolphin	Western North Atlantic	MMPA - NC ESA – NL	44,715	Shelf/slope pelagic	Common
Spinner dolphin	Western North Atlantic	MMPA - NC ESA – NL	11,441[6]	Coastal/pelagic	Rare
Striped dolphin	Western North Atlantic	MMPA - NC ESA – NL	54,807	Off shelf	Common
Clymene dolphin	Western North Atlantic	MMPA - NC ESA – NL	6,086[7]	Slope	Uncommon

Table 6 (cont.) – Marine mammals most likely to be harassed incidental to Lamont-Doherty's survey.

Short-beaked common dolphin	Western North Atlantic	MMPA - NC ESA – NL	173,486	Shelf/pelagic	Common
Atlantic white-sided-dolphin	Western North Atlantic	MMPA - NC ESA – NL	48,819	Shelf/slope	Rare
Fraser's dolphin	Western North Atlantic	MMPA - NC ESA – NL	726[8]	Pelagic	Rare
Risso's dolphin	Western North Atlantic	MMPA - NC ESA – NL	18,250	Shelf/slope	Common
Melon-headed whale	Western North Atlantic	MMPA - NC ESA – NL	2,283[9]	Pelagic	Rare
False killer whale	Northern Gulf of Mexico	MMPA - NC ESA – NL	177[10]	Pelagic	Rare
Pygmy killer whale	Western North Atlantic	MMPA - NC ESA – NL	1,108[11]	Pelagic	Rare
Killer whale	Western North Atlantic	MMPA - NC ESA – NL	28[12]	Coastal	Rare
Long-finned pilot whale	Western North Atlantic	MMPA - NC ESA – NL	26,535	Pelagic	Common
Short-finned pilot whale	Western North Atlantic	MMPA - NC ESA – NL	21,515	Pelagic	Common
Harbor porpoise	Gulf of Maine/ Bay of Fundy	MMPA - NC ESA – NL	79,883	Coastal	Rare
Harbor seal	Western North Atlantic	MMPA - NC ESA – NL	70,142	Coastal	Uncommon

[1] MMPA: D = Depleted, S = Strategic, NC = Not Classified.
[2] ESA: EN = Endangered, T = Threatened, DL = Delisted, NL = Not listed.
[3] 2013 NMFS Stock Assessment Report (Waring et al., 2014) unless otherwise noted. NA = Not Available.
[4] Minimum population estimate based on photo identification studies in the Gulf of St. Lawrence (Waring et al., 2010).
[5] There is no stock designation for this species in the Atlantic. Abundance estimate derived from the ETP stock = 11,163 (Wade and Gerodette, 1993); Hawaii stock = 327 (Barlow, 2006); and Northern Gulf of Mexico stock = 33 (Waring et al., 2012).
[6] There is no abundance information for this species in the Atlantic. Abundance estimate derived from the Northern Gulf of Mexico Stock = 11,441 (Waring et al., 2012).
[7] There is no abundance information for this species in the Atlantic. The best available estimate of abundance was 6,086 (CV=0.93) (Mullin and Fulling, 2003).
[8] There is no abundance information for this species in the Atlantic. The best available estimate of abundance was 726 (CV=0.70) for the Gulf of Mexico stock (Mullin and Fulling, 2004).
[9] There is no abundance information for this species in the Atlantic. The best available estimate of abundance was 2,283 (CV=0.76) for the Gulf of Mexico stock (Mullin, 2007).
[10] There is no abundance information for this species in the Atlantic. The best available estimate of abundance was 177 (CV=0.56) for the Gulf of Mexico stock (Mullin, 2007).
[11] There is no abundance information for this species in the Atlantic. Abundance estimate derived from the Northern Gulf of Mexico stock = 152 (Mullin, 2007) and the Hawaii stock = 956 (Barlow, 2006).
[12] There is no abundance information for this species in the Atlantic. Abundance estimate derived from the Northern Gulf of Mexico stock = 28 (Waring et al., 2012).

Pinnipeds: For the proposed Authorization, we considered authorizing take for one species of pinniped based upon the best available density information (Navy, 2007) and information from the 2013 NMFS Stock Assessment Report (Waring, et al., 2014). This section includes a brief summary on life history information for harbor seals.

Harbor Seals: Harbor seals are part of the "true seal" family, *Phocidae*. True seals lack external ear flaps and have short forelimbs that result in limited locomotion on land. Harbor seals typically inhabit temperate coastal habitats and use rocks, reefs, beaches, and drifting glacial ice as haul outs and pupping sites (Waring, et al., 2014). On the east coast, they range from the Canadian Arctic to southern New England, New York, and occasionally the Carolinas (Waring et al., 2010; Waring, et al., 2014). In recent years, small numbers of seals (<50) have established winter haul-out sites in the Chesapeake Bay and near Oregon Inlet North Carolina.

The best estimate of abundance for harbor seals is 70,142 (CV=0.29) with a minimum population estimate of 55,409 based on corrected available counts along the Maine coast in 2012 (Waring, et al., 2014). Harbor seals eat a variety of prey consisting mainly of fish, shellfish, and crustaceans. Researchers have found that seals complete both shallow and deep dives during hunting depending on the availability of prey (Tollit et al., 1997).

CHAPTER 4 – ENVIRONMENTAL CONSEQUENCES

This chapter of the EA includes a discussion of the impacts of the three alternatives on the human environment. Lamont-Doherty's application, our notice of a proposed Authorization, and other related environmental analyses identified previously, inform our analysis of the direct, indirect, and cumulative effects of our proposed issuance of an Authorization.

Under the MMPA, we have evaluated the potential impacts of Lamont-Doherty's seismic survey activities in order to determine whether to authorize incidental take of marine mammals. Under NEPA, we have determined that an EA is appropriate to evaluate the potential significance of environmental impacts resulting from the issuance of our Authorization.

