



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

AUG 21 2014

Dr. Jonathan R. Childs
Geophysicist
Pacific Coastal and Marine Geology Science Center
U.S. Geological Survey
Mail Stop 999
345 Middlefield Road
Menlo Park, California 94025

Dear Dr. Childs:

Enclosed is an Incidental Harassment Authorization (IHA) issued to the U.S. Geological Survey, Lamont-Doherty Earth Observatory of Columbia University, and National Science Foundation, under the authority of section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C. 1361 *et seq.*), to harass small numbers of marine mammals, by Level B harassment, incidental to the R/V *Marcus G. Langseth's* marine geophysical survey in the northwest Atlantic Ocean off the Eastern Seaboard during August to September 2014 and April to August 2015.

You are required to comply with the conditions contained in the IHA, which have also been included as Terms and Conditions for incidental take of endangered species in the Biological Opinion. In addition, you must submit a report to the National Marine Fisheries Service's (NMFS) Office of Protected Resources within 90 days of the completion of the cruise. The IHA requires monitoring of marine mammals by qualified individuals before, during, and after seismic activities and reporting of marine mammal observations, including species, numbers, and behavioral modifications potentially resulting from this activity.

If you have any questions concerning the IHA or its requirements, please contact Howard Goldstein, Jeannine Cody, or Jolie Harrison, Office of Protected Resources, NMFS, at 301-427-8401.

Sincerely,

Donna S. Wieting

for Donna S. Wieting
Director
Office of Protected Resources

Enclosures



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Incidental Harassment Authorization

The National Marine Fisheries Service (NMFS) hereby authorizes the U.S. Geological Survey, Coastal and Marine Geology Program, 12201 Sunrise Valley Drive, Reston, Virginia 20192, Lamont-Doherty Earth Observatory of Columbia University (L-DEO), P.O. Box 1000, 61 Route 9W, Palisades, New York 10964-8000, and National Science Foundation, Division of Ocean Sciences, 4201 Wilson Boulevard, Suite 725, Arlington, Virginia 22230 (herein referred to collectively as USGS) under section 101(a)(5)(D) of the Marine Mammal Protection Act (MMPA) (16 U.S.C. 1371(a)(5)(D)), to harass small numbers of marine mammals incidental to a high-energy marine geophysical (seismic) survey conducted by the R/V *Marcus G. Langseth* (*Langseth*) in the northwest Atlantic Ocean off the Eastern Seaboard, August to September 2014 and April to August 2015.

1. Effective Dates

This Authorization is valid from August 21, 2014 through August 20, 2015. The seismic survey is scheduled to occur in two phases; the first phase during August to September 2014 (for approximately 17 to 18 days [not including transit]), and the second phase between April to August 2015 (for approximately 17 to 18 days [not including transit], specific dates to be determined).

2. Specified Geographic Region

This Authorization is valid only for the *Langseth*'s specified activities associated with seismic survey operations as specified in the USGS's Incidental Harassment Authorization (IHA) application and the associated *Environmental Assessment for Seismic Reflection Scientific Surveys during 2014 and 2015 in Support of Mapping the U.S. Atlantic Seaboard Extended Continental Margin and Investigating Tsunami Hazards* that shall occur in the following specified geographic area (bounded by the following geographical coordinates):

40.5694° North, -66.5324° West;
38.5808° North, -61.7105° West;
29.2456° North, -72.6766° West;
33.1752° North, -75.8697° West;
39.1583° North, -72.8697° West

The activities for 2014 will generally occur within the outer portions of the study area. The activities for 2015 will in-fill more of the study area. Water depths range from approximately 1,450 to 5,400 meters (m) (4,757.2 to 17,716.5 feet [ft]); no survey lines will extend to water depths less than 1,000 m (3,280.8 ft). The tracklines planned for both 2014 and 2015 would be in International Waters (approximately 80% in 2014 and 90% in 2015) and in the U.S. Exclusive



Economic Zone, as specified in USGS's IHA application and the associated USGS Environmental Assessment.

