Protected Species Observer Report

Prepared for: Alpine Ocean Seismic Survey Inc.
On behalf of Equinor Wind, US, LLC

Equinor Wind, US, LLC

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Final Report

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Executive Summary

The report covers the protected species mitigation and monitoring efforts aboard the *R/V Shearwater & R/V Henry Hudson* from 19 April through 22 July 2019. This is the final report for the Equinor Wind, US, Export Cable Route Geophysical Surveys, which were conducted Lease Area OCS A 0512 by Alpine Ocean Seismic Survey Inc. (Alpine): the offshore engineering, procurement, and construction contractor for the project. High resolution geophysical (HRG) survey data acquisition was conducted by Alpine within the parameters defined in the Equinor Wind, US, High Resolution Geophysical Survey Plan and Project Execution Plan 2018. These survey parameters utilized two survey vessels: *R/V Shearwater* and *R/V Henry Hudson,* to complete data acquisition within export cable route corridors. Protected species monitoring was conducted in accordance with Bureau of Ocean Energy Management (BOEM) and National Marine Fisheries Service (NMFS) standards, as well as Equinor Wind, US, High Resolution Geophysical and Geotechnical Survey Plan Approval Conditions for Lease Outer Continental Shelf (OCS)-A 0512 and an Incidental Harassment Authorization (IHA) issued for the survey program.

The Survey was conducted using single-beam and multi-beam echo sounders (SBES & MBES), a single channel ultra-high-resolution seismic sparker with 8-element hydrophone streamer, a transverse gradiometer (TVG) with dual cesium vapor magnetometers, a high-resolution sub-bottom profiler, a digital dual-frequency sidescan sonar (SSS), Ultra Short Baseline (USBL) sub-surface positioning sonar and sound velocity profiler (SVP). Protected species mitigation measures, as specified in the IHA issued by NMFS, were required for all devices transmitting below frequencies of 200 kHz.

Two protected species observers (PSOs) and two Passive Acoustic Monitoring (PAM) Operators, provided by RPS, were on board the *Shearwater* to undertake visual and acoustic observations and implement mitigation protocols in accordance with Lease OCS-A 0512, IHA protected species mitigation protocols and High Resolution Geophysical and Geotechnical Survey Plan Approval Conditions for the Equinor Wind, US, Survey. The portion of the survey completed by the R/V *Henry Hudson* used two PSOs to conduct visual observations during daylight operations. Mitigation protocols for this survey included establishment of exclusion zones (EZ) for marine mammals and other protected species including sea turtles, visual and acoustic monitoring, and strike avoidance mitigation measures.

The high resolution geophysical (HRG) survey equipment emitting frequencies of less than 200kHz on both vessels was active for a combined total of 587 hours and 20 minutes over the course of the survey.

Visual observations were conducted by PSOs for a total of 888 hours and 45 minutes. Acoustic monitoring by PAM operators was conducted for 195 hours and 39 minutes during darkness and periods of low visibility during the project.

There was a total of 21 detections of protected species made visually by PSOs during the survey. There were no acoustic detections of protected species. Visual detections of cetaceans consisted of fin whales, humpback whales, common bottlenose dolphins, a gray seal, a green sea turtle and unidentified whales and delphinids. Descriptions of these detections can be found in Section 4 and Section 4.1.1.

In accordance with the IHA protected species mitigation protocols, stipulations set forth in BOEM Lease OCS-A 0512, and High-resolution Geophysical Survey Plan Approval Conditions, a total of two mitigation actions were implemented consisting one delay to the initiation of source

activities and one shutdown of the acoustic source. There were no potential non-compliance issues noted. Please see Section 5 for a detailed account of these mitigation actions.

NMFS issued an IHA authorizing potential Level B exposures for 4,703 marine mammals from 11 Species (three dolphin species, five whale species, two seal species and the harbour porpoise) for the survey in its entirety.

During acoustic source operations, no marine mammals were observed within the predicted radius at which there is potential for auditory injury (based upon each species hearing range and how that overlaps with the frequencies produced by the sound source), constituting potential Level A exposure. Additionally, no marine mammals were observed within the predicted 160 decibel radius (where there is a potential for a behavioural response), constituting potential Level B exposures either.