4.1 EFFECTS OF ALTERNATIVE 1 – ISSUANCE OF AN AUTHORIZATION WITH MITIGATION MEASURES

Alternative 1 is the Preferred Alternative where we would issue an Authorization to Lamont-Doherty allowing the incidental take, by Level B harassment, of 31 species of marine mammals from September through October, 2014, subject to the mandatory mitigation and monitoring measures and reporting requirements set forth in the Authorization, if issued.

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 proposed activities. Lamont-Doherty's proposed seismic survey is not located within a marine sanctuary, wildlife refuge, a National Park, or other conservation area. The proposed activity— which uses one seismic source vessel—would minimally add to vessel traffic in the region and would not result in substantial damage to ocean and coastal habitats that might constitute marine mammal habitats. Finally, the proposed Authorization would not impact physical habitat features, such as substrates and/or water quality.

Prey: The overall response of fishes and squids from the seismic survey is to exhibit startle responses and undergo vertical and horizontal movements away from the sound source. We expect that the seismic survey would have no more than a temporary and minimal adverse effect on any fish or invertebrate species. Although there is a potential for injury to fish or marine life in close proximity to the vessel, we expect that the impacts of the seismic survey on fish and other marine life specifically related to acoustic activities would be temporary in nature, negligible, and would not result in substantial impact to these species or to their role in the ecosystem.

4.1.2 IMPACTS TO MARINE MAMMALS

We expect that the Lamont-Doherty's 2-D seismic survey has the potential to take marine mammals by Level B harassment, as defined by the MMPA. Acoustic stimuli generated by the airgun arrays (and to a lesser extent the multibeam echosounder, sub-bottom profiler, and acoustic Doppler current profiler) may affect marine mammals in one or more of the following ways: behavioral disturbance, tolerance, masking of natural sounds, and temporary or permanent hearing impairment, or non-auditory physical effects (Richardson et al., 1995).

Our *Federal Register* notice of proposed Authorization, Lamont-Doherty's application (LGL, 2014), and the Foundation's EA on this action (NSF, 2014) provide detailed descriptions of these potential effects of seismic surveys on marine mammals. We incorporate those discussions by reference here and summarize our consideration of additional studies submitted during the public comment period in the following sections.

The effects of noise on marine mammals are highly variable, ranging from minor and negligible to potentially significant, depending on the intensity of the source, the distances between the animal and the source, and the overlap of the source frequency with the animals' audible frequency. Nevertheless, monitoring and mitigation measures required by us for Lamont-Doherty's proposed activities will effectively reduce any significant adverse effects of these sound sources on marine mammals.

Behavioral Disturbance: The studies discussed in the *Federal Register* notice for the proposed Authorization note that there is variability in the behavioral responses of marine mammals to noise exposure. However, it is important to consider the context in predicting and observing the level and type of behavioral response to anthropogenic signals (Ellison et al., 2012).

Marine mammals may react to sound when exposed to anthropogenic noise. These behavioral reactions are often shown as: changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing or cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where noise sources are located; and/or flight responses (e.g., pinnipeds flushing into water from haul-outs or rookeries). The onset of behavioral disturbance from anthropogenic noise depends on both external factors (characteristics of noise sources and their paths) and the receiving animals (hearing, motivation, experience, demography) and is also difficult to predict (Richardson, et al., 1995; Southall et al., 2007).

Studies have shown that underwater sounds from seismic activities are often readily detectable by marine mammals in the water at distances of many kilometers (Castellote et al., 2012). Many studies have also shown that marine mammals at distances more than a few kilometers away often show no apparent response when exposed to seismic activities (e.g., Akamatsu et al., 1993; Harris et al., 2001; Madsen & Møhl, 2000; Malme et al., 1983, 1984; Richardson et al., 1986; Weir, 2008). Other studies have shown that marine mammals continue important behaviors in the presence of seismic pulses (e.g., Dunn & Hernandez, 2009; Greene Jr. et al., 1999; Holst & Beland, 2010; Holst & Smultea, 2008; Holst et al., 2005; Nieukirk et al., 2004; Richardson, et al., 1986; Smultea et al., 2004).

In a passive acoustic research program that mapped the soundscape in the North Atlantic Ocean, Clark and Gagnon (2006) reported that some fin whales in the northeast Pacific Ocean stopped singing for an extended period starting soon after the onset of a seismic survey in the area. The authors could not determine whether or not the whales left the area ensonified by the survey, but the evidence suggests that most, if not all, of the singers remained in the area. When the survey stopped temporarily, the whales resumed singing within a few hours and the number of singers increased with time. Also, one whale continued to sing while the seismic survey was actively operating (Figure 4, Clark & Gagnon, 2006). The authors conclude that there is not enough scientific knowledge to adequately evaluate whether or not these effects on singing or mating behaviors are significant or would alter survivorship or reproductive success.

It is important to note that Lamont-Doherty's study area is well away from any known breeding grounds for low frequency cetaceans thereby reducing further the likelihood of causing an effect on marine mammal mating behaviors or calving.

MacLeod et al. (2006) discussed the possible displacement of fin and sei whales related to distribution patterns of the species during a large-scale seismic survey offshore the west coast of Scotland in 1998. The authors hypothesized about the relationship between the whale's absence and the concurrent seismic activity, but could not rule out other contributing factors (Macleod, et al., 2006; Parsons et al., 2009). We would expect that marine mammals may briefly respond to underwater sound produced by Lamont-Doherty's seismic survey by slightly changing their behavior or relocating a short distance. Based on the best available information, we expect short-term disturbance reactions that are confined to relatively small distances and durations (Thompson et al., 1998; Thompson et al., 2013), with no long-term effects on recruitment or survival.