3. Species Authorized and Level of Takes

(a) The incidental taking of marine mammals, by Level B harassment only, is limited to the following species in the waters of the northwest Atlantic Ocean off the Eastern Seaboard:

(i) Mysticetes – see Table 1 (attached) for authorized species and take numbers.

(ii) Odontocetes – see Table 1 (attached) for authorized species and take numbers.

(iii) If any marine mammal species are encountered during seismic activities that are not listed in Table 1 (attached) for authorized taking and are likely to be exposed to sound pressure levels (SPLs) greater than or equal to 160 decibels (dB) re 1 μ Pa (rms), then the USGS must alter speed or course, power-down, or shut-down the airguns to avoid take.

(a) (b) The taking by injury (Level A harassment), serious injury, or death of any of the species listed in Condition 3(a) above or the taking of any kind of any other species of marine mammal is prohibited and may result in the modification, suspension or revocation of this Authorization.

4. The methods authorized for taking by Level B harassment are limited to the following acoustic sources without an amendment to this Authorization:

(a) A 36 airgun array with a total volume of 6,600 cubic inches in³ (or smaller);

(b) A multi-beam echosounder; and

(c) A sub-bottom profiler.

5. Prohibited Take

The taking of any marine mammal in a manner prohibited under this Authorization must be reported immediately to the Office of Protected Resources, NMFS, at 301-427-8401 and/or by e-mail to Jolie.Harrison@noaa.gov and Howard.Goldstein@noaa.gov.

6. Mitigation and Monitoring Requirements

The USGS is required to implement the following mitigation and monitoring requirements when conducting the specified activities to achieve the least practicable impact on affected marine mammal species or stocks:

Protected Species Observers and Visual Monitoring

(a) Utilize two, NMFS-qualified, vessel-based Protected Species Visual Observers (PSVOs) (except during meal times and restroom breaks, when at least one PSVO shall be on watch) to visually watch for and monitor marine mammals near the seismic source vessel during daytime airgun operations (from nautical twilight-dawn to nautical twilight-dusk) and before and during ramp-ups of airguns day or night.

(i) The *Langseth's* vessel crew shall also assist in detecting marine mammals, when practicable.

(ii) PSVOs shall have access to reticle binoculars (7 x 50 Fujinon), big-eye binoculars (25 x 150), optical range finders, night vision devices, and thermal imaging cameras.

(iii) PSVO shifts shall last no longer than 4 hours at a time.

(iv) When feasible, PSVOs shall also make observations during daytime periods when the seismic system is not operating for comparison of animal abundance and behavioral reactions during, between, and after airgun operations.

(v) PSVOs shall conduct monitoring while the airgun array and streamer(s) are being deployed or recovered from the water.

(b) PSVO(s) shall record the following information when a marine mammal is sighted:

(i) Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from seismic vessel, sighting cue, apparent reaction to the airguns or vessel (e.g., none, avoidance, approach, paralleling, etc., and including responses to ramp-up), and behavioral pace; and

(ii) Time, location, heading, speed, activity of the vessel (including number of airguns operating and whether in state of ramp-up, power-down, or shut-down), Beaufort sea state and wind force, visibility, and sun glare; and

(iii) The data listed under Condition 6(b)(ii) shall also be recorded at the start and end of each observation watch and during a watch whenever there is a change in one or more of the variables.

Passive Acoustic Monitoring

- (c) Utilize the 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. One NMFS-qualified Protected Species Observer (PSO) and/or expert bioacoustician (i.e., Protected Species Acoustic Observer [PSAO]) shall monitor the PAM at all times in shifts no longer than 6 hours. An expert bioacoustician shall design and set up the PAM system and be present to operate or oversee PAM, and available when technical issues occur during the survey.
- (d) Do and record the following when an animal is detected by the PAM:
- (i) Notify the on-duty PSVO(s) immediately of the presence of a vocalizing marine mammal so a power-down or shut-down can be initiated, if required;
- (ii) Enter the information regarding the vocalization into a database. The data to be entered include an acoustic encounter identification number, whether it was linked with a visual sighting, date, time when first and last heard and whenever any additional information was recorded, position, and water depth when first detected, bearing if determinable, species or species group (e.g., unidentified dolphin, sperm whale), types and nature of sounds heard (e.g., clicks, continuous, sporadic, whistles, creaks, burst pulses, strength of signal, etc.), and any other notable information. The acoustic detection can also be recorded for further analysis.