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1 Introduction

The following report details protected species monitoring and mitigation, as well as HRG survey operations, undertaken for the Equinor Wind, US, High Resolution Geophysical Survey Campaign and performed by Alpine, using the research vessels *Shearwater & Henry Hudson.* The survey was conducted along proposed export cable routes extending from the Outer Continental Shelf lease site (OCS-A 0512) and connecting to the mainland on Long Island, New York City and New Jersey from 19 April 2019 through 22 July 2019.

The objective of this survey was to clear a series of geotechnical locations using HRG methodology and acquire additional data in order to provide a variety of information regarding the characterization and composition of the seabed that could impact subsea installations along proposed export cable routes.

This document serves to meet the reporting requirements dictated in the IHA issued to Equinor Wind, US, LLC by NMFS on 25 April 2019. The IHA outlined authorized potential Level A and Level B sound exposures of specific marine mammals' incidental to the survey program. NMFS has stated that seismic source-received sound levels equal to or greater than 160 dB re 1 µPa (root mean square (rms)) could potentially disturb marine mammals, temporarily disrupting behavior, such that they could be considered non-lethal 'takes' (Level B harassment).

In July 2016, NMFS released new technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing, which established new thresholds for permanent threshold shift (PTS) onset or Level A harassment (auditory injury) for marine mammal species. Predicted distances to Level A harassment vary based on marine mammal hearing groups – low frequency cetaceans, mid frequency cetaceans, high frequency cetaceans, phocid pinnipeds and otariid pinnipeds – and how each group's hearing range overlaps with the frequencies produced by the sound source. For sea turtles, per the Endangered Species Act (ESA), NMFS has stated that received sound levels equal to or greater than 175 dB re 1 µPa rms represents the current best understanding of the threshold at which they exhibit behavioral responses, and that received sound levels equal to or greater than 195 dB re 1 µPa rms represents the current best understanding of the threshold at which they experience PTS.

NMFS requires that provisions such as exclusion zones (EZ), delayed operations, ramp-ups, power-downs and shut-downs be implemented to mitigate for potentially adverse effects of the acoustic source sounds on protected species.

1.1 Project Overview and Location

The *Shearwater* began data acquisition for the survey on 19 April 2019. Over the course of the survey, the *Shearwater* returned to port in Jersey City, New Jersey, on several occasions, each of which are documented in Section 3.1.1 of this report. The *Shearwater* concluded operations on 23 May 2019, at which time the vessel returned to Liberty Landing Marina in the port of Jersey City, NJ.

The *Henry Hudson* began data acquisition for the survey on 16 June 2019. Over the course of the survey the *Henry Hudson* worked during daytime hours only, returning at the end of each day to the port of Liberty Landing Marina in the port of Jersey City, NJ or Atlantic Highlands Marina in Atlantic Highlands, NJ. The survey concluded on 22 July 2019.

The survey was conducted along four proposed export cable routes including Gowanus Route, Barrett Route, Jones Beach Route and Oceanview Route as well as their corresponding subsections and landings situated along the coasts of New Jersey, Long Island and New York City.

The *Shearwater* was mainly tasked with collecting offshore data along each of the proposed export cable routes while the *Henry Hudson* was primarily responsible for collecting near-shore data in each of the prospective landing sites.

The *Shearwater* completed a total survey trackline length of approximately 1,652 kilometers while the *Henry Hudson* completed a total survey trackline length of approximately 557 kilometers for a total combined survey trackline length of approximately 2,209 kilometers.