McDonald et al. (1995) tracked blue whales relative to a seismic survey with a 1,600 in^3 airgun array. One whale started its call sequence within 15 km (9.3 mi) from the source, then followed a pursuit track that decreased its distance to the vessel where it stopped calling at a range of 10 km (6.2 mi) (estimated received level at 143 dB re: 1 μPa (peak-to-peak)). After that point, the ship increased its distance from the whale which continued a new call sequence after approximately one hour and 10 km (6.2 mi) from the ship. The authors reported that the whale had taken a track paralleling the ship during the cessation phase but observed the whale moving diagonally away from the ship after approximately 30 minutes continuing to vocalize. Because the whale may have approached the ship intentionally or perhaps was unaffected by the airguns, the authors concluded that there was insufficient data to infer conclusions from their study related to blue whale responses (McDonald, et al., 1995).

McCauley et al. (2000; 1998) studied the responses of migrating humpback whales off western Australia to a full-scale seismic survey with a 16-airgun array (2,678 cubic inches (in3)) and to a single, 20-in^3airgun. Both studies point to a contextual variability in the behavioral responses of marine mammals to sound exposure. The mean received level for initial avoidance of an approaching airgun was 140 dB re: 1 μPa for humpback whale pods containing females. In contrast, some individual humpback whales, mainly males, approached within distances of 100 to 400 m (328 to 1,312 ft), where sound levels were 179 dB re: 1 μPa (McCauley, et al., 2000). The authors hypothesized that the males gravitated towards the single operating air gun possibly due to its similarity to the sound produced by humpback whales breaching. Despite the evidence that some humpback whales exhibited localized avoidance reactions at received levels below 160 dB re: 1 μPa, the authors found no evidence of any gross changes in migration routes, such as inshore/offshore displacement during seismic operations (McCauley, et al., 2000; McCauley, et al., 1998).

DeRuiter et al.(2013) recently observed that beaked whales (considered a particularly sensitive species) exposed to playbacks (*i.e*., simulated) of U.S. tactical mid-frequency sonar from 89 to 127 dB re: 1 μPa at close distances responded notably by altering their dive patterns . In contrast, individuals showed no behavioral responses when exposed to similar received levels from *actual* U.S. tactical mid-frequency sonar operated at much further distances (DeRuiter, et al., 2013). As noted earlier, one must consider the importance of context (*e.g*., the distance of a sound source from the animal) in predicting behavioral responses.

Tolerance: With repeated exposure to sound, many marine mammals may habituate to the sound at least partially (Richardson & Wursig, 1997). Bain and Williams (2006) examined the effects of a large airgun array (maximum total discharge volume of 1,100 in^3) on six species in shallow waters off British Columbia and Washington: harbor seal, California sea lion (*Zalophus*

californianus), Steller sea lion (*Eumetopias jubatus*), gray whale (*Eschrichtius robustus*), Dall's porpoise (*Phocoenoides dalli*), and the harbor porpoise. Harbor porpoises showed reactions at received levels less than 145 dB re: 1 μPa at a distance of greater than 70 km (43 miles) from the seismic source (Bain & Williams, 2006). However, the tendency for greater responsiveness by harbor porpoise is consistent with their relative responsiveness to boat traffic and some other acoustic sources (Richardson, et al., 1995; Southall, et al., 2007). In contrast, the authors reported that gray whales seemed to tolerate exposures to sound up to approximately 170 dB re: 1 μPa (Bain & Williams, 2006) and Dall's porpoises occupied and tolerated areas receiving exposures of 170–180 dB re: 1 μPa (Bain & Williams, 2006; Parsons, et al., 2009). The authors observed several gray whales that moved away from the airguns toward deeper water where sound levels were higher due to propagation effects resulting in higher noise exposures (Bain & Williams, 2006). However, it is unclear whether their movements reflected a response to the sounds (Bain & Williams, 2006). Thus, the authors surmised that the lack of gray whale responses to higher received sound levels were ambiguous at best because one expects the species to be the most sensitive to the low-frequency sound emanating from the airguns (Bain & Williams, 2006).

Pirotta et al. (2014) observed short-term responses of harbor porpoises to a 2-D seismic survey in an enclosed bay in northeast Scotland which did not result in broad-scale displacement. The harbor porpoises that remained in the enclosed bay area reduced their buzzing activity by 15% during the seismic survey (Pirotta, et al., 2014). Thus, animals exposed to anthropogenic disturbance may make trade-offs between perceived risks and the cost of leaving disturbed areas (Pirotta, et al., 2014). However, unlike the semi-enclosed environment described in the Scottish study area, Lamont-Doherty's seismic study occurs in the open ocean. Because Lamont-Doherty would conduct the survey in an open ocean area, we do not anticipate that the seismic survey would entrap marine mammals between the sound source and the shore as marine mammals can temporarily leave the offshore survey area during the operation of the airgun(s) to avoid acoustic harassment.

Masking: Studies have shown that marine mammals are able to compensate for masking by adjusting their acoustic behavior such as shifting call frequencies and increasing call volume and vocalization rates. For example, blue whales increase call rates when exposed to seismic survey noise in the St. Lawrence Estuary (Di Iorio & Clark, 2010). North Atlantic right whales exposed to high shipping noise increased call frequency (Parks et al., 2007), while some humpback whales respond to low-frequency active sonar playbacks by increasing song length (Miller et al., 2000).