Buffer and Exclusion Zones

- (e) Establish a 160 dB re 1 μ Pa (rms) buffer zone as well as 180 and 190 dB re 1 μ Pa (rms) exclusion zone for marine mammals before the 2-string airgun array (6,600 in³) is in operation; and a 180 and 190 dB re 1 μ Pa (rms) exclusion zone before a single airgun (40 in³) is in operation, respectively. See Table 2 (attached) for distances and exclusion zones.

Visual Monitoring at the Start of Airgun Operations

- (f) Visually observe the entire extent of the exclusion zone (180 dB re 1 μ Pa [rms] for cetaceans; see Table 2 [attached] for distances) using NMFS-qualified PSVOs, for at least 30 minutes prior to starting the airgun array (day or night).
- (i) If the PSVO observes a marine mammal within the exclusion zone, USGS must delay the seismic survey until the marine mammal(s) has left the area. If the PSVO sees a marine mammal that surfaces, then dives below the surface, the

PSVO shall wait 30 minutes. If the PSVO sees no marine mammals during that time, he/she should assume that the animal has moved beyond the exclusion zone.

(ii) If for any reason the entire radius cannot be seen for the entire 30 minutes (i.e., rough seas, fog, darkness), or if marine mammals are near, approaching, or within the exclusion zone, the airguns may not be resume airgun operations.

(iii) If one airgun is already running at a source level of at least 180 dB re 1 μ Pa (rms), USGS may start the second airgun, and subsequent airguns, without observing the entire exclusion zone for 30 minutes prior, provided no marine mammals are known to be near the relevant exclusion zone (in accordance with Condition 6[h] below).

Ramp-up Procedures

(g) Ramp-up procedures at the start of seismic operations or after a shut-down - Implement a "ramp-up" procedure when starting up at the beginning of seismic operations or any time after the entire array has been shut-down for more than 10 minutes, which means start the smallest airgun first and add airguns 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 PSVOs shall monitor the 180 and 190 dB exclusion zone for cetaceans and pinnipeds, respectively, and if marine mammals are sighted within or about to enter the relevant exclusion zone, a power-down, or shut-down shall be implemented as though the full array were operational. Therefore, initiation of ramp-up procedures from a shut-down or at the beginning of seismic operations requires that the PSVOs be able to view the full exclusion zone as described in Condition 6(f) (above).

Power-down Procedures

(h) Power-down the airgun(s) if a marine mammal is detected within, approaches, or enters the relevant exclusion zone (as defined in Table 2, attached). A power-down means reducing the number of operating airguns to a single operating 40 in³ airgun, which reduces the exclusion zone to the degree that the animal(s) is no longer in or about to enter it for the full airgun array. When appropriate or possible, power-down of the airgun array shall also occur when the vessel is moving from the end of one trackline to the start of the next trackline.

(i) Following a power-down, if the marine mammal approaches the smaller designated exclusion zone, the airguns must then be completely shut-down. Airgun activity shall not resume until the PSVO has visually observed the marine mammal(s) exiting the exclusion zone and is not likely to return, or has not been seen within the exclusion zone for 15 minutes for species with shorter dive durations (small odontocetes and pinnipeds) or 30 minutes for species with longer dive durations (mysticetes and large

odontocetes, including sperm [*Physeter macrocephalus*], pygmy sperm [*Kogia breviceps*], dwarf sperm [*Kogia sima*], killer [*Orcinus orca*], and beaked whales).

(j) Following a power-down and subsequent animal departure, the airgun operations may resume at full power. Initiation requires that the PSVOs can effectively monitor the full exclusion zones described in Condition 6(f). If the PSVO(s) sees a marine mammal within or about to enter the relevant zones, then a course/speed alteration, power-down or shut-down will be implemented.

