Protected Species Mitigation and Monitoring Report

Wiens Marine Geophysical Survey
in the
Commonwealth of the Northern Mariana Islands

1 February 2012- 28 February 2012

R/V Marcus G. Langseth

Prepared for

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1. EXECUTIVE SUMMARY

The National Science Foundation (NSF) owned research vessel (R/V), the *Marcus G. Langseth*, operated by Lamont-Doherty Earth Observatory (L-DEO), a part of Columbia University, conducted a seismic survey in the Commonwealth of the Northern Mariana Islands. The purpose of the survey was to understand the water cycle within subduction-zone systems . The *Langseth* left Apra Harbor in Guam on 1 February 2012 and began the survey on 3 February 2012. The survey was completed on 27 February 2012 and the *Langseth* returned to Apra Harbor on 28 February 2012.

L-DEO submitted an application to the National Marine Fisheries Service (NMFS) for a permit to harass marine mammals that are incidental to the marine geophysical survey. An Incidental Harassment Authorization (IHA) was granted on 1 February 2012 (Appendix A) with several mitigation measures that stipulated harassment to marine mammals. Mitigation measures were implemented to minimize potential impacts to marine mammals throughout the duration of the survey. Mitigation measures included, but were not limited to, the use of NMFS approved Protected Species Observers (PSOs) for both visual and acoustic monitoring, establishment of safety radii, and implementation of ramp-up, power-down and shut-down procedures.

RPS was contracted by L-DEO to provide continuous protected species observation coverage and to fulfill the environmental regulatory requirements and reporting mandated by NMFS in the IHA. Four PSOs and one passive acoustic monitoring (PAM) Operator/PSO were present on board the *Langseth* throughout the survey in this capacity.

PSOs undertook a combination of visual and acoustic watches, conducting a total of 327 hours 36 minutes of visual observations and 436 hours 26 minutes of acoustic monitoring over the course of the survey.

This visual monitoring effort produced a project total of four protected species detection records, which were all of cetaceans. Of the four cetacean records collected, two records were collected for odontocetes, one record of an unidentified mysticete and one of an unidentified large cetacean. Additionally, there were two acoustic detections made using the PAM system. Both acoustic detections were of unidentified Delphinids.

Detections of protected species did not result in any mitigation actions being implemented. During all visual detections the protected species remained outside of the 180 dB safety radius. A known six cetaceans were exposed to received sound levels equal to or greater than 160 dB of sound from the acoustic source, constituting a level B harassment take as defined by NMFS. Cetacean Level B harassment takes included four sperm whale takes. Additionally, two unidentified whales were observed within the 160 dB safety radius.

A project summary sheet of observation, detection, and operational totals can be found in Appendix B.

2. INTRODUCTION

The following report details the protected species monitoring and mitigation as well as seismic survey operations undertaken as part of the Wiens seismic survey on board the *R/V Langseth* from 1 February to 28 February 2012 in the Northern Mariana Islands.

This document serves to meet the reporting requirements dictated in the IHA issued to L-DEO by NMFS on 1 February 2012. The IHA authorized non-lethal takes of Level B harassment of specific marine mammals incidental to a marine seismic survey program. NMFS has stated that seismic source received sound levels greater than 160 dB could potentially disturb marine mammals, temporarily disrupting behavior, such that they could be considered as "takes" of these exposed animals. Potential consequences of Level B harassment taking could include effects such as temporary or permanent hearing threshold shifts, behavior modification and other reactions. It is unknown to what extent cetaceans exposed to seismic noise of this level would express these effects, and in order to take a precautionary approach, NMFS requires that provisions such as safety radii, power-downs and shut-downs be implemented to mitigate for these potential effects.

2.1. PROJECT OVERVIEW AND LOCATION

The survey was conducted in the Commonwealth of the Northern Mariana Islands. The survey took place in the area 16.5 to 19° North and 146.5 to 150.5° East, where water depths ranged from ~2000 meters to >8000 meters (Figure 1). The seismic survey was conducted in the U.S. Exclusive Economic Zone (EEZ) and in International waters. The closest that the vessel approached to any island is ~50 kilometers from Alamagan. The *Langseth* deployed an array of 36 airguns as an energy source. The receiving system consisted of one 6 kilometer hydrophone streamer and/or ocean bottom seismometers (OBSs). As the airgun array was towed along the survey lines, the hydrophone streamer received the returning acoustic signals and transferred the data to the onboard processing system. The OBSs recorded the returning acoustic signals internally for later analysis. Before the Langseth arrived to the survey area the *R/V Thomas Thompson* deployed at total of 80 OBSs, consisting of 61 short-period and 19 broad band OBSs.

The total survey effort consisted of approximately 4402 kilometers of transect lines. The transect lines was shot twice: once using the streamer as the receiver and once again using the OBSs.

The *Langseth*'s cruising speed was about 10-12 knots during transits and varied between 4 and 5 knots during the seismic survey. Seismic acquisition began on 3 February and continued until 27 February.

L-DEO conducted the seismic survey over the Mariana outer forearc, the trench and the outer rise of the subducting and bending Pacific plate. The objective was to understand the water cycle within subduction-zone systems. Subduction systems are where the basic building blocks of continental crust are made and where Earth's great earthquakes occur. Little is known about either of these processes, but water cycling through the system is thought to be the primary controlling factor in both arc-crust generation and megathrust seismicity.

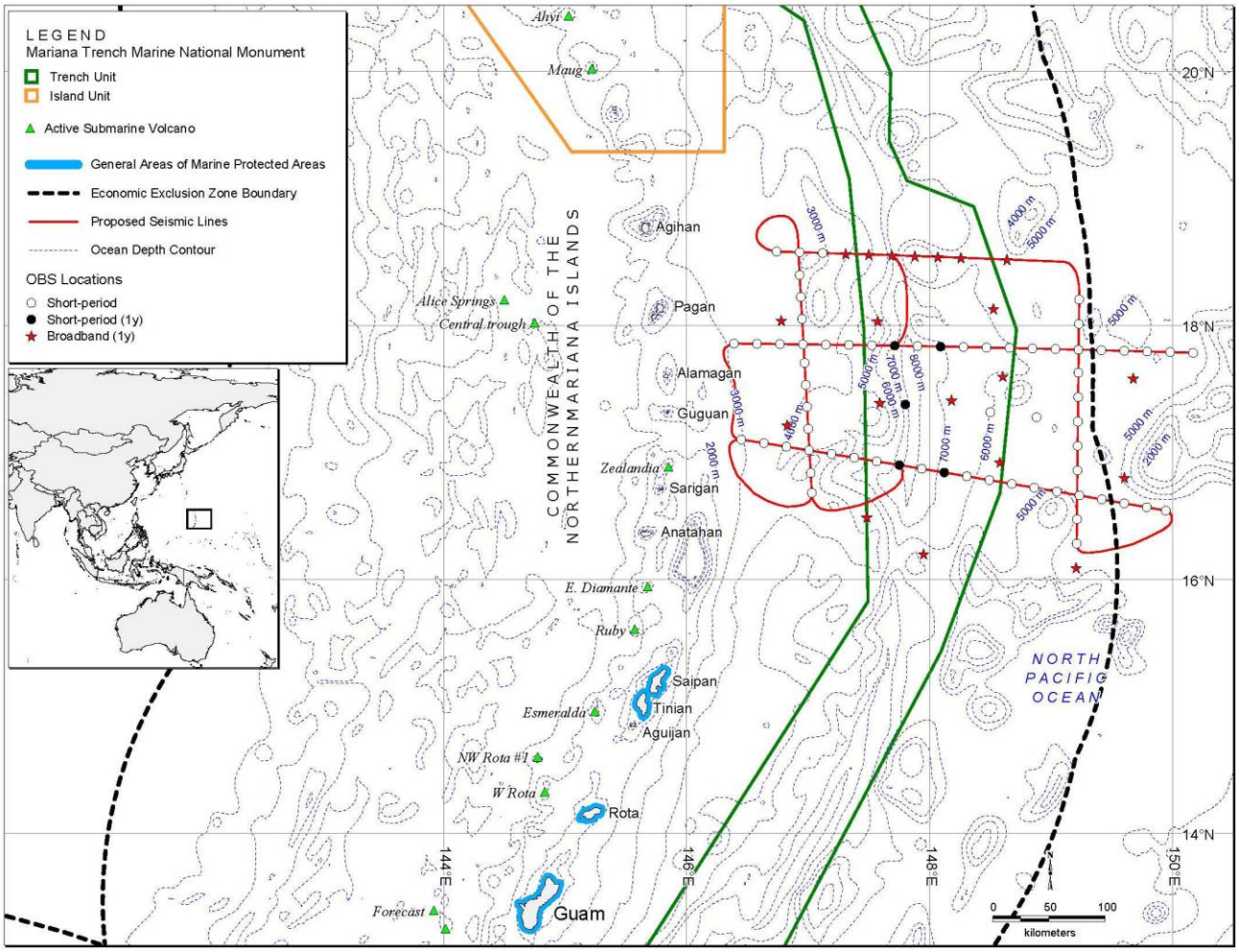


Figure 1. Location of the Wiens marine geophysical survey in the Pacific Ocean (LGL EIA 2011).

2.1.1. Energy Source

The acoustic source consisted of four towed airgun sub-arrays and one hydrophone streamer cable. The sub-arrays were deployed centrally astern as a single acoustic source with each array separated by eight meters. The airguns were towed at a depth of nine meters and were situated 232 meters from the Navigational Reference Point (NRP), which was located on the PSO observation tower.

Each source array utilized a mixture of Bolt 1500LL and Bolt 1900LLX airguns ranging in volume from the smallest airgun of 40 in^3 to 360 in^3. Each sub-array contained ten airguns, with the first and last spaced 16 meters apart. Only nine airguns on each sub-array were firing during survey acquisition, with the tenth gun utilized as a spare. The total volume of each sub-array was 1,650 in^3. The full power source of four sub-arrays (36 airguns) had a total discharge volume of 6,600 in^3 and a pressure of 1,900 psi. Each discharge of the source consisted of a single brief pulse of sound (duration of approximately 0.1 second) with the greatest energy output occurring in the two to 188 hertz frequency range.

The shot point interval for the multichannel seismic (MCS) survey was 50 meters, equating to approximately 20 to 24 seconds at typical survey speed, but was increased to 500 meters

during the acquisition of the three OBS survey lines, or approximately 220 seconds at typical survey speed. The sound signal receiving system during the acquisition of the MCS transect lines consisted of a single six kilometer long hydrophone streamer, which received the returning acoustic signals and transferred the data to the processing system located onboard the vessel. Due to the length and placement of the cables, the maneuverability of the vessel was limited to turns of five degrees per minute while the gear was being towed.

In addition to the operations of the airgun array, a Kongsberg EM 122 multibeam echosounder (MBES), a Knudsen Chirp 3260 sub-bottom profiler (SBP), and a hull-mounted acoustic Doppler current profiler (ADCP) was operated from the *Langseth* continuously throughout the cruise. These sound sources are operated from the *Langseth* simultaneous with the airgun array.

3. MITIGATION AND MONITORING METHODS

The PSO monitoring program on the *Langseth* was established to meet the IHA requirements that were issued to the L-DEO by NMFS, which included both monitoring and mitigation objectives. The survey mitigation program is designed to minimize potential impacts of the *Langseth*'s seismic program on marine turtles, marine mammals, and other protected species of interest. The following monitoring protocols were followed to meet these objectives.

- Visual observations were established to provide real-time sighting data, allowing for the implementation of mitigation procedures as necessary.
- Operation of a PAM system to compliment visual observations and provide additional marine mammal detection data.
- Ascertain the effects of marine mammals and marine turtles exposed to sound levels constituting a "take".

In addition to the mitigation objectives outlined in the IHA, PSOs collected and analyzed necessary data mandated by the IHA for this report including but not limited to:

- Dates, times and locations, heading, speed, weather, sea conditions (including Beaufort sea state and wind force), and related activities during all seismic operations and marine mammal detections.
- Species, number, location, distance from the vessel, and behavior of any marine mammals, as well as associated seismic activity including the number of power-downs and shut-downs, were observed and logged throughout all monitoring actions.
- An estimate of the number, decided 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 µPa (rms), 180 dB re 1 µPa (rms) and/or 190 dB re 1 µPa (rms) along with a discussion of any specific behaviors those individuals exhibited; and (B) may have been exposed (based on modeling results) to the seismic activity at received levels greater than or equal to 160 dB re 1 µPa (rms), 180 dB re 1 µPa (rms) and/or 190 dB re 1 µPa (rms) along with a discussion of the plausible consequences of that exposure on the individuals that were within the safety radii.
- A description of the implementation and effectiveness of the: (A) terms and conditions of the ITS and (B) mitigation measures of the IHA.

3.1. VISUAL MONITORING SURVEY METHODOLOGY

There were five trained and experienced PSOs on board to conduct the monitoring for marine mammals, record and report on observations, and request mitigation actions in accordance to the IHA. The PSOs on board were NMFS approved and held certifications from a recognized Joint Nature Conservation Committee (JNCC) course and/or approved Bureau of Ocean Energy Management (BOEM) course. Visual monitoring was primarily carried out from an observation tower (Figure 2) located 18.9 meters above the water surface which afforded the PSOs a 360 degree viewpoint around the acoustic source.

Figure 2. Protected Species Observer observation tower with mounted big-eye binoculars.

The PSO tower was equipped with Fujinon 7x50 binoculars as well as two mounted 25x150 Big-eye binoculars. Inside the tent located in the middle of the platform was a laptop for data collection as well as a telephone for communication with the PAM station, bridge, or main lab. Also inside the tent was a monitor that displayed current information about the vessel's position, speed, and heading, along with water depth, wind speed and direction, and source activity. Most observations were held from the tower; however, when there was severe weather or poor environmental conditions observations would be performed from the bridge (~12.8m above sea level) or the catwalk (~12.3m above sea level) in front of the bridge. Night Quest NQ2200 Night Vision Devices were also available to conduct night time observations for nighttime ramp-ups of the acoustic source, but were not used during this survey.

Visual monitoring methods were implemented in accordance with the survey requirements outlined in the IHA. At least one PSO, but most often two PSOs, watched for marine mammals and sea turtles at all times while airguns operated during daylight periods and whenever the vessel was underway when the airguns were not firing.