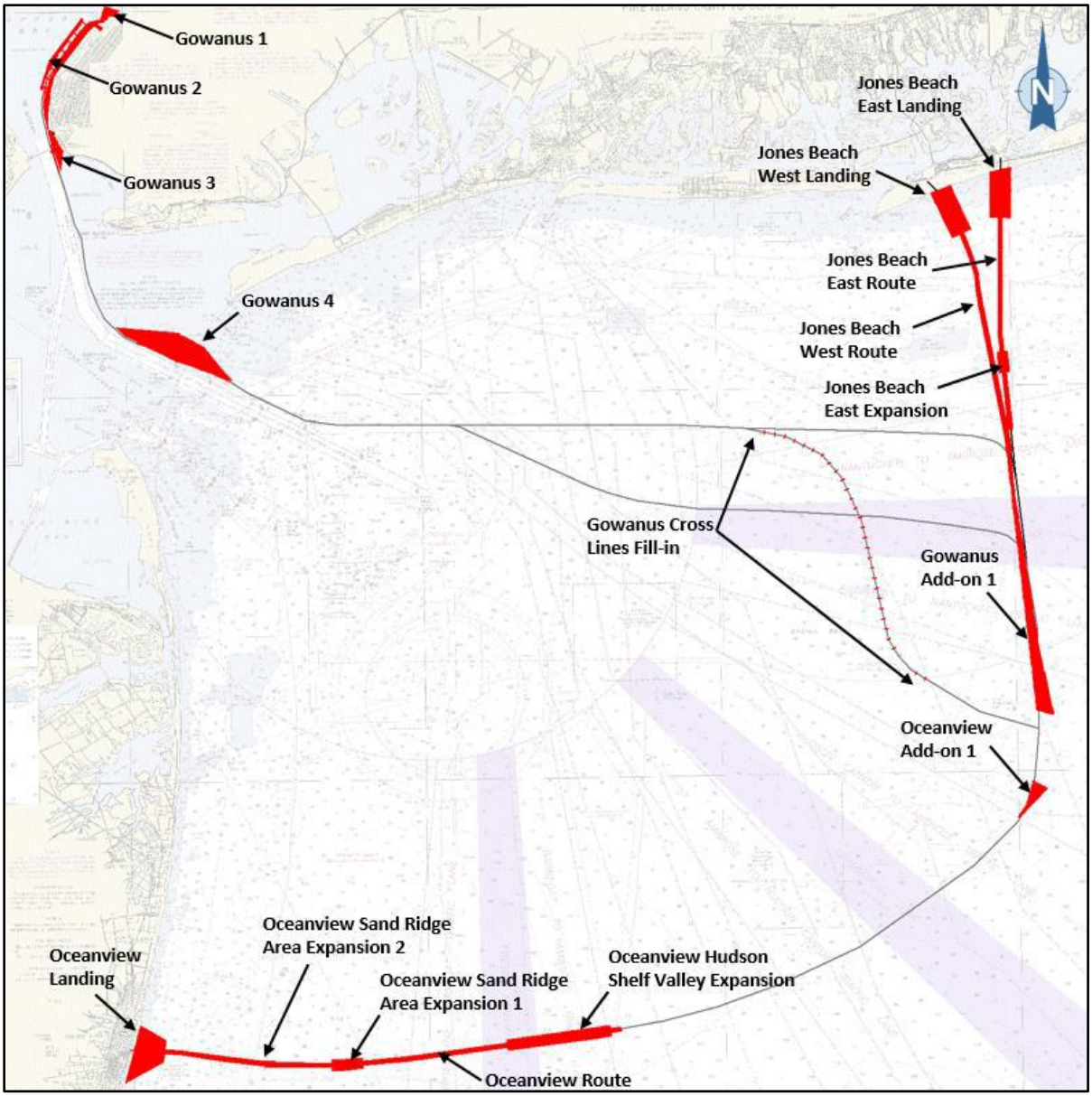

Figure 1: Export Cable Routes

1.2 Vessel and Energy Sources Specifications

The HRG survey operations were conducted from the R/V *Shearwater* (Figure 2) with nearshore operations conducted from the R/V Henry Hudson (Figure 3).

The *Shearwater* measures 34 meters in length with a breadth of 12 meters. The Henry Hudson measures 14 meters in length with a breadth of 5 meters. Cruising speed for the Shearwater was less than 10 knots during transits and varied between three to five knots during survey activity. The Henry Hudson averaged speeds between 10 and 15 knots during transits and varied between three to five knots during survey activity. Survey data acquisition was conducted between 19 April and 22 July 2019.

Figure 2: R/V Shearwater

Figure 3: R/V Henry Hudson

The survey equipment for the R/V Shearwater consisted of a differential GNSS positioning system, single-beam and multi-beam echo sounders (SBES & MBES), a single channel ultra-high resolution seismic sparker with 8-element hydrophone streamer, a transverse gradiometer (TVG) with dual cesium vapor magnetometers, a high resolution sub-bottom profiler, a digital dual-frequency sidescan sonar (SSS), ultra-short baseline (USBL) sub-surface positioning sonar and sound velocity profiler (SVP). The Henry Hudson utilized the same type of equipment with the exception of the USBL. An overview of the towing configuration of the survey equipment is provided in Figure 5. The operating frequencies of the survey equipment are summarized in Table 1.