Shut-down Procedures

(k) Shut-down the airgun(s) if a marine mammal is detected within, approaches, or enters the relevant exclusion zone (as defined in Table 2, attached). A shut-down means all operating airguns are shut-down (i.e., turned off).

(l) Following a shut-down, if the PSVO has visually confirmed that the animal has departed the relevant exclusion zone (and is not likely to return) within a period less than or equal to 10 minutes after the shut-down, then the airgun operations may resume at full power. If the PSVO has not observed the marine mammal(s) exiting the exclusion zone, the airgun operations shall not resume for 15 minutes for species with shorter dive durations (small odontocetes) or 30 minutes for species with longer dive durations (mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, and beaked whales). Following a shut-down, the *Langseth* may resume airgun operations following ramp-up procedures described in Condition 6(g).

Speed or Course Alteration

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

Survey Operations at Night

(n) Marine seismic surveys may continue into night and low-light hours if such segment(s) of the survey is initiated when the entire relevant exclusion zones are visible and can be effectively monitored.

(o) No initiation of airgun array operations is permitted from a shut-down position at night or during low-light hours (such as in dense fog or heavy rain) when the entire relevant exclusion zone cannot be effectively monitored by the PSVO(s) on duty.

Mitigation Airgun

(p) Use of small-volume airgun (i.e., mitigation airgun) during turns and maintenance shall be operated at approximately one shot per minute and would not be operated for longer than three hours in duration. During turns or brief transits between seismic tracklines, one airgun will continue operating.

Special Procedures for Situations or Species of Concern

(q) If a North Atlantic right whale (*Eubalaena glacialis*) is visually sighted, the airgun array shall be shut-down regardless of the distance of the animal(s) to the sound source. The array shall not resume firing until 30 minutes after the last documented whale visual sighting.

(r) Concentrations of humpback (*Megaptera novaeangliae*), sei (*Balaenoptera borealis*), fin (*Balaenoptera physalus*), blue (*Balaenoptera musculus*), and/or sperm whales (*Physeter macrocephalus*) will be avoided if possible (i.e., exposing concentrations of animals to 160 dB), and the array will be powered-down if necessary. 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.).

7. Reporting Requirements

The USGS is required to:

(a) Submit a draft comprehensive report on all activities and monitoring results to the Office of Protected Resources, NMFS, within 90 days of the completion of the *Langseth's* cruise in the northwest Atlantic Ocean off the Eastern Seaboard after the end of phase 1 in 2014 and another draft comprehensive report after the end of phase 2 in 2015. This report must contain and summarize the following information:

(i) 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;

(ii) Species, number, location, distance from the vessel, and behavior of any marine mammals, as well as associated seismic activity (number of power-downs and shut-downs), observed throughout all monitoring activities.

(iii) An estimate of the number (by species) of marine mammals that: (A) are known to have been exposed to the seismic activity (based on visual observation) at received levels greater than or equal to 160 dB re 1 μ Pa (rms) and/or 180 dB re 1 μ Pa (rms) for cetaceans and 190 dB re 1 μ Pa (rms) for pinnipeds with a discussion of any specific behaviors those individuals exhibited; and (B) may have been exposed (based on reported and corrected empirical values for the 36

airgun array and modeling measurements for the single airgun) to the seismic activity at received levels greater than or equal to 160 dB re 1 μ Pa (rms) and/or 180 dB re 1 μ Pa (rms) for cetaceans and 190 dB re 1 μ Pa (rms) for pinnipeds with a discussion of the nature of the probable consequences of that exposure on the individuals that have been exposed.

(iv) A description of the implementation and effectiveness of the: (A) terms and conditions of the Biological Opinion's Incidental Take Statement (attached); and (B) mitigation measures of the Incidental Harassment Authorization. For the Biological Opinion, the report shall confirm the implementation of each Term and Condition, as well as any conservation recommendations, and describe their effectiveness, for minimizing the adverse effects of the action on Endangered Species Act-listed marine mammals.

(b) Submit a final report to the Chief, Permits and Conservation Division, Office of Protected Resources, NMFS, within 30 days after receiving comments from NMFS on the draft report. If NMFS decides that the draft report needs no comments, the draft report shall be considered to be the final report.