When the acoustic source was activated from silence, PSOs maintained a two-person watch for 30 minutes prior to the activation of the source. Visual watches commenced each day before sunrise, beginning as soon as the safety radii were visible, and continued past sunset until the safety radii became obscured. Start of observation times ranged from 6:00 to 6:37 local time, while end of observation times ranged from 18:14 to 18:48 local time.

A visual monitoring schedule was established by the PSOs where each person completed visual watches which varied in length between one to four hours, one to three times a day, for a total of four to six hours of visual monitoring per day. This schedule was arranged to ensure that two PSOs were on visual observation duty at all times except during meal breaks when PSOs would each maintain a solo watch so that the team could eat while maintaining both visual and acoustic monitoring. Solo watches lasted less than 45 minutes and occurred twice each day for lunch and dinner.

Observations were focused forward of the vessel and to the sides but with regular sweeps through the area around the active acoustic source. PSOs searched for blows indicating the presence of a marine mammal, splashes or disturbances to the sea surface, the presence of large flocks of feeding seabirds and other sighting cues indicating the possible presence of a protected species.

Upon the visual detection of a protected species, PSOs would first identify the animals range to the acoustic source while identifying the observed animal (cetacean, pinniped, or sea turtle) to determine which safety radius applied to the animal. The visual PSOs would then notify the PAM operator, who was located in the main science lab, that there was an animal inside or outside of the safety radius. If the animal was observed inside the safety radius and a mitigation action was necessary, the PAM operator would relay the message to the seismic technician who was sitting nearby. Table 1 describes the various exclusion zone radii applied to cetaceans and pinnipeds, as well as what constituted the Level B harassment zone. The PAM operator was also notified of all marine mammal sightings as soon as possible in order to enable recordings to be made for possible analysis later by one of the more experienced acoustic operators to determine whether vocalizations had been detected on the PAM system during the sighting.

Table 1. Exclusion zone (EZ) radii for triggering mitigation.

Source and Volume	Array Tow Depth (m)	Water Depth (m)	Shut-down EZ for Pinnipeds 190 dB (m)	Shut-down EZ for Cetaceans 180 dB (m)	Level B Harassment Zone 160 dB (m)
Single bolt airgun (40 in^3)	9	Deep (>1,000)	12	40	385
4 strings 36 airguns (6600 in^3)	9	Deep (>1,000)	400	940	3,850

When a protected species was observed range estimations were made using reticle binoculars, the naked eye, and by relating the animal to an object at a known distance, such as the acoustic array located 232 meters from the PSO tower. Specific species identifications were made whenever distance, length of sighting and visual observation conditions allowed. PSOs observed anatomical features of animals sighted with the naked eye, the Big-eye binoculars, and/or reticule binoculars and noted behavior of the animal or group. Photographs were taken during most sightings. Sometimes photographs were not taken due to the brevity of a sighting. The camera used was a Canon EOS 60D with a 300 millimeter telephoto lens. Marine mammal and sea turtle identification manuals were consulted and photos were examined during visual watch breaks to confirm identifications.

During or immediately after each sighting event PSOs recorded the position, time at first and last sighting, number of animals present (adults and juveniles), the initial and any subsequent behaviors observed, the initial range, bearing and movement of the animal(s), the source activity at the initial and final detections and any mitigation measures that were applied. Specific information regarding the animal(s) closest approach to the vessel, acoustic source and the acoustic source output at the closest approach were recorded to determine if the animals had been exposed to 160 dB and/or 180/190 dB of sound from the source during the sighting event. Additionally, the vessel position, water depth, vessel heading and speed, the wind speed

and direction, Beaufort sea state, swell level, visibility and glare were recorded every half an hour at minimum or every time environmental conditions, vessel, or seismic activity changed. Each sighting event was linked to an entry on a datasheet such that environmental conditions were available for each sighting event.

3.1.1. Forward Looking InfraRed (FLIR) Camera

A Forward Looking InfraRed (FLIR) Camera was utilized each day during the project in order to test its application and effectiveness in the detection of protected species. FLIR is a thermal imaging system that detects temperature differences between objects. The camera was mounted above the ship's wheelhouse at a height of 17.25 meters above the water (when the ship's draft is 4.5 meters). The monitor and joystick control unit of the system were located in the wheelhouse on the port side of the main steering console and were moved to the PAM station on 17 February 2012. The FLIR model used was the M-324XP model, designed specifically for marine use. The camera's operating temperatures range from -25˚ C to +55˚ C. The FLIR camera has a focal length of 19 mm and a zoom of 2x. It is capable of detecting objects 1.8 meters high from a distance of 450 meters, as well as a small vessel 4.0 m X 1.5 m from a distance of 1.3 kilometers. It is also designed to withstand a 100 knot wind and has a radial view of 360˚. Some of the ship's infrastructure impedes approximately 20% of the view of the water, (primarily in an aft direction toward the guns) as a result the camera's location is forward of the exhaust stacks.

The PSOs monitored the FLIR camera daily, averaging four hours per day for a total effort of 81 hours. These four hours were timed to coincide with visual monitoring efforts. Two visual detections occurred while FLIR was being monitored: one small unidentified baleen whale approximately 1800m from the vessel, and one sperm whale approximately 1100m from the vessel. Neither of these detections was observed by the PSO monitoring FLIR. FLIR monitoring efforts yielded a few seabird detections, usually only captured on FLIR at distances less than 100 meters. During periods of rain or high winds with sea spray the monitor would become hazy and difficult to observe with.

3.2. ACOUSTIC MONITORING SURVEY METHODOLOGY

PAM was used to augment visual monitoring efforts, by helping to detect, identify, and locate marine mammals within the area. PAM was also used during periods of darkness or low visibility when visual monitoring might not be applicable or effective. The PAM system was monitored to the maximum extent possible, 24-hours a day during seismic operations, and the times when monitoring was possible while the airguns were not in operation. PAM was not used exclusively to execute any mitigation actions without a concurrent visual sighting of the marine mammal.

Two PSOs who were trained and experienced with the use of PAM, were present throughout the cruise. One person was designated as the PAM operator to oversee and conduct the PAM operations. All PSOs completed a PAM training provided by the PAM Operator in the initial days of the hydrophone deployment during which basic PAM system operation was covered. To achieve 24-hours of monitoring, the PSOs and the PAM operator rotated through acoustic monitoring shifts with the PAM operator monitoring many of the night time hours when PSOs were not making visual observations and when the PAM was the only system in use for detecting cetaceans. Monitoring shifts lasted two to six hours. During daylight hours, acoustic operators were in communication with visual PSOs in the tower relaying sighting and seismic activity information. The PAM system was located in the main science lab to provide adequate

space for the system, allow a quick exchange of communications with the visual PSOs on watch and seismic technicians, and to provide access to the vessel's instrumentation. The vessel's position, water depth, heading and speed, vessel and airgun activity were recorded every half hour.

Acoustic monitoring for marine mammals was conducted aurally with *Sennheiser* headphones and visually with *Pamguard Beta 1.9.01*. Delphinid whistles, clicks, and burst pulses as well as sperm whale and baleen whale vocalizations may be viewed on a spectrogram display within *Pamguard*. Sperm whale, beaked whale, *Kogia* species, and delphinid echolocation clicks may be viewed on low and high frequency click detector displays. The Spectrogram's amplitude range and appearance were adjusted as needed to suit the operator's preference to maximize the vocalizations appearance above the pictured background noise.

3.2.1. Passive Acoustic Monitoring Parameters

Acoustic monitoring was carried out using a PAM system developed by Seiche Measurements Limited. The PAM system specifications can be found in Appendix C. The PAM system consists of seven main components: a 250m hydrophone tow cable, a 100m deck cable, a data processing unit, two laptops, an acoustic analysis software package, and headphones for aural monitoring.

The hydrophone cable contains four hydrophone elements and a depth gauge molded into a 5m section of the cable. Three of the hydrophone elements are broadband (2 to 200kHz) and the fourth element is for sampling lower frequencies (75Hz to 30kHz). Preamplifiers are also embedded into the array cable just ahead of each hydrophone element. The four-element linear hydrophone array permits a large range for sampling marine mammal vocalizations.

The electronic processing unit contained a buffer processing unit with USB output, an *RME Fireface 800 ADC* processing unit with firewire output, a *Behringer Ultralink Pro mixer*, a *Behringer Ultralink Pro graphic equalizer* and a Sennheiser radio headphone transmitter. Two laptops were set-up in the main lab next to the electronic processing unit to display a high frequency range on one laptop (hereafter referred to as the HF laptop), using the signal from two hydrophones, and the low frequency on the other laptop (LF laptop) receiving signal from all four hydrophones. A GPS feed of INGGA strings was supplied from the ship's navigation system and connected to the LF laptop, reading data every 20 seconds.

The high frequency (HF) system was used to detect and localize ultrasonic pulses used by some dolphins, beaked whales and *Kogia* species. The signal from two hydrophones was digitized using an analogue-digital National Instruments data acquisition (DAQ) soundcard at a sampling rate of 500 kilohertz, then processed and displayed on a laptop computer using the program *Pamguard Beta 1.9.01* via USB connection. The amplitude of clicks detected at the front hydrophone was measured at 5th order Butterworth band-pass filters ranging from 35 kilohertz to 120 kilohertz with a high pass digital pre-filter set at 35 kilohertz (Butterworth 2nd order). *Pamguard* can use the difference between the time that a sound signal arrived at each of the two hydrophones to calculate and display the bearing to the source of the sound. A scrolling bearing time display in *Pamguard* also can display the detected clicks within the HF envelope band pass filter in real time, which would allow the identification and directional mapping of detected animal click trains.

The low frequency (LF) system was used to detect sounds produced by marine mammals in the

human audible band between approximately four kilohertz and 24 kilohertz. The low frequency system used four hydrophones; the signal was interfaced via a firewire cable to a laptop computer, where it was digitized at 48 kilohertz per channel. The LF hydrophone signal was further processed within the *Pamguard* monitoring software by applying Engine Noise Fast Fourier Transform (FFT) filters including click suppression and spectral noise removal filters (median filter, average subtraction, Gaussian kernel smoothing and thresholding). In addition to the Spectrogram available for each of the four hydrophones, modules for Click Detector, Mapping, Sound Recording and Radar displays for bearings of whistles and moans were configured. The bearings and distance to detected whistles and moans can be calculated using a Time-of-Arrival-Distance (TOAD) method (the signal time delay between the arrival of a signal on each hydrophone is compared), and presented on a radar display along with amplitude information for the detected signal as a proxy for range. The vessel's GPS connected to the LF laptop via serial USB and allowed delphinid whistles and other cetacean vocalizations to be plotted onto a map module where bearing and range to the vocalizing animal's actual position could be obtained. A mixer unit enabled the operator to adjust stereo signal levels from each of the four hydrophones. The PAM Operator monitored the hydrophone signals aurally using headphones.

3.2.2. Hydrophone Deployment

The vessel had a winch installed on the port stern deckhead of the gun deck for deployment of the PAM hydrophone cable. Two deck cables, the main cable and a spare, were installed along the gun deck deckhead running from the winch to the science lab.

Figure 3 shows the position of the hydrophone deployments in relation to the vessel and seismic equipment. Photos of the hydrophone deployment methods and equipment discussed below can be found in Appendix D.

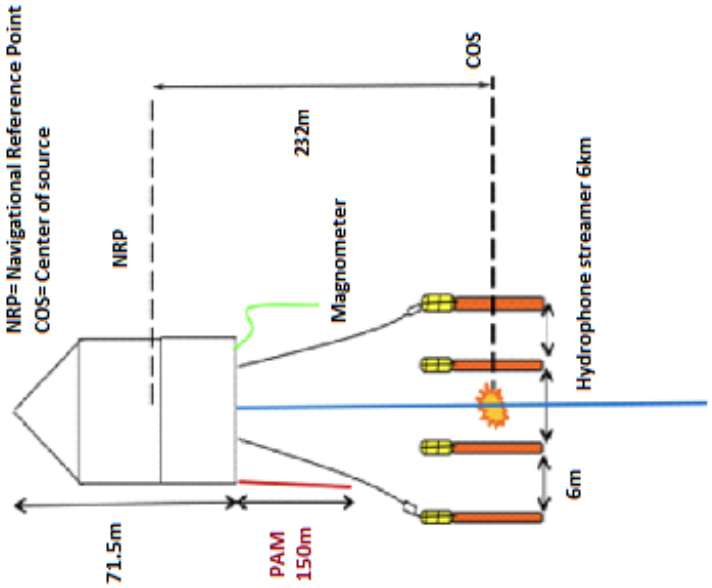


Figure 3. Location of the hydrophone deployment.

4. MONITORING EFFORT SUMMARY

4.1. SURVEY OPERATIONS SUMMARY

The *R/V Langseth* departed Apra Harbor, Guam for the seismic survey site at 23:00 UTC on 1 February 2012. The seismic gear was deployed and use of the acoustic source commenced at 03:05 UTC on 3 February 2012. Acquisition began on the first MCS survey line began at 05:35 UTC on 3 February 2012. Acquisition of the MCS survey lines was completed at 00:24 UTC on 12 February 2012. The hydrophone streamer was retrieved at this point and acquisition of the OBS survey lines began at 10:46 UTC on 12 February 2012. Table 2 outlines the dates and times of acquisition for each survey line.

Acquisition of OBS survey lines was completed at 10:02 UTC on 27 February 2012. At this time the seismic gear was brought on board and the *Langseth* began the transit back at Apra Harbor, Guam arriving at 22:23 UTC on 28 February 2012.

Table 2. Wiens marine geophysical survey multi-channel seismic and ocean-bottom seismometer examination lines acquired.