Risch et al. (2012) documented reductions in humpback whale vocalizations in the Stellwagen Bank National Marine Sanctuary concurrent with transmissions of the Ocean Acoustic Waveguide Remote Sensing (OAWRS) low-frequency fish sensor system at distances of 200 km from the source. The recorded OAWRS produced series of frequency modulated pulses and the signal received levels ranged from 88 to 110 dB re: 1 μPa (Risch, et al., 2012). The authors hypothesized that individuals did not leave the area but instead ceased singing and noted that the duration and frequency range of the OAWRS signals (a novel sound to the whales) were similar to those of natural humpback whale song components used during mating (Risch, et al., 2012). Thus, the novelty of the sound to humpback whales in the study area provided a compelling contextual probability for the observed effects (Risch, et al., 2012). However, the authors did not state or imply that these changes had long-term effects on individual animals or populations (Risch, et al., 2012). The change in vocal behaviors related to mating activities do not apply to the marine mammal species present in the area of Lamont-Doherty's seismic survey. Again,

Lamont-Doherty's study area is well away from any known breeding grounds for low frequency cetaceans, thereby reducing further the likelihood of causing an effect on marine mammal mating behaviors.

We expect that masking effects of seismic pulses would be limited in the case of smaller odontocetes given the intermittent nature of seismic pulses (22 or 65 seconds) plus the fact that sounds important to them are predominantly at much higher frequencies than are the dominant components of airgun sounds. Pinnipeds have best hearing sensitivity and/or produce most of their sounds at frequencies higher than the dominant components of airgun sounds, but there is some overlap in the frequencies of the airgun pulses and the calls. However, the intermittent nature of airgun pulses presumably reduces the potential for masking.

Hearing Impairment: Marine mammals exposed to high intensity sound repeatedly or for prolonged periods can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Finneran et al., 2005; Finneran & Schlundt, 2013; Finneran et al., 2000; Kastak & Schusterman, 1998; Kastak et al., 1999; Schlundt et al., 2013; Schlundt et al., 2000). However, there has been no specific documentation of temporary threshold shift (TTS) or permanent hearing damage, *i.e*., permanent threshold shift (PTS) in free-ranging marine mammals exposed to sequences of airgun pulses during realistic field conditions (NSF, 2014).

Lucke et al. (2009) found a threshold shift (TS) of a harbor porpoise after exposing it to airgun noise with a received sound pressure level (SPL) at 200.2 dB (peak –to-peak) re: 1 μPa, which corresponds to a sound exposure level of 164.5 dB re: 1 μPa^2 s after integrating exposure. NMFS currently uses the root-mean-square (rms) of received SPL at 180 dB and 190 dB re: 1 μPa as the threshold above which permanent threshold shift (PTS) could occur for cetaceans and pinnipeds, respectively. Because the airgun noise is a broadband impulse, one cannot directly determine the equivalent of rms SPL from the reported peak-to-peak SPLs. However, applying a conservative conversion factor of 16 dB for broadband signals from seismic surveys (McCauley, et al., 2000) to correct for the difference between peak-to-peak levels reported in Lucke et al. (2009) and rms SPLs, the rms SPL for TTS would be approximately 184 dB re: 1 μPa, and the received levels associated with PTS (Level A harassment) would be higher. This is still above our current 180 dB rms re: 1 μPa threshold for injury. However, we recognize that TTS of harbor porpoises is lower than other cetacean species empirically tested (Finneran & Schlundt, 2010; Finneran et al., 2002; Kastelein & Jennings, 2012).

Recent studies by Kujawa and Liberman (2009) and Lin et al. (2011) found that despite completely reversible threshold shifts that leave cochlear sensory cells intact, large threshold shifts could cause synaptic level changes and delayed cochlear nerve degeneration in mice and guinea pigs, respectively. We note that the high level of TTS that led to the synaptic changes shown in these studies is in the range of the high degree of TTS that Southall et al. (2007) used to calculate PTS levels. It is unknown whether smaller levels of TTS would lead to similar changes. We, however, acknowledge the complexity of noise exposure on the nervous system, and will re-examine this issue as more data become available.

A recent study on bottlenose dolphins (Schlundt, et al., 2013) measured hearing thresholds at multiple frequencies to determine the amount of TTS induced before and after exposure to a sequence of impulses produced by a seismic air gun. The air gun volume and operating pressure varied from 40-150 in^3 and 1000-2000 psi, respectively. After three years and 180 sessions, the

authors observed no significant TTS at any test frequency, for any combinations of air gun volume, pressure, or proximity to the dolphin during behavioral tests (Schlundt, et al., 2013). Schlundt et al. (2013) suggest that the potential for airguns to cause hearing loss in dolphins is lower than previously predicted, perhaps as a result of the low-frequency content of air gun impulses compared to the high-frequency hearing ability of dolphins.

The predicted distances at which sound levels could result in Level A harassment are relatively small (585 m; 1,919 ft for cetaceans, and 157 m; 515 ft for pinnipeds). The avoidance behaviors observed in Thompson et al.'s (1998) study supports our expectation that individual marine mammals would avoid exposure at higher levels. Also, it is unlikely that animals would encounter repeated exposures at very close distances to the sound source because Lamont-Doherty would implement the required shutdown and power down mitigation measures to ensure that marine mammals do not approach the applicable exclusion zones for Level A harassment. We also expect that Level A harassment will be prevented through the required vessel-based visual monitoring of the exclusion zones and implementation of mitigation measures.