8. Reporting Prohibited Take

In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by this Authorization, such as an injury (Level A harassment), serious injury or mortality (e.g., ship-strike, gear interaction, and/or entanglement), USGS shall immediately cease the specified activities and immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, at 301-427-8401 and/or by e-mail to Jolie.Harrison@noaa.gov, and Howard.Goldstein@noaa.gov and the NMFS Greater Atlantic Region Marine Mammal Stranding Network at 866-755-6622 (Mendy.Garron@noaa.gov), and NMFS Southeast Region Marine Mammal Stranding Network at 877-433-8299 (Blair.Mase@noaa.gov and Erin.Fougeres@noaa.gov). The report must include the following information:

(a) Time, date, and location (latitude/longitude) of the incident; the name and type of vessel involved; the vessel's speed during and leading up to the incident; description of the incident; status of all sound source use in the 24 hours preceding the incident; water depth; environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility); description of marine mammal observations in the 24 hours preceding the incident; species identification or description of the animal(s) involved; the fate of the animal(s); and photographs or video footage of the animal (if equipment is available).

USGS shall not resume its activities until NMFS is able to review the circumstances of the prohibited take. NMFS shall work with USGS to determine what is necessary to

minimize the likelihood of further prohibited take and ensure MMPA compliance. USGS may not resume their activities until notified by NMFS via letter, e-mail, or telephone.

Reporting an Injured or Dead Marine Mammal with an Unknown Cause of Death

In the event that USGS discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (i.e., in less than a moderate state of decomposition as described in the next paragraph), USGS will immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, at 301-427-8401, and/or by email to Jolie.Harrison@noaa.gov, and Howard.Goldstein@noaa.gov, and the NMFS Greater Atlantic Region Marine Mammal Stranding Network (866-755-6622) and/or by e-mail to the NMFS Greater Atlantic Regional Stranding Coordinator (Mendy.Garron@noaa.gov), and the NMFS Southeast Region Marine Mammal Stranding Network (877-433-8299) and/or by e-mail to the Southeast Regional Stranding Coordinator (Blair.Mase@noaa.gov) and Southeast Regional Stranding Program Administrator (Erin.Fougeres@noaa.gov). The report must include the same information identified in Condition 8(a) (above). Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with USGS to determine whether modifications in the activities are appropriate.

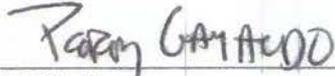
Reporting an Injured or Dead Marine Mammal Not Related to the Activities

In the event that USGS discovers an injured or dead marine mammal, and the lead PSO determines that the injury or death is not associated with or related to the activities authorized in Condition 2 of this Authorization (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), USGS shall report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, at 301-427-8401, and/or by e-mail to Jolie.Harrison@noaa.gov, and Howard.Goldstein@noaa.gov, and the NMFS Greater Atlantic Marine Mammal Stranding Network (866-755-6622), and/or by e-mail to the Greater Atlantic Regional Stranding Coordinator (Mendy.Garron@noaa.gov), and the NMFS Southeast Regional Stranding Network 9877-433-8299, and/or by e-mail to the Southeast Regional Stranding Coordinator (Blair.Mase@noaa.gov) and Southeast Regional Stranding Program Administrator (Erin.Fougeres@noaa.gov), within 24 hours of the discovery. USGS shall provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network. Activities may continue while NMFS reviews the circumstances of the incident.

Endangered Species Act Biological Opinion and Incidental Take Statement

9. USGS is required to comply with the Terms and Conditions of the Incidental Take Statement corresponding to NMFS's ESA Biological Opinion issued to both USGS and NMFS's Office of Protected Resources, Permits and Conservation Division (attached).

10. A copy of this Authorization and the Incidental Take Statement must be in the possession of all contractors and PSOs operating under the authority of this Incidental Harassment Authorization.



Donna S. Wieting
Director
Office of Protected Resources
National Marine Fisheries Service

AUG 21 2014

Date

Attachment

Table 1. Authorized take numbers, by Level B harassment, for each marine mammal species during USGS's marine seismic survey in the northwest Atlantic Ocean off the Eastern Seaboard, August to September 2014 and April to August 2015.