Survey Line	Date Acquisition Commenced	Time Acquisition Commenced	Date Acquisition Completed	Time Acquisition Completed
MGL1204MCST1 Seq 1	3-Feb-12	03:27	3-Feb-12	05:12
MGL1204MCS01 Seq 2	3-Feb-12	05:35	4-Feb-12	11:29
MGL1204MCS02 Seq 3	4-Feb-12	13:01	5-Feb-12	02:13
MGL1204MCS03 Seq 4	5-Feb-12	04:38	6-Feb-12	01:12
MGL1204MCS03A Seq 5	6-Feb-12	06:33	7-Feb-12	18:19
MGL1204MCS04 Seq 6	7-Feb-12	19:23	8-Feb-12	06:44
MGL1204MCS05 Seq 7	8-Feb-12	07:27	8-Feb-12	08:26
MGL1204MCS05A Seq 8	8-Feb-12	08:47	9-Feb-12	12:36
MGL1204MCS06 Seq 9	9-Feb-12	15:03	10-Feb-12	01:46
MGL1204MCS07 Seq 10	10-Feb-12	02:49	10-Feb-12	23:13
MGL1204MCS07A Seq 11	10-Feb-12	23:14	12-Feb-12	00:24
MGL1204OBS01 Seq 12	12-Feb-12	10:46	14-Feb-12	10:03
MGL1204OBS02 Seq 13	14-Feb-12	11:10	14-Feb-12	20:43
MGL1204OBS03 Seq 14	14-Feb-12	20:47	15-Feb-12	02:51
MGL1204OBS04 Seq 15	15-Feb-12	04:51	16-Feb-12	10:38
MGL1204OBS05 Seq 16	16-Feb-12	13:19	16-Feb-12	21:17
MGL1204OBS06 Seq 17	16-Feb-12	21:24	17-Feb-12	06:59
MGL1204OBS07 Seq 18	17-Feb-12	09:06	19-Feb-12	02:37
MGL1204OBS08 Seq 19	19-Feb-12	02:47	19-Feb-12	12:48
MGL1204OBS09 Seq 20	19-Feb-12	14:00	20-Feb-12	00:32
MGL1204OBS10 Seq 21	20-Feb-12	00:39	20-Feb-12	08:13
MGL1204OBS11 Seq 22	20-Feb-12	09:30	20-Feb-12	17:43
MGL1204OBS12 Seq 23	20-Feb-12	17:45	21-Feb-12	10:38
MGL1204OBS13 Seq 24	21-Feb-12	11:47	21-Feb-12	17:48
MGL1204OBS18 Seq 25	21-Feb-12	17:58	22-Feb-12	23:04
MGL1204OBS19 Seq 26	22-Feb-12	23:09	23-Feb-12	14:53
MGL1204OBS20 Seq 27	23-Feb-12	14:56	24-Feb-12	22:12
MGL1204OBS21 Seq 28	24-Feb-12	22:25	25-Feb-12	09:20
MGL1204OBS22 Seq 29	25-Feb-12	09:31	25-Feb-12	16:34
MGL1204OBS23 Seq 30	25-Feb-12	17:53	27-Feb-12	06:29
MGL1204OBS24 Seq 31	27-Feb-12	06:39	27-Feb-12	10:02

The acoustic source was active throughout the survey, with one period of source silence, for a total of 576 hours 32 minutes of source activity. This includes ramp-up of the airguns, full power and partial power firing both online and during line changes, and operation of a single 40 in³ mitigation airgun (Figure 4). The mitigation source was to be used during mitigation power-downs initiated for protected species inside the safety radius as well as for mechanical/technical reasons and was not used during the survey. Full power source operations, while online, accounted for 94% (541 hours 02 minutes) of airgun activity during the project. Line changes were often shot at full or partial power, totalling 32 hours 58 minutes of array activity. Additionally, the full volume of the acoustic source (36 airguns firing) ranged from 5940 in³ to 6600 in³, caused by various guns of different sizes being changed out on the arrays.

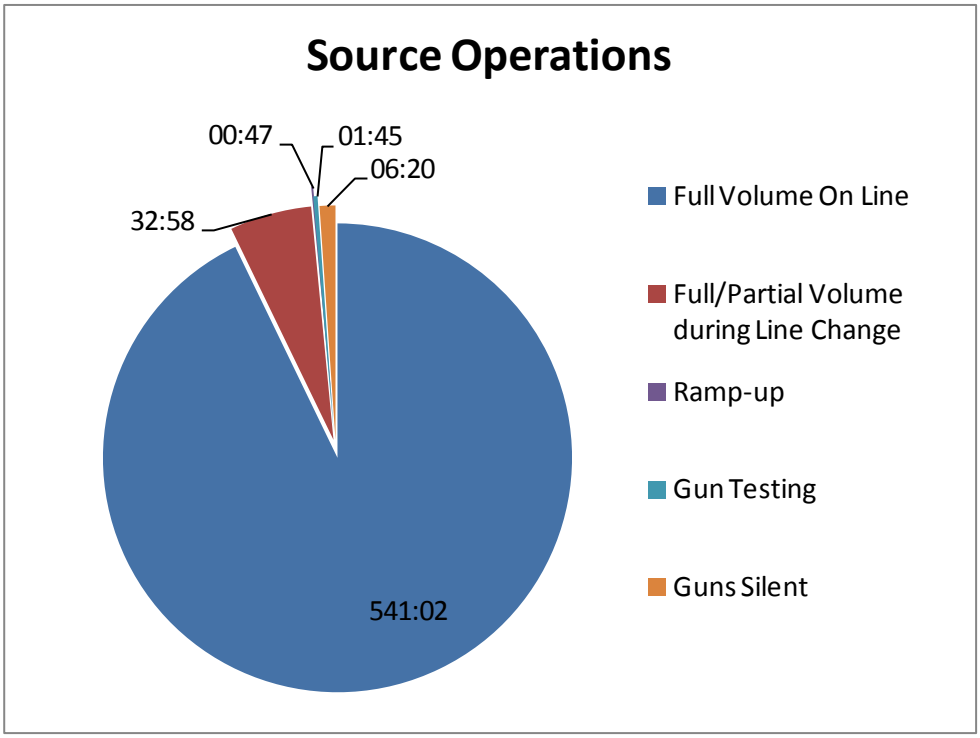


Figure 4. Total acoustic source operations.

The acoustic source was ramped up twice over the course of the survey in order to commence full power survey operations in compliance with the IHA (Table 3). The first ramp up of one array string was conducted over 17 minutes. As each additional airgun string was deployed over the next 1 hour 40 minutes its airguns were activated. The second ramp up was conducted over 30 minutes using the NMFS approved automated gun controller program, DigiShot which adds guns sequentially to achieve full source over the required period of time. Since a doubling of the number of airguns is typically equal to a 6 dB increase in sound level, the array was not ramped up if more than half of the airguns in the array were already firing. Both ramp-ups were conducted from airgun silence, during daylight hours, during the Wiens marine geophysical survey.

Table 3. Total acoustic source operations during Wiens marine geophysical survey.

Acoustic Source Operations	Number	Duration (hh:mm)
Gun Tests		**1:45**
Ramp-up	**2**	**0:47**
Day time ramp-ups from silence	**2**	
Day time ramp-ups from mitigation	**0**	
Night time ramp-ups from mitigation	**0**	
Full power survey acquisition		**541:02**
Full/partial power line changes		**32:58**
Single airgun (40 in³)		**0:00**
Total time acoustic source was active		**576:32**

4.2. VISUAL MONITORING SURVEY SUMMARY

The PSOs began visual observations immediately upon departure and while in transit to the survey site. This was done to collect baseline data about protected species abundance in the area. Visual monitoring began at 23:10 UTC on 1 February 2012 and continued until 8:45 UTC on 28 February 2012 when the vessel returned to Apra Harbor at the completion of the survey project. Visual monitoring was over a period of about 28 days. Monitoring was conducted by two PSOs each day between just before dawn until just after dusk, when it was too dark for the entire safety radius to be visible, averaging approximately 12 hours 15 minutes of visual observations per day.

Visual watches were held by two PSOs except during the scheduled meal hours for lunch and dinner when a single PSO continued visual monitoring, in addition to acoustic monitoring conducted by the PAM operator on duty while each PSO rotated for a meal break. Single PSO visual observations during these periods lasted a maximum of 45 minutes. In the event of a sighting event during a single PSO watch a second PSO would be notified and would immediately return to assist observations.

The acoustic source was active during the majority of visual monitoring (90%) as well as the majority of acoustic monitoring (99.9%), as shown in Figure 5. Once the survey began the acoustic source was only disabled once while retrieving the hydrophone streamer.

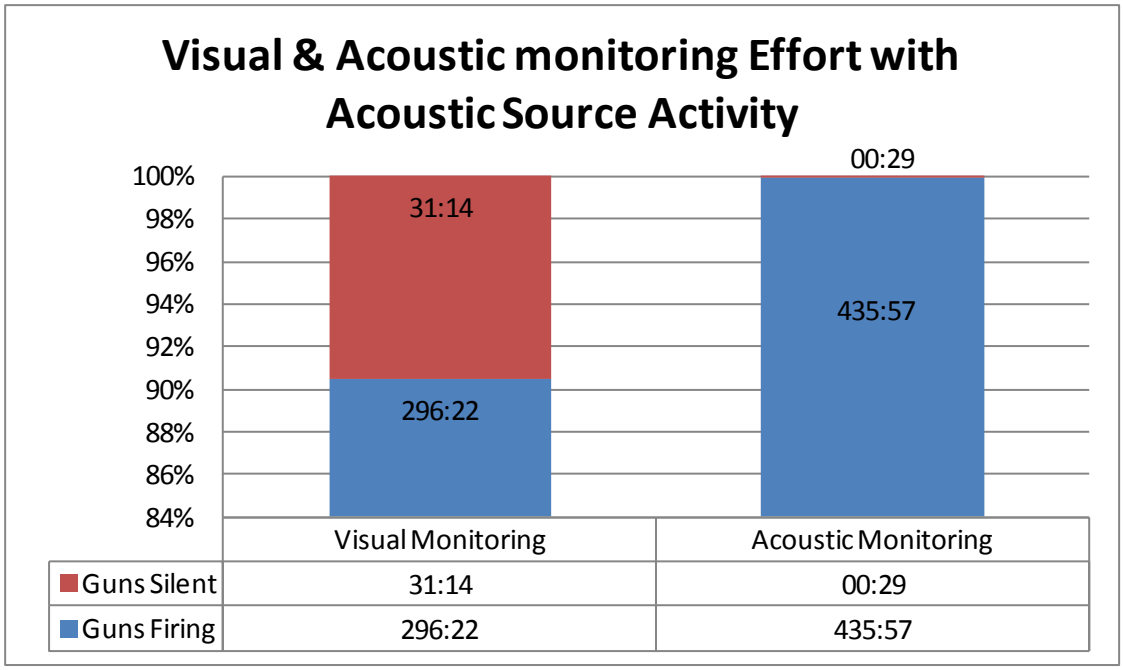


Figure 5. Duration of visual and acoustic monitoring effort while the acoustic source was active vs. silent.

Total visual monitoring effort, divided by monitoring effort while the acoustic source was active and monitoring effort while the source was silent, is listed in Table 4.

Table 4. Total visual monitoring effort.

Visual Monitoring Effort	Duration (hh:mm)
Total monitoring while acoustic source active	**296:22**
Total monitoring while acoustic source silent	**31:14**
Total monitoring effort	**327:36**

The PSOs preferred to conduct visual observations from the PSO tower, which provided the PSOs with a 360° view of the water around the vessel and acoustic source. However, visual watches would be conducted from the catwalk or bridge for any health or safety reason or during periods with high winds, large swells, or heavy rain. As Figure 6 demonstrates approximately 76% of visual monitoring was conducted from the PSO tower during the Wiens marine geophysical survey.

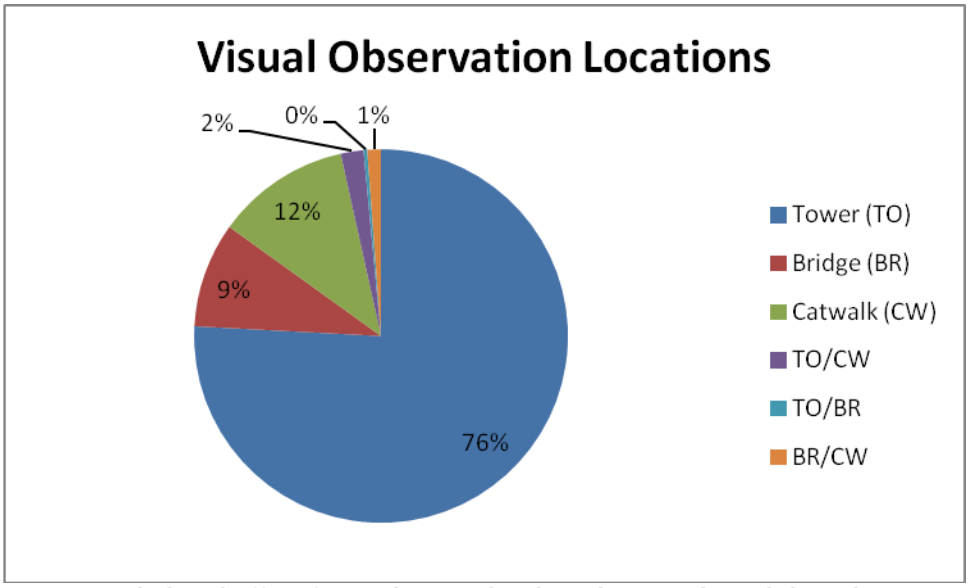


Figure 6. Total visual effort from observation locations on board the *R/V Langseth*.

4.3. ACOUSTIC MONITORING SURVEY SUMMARY

The hydrophone cable was deployed for the first time on 03 February 2012 after the vessel had completed deployment of the source arrays. Acoustic monitoring began immediately at 02:36 UTC and continued throughout the project with PSOs monitoring the hydrophones aurally and monitoring the *Pamguard* detection software visually both day and night. Acoustic monitoring for the project ended at 09:10 UTC on 27 February 2012 when the hydrophone cable was retrieved in preparation for the retrieval of the seismic equipment. Over the course of the project, PSOs conducted 436 hours and 26 minutes of acoustic monitoring, all but 29 minutes occurred while the acoustic source was active (Table 5).

Table 5. Total passive acoustic monitoring (PAM) effort.

Passive Acoustic Monitoring Effort	Duration (hh:mm)
Total night time monitoring	**218:37**
Total day time monitoring	**217:49**
Total monitoring while acoustic source active	**435:57**
Total monitoring while acoustic source silent	**00:29**
Total acoustic monitoring	**436:26**

The majority of acoustic monitoring downtime was attributed to weather when the cable was retrieved to prevent entanglement, or when the cable became entangled, with the seismic equipment (Table 6). The cable would remain on board until the sea state had decreased to a sufficient level to ensure the cable was safe to deploy without risk of entanglement. Weather and entanglement accounted for 133 hours and 10 minutes of acoustic monitoring downtown. Acoustic monitoring was suspended for 10 hours and 2 minutes when the hydrophone cable was retrieved prior to the retrieval of the seismic streamer after the completion of the MCS survey lines. The hydrophone cable was retrieved once for seismic repairs/maintenance to avoid a potential entanglement when the seismic equipment was retrieved; accounting for 2

hours and 56 minutes of the total acoustic monitoring downtime of the project. A description of each instance of acoustic monitoring downtime is located in Appendix E.