Strandings: In 2013, an International Scientific Review Panel (ISRP) investigated a 2008 mass stranding of approximately 100 melon-headed whales in a Madagascar lagoon system (Southall et al., 2013) associated with the use of a high-frequency mapping system. The report indicated that the use of a 12-kHz multibeam echosounder was the most plausible and likely initial behavioral trigger of the mass stranding event. This was the first time that a relatively high-frequency mapping sonar system had been associated with a stranding event. However, the report also notes that there were several site- and situation-specific secondary factors that may have contributed to the avoidance responses that lead to the eventual entrapment and mortality of the whales within the Loza Lagoon system (*e.g*., the survey vessel transiting in a north-south direction on the shelf break parallel to the shore may have trapped the animals between the sound source and the shore driving them towards the Loza Lagoon). They concluded that for odontocete cetaceans that hear well in the 10-50 kHz range, where ambient noise is typically quite low, high-power active sonars operating in this range may be more easily audible and have potential effects over larger areas than low frequency systems that have more typically been considered in terms of anthropogenic noise impacts (Southall, et al., 2013). However, the risk may be very low given the extensive use of these systems worldwide on a daily basis and the lack of direct evidence of such responses previously (Southall, et al., 2013).

We have considered the potential for behavioral responses and indirect injury or mortality from Lamont-Doherty's use of the multibeam echosounder. Given that Lamont-Doherty proposes to conduct the survey offshore and transit in a manner that would not entrap marine mammals in shallow water, we do not anticipate that the use of the source during the seismic survey would entrap marine mammals between the vessel's sound sources and the North Carolina coastline. In addition the proposed Authorization outlines reporting measures and response protocols intended to minimize the impacts of, and enhance the analysis of, any potential stranding in the survey area.

NOAA has declared an Unusual Mortality Event (UME) for bottlenose dolphins along the Atlantic coast from early July 2013 through the present. Elevated strandings of bottlenose dolphins have occurred in New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia and Florida (through Brevard County). All age classes of bottlenose dolphins are involved and strandings range from a few live animals to mostly dead animals with many very decomposed. Many dolphins have presented with lesions on their skin,

mouth, joints, or lungs (NMFS, 2014a). At this time, all age classes of bottlenose dolphins are involved. Based upon preliminary diagnostic testing and discussion with disease experts the tentative cause of this UME could be cetacean morbillivirus (NMFS, 2014c). However the investigation is still ongoing and additional contributory factors to the UME are under investigation including other pathogens, biotoxins, range expansion, etc. (NMFS, 2014c).

No studies are available that would inform our analysis of whether seismic surveys have any additional impacts on marine mammal species subject to a UME. As discussed above, we have evaluated the potential effects of seismic surveys on a number of marine mammal species, including bottlenose dolphins and beaked whales, and have concluded that Lamont-Doherty's proposed seismic survey would, at most, result in a temporary modification in behavior, temporary changes in animal distribution, and/or low-level physiological effects. We base this conclusion on the following factors: (1) the available literature supports our conclusion that the low-frequency content of air gun impulses may have fewer predicted impacts on bottlenose dolphins Sclundt (2013); (2) the proposed project will occur approximately 3 km away from identified coastal habitats for bottlenose dolphins thereby reducing significantly the probability of coastal bottlenose dolphin exposure; (3) the mitigation and monitoring measures are expected to limit the occurrence and intensity of any exposure; and (4) any effect on the human environment due to the project's impacts on dolphins is not expected to be significant.

In sum, we interpret these effects on all marine mammals as falling within the MMPA definition of Level B (behavioral) harassment. We expect these impacts to be minor because we do not anticipate measurable changes to the population or impacts to rookeries, mating grounds, and other areas of similar significance.

Under the Preferred Alternative, we would authorize incidental take, by Level B harassment only, of 31 species of marine mammals. Based on our best professional judgment and our evaluation of all of the available data, we expect no long-term or substantial adverse effects on marine mammals, their habitats, or their role in the environment.

Lamont-Doherty proposed a number of monitoring and mitigation measures for marine mammals as part of our evaluation for the Preferred Alternative. In consideration of the potential effects of the proposed seismic survey, we determined that the mitigation and monitoring measures described in section 2.3.1 of this EA would be appropriate for the preferred alternative to meet the Purpose and Need.

Injury: Lamont-Doherty did not request authorization to take marine mammals by injury (Level A harassment), serious injury, or mortality. Based on the results of our analyses, Lamont-Doherty's environmental analyses, and previous monitoring reports for the same activities, we do not expect Lamont-Doherty's planned activities to result in injury, serious injury, or mortality within the action area. The required mitigation and monitoring measures would minimize any potential risk for marine mammals.

Vessel Strikes: The potential for striking marine mammals is a concern with vessel traffic. Studies have associated ship speed with the probability of a ship strike resulting in an injury or mortality of an animal. However, it is highly unlikely that Lamont-Doherty would strike a marine mammal given the *Langseth's* slow survey speed (8 to 12 km/hr; 4 to 6 kt). Moreover, mitigation measures would be required of Lamont-Doherty to reduce speed or alter course if a collision with a marine mammal appears likely.

Estimated Take of Marine Mammals by Level B Incidental Harassment: Lamont-Doherty has requested take by Level B harassment as a result of the acoustic stimuli generated by their proposed seismic survey. We expect that the survey would cause a short-term behavioral disturbance for marine mammals in the proposed area.

As mentioned previously, we estimate that the activities could potentially affect, by Level B harassment only, 31 species of marine mammals under our jurisdiction. For each species, these estimates are small numbers relative to the population sizes. Table 7 outlines, the regional density estimates for marine mammals in the action area, the number of Level B harassment takes that we propose to authorize in this Authorization, the percentage of each population or stock proposed for take as a result of Lamont-Doherty's activities, and the population trend for each species.

Table 7 – Proposed Level B harassment take levels, species or stock abundance, and percentage of population proposed for take during the proposed seismic survey in the Atlantic Ocean, September through October, 2014.