Species	Authorized Take in the Northwest Atlantic Ocean Study Area (2014/2015=Total)
Mysticetes	
North Atlantic right whale (<i>Eubalaena glacialis</i>)	1 or 2/1 or 2=3
Humpback whale (<i>Megaptera novaeangliae</i>)	3/38=41
Minke whale (<i>Balaenoptera acutorostrata</i>)	2/2=4
Bryde's whale (<i>Balaenoptera edeni</i>)	3/3=6
Sei whale (<i>Balaenoptera borealis</i>)	3/3=6
Fin whale (<i>Balaenoptera physalus</i>)	3/3=6
Blue whale (<i>Balaenoptera musculus</i>)	1/1=2
Odontocetes	
Sperm whale (<i>Physeter macrocephalus</i>)	83/83=166
Pygmy sperm whale (<i>Kogia breviceps</i>)	33/33=66
Dwarf sperm whale (<i>Kogia sima</i>)	33/33=66
Northern bottlenose whale (<i>Hyperoodon ampullatus</i>)	2/2=4
Cuvier's beaked whale (<i>Ziphius cavirostris</i>) and Unidentified <i>Mesoplodon</i> beaked whale (<i>Mesoplodon</i> spp. includes True's [<i>M. mirus</i>], Gervais' [<i>M. europaeus</i>], Sowerby's [<i>M. bidens</i>], and Blainville's [<i>M. densirostris</i>] beaked whale)	84/84=168
Bottlenose dolphin (<i>Tursiops truncatus</i>)	244/255=499

Atlantic white-sided dolphin (<i>Lagenorhynchus acutus</i>)	33/33=66
Fraser's dolphin (<i>Lagenodelphis hosei</i>)	100/100=200
Atlantic spotted dolphin (<i>Stenella frontalis</i>)	1,056/1,056-2,112
Pantropical spotted dolphin (<i>Stenella attenuata</i>)	724/724=1,448
Striped dolphin (<i>Stenella coeruleoalba</i>)	4,916/4,916=9,832
Spinner dolphin (<i>Stenella longirostris</i>)	65/65=130
Clymene dolphin (<i>Stenella clymene</i>)	52/341=393
Short-beaked common dolphin (<i>Delphinus delphis</i>)	203/203=406
Rough-toothed dolphin (<i>Steno bredanensis</i>)	16/16=32
Risso's dolphin (<i>Grampus griseus</i>)	342/342=684
Melon-headed whale (<i>Peponocephala electra</i>)	100/100=200
Pygmy killer whale (<i>Feresa attenuata</i>)	25/25=50
False killer whale (<i>Pseudorca crassidens</i>)	15/15=30
Killer whale (<i>Orcinus orca</i>)	6/6=12
Short-finned pilot whale (<i>Globicephala macrorhynchus</i>)	697/697=1,394
Long-finned pilot whale (<i>Globicephala melas</i>)	697/697=1,394
Harbor porpoise (<i>Phocoena phocoena</i>)	4/4=8
Pinnipeds	
Harbor seal (<i>Phoca vitulina concolor</i>)	0
Gray seal (<i>Halichoerus grypus</i>)	0
Harp seal (<i>Phoca groenlandica</i>)	0
Hooded seal	0

<i>(Cystophora cristata)</i>	
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Table 2. Modeled distances to which sound levels greater than or equal to 160, 180 and 190 dB could be received during the marine seismic survey in the northwest Atlantic Ocean off the U.S. Eastern Seaboard during August to September 2014 and April to August 2015. The buffer and exclusion zone radii are used for triggering mitigation.

Source and Volume	Tow Depth (m)	Water Depth (m)	Predicted RMS Distances (m)		
			Shut-down Exclusion Zone for Pinnipeds 190 dB	Shut-down Exclusion Zone for Cetaceans 180 dB	Level B Harassment Zone 160 dB
Single Bolt Airgun 40 in ³	9	Deep (>1,000)	100	100	388
36 Airguns 6,600 in ³	9	Deep (>1,000)	286	927	5,780