Table 6. Passive acoustic monitoring (PAM) downtime.

Passive Acoustic Monitoring Downtime	Duration (hh:mm)
PAM cable entanglement	**133:10**
Seismic streamer deployment/retrieval	**10:02**
Seismic equipment repairs	**02:56**
Total Passive Acoustic Monitoring Downtime	**146:08**

4.4. SIMULTANEOUS VISUAL AND ACOUSTIC MONITORING SUMMARY

While visual observations began on 1 February 2012 while acoustic observations began on 3 February 2012, due to the hydrophone cable needing to be deployed after the airgun arrays to avoid entanglement. Of the total observation effort performed by PSOs during this survey, visual monitoring accounted for 39% (327 hours 36 minutes) while acoustic monitoring accounted for 52% (436 hours 26 minutes) and FLIR monitoring accounted for 9% (81 hours). As displayed in Figure 7 there were 217 hours 49 minutes of simultaneous visual and acoustic observations conducted during this survey. Simultaneous visual and acoustic monitoring accounted for 50% of total acoustic monitoring and 66% of the total visual observation.

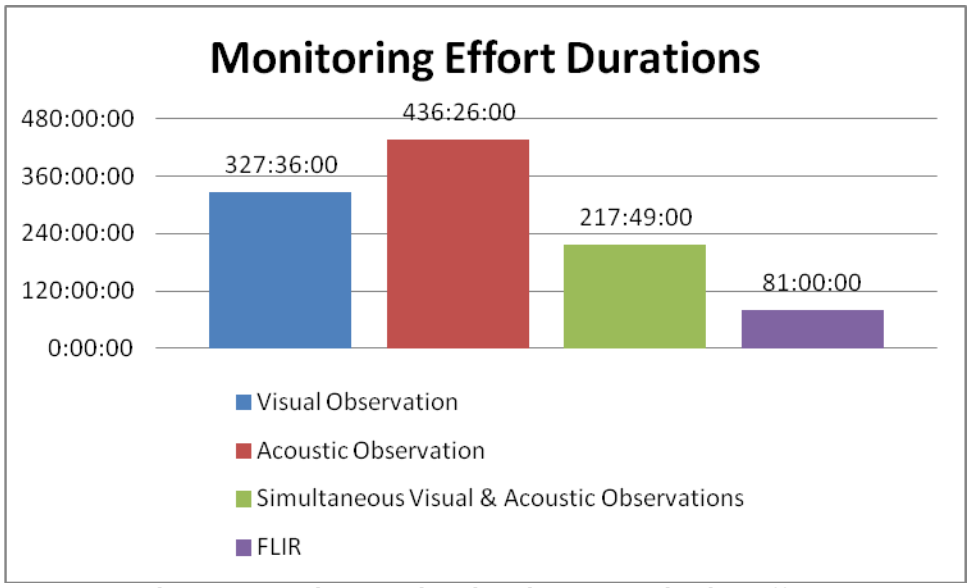


Figure 7. Total PAM, visual and FLIR monitoring effort.

4.5. ENVIRONMENTAL CONDITIONS

A majority of visual monitoring effort was conducted during moderate observations conditions. There were a few brief periods where visibility was obscured/hindered by precipitation and the safety radii were almost always visible. Visibility remained clear, 5 kilometers or more, for the majority of the cruise.

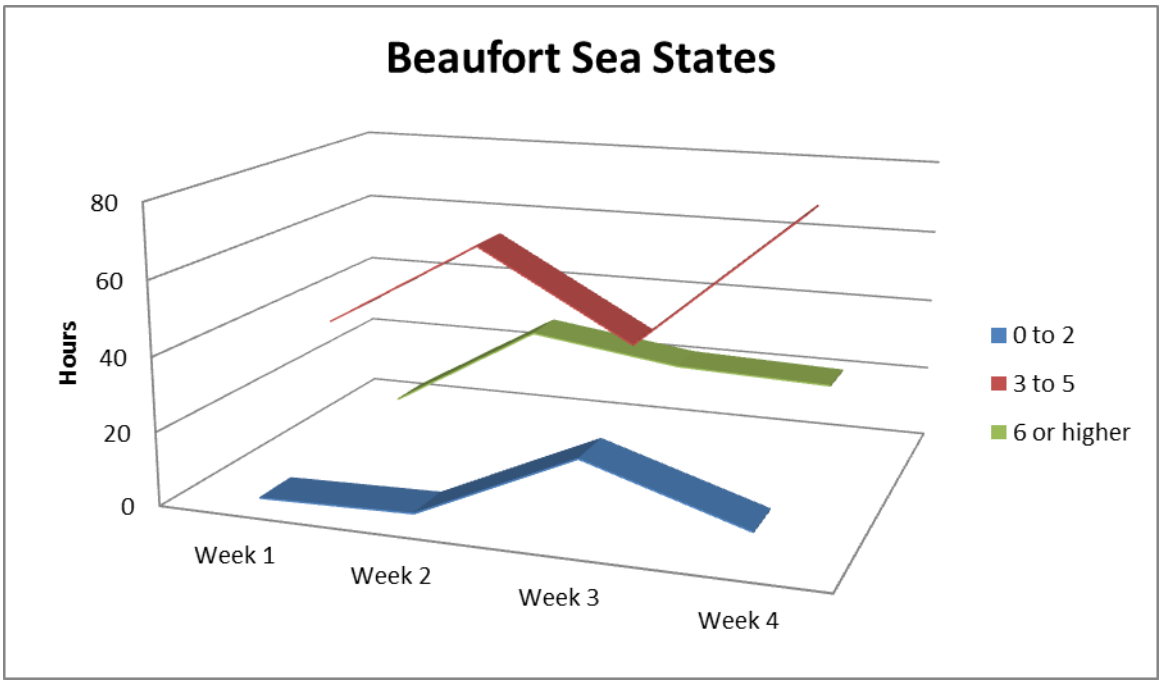


Figure 8. Beaufort sea state during visual monitoring over the Wiens marine geophysical survey.

Periods of light to heavy rain were infrequent throughout the cruise and did not affect observations. A total of 19 hours of precipitation was recorded. The Beaufort Sea states ranged from levels 1 through 7 but remained between a level 3 and level 5 for a total of 215.5 hours (Figure 8).

Wind forces remained relatively stable throughout the cruise with a minimum of less than 1 knot during the third week to a maximum of 35 knots during the second week. Forces from 10-20 knots were the average during the cruise totaling 162 hours (Figure 9).

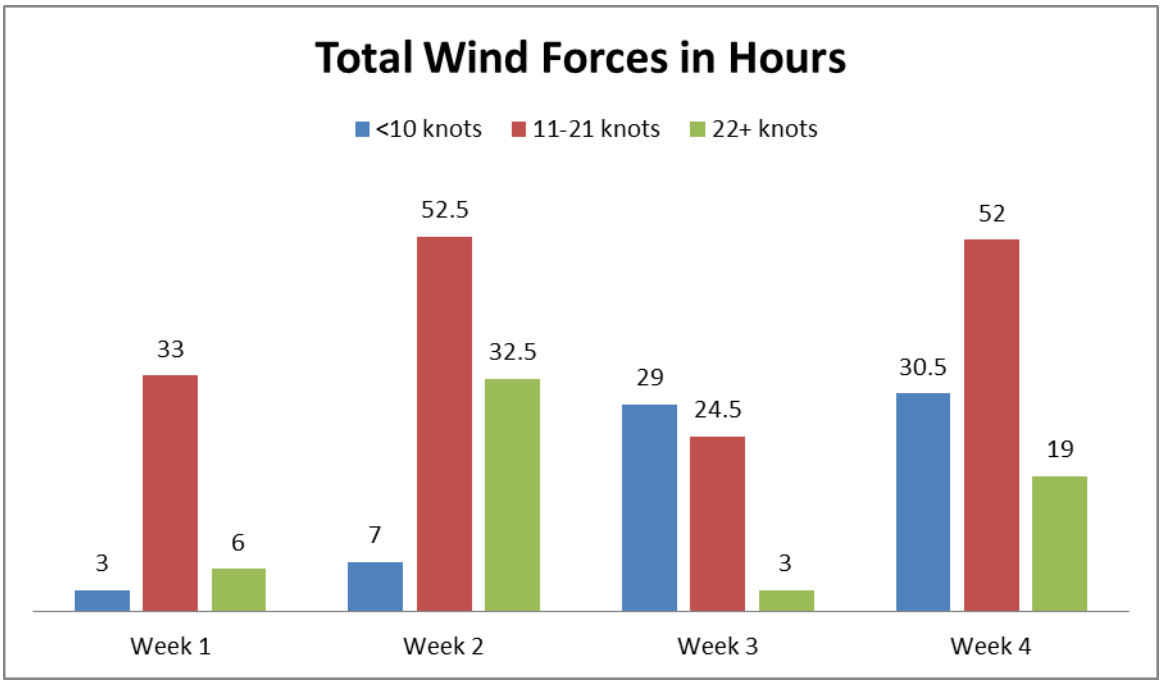
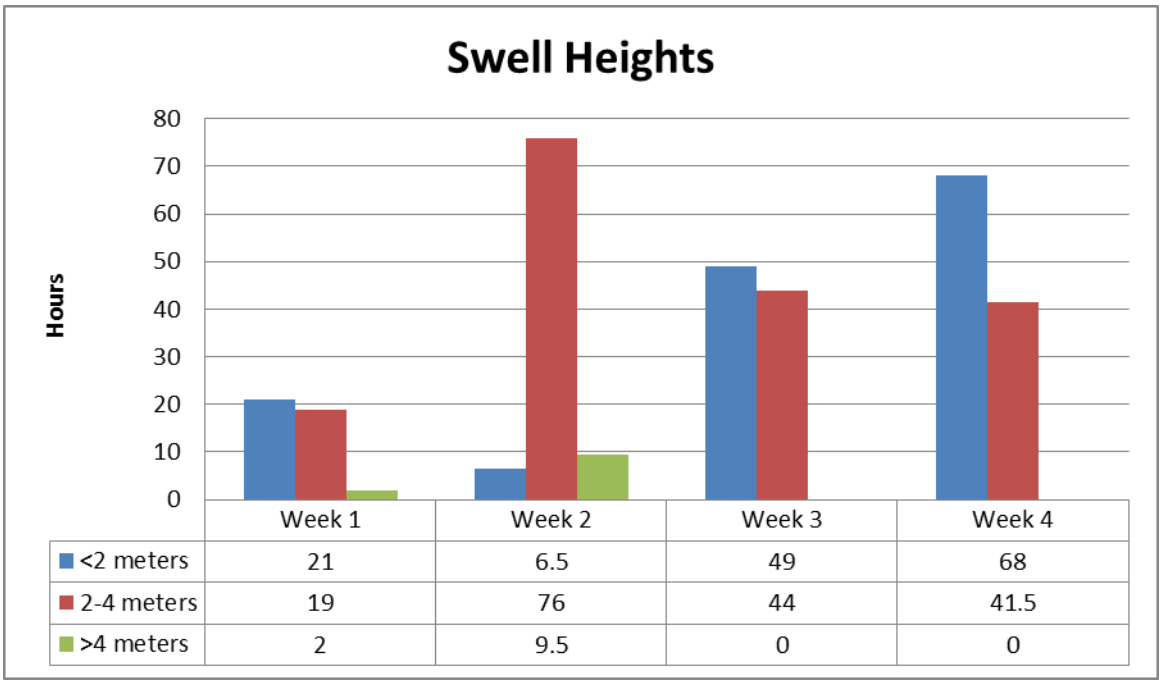


Figure 9. Average wind force each week during visual monitoring.



	Week 1	Week 2	Week 3	Week 4
<2 meters	21	6.5	49	68
2-4 meters	19	76	44	41.5
>4 meters	2	9.5	0	0

Figure 10. Swell heights while visual monitoring was conducted.

5. MONITORING AND DETECTION RESULTS

5.1. VISUAL DETECTIONS

Visual monitoring conducted during the Wiens marine geophysical survey resulted in the collection of four records of detection for protected species (summarized in Appendix F). One species of marine mammal was positively identified, along with one unidentified small baleen whale, and one unidentified whale. The total number of detection events and total number of animals recorded by species is described in Table 7.

A complete list of bird species observed and identified in addition to the approximate number of individuals observed and the number of days on which they were observed can be found in Appendix G.

Table 7. Number of visual detection records collected for each protected species.

	Total Number of Detection Records	Total Number of Animals Recorded
Cetaceans		
Unidentifiable whale	1	1
Odontocetes		
Sperm whale	2	4
Mysticetes		
Unidentifiable baleen whale	1	1
TOTAL	**4**	**6**

There were very few sightings of protected species during the Wiens survey and it was common to go many days without detections of protected species (Figure 11). Three of the detections occurred within a seven hour period on 18-19 February 2012.

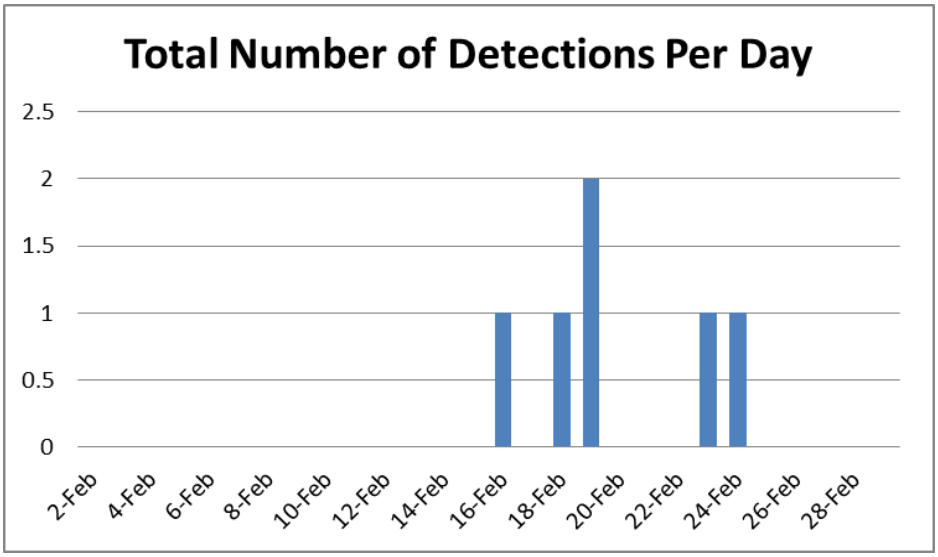


Figure 11. Number of protected species detections each day of the Wiens marine geophysical survey.