Species	Density Estimate[1] (#/1000 km^2)	Modeled Number of Individuals Exposed to Sound Levels ≥ 160 dB[2]	Proposed Take Authorization[3]	Percent of Species or Stock[4]	Population Trend[5]
North Atlantic right whale	0.13, 0.01, 0.001[6]	5	5	1.25	Increasing
Humpback whale	0.73, 0.56, 1.06	38	44	5.24	Increasing
Minke whale	0.03, 0.02, 0.04	2	2	0.01	No data
Sei whale	1.69, 2.24, 2.19[6,7]	86	98	27.34	No data
Fin whale	0.98, 0.48,0.14[6,7]	16	19	0.52	No data
Blue whale	0.003, 0.02, 0.03[6,7]	2	3	0.52	No data
Bryde's whale	0.429, 0.429, 0.429[6]	18	20	0.17	No data
Sperm whale	0.03, 0.68, 3.23	91	104	6.48	No data
Dwarf sperm whale	0.64, 0.49, 0.93	34	39	1.01	No data
Pygmy sperm whale	0.64, 0.49, 0.93	34	39	1.01	No data
Cuvier's beaked whale	0.01, 0.14, 0.58	17	19	0.29	No data
Blainville's beaked whale	0.01, 0.14, 0.58	17	19	0.26	No data
Gervais' beaked whale	0.01, 0.14, 0.58	17	19	0.26	No data
True's beaked whale	0.01, 0.14, 0.58	17	19	0.26	No data
Rough-toothed dolphin	0.30, 0.23, 0.44	16	18	6.62	No data
Bottlenose dolphin (Offshore)	70.4, 331, 49.4	3,374	3,829	4.94	No data
Bottlenose dolphin (SMC)	70.4, 0, 0	686	778	8.01	No data
Bottlenose dolphin (SNCES)	70.4, 0, 0	1[7]	23[8]	12.07	No data
Bottlenose dolphin (NNCES)	70.4, 0, 0	1[7]	7[8]	0.72	No data
Pantropical spotted dolphin	14, 10.7, 20.4	732	830	24.9	No data
Atlantic spotted dolphin	216.5, 99.7, 77.4	4,616	5,239	11.72	No data
Spinner dolphin	0, 0, 0	65[8]	74	No data	No data
Striped dolphin	0, 0.4, 3.53	98	112	0.20	No data
Clymene dolphin	6.7, 5.12, 9.73	351	398	6.53	No data
Short-beaked comm. dolphin	5.8, 138.7, 26.4	1,338	1,519	0.88	No data
Atlantic white-sided dolphin	0, 0, 0	0	0	0	No data
Fraser's dolphin	0, 0, 0	100[8]	114	15.63	No data
Risso's dolphin	1.18, 4.28, 2.15	88	100	0.54	No data
Melon-headed whale	0, 0, 0	100[8]	100	No data	No data
False killer whale	0, 0, 0	15[8]	18	9.62	No data
Pygmy killer whale	0, 0, 0	25[8]	29	2.56	No data
Killer whale	0, 0, 0	6[8]	7	No data	No data
Long-finned pilot whale	3.74, 58.9, 19.1	795	903	3.4	No data
Short-finned pilot whale	3.74, 58.9, 19.1	795	903	4.19	No data
Harbor porpoise	0, 0, 0	0	0	0	No data
Harbor seal	0, 0, 0	4[8]	5	0.01	No data

[1] Except where noted, densities are the mean values for the shallow (<100 m), intermediate (100-1,000m), and deep (>1,000m) water stratum in the survey area calculated from the SERDP SDSS NODES summer model (Read et al., 2009) as presented in Table 3 of Lamont-Doherty's application.
[2] Modeled take in this table corresponds to the total modeled take over all depth ranges within a total ensonified area of 40,968 km^2. See Table 3 of Lamont-Doherty's application for their original take estimates by shallow, intermediate, and deep strata. See Table 9 in Lamont-Doherty's EA for revised take estimates based on modifications to the tracklines to reduce the total ensonified area (40,968 km^2).
[3] The Authorization includes additional coverage for those potential takes of individuals where Lamont-Doherty would repeat tracklines. This estimate accounts for overlap and turnover within the area to account for take of additional individuals that could experience Level B harassment within those areas where the tracklines overlap.
[4] Stock/species abundance estimates from Table 1 in (79 FR 44549, July 31, 2014) used in calculating the percentage of species/stock.
[5] Population trend information from Waring et al., 2014. No data = Insufficient data to determine population trend.
[6] Density data derived from the Navy's NMSDD.
[7] Density estimates revised from proposed density estimate (79 FR 44549, July 31, 2014).
[6] Density estimates revised from proposed density based on information from ESA section 7 consultation.
[7] Modeled estimate includes the area that is less than 3 km from shore ensonified to greater than or equal to 160 dB (10 km^2 total).
[8] Increases for group size based on pers. com. with Dr. Caroline Good (2014) and Mr. McLellan (2014) on large whale presence offshore NC; or from CETAP (1982) and AMAPPS surveys (NMFS, 2012; 2013) for odontocetes and pinnipeds; and Read et al., 2003 for bottlenose dolphins.

Our *Federal Register* notice for the proposed Authorization and Lamont-Doherty's application contain descriptions of how we derived the take estimates. We do not expect the proposed activities to impact rates of recruitment or survival for any affected species or stock. Further, the activities would not adversely affect marine mammal habitat.

Under Alternative 1, the proposed action has no unmitigable adverse impact to subsistence uses, because there are no permitted subsistence uses of marine mammals in the region.

4.2 Effects of Alternative 2– No Action Alternative

Under the No Action Alternative, we would not issue an Authorization to Lamont-Doherty. As a result, Lamont-Doherty would not receive an exemption from the MMPA prohibitions against the take of marine mammals and would, if they proceeded with their activities, be in violation of the MMPA if take of marine mammals occurs.

The impacts to elements of the human environment resulting from the No Action alternative—conducting the 2-D seismic survey program in the absence of required protective measures for marine mammals under the MMPA—would be greater than those impacts resulting from Alternative 1, the Preferred Alternative.