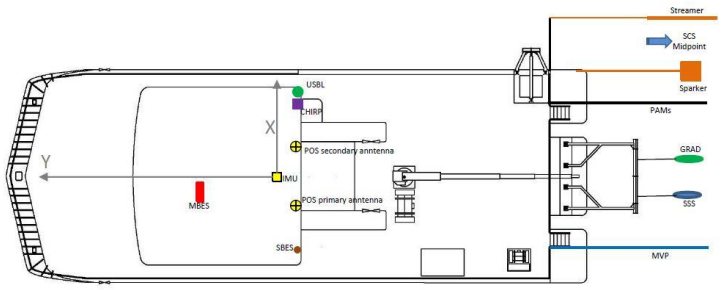

Figure 5: Bird's eye view of the *Shearwater* with towing gear location

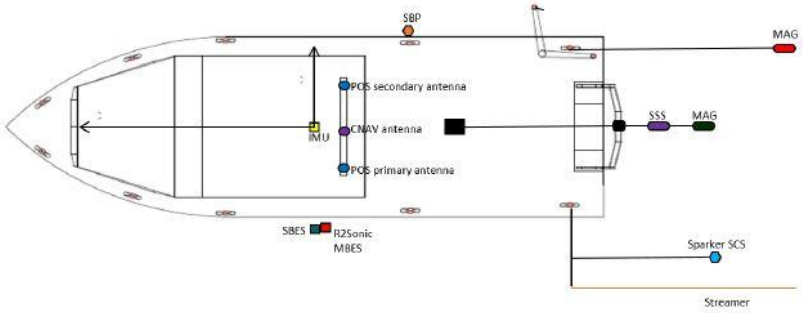

Figure 5: Bird's eye view of the *Henry Hudson* with towing gear location

Table 1: Acquisition Parameters Summary Table

General Specifications			
R/V Shearwater		**R/V Henry Hudson**	
General Location:	Offshore New Jersey	Inshore New Jersey	
Vessel Length (m):	33.25 meters	13.71 meters	
Energy Source Specifications	Frequency Range	Energy Source	Frequency Range
Geo-Source Sparker (UHRS)	500 Hz – 3kHz	Geo-Source Sparker (UHRS)	500 Hz – 3kHz
Teledyne Benthos Chirp Sub-bottom profiler	2-7 kHz	Edgetech 3100 Chirp Sub-Bottom Profiler	2-16 kHz
Sonardyne Scout Pro USBL	0-10 Hz	Odom Echotrac Single Beam Echosounder	24-340 kHz
Odom Echotrac Single Beam Echosounder	24-340kHz	R2Sonic 2024 Multibeam Echosounder	200-400 kHz
R2Sonic 2024 Multibeam Echosounder	200-400 kHz	Edgetech 4200 Dual Frequency Sidescan Sonar	300/600 kHz
Edgetech 4200 Dual Frequency Sidescan Sonar	300/600 kHz	Geometrics Transverse Gradiometer Magnetometer	500 kHz
Geometrics Transverse Gradiometer Magnetometer	500 kHz		

2 Mitigation and Monitoring Methods

The PSO monitoring program on the *Shearwater* and the *Henry Hudson* was established to meet the standards approved by BOEM in the Geophysical Survey Plan as well as the IHA issued by NMFS. Survey mitigation measures were designed to minimize potential impacts of the survey activities on marine mammals, sea turtles, and other protected species of interest.

The following monitoring protocols were implemented on the *Shearwater* to meet these objectives.

- Visual observations were conducted day and night to provide real-time sighting data, allowing for the implementation of mitigation procedures as necessary.
- A PAM system was operated continuously during periods of reduced visibility to augment visual observations and provide additional marine mammal detection data.
- Effects of marine mammals and sea turtles exposed to sound levels constituting a potential "take" were observed and documented. The nature of the probable consequences was discussed when possible.

The following monitoring protocols were implemented on the *Henry Hudson* to meet these objectives.

- Visual observations were conducted throughout the day to provide real-time sighting data, allowing for the implementation of mitigation procedures as necessary.
- During periods of reduced visibility operations were stopped until the exclusion zones were visible for the required 60-minutes clearance period.
- Effects of marine mammals and sea turtles exposed to sound levels constituting a potential "take" were observed and documented. The nature of the probable consequences was discussed when possible.