All of the four visual protected species detection events during the Wiens marine geophysical survey occurred while the acoustic source was active.

Table 8 demonstrates the average closest approach of protected species to the source at various volumes.

Table 8. Average closest approach of protected species to the acoustic source at various volumes.

Species Detected	Full Power (5940-6600 in³)		Single Airgun 40 in³		Ramp-up / Other Reduced Volume		Not Firing	
	Number of detections	Average closest approach to source (meters)	Number of detections	Average closest approach to source (meters)	Number of detections	Average closest approach to source (meters)	Number of detections	Average closest approach to source (meters)
Sperm whale	2	1450	-	-	-	-	-	-
Unidentified whale	1	1535	-	-	-	-	-	-
Unidentified baleen whale	1	1900	-	-	-	-	-	-

All protected species detection records were of cetaceans. Figure 12 demonstrates the total number of animals observed, per species, during the detection events. Sperm whales were the most abundant positively identified protected species accounting for two visual detections totaling four animals.

The spatial distribution of marine mammal detections can be seen in Figure 13.

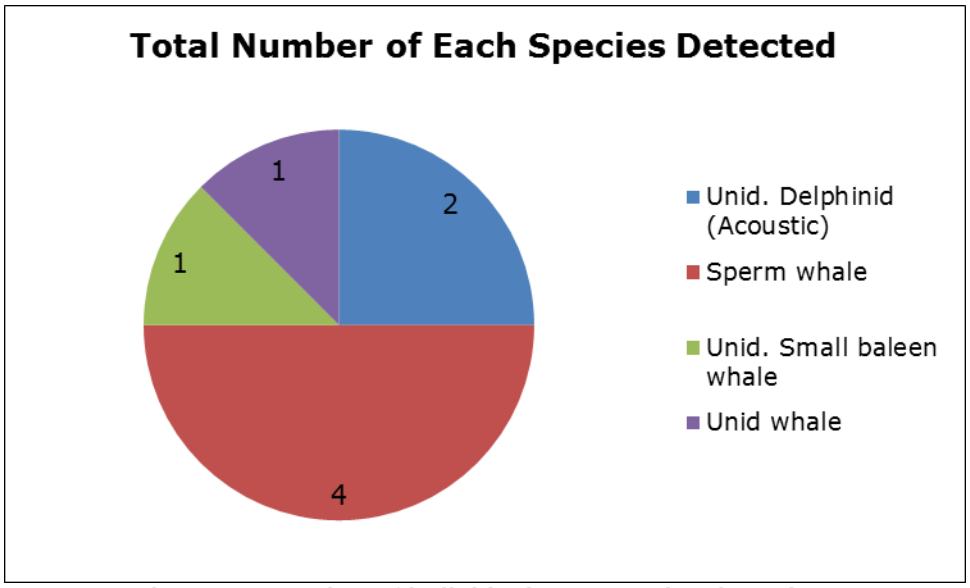


Figure 12. Number of individuals per species detection.

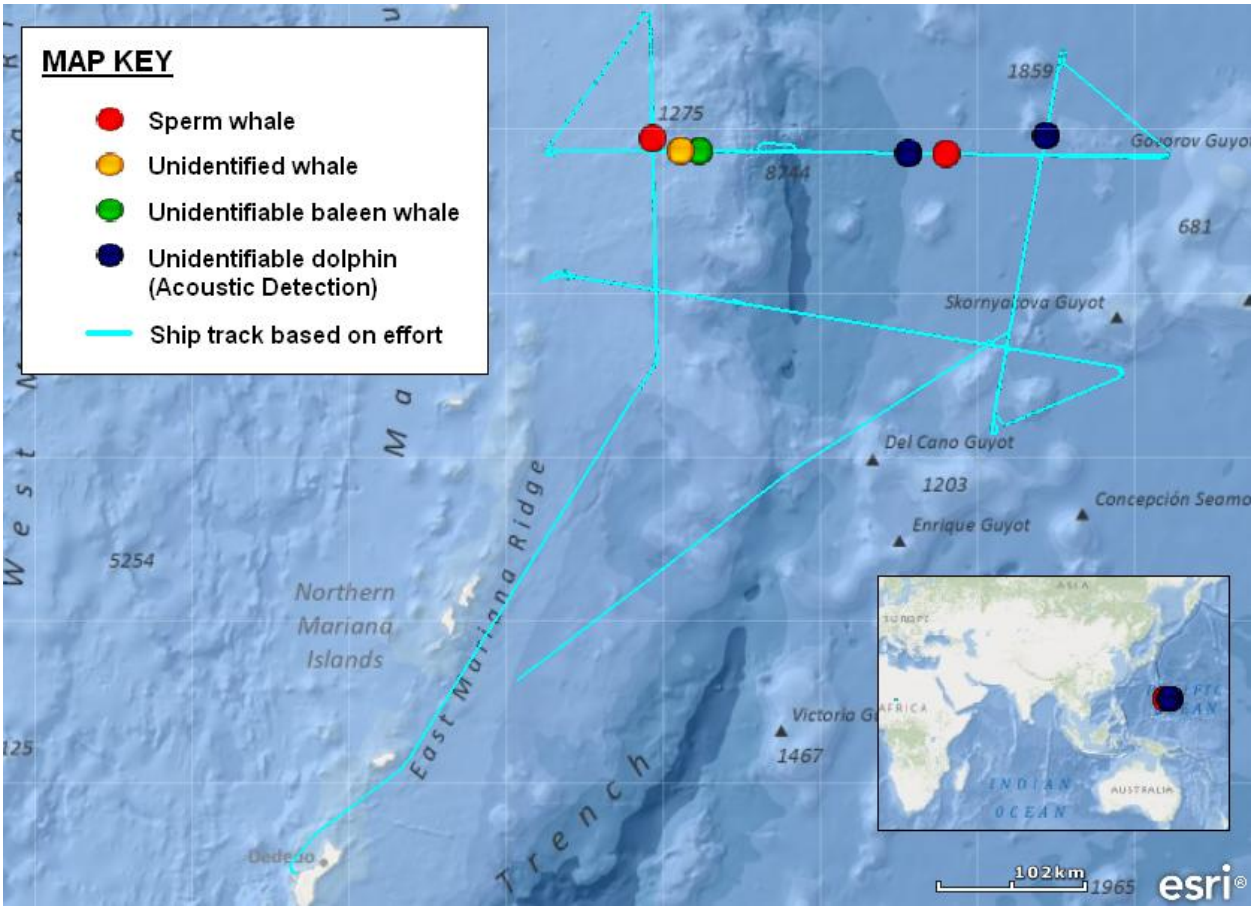


Figure 13. Marine mammal spatial distribution of detections from 1 February 2012- 28 February 2012 on board the *Langseth*.

5.1.1. Cetacean Detections

5.1.1.1. Unidentified baleen whale

On 18 February 2012 a small unidentified baleen whale was observed from 22:47 to 23:10 UTC. Two faint blows were originally seen approximately 2 km off the starboard bow of the vessel. The whale made an eight minute dive before resurfacing ~1800m off the starboard side of the vessel, making three blows followed by a 15 minute dive. It was last seen ~4 km off the starboard stern of the vessel blowing 4 times. The whale was ~10m in length, with a tall falcate dorsal fin visible after the blow hole. The whale was thought to likely be an Omura's whale (*Balaenoptera omurai*), but also may have been a minke whale (*Balaenoptera acutorostrata*). The whale remained outside of the 180 dB safety radius and no mitigation actions were necessary.

5.1.1.2. Unidentified whale

On 19 February 2012 from 00:15 to 00:16 UTC there was a brief sighting of an unidentifiable whale. The detection consisted of two tall tapered blows approximately 1500m from the vessel. The whale was not observed within the 180 dB safety radius and no mitigation actions were necessary.

5.1.1.3. Sperm whale

On 19 February 2012 there was a long detection of three sperm whales (*Physeter macrocephalus*) lasting from 3:35 to 5:06 UTC. What appeared to be two adult and one juvenile sperm whale were observed logging and rolling, creating large splashes and often showing pectoral fins. One whale was observed fluking. As the vessel passed the whales closest distance to the airguns was 1600m. The whales were last sighted ~4 km off the starboard stern of the vessel. The whales did not enter the 180 dB safety radius and no mitigation actions were necessary.

5.2. ACOUSTIC DETECTIONS

5.2.1. Delphinid Detections

There were two acoustic detections on the PAM system during the Wiens survey. On 16 February at 19:37 UTC multiple short repetitive whistles with frequencies of 7, 15, and 22 kHZ were heard aurally by the PAM operator and detected by the *Pamguard Spectrogram* and *Whistle and Moan detector* (Figure 14). High frequency click trains were also detected visually on the high frequency click detector (Figure 15).

The second acoustic detection occurred on 24 February at 01:40 UTC when high frequency click trains were observed visually on the high frequency click detector (Figure 16). The detection was not observed on the low frequency *Pamguard Spectrogram* or *Whistle and Moan detector*, or heard aurally by the PAM operator.

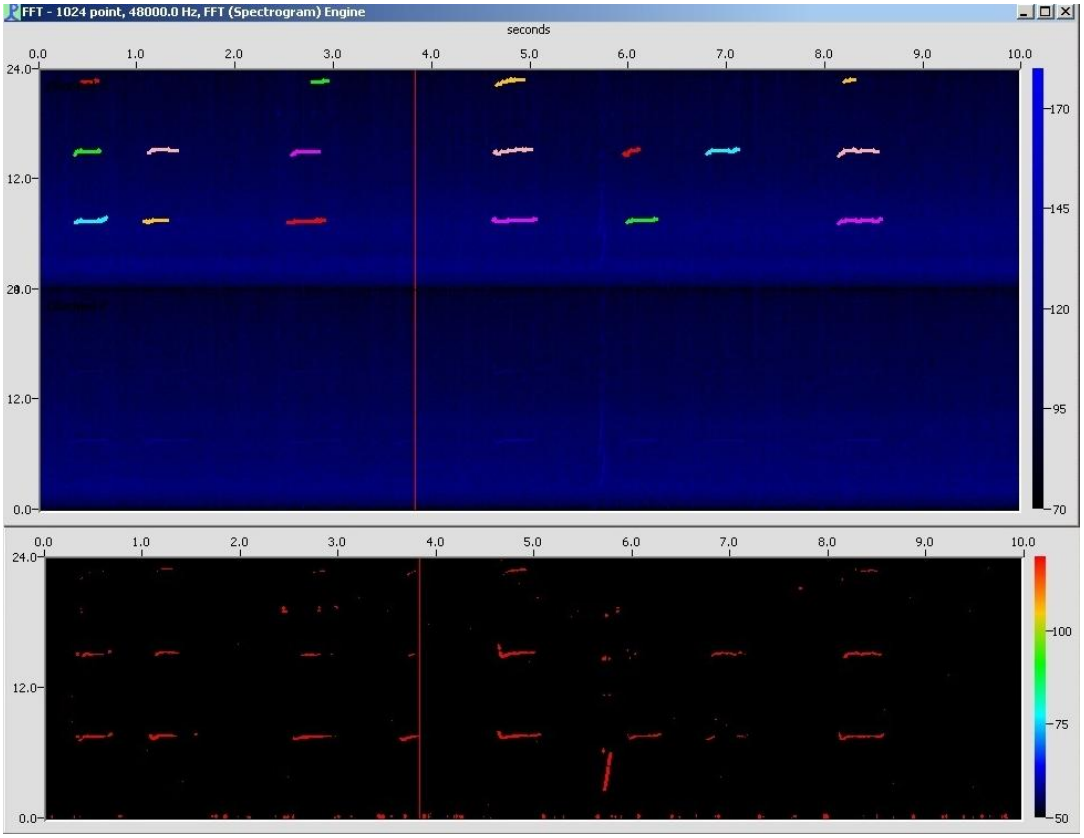


Figure 14. Unidentified dolphin whistles on 16 February shown on *Pamguard spectrogram* and *whistle and moan detector*.

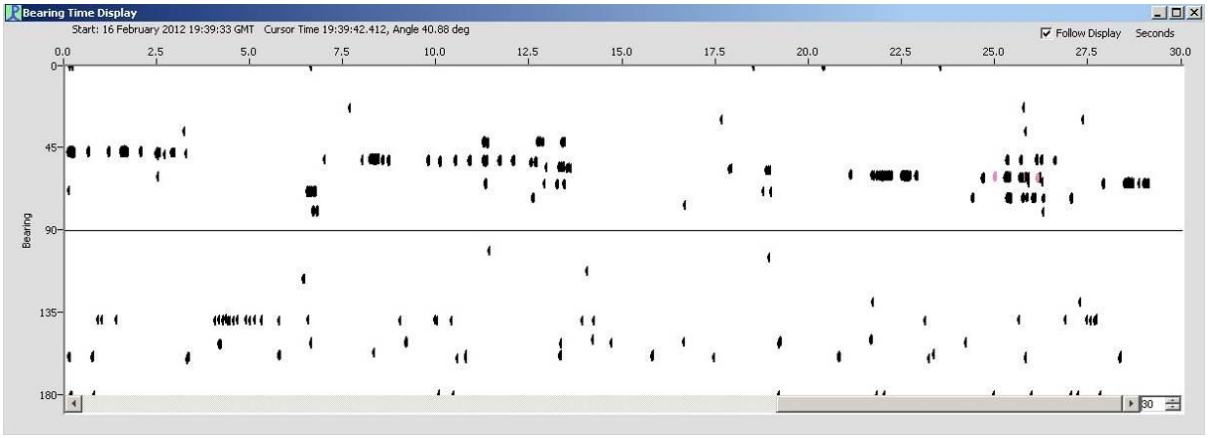


Figure 15. Click trains from unidentified dolphin shown on high frequency click detector on 16 February.