4.2.1 Impacts to Marine Mammal Habitat

Under the No Action Alternative, the survey would have no additive effects on the physical environment beyond those resulting from Lamont-Doherty's activities, which we evaluated in the referenced documents. This Alternative would result in similar effects on the physical environment as Alternative 1.

4.2.2 Impacts to Marine Mammals

Under the No Action Alternative, Lamont-Doherty's activities would likely result in increased amounts of Level B harassment to marine mammals and possibly takes by injury (Level A harassment), serious injury, or mortality—specifically related to acoustic stimuli—due to the absence of mitigation and monitoring measures required under the proposed Authorization.

While it is difficult to provide an exact number of takes that might occur under the No Action Alternative, we would expect the numbers to be larger than those presented in Table 8 because of

the lack of restrictions imposed on Lamont-Doherty's survey operations. Lamont-Doherty could take significantly more marine mammals by harassment due to the lack of required mitigation measures including shutdowns and power downs for marine mammals.

If the activities proceeded without the protective measures and reporting requirements required by a final Authorization under the MMPA, the direct, indirect, or cumulative effects on the human or natural environment of not issuing the Authorization would include the following:

- Marine mammals within the survey area could experience injury (Level A harassment) and potentially serious injury or mortality. The lack of mitigation measures that would otherwise be required in an Authorization could lead to vessels not altering their course or speed around marine mammals, not ramping up or powering or shutting down airguns when marine mammals are within applicable injury harassment zones; and not shutting down for North Atlantic right whales or for groups of six or more large whales;
- Increases in the number of behavioral responses and frequency of changes in animal distribution because of the lack of mitigation measures required in the proposed Authorization. Thus, the incidental take of marine mammals would likely occur at higher levels than we have already identified and evaluated in our *Federal Register* notice on the proposed Authorization; and
- We 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; and increased knowledge of the species as required under the MMPA.

Under Alternative 2, the action has no unmitigable adverse impact to subsistence uses, as there are no permitted subsistence uses of marine mammals in the region.

4.3 Effects of Alternative 3 – Issuance of with Additional Mitigation Measures

4.3.1 Impacts to Marine Mammal Habitat

Effects to the physical environment would be the same under Alternative 3 as those described above for Alternative 1. We would expect no additional effects beyond those already described.

4.3.2 Impacts to Marine Mammals

Under this Alternative, marine mammals would still experience harassment by Lamont-Doherty's proposed seismic survey in the Atlantic Ocean. As described in Alternative 1, anticipated impacts to marine mammals associated with Lamont-Doherty's proposed activities primarily result from noise propagation. Potential impacts to marine mammals might include one or more of the following: tolerance, masking of important natural signals, behavioral disturbance, and temporary or permanent hearing impairment or non-auditory effects. These are the same types of reactions that we would anticipate under the Preferred Alternative (Alternative 1)

The primary difference under Alternative 3 is that we would require additional mitigation and monitoring measures for detecting marine mammals. These additional measures include requiring an alternate time for the survey; implementing operational restrictions for nighttime operations; and the use of alternate technologies to augment monitoring.

Alternate Survey Timing: This measure would require Lamont-Doherty to postpone their research to minimize interactions with marine life. The Foundation considered this mitigation

measure in their EA (NSF, 2014) and concluded that the proposed dates for the cruise (September - October) would minimize impacts to species of concern such as the North Atlantic right whale because of the low likelihood of their presence in the area at that time. This measure, however, may have the added effect of increasing the number of takes for North Atlantic right whales (Dr. Good, pers. comm.).The Foundation also concluded that this option was not practicable because the personnel and equipment essential to meet the overall project objectives were not available.

Operational Restrictions: This measure would require Lamont-Doherty to suspend their activities in low-light/nighttime conditions and minimize the number of repeated tracklines for the survey. This measure fails to meet the meet one of Lamont-Doherty's research requirements which is to conduct the survey in the shortest time span possible, day and night. The MMPA requires us to take into account the practicability of mitigation measures. Restricting activities to daytime operations only would unnecessarily lengthen the time to complete the survey which would not be practicable from an operational standpoint. Suspending the survey at night would inevitably increase the number of days to complete the survey and would likely result in increased amounts of Level B harassment to marine mammals over a longer duration of time. While the additional measure may provide some added protection for marine mammals present in the research area during nighttime operations, we do not expect that this measure would reduce the overall level of effects. Level B harassment of marine mammals would still occur.

Augmented Monitoring: This measure would require the use of alternative methods to detect marine mammals beyond the proposed visual observation and acoustic monitoring. The Foundation considered this mitigation measure in their EA (NSF, 2014) and concluded that at the present time, these technologies are still not feasible, commercially viable, or appropriate to meet their Purpose and Need.

While the technologies for these monitoring methods are still being developed and refined, we expect that they would allow for additional detection of marine mammals beyond visual observations from shipboard observers. These additional monitoring measures could allow for necessary mitigation measures (*i.e.*, power-downs and shutdowns) to be implemented more quickly and more frequently, thereby potentially reducing further the number of marine mammal takes. However, until these technologies are developed and fully tested, we are unable to provide a reasonable estimate of this reduction in take levels.

Under Alternative 3, the action has no unmitigable adverse impact to subsistence uses, as there are no permitted subsistence uses of marine mammals in the region.

4.4 Compliance with Necessary Laws – Necessary Federal Permits

We have determined that the issuance of an Authorization would be consistent with the applicable requirements of the MMPA, ESA, MSFMCA, and CZMA, and our regulations. Please refer to section 1.4 of this EA for more information.