In addition to the mitigation objectives outlined in the above-referenced documents, PSOs collected and analyzed necessary data mandated by the IHA (see Appendix A).

2.1 Mitigation Methodology

Mitigation actions were implemented for visual and acoustic detections of protected species aboard the *Shearwater*, including marine mammals and sea turtles as outlined in the Geophysical Survey Plan and the IHA, including:

- Establishment of Exclusion Zones around energy sources with operating frequencies below 200 kHz
  - 500-meter exclusion zone (EZ) for North Atlantic right whales.
  - 100-meter EZ was implemented for all other large whales including sperm whales and mysticetes, and harbor porpoises.
  - 50-meter EZ was used for delphinoid cetacean, pinniped, and sea turtles.
- Search periods of 60 minutes conducted visually (daytime) or visually and acoustically (all periods of reduced visibility, including night) prior to the initiation of the sound sources from silence.
- Delays to the initiation of the sound sources if marine mammals or sea turtles were detected inside their respective exclusion zones during the search period prior to the initiation of the source.

- Shut-down of the active source upon detection of marine mammals or sea turtles inside their respective exclusion zones while a sound source with an operating frequency below 200 kHz was active and a subsequent search period of the exclusion zones.
- Once the sound source had been shut down for a protected species detection, operations would not resume until a specific time had passed following the last detection of the animal(s) or once the animal had exited the EZ: 15 minutes for small delphinoid cetaceans and pinnipeds, 30 minutes for non-delphinoid cetaceans, 30 minutes for North Atlantic right whales, and 60 minutes for sea turtles.

The same mitigations action protocols for daytime operations were followed aboard the *Henry Hudson*.

2.2 Visual Monitoring Survey Methodology

There were four trained and experienced PSOs on board the *Shearwater* and two PSOs on board the Henry Hudson during the program to conduct the monitoring for protected species, record and report detections, and request mitigation actions in accordance with the IHA and Geophysical Survey Plan Approval Conditions. The PSOs on board were NMFS approved and held certifications from an accepted BOEM PSO course. Visual monitoring was primarily carried out from the bridge wings of the *Shearwater* located approximately seven meters above the surface of the water, which allowed a 360-degree viewpoint around the vessel and acoustic sources. Visual watches on the Henry Hudson were held on the back deck to allow for the most comprehensive viewpoint given the limited size and space on the vessel.

The PSOs were equipped with 7x50 reticle binoculars, as well as DSLR cameras (Nikon and Canon) with 200mm and 300mm zoom lens to aid in visual monitoring watches conducted during the day. Reticle binocular were calibrated weekly to ensure accuracy of distance data. Tables of the reticle calibrations can be found in Appendix B.

PSOs on the Shearwater conducting night watches were equipped with infrared LED handheld spotlights and night vision goggles with head mounts and thermal clip-ons. Specifications for the night monitoring equipment can be found in Appendix C.

A monitor inside the wheelhouse of each vessel displayed current information about the vessel (e.g. position, speed, heading, etc.), sea conditions (e.g. water depth, sea temperature, etc.), weather (e.g. wind speed and direction, air temperature, etc.), and source activity (e.g. survey line number, total number of active elements, volume, etc.). Environmental conditions, along with vessel and acoustic source activity, were recorded at least once an hour, or every time there was a change of one or more of the variables.

Most observations were held from the bridge wings of the Shearwater or back deck of the Henry Hudson such that the exclusion zones around the sound sources and the strike avoidance exclusion zone could be simultaneously monitored; however, during severe weather or during transits when the sound sources were not active, observations of the vessel strike avoidance zone could be conducted from inside the wheelhouses.

Visual monitoring methods were implemented in accordance with the survey requirements outlined in the IHA and Geophysical Survey Plan Approval Conditions. Visual watch was maintained for 24 hours a day on the Shearwater and 12 hours a day on the Henry Hudson throughout the survey, from the moment the vessels departed the dock until the vessels returned

to dock regardless of acoustic source activity. Visual monitoring during periods of acoustic source silence were conducted to gather baseline data on the presence and abundance of protected species in the areas.