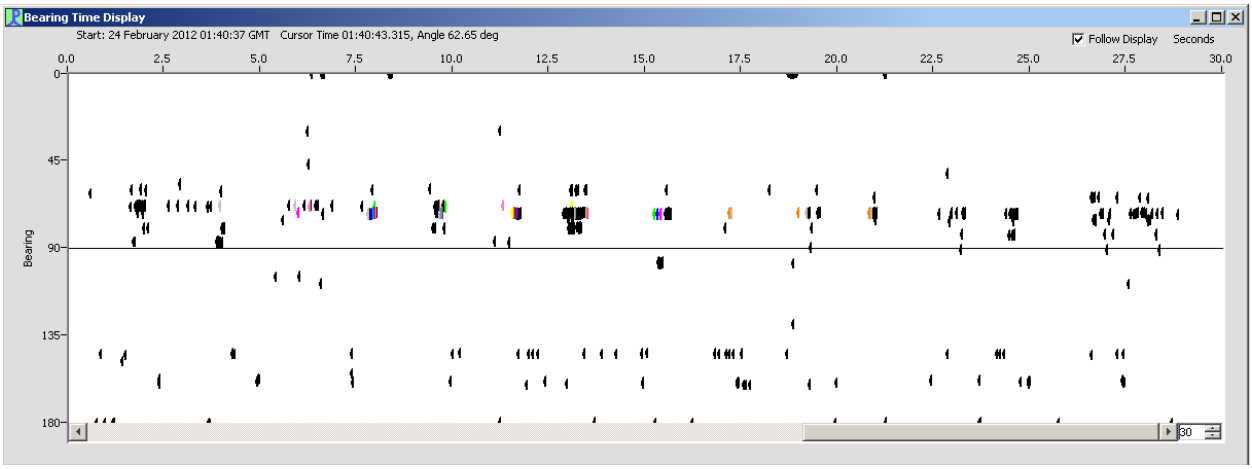


Figure 16. Click trains from unidentified Delphinid shown on high frequency click detector on 24 February.

6. MARINE MAMMALS EXPOSED TO 160 DB

NMFS granted an IHA to L-DEO for a marine seismic survey allowing Level B harassment takes (exposure to 160 dB received sound) for 18 marine mammal species: two mysticetes and 16 odontocete species. Direct visual observations recorded by PSOs of one species of marine mammals for which takes were granted in the IHA provide a minimum estimate of the actual number of cetaceans exposed to received sound levels or 180 dB and 160 dB.

During the Wiens marine geophysical survey four sperm whales and two unidentified whales were observed within the 160 dB predicted distances where Level B harassment is expected to occur while the acoustic source was active (Table 12).

Table 9. Level B Harassment Takes authorized by NMFS IHA for the Wiens marine geophysical and number of known individuals exposed to 160 dB and 180 dB through visual observations.

Species	IHA Authorized Takes	Number of animals exposed to 180 dB	Number of animals exposed to 160 dB
Mysticetes			
North Pacific right whale	0	0	0
Humpback whale	30	0	0
Minke whale	3	0	0
Bryde's whale	8	0	0
Sei whale	6	0	0
Fin whale	0	0	0
Blue whale	0	0	0
Unidentified Bryde's/Sei-type whale	2	0	0
Odontocetes			
Sperm whale	24	0	4
Pygmy sperm whale	62	0	0
Dwarf sperm whale	150	0	0
Cuvier's beaked whale	131	0	0
Longman's beaked whale	18	0	0
Blainville's beaked whale	25	0	0
Gingko-toothed beaked whale	0	0	0
Rough-toothed dolphin	9	0	0
Bottlenose dolphin	20	0	0
Pantropical spotted dolphin	443	0	0
Spinner dolphin	98	0	0
Striped dolphin	121	0	0
Fraser's dolphin	286	0	0
Short-beaked common dolphins	189	0	0
Risso's dolphin	16	0	0
Melon-headed whale	95	0	0
Pygmy killer whale	12	0	0
False killer whale	22	0	0
Killer whale	5	0	0
Short-finned pilot whale	31	0	0
Cetaceans			
Unidentified whale	-	0	2

These numbers are likely to be an underestimate and provide the absolute minimum number of animals actually exposed. There were many days with high winds making it difficult to observe

the 160 dB radius. Additionally, there were two detections of unidentified delphinids using the PAM system and it is likely these animals were exposed to received sound levels greater than 160 dB. It is also possible that estimated numbers of animals recorded during each sighting event were underestimates, with some animals possibly not being seen or having moved away before they were observed. Table 13 describes the behavior of all animals, including unidentified species, which were exposed to 160 dB for the duration they were observed.

Table 10. Behavior of species exposed to 160 dB.

Species	Detection No.	No. of Animals	Initial behavior	Initial direction in relation to vessel	Final behavior	Final direction in relation to vessel
Unidentified baleen whale	1	1	Blowing	Perpendicular, ahead of vessel	Diving	Away from vessel
Unidentified whale	2	1	Blowing	Unknown	Blowing	Unknown
Sperm whale	3	3	Blowing, rolling	Parallel, opposite direction	Diving	Parallel, opposite direction
Sperm whale	4	1	Blowing	Parallel, opposite direction	Diving	Parallel, opposite direction

6.1.1. Unidentified Baleen Whale

On 18 February one unidentified small baleen whale was observed ~1900m from the acoustic source while it was firing full power (6540 in^3) on a survey line. The whale was exposed to received sound levels greater than 160 dB and no mitigation actions were necessary. The whale was traveling perpendicular ahead of the vessel and did not change course over the duration of the sighting. The whale was last seen ~4 km from the vessel.

6.1.2. Unidentified Whale

On 19 February there was a very brief sighting of an unidentified whale ~1500m from the acoustic source while it was firing at full power (6540 in^3) on a survey line. The whale was exposed to received sound levels greater than 160 dB and no mitigation actions were necessary. Due to the brevity of the sighting PSOs were unable to determine the whale's direction of travel.

6.1.3. Sperm Whale

Sperm whales were the only positively identified protected species exposed to noise levels constituting Level-B harassment during the Wiens marine geophysical survey. Two detection events of sperm whales totalling a minimum of four animals were observed within the 160 dB safety radius while the acoustic source was active.

On 19 February three sperm whales, consisting of two adults and one juvenile, were observed ~1500m from the acoustic source while it was firing full power (6540 in^3) on a survey line. All three whales were exposed to received sound levels greater than 160 dB and no mitigation actions were necessary. The whales were traveling parallel, in the opposite direction of the vessel, angled away a bit. The whales did not change course over the duration of the sighting and were last seen blowing ~4 km from the vessel.

On 23 February one sperm whale was observed ~1300m from the acoustic source while it was firing full power (6500 in^3) on a survey line. The whale was exposed to received sound levels greater than 160 dB and no mitigation actions were necessary. The whale was traveling parallel to the vessel in the opposite direction, angled slight away from the vessel. The whale did not change course over the duration of the sighting and was last seen diving ~2.5 km away.

6.2. IMPLEMENTATION AND EFFECTIVENESS OF THE BIOLOGICAL OPINIONS'S ITS AND IHA

In order to minimize the Level-B incidental taking of marine mammals and sea turtles during the Wiens marine geophysical survey, mitigation measures were implemented whenever these protected species were seen near or within the safety radii designated in the IHA. No mitigation actions were necessary during this survey.

7. ACKNOWLEDGEMENTS

The Protected Species Observers on board Langseth during the Wiens marine geophysical survey in the central Pacific Ocean would like to thank the National Science Foundation, Lamont-Doherty Earth Observatory, and Woods Hole Oceanographic Institiute for the opportunity to work on this project. It was a pleasure to work with Dr. Dan Lizzeralde, as well as Meagan Cummings, the Marine Environmental Safety Coordinator for L-DEO. We would also like to thank the marine crew and science team on board the *R/V Langseth* for their assistance and hospitality.

We would like to thank the following individuals for their considerable help in making the program a success.

- Meagan Cummings and Jeff Rupert from L-DEO and Holly Smith and Olivia Lee from NSF for their assistance, planning and preparation for the cruise.
- Rebecca Snyder from RPS for her support and installation of the PAM system.
- Matthew Dellinger from RPS for providing logistical support for the project.
- We also thank Meagan Cummings for reviewing this report.

We would like to extend our sincere thanks and gratitude to everyone who helped support this project as it would not have been possible without the efforts and assistance of the many individuals and organizations involved.

8. LITERATURE CITED

LGL Ltd., Environmental Research Associates, 2011. “Environmental Assessment of a Marine Geophysical Survey by the R/V Marcus G. Langseth in the Commonwealth of the Northern Mariana Islands, February–March 2012”.

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

FEB 01 2012

Meagan J. Cummings
Marine Environmental & Safety Coordinator
Department of Marine Operations
Lamont-Doherty Earth Observatory
P.O. Box 1000
Palisades, New York 10964-8000

Dear Ms. Cummings:

Enclosed is an Incidental Harassment Authorization (IHA) issued to the Lamont-Doherty Earth Observatory, 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 seismic survey in the Commonwealth of the Mariana Islands during February to March, 2012.

You are required to comply with the conditions contained in the IHA. In addition, you must cooperate with any Federal, state, or local agency monitoring the impacts of your activity and 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 or Jolie Harrison, Office of Protected Resources, NMFS, at 301-427-8401.

Sincerely,

for James H. Lecky
Director
Office of Protected Resources

Enclosures

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

Incidental Harassment Authorization

Lamont-Doherty Earth Observatory (L-DEO), P.O. Box 1000, Palisades, New York 10964-8000, is hereby authorized 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 marine geophysical (seismic) survey conducted by the R/V *Marcus G. Langseth* (*Langseth*) in the Commonwealth of the Northern Mariana Islands (CNMI), February to March, 2012:

1. This Authorization is valid from February 2 through May 2, 2012.

2. This Authorization is valid only for the *Langseth*'s specified activities associated with seismic survey operations that shall occur in the following specified geographic area:

> In the CNMI, in the area 16.5° to 19° North, 146.5° to 150.5° East, within the Exclusive Economic Zone of the United States and in International Waters, in water depths ranging from approximately 2,000 to greater than 8,000 meters (m) (6,561.7 to 26,246.7 feet [ft]), as specified in L-DEO's Incidental Harassment Authorization application and the National Science Foundation's (NSF) associated 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 off of the CNMI:
>
> (i) Mysticetes – see Table 2 (attached) for authorized species and take numbers.
>
> (ii) Odontocetes – see Table 2 (attached) for authorized species and take numbers.
>
> (iii) If any marine mammal species under NMFS jurisdiction are encountered during seismic activities that are not listed in Table 2 (attached) for authorized taking and are likely to be exposed to sound pressure levels (SPLs) greater than or equal to 160 dB re 1 µPa (rms), then the Holder of this Authorization must alter speed or course, power-down or shut-down the airguns to avoid take.
>
> (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:

(i) A 36 Bolt airgun array with a total capacity of 6,600 in^3 (or smaller);
(ii) A multi-beam echosounder;
(iii) A sub-bottom profiler; and
(iv) An acoustic release transponder used to communicate with ocean bottom seismometers (OBS).

5. The taking of any marine mammal in a manner prohibited under this Authorization must be reported immediately to the Office of Protected Resources, National Marine Fisheries Service (NMFS), at 301-427-8401.

6. Mitigation and Monitoring Requirements

The Holder of this Authorization 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:

(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 start-ups of airguns day or night. The *Langseth*'s vessel crew shall also assist in detecting marine mammals, when practicable. PSVOs shall have access to reticle binoculars (7 x 50 Fujinon), big-eye binoculars (25 x 150), night vision devices, and thermal imaging cameras. PSVO shifts shall last no longer than 4 hours at a time. PSVOs shall also make observations during daytime periods when the seismic system is not operating for comparison of animal abundance and behavior, when feasible.

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

(c) 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 or power-down), Beaufort sea state and wind force, visibility, and sun glare; and

(iii) The data listed under Condition 6(c)(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.

(d) 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.

(e) Do and record the following when an animal is detected by the PAM:

(i) Notify the on-duty PSVO(s) immediately 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.

(f) Visually observe the entire extent of the exclusion zone (EZ) (180 dB re 1 µPa [rms] for cetaceans and 190 dB re 1 µPa [rms] for pinnipeds; see Table 1 [attached] for distances) using NMFS-qualified PSVOs, for at least 30 minutes (min) prior to starting the airgun array (day or night). If the PSVO finds a marine mammal within the EZ, L-DEO 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 min. If the PSVO sees no marine mammals during that time, they should assume that the animal has moved beyond the EZ. If for any reason the entire radius cannot be seen for the entire 30 min (i.e., rough seas, fog, darkness), or if marine mammals are near, approaching, or in the EZ, the airguns may not be ramped-up. If one airgun is already running at a source level of at least 180 dB re 1 µPa (rms), L-DEO may start the second airgun without observing the entire EZ for 30 min prior, provided no marine mammals are known to be near the EZ (in accordance with Condition 6[h] below).

(g) Establish a 180 dB re 1 µPa (rms) and 190 dB re 1 µPa (rms) EZ for marine mammals before the 4-string airgun array (6,600 in^3) is in operation; and a 180 dB re 1 µPa (rms) and 190 dB re 1 µPa (rms) EZ before a single airgun (40 in^3) is in operation, respectively. See Table 1 (attached) for distances and EZs.

(h) Implement a "ramp-up" procedure when starting up at the beginning of seismic operations or anytime after the entire array has been shut-down for more than 8 min, which means start the smallest gun 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-min period. During ramp-up, the PSVOs shall monitor the EZ, and if marine mammals are sighted, a power-down, or shut-down shall be implemented as though the full array were operational. Therefore, initiation of ramp-up procedures from shut-down requires that the PSVOs be able to view the full EZ as described in Condition 7(f) (above).

(i) 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 alteration the marine mammal still appears likely to enter the EZ, further mitigation measures, such as a power-down or shut-down, shall be taken.

(j) Power-down or shut-down the airgun(s) if a marine mammal is detected within, approaches, or enters the relevant EZ (as defined in Table 1, attached). A shut-down means all operating airguns are shut-down (i.e., turned off). A power-down means reducing the number of operating airguns to a single operating 40 in^3 airgun, which reduces the EZ to the degree that the animal(s) is no longer in or about to enter it.

(k) Following a power-down, if the marine mammal approaches the smaller designated EZ, 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 EZ and is not likely to return, or has not been seen within the EZ for 15 min for species with shorter dive durations (small odontocetes and pinnipeds) or 30 min for species with longer dive durations (mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, and beaked whales).