4.5 Unavoidable Adverse Impacts

Lamont-Doherty's application, our *Federal Register* notice of a proposed Authorization, and other environmental analyses identified previously summarize unavoidable adverse impacts to marine mammals or the populations to which they belong or on their habitats, as well as subsistence uses of

marine mammals, occurring in the seismic survey area. We incorporate those documents by reference.

We acknowledge that the incidental take authorized would potentially result in unavoidable adverse impacts. However, we do not expect Lamont-Doherty's activities to have adverse consequences on the viability of marine mammals in the Atlantic Ocean. 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. We expect that the numbers of individuals of all species taken by harassment would be small (relative to species or stock abundance), that the seismic survey and the take resulting from the seismic survey activities would have a negligible impact on the affected species or stocks of marine mammals, and that there would not be an unmitigable adverse impact to subsistence uses of marine mammals in the Atlantic Ocean.

4.6 Cumulative Effects

NEPA defines cumulative effects 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.

The proposed seismic survey would add another, albeit temporary activity to the marine environment in the Atlantic Ocean and the proposed survey would be limited to a relatively small area for a comparatively short period of time. The Foundation's EA (NSF, 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. This section incorporates the Foundation's EA by reference and provides a brief summary of the human-related activities affecting the marine mammal species in the action area.

4.6.1 Previous and Future Seismic Research Surveys in the Same Area

The U.S. Geological Survey (USGS) would conduct two seismic surveys over the span of two years to support the delineation of the U.S. Extended Continental Shelf (ECS) in the Atlantic Ocean August through September, 2014, and April to August, 2015. The USGS would use the *Langseth* to conduct survey for approximately 18 to 21 days covering approximately 3,000 km of seismic tracklines that overlap in within the northern portion of Lamont-Doherty's proposed survey offshore North Carolina.

On August 21, 2014, we issued an Authorization for the USGS survey (79 FR 5212, September 2, 2014) for the take of marine mammals, by Level B harassment, incidental to conducting a marine geophysical (seismic) survey in the Atlantic Ocean off the Eastern Seaboard, August to September, 2014 and April to August, 2015. The USGS prepared a separate EA for their action and determined that the conduct of the both surveys would not likely result in significant impacts on the human environment and prepared and issued a FONSI.

Both USGS surveys are dispersed both geographically and temporally, are short-term in nature, and all of the Authorization holders would be required to use mitigation and monitoring measures to minimize impacts to marine mammals and other living marine resources in the activity area. 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 as the proposed survey.

4.6.2 UNUSUAL MORTALITY EVENT (UME) FOR BOTTLENOSE DOLPHINS

NOAA has declared an UME for bottlenose dolphins along the Atlantic coast from early July 2013 through the present. Elevated strandings of bottlenose dolphins have occurred in North Carolina. All age classes of bottlenose dolphins are involved and strandings range from a few live animals to mostly dead animals with many very decomposed (NMFS, 2014a). Based upon preliminary diagnostic testing and discussion with disease experts, the tentative cause of this UME could be cetacean morbillivirus (NMFS, 2014c). However the investigation is still ongoing and additional contributory factors to the UME are under investigation including other pathogens, biotoxins, range expansion, etc. (NMFS, 2014c).

4.6.3 MILITARY ACTIVITIES

The proposed survey is located within the U.S. Navy's Virginia Capes Operating Area (VACAPES OPAREA) and Cherry Point Operating Area (CHPT OPAREA). The Virginia Capes, Cherry Point, and Charleston/Jacksonville OPAREAs are known as the Southeast OPAREA. The VACAPES OPAREA is located in the coastal and offshore waters off Delaware, Maryland, Virginia, and North Carolina, from the entrance to Chesapeake Bay south to just north of Cape Hatteras. The CHPT OPAREA is located in the coastal and offshore waters off North Carolina from just north of Cape Hatteras south to its southeast corner southeast of Cape Fear at 32.1° N. The types of activities that could occur in the OPAREAs include aircraft carrier, ship and submarine operations; anti-air and surface gunnery, missile firing, anti-submarine warfare, mine warfare, and amphibious operations; all weather flight training, air warfare, refueling, UAV flights, rocket and missile firing, and bombing exercises; and fleet training and independent unit training. Lamont-Doherty are coordinating with the U.S. Navy to minimize conflicts.

4.6.4 FUTURE OIL AND GAS EXPLORATION

The proposed survey site is within the Bureau of Ocean and Energy's (BOEM) Outer Continental Shelf (OCS) Mid-Atlantic and South Atlantic Planning Areas for proposed geological and geophysical (G&G) activities (BOEM, 2014). BOEM's intention is to authorize oil and gas activities in support of all three BOEM program areas: oil and gas exploration and development, renewable energy, and marine minerals in the future. We do not anticipate that the BOEM activities would occur simultaneously to Lamont-Doherty's proposed seismic survey and 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 as the proposed survey.

4.6.5 CLIMATE CHANGE

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

Increased ocean temperatures will reduce oxygen, and atmospheric CO_2 will reduce ocean pH and threaten the health of the marine ecosystem. Ocean circulation patterns will change, with less

mixing of cold and warm water in tropical and subtropical areas, affecting the ability of near-surface species to reach nutrients at lower depths (NJCAA, 2014). At more northern latitudes mixing could actually increase with melting of sea ice, but general ocean warming will alter migration and breeding patterns and push species further northward (NJCAA, 2014).

With the large degree of uncertainty on the impact of climate change to marine mammals in the Atlantic Ocean, we recognize that warming of this region could affect the prey base and habitat quality for marine mammals. Nonetheless, we expect that the conduct of the seismic survey and the issuance of an Authorization to Lamont-Doherty would not result in any noticeable contributions to climate change.

CHAPTER 5 – LIST OF PREPARERS AND AGENCIES CONSULTED

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