(l) Following a power-down or shut-down and subsequent animal departure, airgun operations may resume following ramp-up procedures described in Condition 6(h).

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

(n) 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 EZ cannot be effectively monitored by the PSVO(s) on duty.

(o) If a North Pacific right whale (*Eubalaena japonica*) 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 min after the last documented whale visual sighting.

(p) To the maximum extent practicable, schedule seismic operations (i.e., shooting airguns) during daylight hours and OBS operations (i.e., deploy/retrieve) to nighttime hours.

7. Reporting Requirements

The Holder of this Authorization is required to:

(a) Submit a draft report on all activities and monitoring results to the Office of Protected Resources, NMFS, within 90 days of the completion of the *Langseth*'s CNMI cruise. 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 μPa (rms) and/or 180 dB re 1 μPa (rms) for cetaceans and 190 dB re 1 μPa (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 μPa (rms) and/or 180 dB re 1 μPa (rms) for cetaceans and 190 dB re 1 μPa (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 (ITS) (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.

(c) 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), L-DEO 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 email to Michael.Payne@noaa.gov and Howard.Goldstein@noaa.gov and the Pacific Islands Regional Stranding Coordinator at 808-944-2269 (David.Schofield@noaa.gov). The report must include the following information:

(i) 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).

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

In the event that L-DEO 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), L-DEO 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 Michael.Payne@noaa.gov and Howard.Goldstein@noaa.gov, and the NMFS Pacific Islands Regional Office (808-944-2269) and/or by email to the Pacific Islands Regional Stranding Coordinator (David.Schofield@noaa.gov). The report must include the same information identified in Condition 7(c)(i) above. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with L-DEO to determine whether modifications in the activities are appropriate.

In the event that L-DEO 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), L-DEO 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 email to Michael.Payne@noaa.gov and Howard.Goldstein@noaa.gov, and the NMFS Pacific Islands Regional Office (808-944-2269) and/or by email to the Pacific Islands Regional

Stranding Coordinator (David.Schofield@noaa.gov), within 24 hours of the discovery. L-DEO 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.

9. L-DEO is required to comply with the Terms and Conditions of the ITS corresponding to NMFS's Biological Opinion issued to both NSF and NMFS's Office of Protected Resources (attached).

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

for James H. Lecky
Director
Office of Protected Resources
National Marine Fisheries Service

2/1/12
Date

Attachments

Attachment

Table 1. Exclusion Zone Radii for Triggering Mitigation.

Source and Volume	Tow Depth (m)	Water Depth (m)	Predicted RMS Distances (m)		
			Shut-down EZ for Pinnipeds 190 dB	Shut-down EZ for Cetaceans 180 dB	Level-B Harassment Zone 160 dB
Single Bolt airgun 40 in^3	9	Deep (>1,000)	12	40	385
4 strings 36 airguns 6,600 in^3	9	Deep (>1,000)	400	940	3,850

Table 2. Authorized Take Numbers for Each Marine Mammal Species in the Commonwealth of the Northern Mariana Islands.

Species	Authorized Take in the CNMI Study Area
Mysticetes	
North Pacific right whale (*Eubalaena japonica*)	0
Humpback whale (*Megaptera novaeangliae*)	30
Minke whale (*Balaenoptera acutorostrata*)	3
Bryde's whale (*Balaenoptera edeni*)	8
Sei whale (*Balaenoptera physalus*)	6
Fin whale (*Balaenoptera borealis*)	0
Blue whale (*Balaenoptera musculus*)	0
Unidentified Bryde's/sei-type whale	2
Odontocetes	
Sperm whale (*Physeter macrocephalus*)	24
Pygmy sperm whale (*Kogia breviceps*)	62
Dwarf sperm whale (*Kogia sima*)	150
Cuvier's beaked whale (*Ziphius cavirostris*)	131
Longman's beaked whale (*Indopacetus pacificus*)	18
Blainville's beaked whale (*Mesoplodon densirostris*)	25
Ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*)	0
Rough-toothed dolphin (*Steno bredanensis*)	9
Bottlenose dolphin (*Tursiops truncatus*)	20
Pantropical spotted dolphin (*Stenella attenuata*)	443
Spinner dolphin (*Stenella longirostris*)	98

Striped dolphin (*Stenella coeruleoalba*)	121
Fraser's dolphin (*Lagenodelphis hosei*)	286
Short-beaked common dolphins (*Delphinus delphis*)	189
Risso's dolphin (*Grampus griseus*)	16
Melon-headed whale (*Peponocephala electra*)	95
Pygmy killer whale (*Feresa attenuata*)	12
False killer whale (*Pseudorca crassidens*)	22
Killer whale (*Orcinus orca*)	5
Short-finned pilot whale (*Globicephala macrorhynchus*)	31

APPENDIX A: Incidental Harassment Authorization for the Wiens marine geophysical survey

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

FEB 01 2012

Meagan J. Cummings
Marine Environmental & Safety Coordinator
Department of Marine Operations
Lamont-Doherty Earth Observatory
P.O. Box 1000
Palisades, New York 10964-8000

Dear Ms. Cummings:

Enclosed is an Incidental Harassment Authorization (IHA) issued to the Lamont-Doherty Earth Observatory, 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 seismic survey in the Commonwealth of the Mariana Islands during February to March, 2012.

You are required to comply with the conditions contained in the IHA. In addition, you must cooperate with any Federal, state, or local agency monitoring the impacts of your activity and 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 or Jolie Harrison, Office of Protected Resources, NMFS, at 301-427-8401.

Sincerely,

for James H. Lecky
Director
Office of Protected Resources

Enclosures

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

Incidental Harassment Authorization

Lamont-Doherty Earth Observatory (L-DEO), P.O. Box 1000, Palisades, New York 10964-8000, is hereby authorized 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 marine geophysical (seismic) survey conducted by the R/V *Marcus G. Langseth* (*Langseth*) in the Commonwealth of the Northern Mariana Islands (CNMI), February to March, 2012:

1. This Authorization is valid from February 2 through May 2, 2012.

2. This Authorization is valid only for the *Langseth*'s specified activities associated with seismic survey operations that shall occur in the following specified geographic area:

> In the CNMI, in the area 16.5° to 19° North, 146.5° to 150.5° East, within the Exclusive Economic Zone of the United States and in International Waters, in water depths ranging from approximately 2,000 to greater than 8,000 meters (m) (6,561.7 to 26,246.7 feet [ft]), as specified in L-DEO's Incidental Harassment Authorization application and the National Science Foundation's (NSF) associated 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 off of the CNMI:
>
> (i) Mysticetes – see Table 2 (attached) for authorized species and take numbers.
>
> (ii) Odontocetes – see Table 2 (attached) for authorized species and take numbers.
>
> (iii) If any marine mammal species under NMFS jurisdiction are encountered during seismic activities that are not listed in Table 2 (attached) for authorized taking and are likely to be exposed to sound pressure levels (SPLs) greater than or equal to 160 dB re 1 µPa (rms), then the Holder of this Authorization must alter speed or course, power-down or shut-down the airguns to avoid take.
>
> (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:

(i) A 36 Bolt airgun array with a total capacity of 6,600 in^3 (or smaller);
(ii) A multi-beam echosounder;
(iii) A sub-bottom profiler; and
(iv) An acoustic release transponder used to communicate with ocean bottom seismometers (OBS).

5. The taking of any marine mammal in a manner prohibited under this Authorization must be reported immediately to the Office of Protected Resources, National Marine Fisheries Service (NMFS), at 301-427-8401.

6. Mitigation and Monitoring Requirements

The Holder of this Authorization 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:

(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 start-ups of airguns day or night. The *Langseth*'s vessel crew shall also assist in detecting marine mammals, when practicable. PSVOs shall have access to reticle binoculars (7 x 50 Fujinon), big-eye binoculars (25 x 150), night vision devices, and thermal imaging cameras. PSVO shifts shall last no longer than 4 hours at a time. PSVOs shall also make observations during daytime periods when the seismic system is not operating for comparison of animal abundance and behavior, when feasible.

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

(c) 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 or power-down), Beaufort sea state and wind force, visibility, and sun glare; and

(iii) The data listed under Condition 6(c)(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.

(d) 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.

(e) Do and record the following when an animal is detected by the PAM:

(i) Notify the on-duty PSVO(s) immediately 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.

(f) Visually observe the entire extent of the exclusion zone (EZ) (180 dB re 1 µPa [rms] for cetaceans and 190 dB re 1 µPa [rms] for pinnipeds; see Table 1 [attached] for distances) using NMFS-qualified PSVOs, for at least 30 minutes (min) prior to starting the airgun array (day or night). If the PSVO finds a marine mammal within the EZ, L-DEO 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 min. If the PSVO sees no marine mammals during that time, they should assume that the animal has moved beyond the EZ. If for any reason the entire radius cannot be seen for the entire 30 min (i.e., rough seas, fog, darkness), or if marine mammals are near, approaching, or in the EZ, the airguns may not be ramped-up. If one airgun is already running at a source level of at least 180 dB re 1 µPa (rms), L-DEO may start the second airgun without observing the entire EZ for 30 min prior, provided no marine mammals are known to be near the EZ (in accordance with Condition 6[h] below).

(g) Establish a 180 dB re 1 µPa (rms) and 190 dB re 1 µPa (rms) EZ for marine mammals before the 4-string airgun array (6,600 in^3) is in operation; and a 180 dB re 1 µPa (rms) and 190 dB re 1 µPa (rms) EZ before a single airgun (40 in^3) is in operation, respectively. See Table 1 (attached) for distances and EZs.

(h) Implement a "ramp-up" procedure when starting up at the beginning of seismic operations or anytime after the entire array has been shut-down for more than 8 min, which means start the smallest gun 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-min period. During ramp-up, the PSVOs shall monitor the EZ, and if marine mammals are sighted, a power-down, or shut-down shall be implemented as though the full array were operational. Therefore, initiation of ramp-up procedures from shut-down requires that the PSVOs be able to view the full EZ as described in Condition 7(f) (above).

(i) 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 alteration the marine mammal still appears likely to enter the EZ, further mitigation measures, such as a power-down or shut-down, shall be taken.

(j) Power-down or shut-down the airgun(s) if a marine mammal is detected within, approaches, or enters the relevant EZ (as defined in Table 1, attached). A shut-down means all operating airguns are shut-down (i.e., turned off). A power-down means reducing the number of operating airguns to a single operating 40 in^3 airgun, which reduces the EZ to the degree that the animal(s) is no longer in or about to enter it.

(k) Following a power-down, if the marine mammal approaches the smaller designated EZ, 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 EZ and is not likely to return, or has not been seen within the EZ for 15 min for species with shorter dive durations (small odontocetes and pinnipeds) or 30 min for species with longer dive durations (mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, and beaked whales).

(l) Following a power-down or shut-down and subsequent animal departure, airgun operations may resume following ramp-up procedures described in Condition 6(h).

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

(n) 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 EZ cannot be effectively monitored by the PSVO(s) on duty.

(o) If a North Pacific right whale (*Eubalaena japonica*) 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 min after the last documented whale visual sighting.

(p) To the maximum extent practicable, schedule seismic operations (i.e., shooting airguns) during daylight hours and OBS operations (i.e., deploy/retrieve) to nighttime hours.

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The Holder of this Authorization is required to:

(a) Submit a draft report on all activities and monitoring results to the Office of Protected Resources, NMFS, within 90 days of the completion of the *Langseth*'s CNMI cruise. This report must contain and summarize the following information:

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(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 μPa (rms) and/or 180 dB re 1 μPa (rms) for cetaceans and 190 dB re 1 μPa (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 μPa (rms) and/or 180 dB re 1 μPa (rms) for cetaceans and 190 dB re 1 μPa (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 (ITS) (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.

(c) 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), L-DEO 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 email to Michael.Payne@noaa.gov and Howard.Goldstein@noaa.gov and the Pacific Islands Regional Stranding Coordinator at 808-944-2269 (David.Schofield@noaa.gov). The report must include the following information:

(i) 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).

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

In the event that L-DEO 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), L-DEO 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 Michael.Payne@noaa.gov and Howard.Goldstein@noaa.gov, and the NMFS Pacific Islands Regional Office (808-944-2269) and/or by email to the Pacific Islands Regional Stranding Coordinator (David.Schofield@noaa.gov). The report must include the same information identified in Condition 7(c)(i) above. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with L-DEO to determine whether modifications in the activities are appropriate.

In the event that L-DEO 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), L-DEO 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 email to Michael.Payne@noaa.gov and Howard.Goldstein@noaa.gov, and the NMFS Pacific Islands Regional Office (808-944-2269) and/or by email to the Pacific Islands Regional

Stranding Coordinator (David.Schofield@noaa.gov), within 24 hours of the discovery. L-DEO 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.

9. L-DEO is required to comply with the Terms and Conditions of the ITS corresponding to NMFS's Biological Opinion issued to both NSF and NMFS's Office of Protected Resources (attached).

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

for James H. Lecky
Director
Office of Protected Resources
National Marine Fisheries Service

2/1/12
Date

Attachments

Attachment

Table 1. Exclusion Zone Radii for Triggering Mitigation.

Source and Volume	Tow Depth (m)	Water Depth (m)	Predicted RMS Distances (m)		
			Shut-down EZ for Pinnipeds 190 dB	Shut-down EZ for Cetaceans 180 dB	Level-B Harassment Zone 160 dB
Single Bolt airgun 40 in^3	9	Deep (>1,000)	12	40	385
4 strings 36 airguns 6,600 in^3	9	Deep (>1,000)	400	940	3,850

Table 2. Authorized Take Numbers for Each Marine Mammal Species in the Commonwealth of the Northern Mariana Islands.

Species	Authorized Take in the CNMI Study Area
Mysticetes	
North Pacific right whale (*Eubalaena japonica*)	0
Humpback whale (*Megaptera novaeangliae*)	30
Minke whale (*Balaenoptera acutorostrata*)	3
Bryde's whale (*Balaenoptera edeni*)	8
Sei whale (*Balaenoptera physalus*)	6
Fin whale (*Balaenoptera borealis*)	0
Blue whale (*Balaenoptera musculus*)	0
Unidentified Bryde's/sei-type whale	2
Odontocetes	
Sperm whale (*Physeter macrocephalus*)	24
Pygmy sperm whale (*Kogia breviceps*)	62
Dwarf sperm whale (*Kogia sima*)	150
Cuvier's beaked whale (*Ziphius cavirostris*)	131
Longman's beaked whale (*Indopacetus pacificus*)	18
Blainville's beaked whale (*Mesoplodon densirostris*)	25
Ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*)	0
Rough-toothed dolphin (*Steno bredanensis*)	9
Bottlenose dolphin (*Tursiops truncatus*)	20
Pantropical spotted dolphin (*Stenella attenuata*)	443
Spinner dolphin (*Stenella longirostris*)	98

Striped dolphin (*Stenella coeruleoalba*)	121
Fraser's dolphin (*Lagenodelphis hosei*)	286
Short-beaked common dolphins (*Delphinus delphis*)	189
Risso's dolphin (*Grampus griseus*)	16
Melon-headed whale (*Peponocephala electra*)	95
Pygmy killer whale (*Feresa attenuata*)	12
False killer whale (*Pseudorca crassidens*)	22
Killer whale (*Orcinus orca*)	5
Short-finned pilot whale (*Globicephala macrorhynchus*)	31

APPENDIX B: Basic Summary Data Form

Table B1. Project Summary Form.

BASIC DATA FORM					
LDEO Project Number	MGL1204				
Seismic Contractor	Lamont-Doherty Earth Observatory of Columbia University				
Area Surveyed During Reporting Period	Commonwealth of the Northern Mariana Islands				
	Approximately between 16.5 to 19°N and 146.5 to 150.5°E				
Survey Type	2D marine seismic				
Vessel and/or Rig Name	*R/V Marcus G. Langseth*				
Permit Number	IHA granted by NMFS on 1 February 2012				
Location / Distance of Airgun Deployment			181m astern of vessel		
Water Depth	**Min**		~3000m		
	Max		~8700m		
Dates of project			1 Feb 2012	THROUGH	28 Feb 2012
Total time airguns operating – all power levels:			576 hours 32 minutes		
Time airguns operating at full power on survey lines:			541 hours 02 minutes		
Time airguns operating at full/partial power on line changes:			32 hours 58 minutes		
Amount of time mitigation gun (40 in³) operations:			None		
Amount of time in ramp-up:			47 minutes		
Number daytime ramp-ups:			2		
Number of night time ramp-ups:			0		
Number of ramp-ups from mitigation source:			0		
Amount of time conducted in airgun testing:			1 hour 45 minutes		
Duration of visual observations:			327 hours 36 minute		
Duration of observations while airguns firing:			296 hours 22 minutes		
Duration of observation during airgun silence:			31 hours 14 minutes		
Duration of acoustic monitoring:			436 hours 26 minutes		
Duration of acoustic monitoring while airguns firing:			435 hours 57 minutes		
Duration of acoustic monitoring during airgun silence:			29 minutes		
Duration of simultaneous acoustic and visual monitoring:			217 hours 49 minutes		
Duration of FLIR monitoring:			81 hours		
Lead Protected Species Observer:			Heidi Ingram		
Protected Species Observers:			Amanda Harrison		
			Meghan Piercy		
			Tatiana Moreno		
Acoustic Observer:			Emily Ellis		
Number of Marine Mammals Visually Detected:			4		
Number of Marine Mammals Acoustically Detected:			2		
Number of Marine Mammals Detected by FLIR:			0		
Number of acoustic detections confirmed by visual sighting:			0		
Number of visual sighting confirmed by acoustic detection:			0		
Number of Sea Turtles detected:			0		
List Mitigation Actions (eg. Power-downs, shut-downs, ramp-up delays)			None		
Duration of operational downtime due to mitigation:			None		

APPENDIX C: Passive Acoustic Monitoring System Specifications

Passive Acoustic Monitoring System Specifications

Main cable and spare cable:

Mechanical Information

Length 250m			
Diameter	14mm over cable	32mm over mouldings	64mm over connectors
Weight 60kg			
Connector	CEEP 39 pin		

Hydrophone elements

Hydrophone 1	Sphere 1	Broad band	2 kHz to 200 kHz	(3dB points)
Hydrophone 2	Sphere 2	Broad band	2 kHz to 200 kHz	(3dB points)
Hydrophone 3	Sphere 3	Broad band	2 kHz to 200 kHz	(3dB points)
Hydrophone 4	Sphere 4	Low frequency	75Hz to 30 kHz	(3dB points)

Depth Capability 100m

Spacing between elements 1 & 2 (for HF detection)	0.25m	0.16mSecs
Spacing between elements 2 & 3 (for HF detection)	1.2m	0.8mSecs
Spacing between elements 3 & 4 (for LF detection)	1.2m	0.8mSecs

Interface unit Array 1 outputs

Broad band channel sensitivity	-166dB re 1V/uPa
Low frequency channel sensitivity	-157dB re 1V/uPa

Deck cable specification

Length	100m
Diameter	14mm
Connectors	39 pin ITT female
Flying lead for onboard connection	
Connector Diameter	64mm

Inboard Deck Cable
Deck cable specification

Length	1m
Diameter	14mm
Connectors	39 pin ITT male
Flying lead for onboard connection	
Connector Diameter	64mm

APPENDIX D: PAM Hydrophone Deployment on the *R/V Marcus Langseth*

PAM hydrophone deployment and retrieval procedure on the *R/V Marcus G. Langseth*

The hydrophone deployment procedure is a "living" document and may be altered at any time to reflect changes in deployment over time.

Overview

The research vessel *Langseth* is equipped with a towed PAM array system comprised of a low frequency laptop, a high frequency laptop, a data processing unit, a 100m deck cable, and a 250m linear hydrophone cable with 4 hydrophones and a depth gauge at the last 5m of the cable (Figure D1). The system is capable of detected a broad range of marine mammal vocalizations due to three of the hydrophone elements having a broadband frequency range of 2 to 200kHz while the fourth hydrophone has a shorter frequency range of 75 to 30kHz for lower frequency detections and all four hydrophones having preamplifiers.

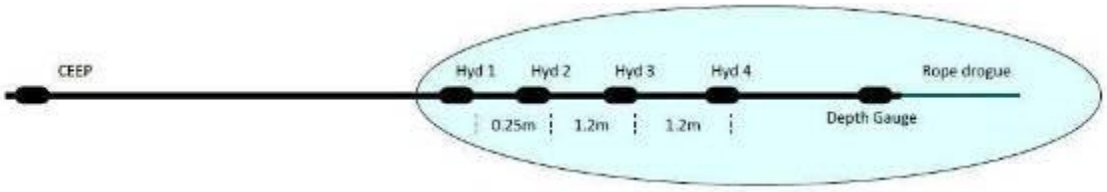

Figure D1. Diagram of Linear Hydrophone Array.

The two laptops and data processing unit are set up in the main lab with a GPS cable feed (INGGA string) directly from the ship's navigation system to the low frequency laptop (Figure D2). The data processing unit connects to the 250m hydrophone cable through a 100m deck cable that is run from the main lab out to the gun deck. Both the deck cable in use and the spare are run from the main lab out to out to the gun deck just in case one failed because the cable had to be run through the bulk head which can only be done while in port. The 250m hydrophone cable is wound on a section of a deckhead winch on the port side of the gun deck (Figure D3). From the winch the hydrophone cable is fed astern and pulled further port by a line secured by a yale grip to the port sponson. (Figure D4). An 8m rope drogue was secured to the end of the hydrophone cable with zip ties with a 9kg shackle secured to the end of the rope drogue with a knot and tape (Figure D5). Second four lengths of chain weighing approximately 2.5kg each were secured on the cable with tape, 3m, 45m, 96, and 132m up from the depth gauge (Figure D6). The hydrophone is deployed approximately 150m from the stern and 50m before the center of string. Being that the hydrophone cable is free and independent of the guns the cable is always retrieved before port gun strings are moved.

Figure D2. PAM Laptops and data processing unit setup.

Figure D3. Hydrophone cable on winch.

Figure D4. Hydrophone cable secured by a yale grip to the port sponson.

Figure D5. Rope drogue and first chain weight secured near hydrophone elements.

Figure D6. One of the four lengths of chain used to weigh down the cable.

Deployment

- Make sure the data processing unit is off.
- Make sure the deck cable is disconnected from the hydrophone cable.
- Make sure chains on the hydrophone cable are secure.
- Lower the rope drogue and end of the hydrophone cable over the stern and on the port side of the yellow umbilicals and the spreader rope (rope through stern chock) making sure the elements don't hit against the vessel.
- Feed out the hydrophone from the winch.
- Shut off winch controls, connect hydrophone cable to deck cable, turn on data processing unit.

Retrieval

- Make sure data processing unit is off.
- Make sure the deck cable is disconnected to the hydrophone cable.
- Retrieval is the opposite of deployment.
- Make sure the hydrophone elements don't hit against the stern and store them loosely around the winch.

HSE

All PPE required while on gun deck, including coveralls, hardhat, steel toe boots, safety glasses and gloves. Working close to the side, pinch points at the winch, trip hazards, and potential for jellyfish tentacles on the cable upon retrieval are potential hazards.

APPENDIX E: Passive Acoustic Monitoring Downtime

Table E1. Passive Acoustic Monitoring Downtime

Date	Monitoring Suspended	Date	Monitoring Resumed	Duration acoustic monitoring suspended	Comments
2012-02-05	03:36	2012-02-05	06:24	2:48	The hydrophone cable was retrieved due to high swells and risk of entanglement
2012-02-06	00:23	2012-02-08	07:51	55:28	The hydrophone cable was retrieved due to shallow depth and the risk of entanglement with the seismic gear. The Hydrophone cable remained on board due to high swells and side seas.
2012-02-09	12:14	2012-02-09	15:10	2:56	Hydrophone cable retrieved prior to the retrieval of source array 3&4 for maintenance.
2012-02-12	00:07	2012-02-12	10:09	10:02	Hydrophone cable retrieved prior to the retrieval of the seismic streamer in preparation of the acquisition of the OBS lines.
2012-02-12	22:32	2012-02-12	22:51	0:19	Depth of hydrophone was too shallow and was retrieved and redeployed to ensure it was not entangled with the seismic gear and obtain a lower depth.
2012-02-12	23:18	2012-02-14	21:41	46:23	The hydrophone cable was retrieved due to shallow depth and the risk of entanglement with the seismic gear. The Hydrophone cable remained on board due to high swells and side seas.
2012-02-15	3:07	2012-02-15	4:43	1:46	Hydrophone became entangled with XBT wire. Remained on board until seas were calmer and ship's heading was more conducive to hydrophone remaining at a lower depth
2012-02-16	13:00	2012-02-16	13:15	00:15	Muffled knocking noise heard followed by a sudden decrease in hydrophone depth. Hydrophone cable was retrieved and redeployed to ensure it was not entangled with the seismic gear.
2012-02-20	19:08	2012-02-20	19:28	00:20	Depth of hydrophone was too shallow and was retrieved and redeployed to ensure it was not entangled with the seismic gear and obtain a lower depth.
2012-02-20	20:35	2012-02-21	22:26	25:51	Hydrophone was wrapped around lead in. Cable was retrieved and remained on board due to high swells and side seas.

APPENDIX F: Summary of detections of protected species during the Wiens marine geophysical survey.

Table F1. Visual detections of protected species during the Wiens marine geophysical survey.

Record No.	Date	Time (UTC)	Species	Group Size	Vessel Position	Source Activity Initial Detection	Movement/ Behaviour		CPA Source / Source Activity	Mitigation Action	Comments
1	18 Feb	22:47	Unidentified baleen whale	1	17.86592°N 147.23005°E	Firing full power	PE/AH	SB DI	1900m / Full power	None	Whale exposed to 160 dB of received sound.
2	19-Feb	00:15	Unidentified whale	1	17.86673°N 147.11068°E	Firing full power	UN	SB	1535m / Full power	None	Whale exposed to received sound levels greater than 160 dB.
3	19-Feb	03:35	Sperm whale	3	17.94208°N 146.93187°E	Firing full power	PV/OD	SA DF	1600m / Full power	None	Whales exposed to received sound levels greater than 160 dB.
4	23-Feb	22:36	Sperm whale	1	17.84868°N 148.80075°E	Firing full power	PV/OD	NS DF	1300m / Full power	None	Whale exposed to received sound levels greater than 160 dB.

Table F2. Acoustic detections of protected species during the Wiens marine geophysical survey.

Record No.	Date	Time (UTC)	Species	Group Size	Vessel Position	Source Activity Initial Detection	Acoustic Detection Details	CPA Source / Source Activity	Mitigation Action	Comments
1	Feb-16	19:37	Unidentified dolphin	1	17.95848°N 149.43500°E	Firing full power	Repetitive short whistles at 7, 15 and 22 kHz.	Unknown / Full power	None	Clicks detected on high frequency click detector.
2	24-Feb	01:40	Unidentified delphind	unknown	17.85202°N 148.55987°E	Firing full power	Multiple high frequency click trains.	Unknown	None	Nothing detected aurally or on low frequency spectrogram.

APPENDIX G: Species of birds and other wildlife observed during the Wiens marine geophysical survey

Table G1. Bird species observed during visual monitoring.

Common Name	Family	Genus	Species	Approximate Number of Individuals Observed	Approximate Number of Days Species Was Observed
Sooty Tern	Laridae	*Sterna*	*fuscata*	33	9
Brown Noddy	Laridae	*Anous*	*stolidus*	3	1
White Tern	Laridae	*Gygis*	*alba*	9	4
Red-footed Booby	Pelecaniformidae	*Sula*	*sula*	24	12
Red-tailed tropicbird	Phaethontidae	Phaethon	*rubricauda*	4	3
Black-footed albatross	Diomedeidae	*Phoebastra*	*nigripes*	1	1
Great Frigatebird	Fregatidae	*Frigata*	*minor*	4	4
Unidentified shearwater	Procellariidae			40	4
Unidentified seabirds				61	5
Unidentified Tropicbird	Phaethontidae			13	5

Table G2. Other wildlife observed during visual monitoring.

Common Name	Family	Genus	Species	Approximate Number of Individuals Observed	Approximate Number of Days Species Was Observed
Flying Fish	Exocoetidae			124	12
Mahi mahi	Coryphaenidae	*Coryphenus*	*hippurus*	4	4
Unidentified Fish				181	5
Portuguese Man-O-War				1	1
Barnacles				50	1