A visual monitoring schedule was established by the PSOs where each person completed visual watches of varying lengths throughout the day. Scheduled watches were no more than four hours in duration and were each followed by at least two hours of scheduled break time.

Visual observations were conducted around the entire area of the vessel and acoustic sources. PSOs searched for blows, fins, splashes or disturbances of the sea surface, large flocks of feeding sea birds, 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 vessel and acoustic source. Range estimations were made using reticle binoculars, the naked eye, and by relating the animal(s) to an object at a known distance. PSOs would also identify the animals' species upon initial detection, if possible, to ensure that the proper mitigation measures were implemented as protocols required.

PSOs recorded the following information for each protected species detection:

I. Date, time of first and last sighting, observers on duty during the detection, location of the observers, vessel information (e.g. position, speed, heading), water depth, acoustic source activity (e.g. volume and number of active elements), and environmental conditions (e.g. Beaufort sea state, wind force, swell height, visibility and glare).
II. Species, detection cue, group size (including number of adults and juveniles), visual description (e.g. overall size, shape of the head, position and shape of the dorsal fin, shape of the flukes, height and direction of the blow), observed behaviors (e.g. porpoising, logging, diving, etc.), and the initial and final pace, heading, bearing, and direction of travel in relation to both the vessel and the source (e.g. towards, away, parallel, perpendicular, etc.).
III. Initial and final distance to the vessel and the source, time and distance of the closest distance to the source, time when entering and exiting the exclusion zones, type of mitigation action implemented, total time of the mitigation action and any production loss, description of other vessels in the area, and any avoidance maneuvers conducted.

During or immediately after each sighting event, the PSOs recorded the detection details per the requirements of the IHA and Geophysical Survey Plan Approval Conditions in a provided detection datasheet. Each sighting event was linked to an entry on an effort datasheet where specific environmental conditions and vessel activity were logged.

Species identifications were made whenever the distance of the animal(s), length of the sighting, and visual observation conditions allowed. Whenever possible during detections, photographs were taken with Canon and Nikon SLR cameras that had 200 and 300-millimeter telephoto lenses. Marine mammal identification manuals were consulted, and photos were examined during observation breaks to confirm identifications.

2.3 Passive Acoustic Monitoring Survey Methodology

Passive Acoustic Monitoring (PAM) was used to augment visual monitoring efforts in the detection, identification, and locating of marine mammals. PAM was particularly beneficial during periods of darkness or low visibility when visual monitoring was not as effective. Acoustic

monitoring was conducted continuously during all survey operations and to the maximum extent possible during periods of acoustic source silence. When the acoustic source was activated following any period of silence, acoustic monitoring and visual monitoring were conducted for 60 minutes prior to the activation of the sound source.

Acoustic monitoring was undertaken by trained PAM Operators each of whom had completed a BOEM accepted PSO training course and an RPS in-house PAM training course, which includes use of the PAM systems on board a vessel offshore. PAM monitoring shifts were no longer than four hours in duration followed by at least a one-hour break.

The PAM system was in the main survey lab, which provided space for the system, allow for quick communication with the visual PSOs and survey technicians, and provided access to the vessel's instrumentation screens. Information about the vessel (e.g. position, heading, and speed), water depth, source activity (e.g. line number, total volume, number of active elements), and the PAM system (e.g. cable deployments/retrievals, changes to the system, background noise score) were recorded at least once an hour, or whenever any of the parameters changed.

Acoustic monitoring for marine mammals was conducted aurally, utilizing Sennheiser headphones, and visually with the *Pamguard* software program. Low to mid-frequency delphinid whistles, clicks, and burst pulses, as well as sperm whale clicks and baleen whale vocalizations, could be visualized in *Pamguard's* spectrogram modules. Sperm whale, beaked whale, Kogia species, and delphinid clicks could also be visualized in low and high frequency click detector modules. Settings adjustments to amplitude range, amplitude triggers, and spectral content filters, among others, could be made in *Pamguard*'s spectrogram and click detector modules to maximize the distinction between cetacean vocalizations and ambient signal. The map module within *Pamguard* could be utilized to attempt localizing the position and range of vocalizing marine mammals. Sound recordings could be made using the high and low frequency sound recording modules when potential marine mammal vocalizations were detected, or when the operator noted unknown or unusual sound sources.

PAM operators recorded the following information during acoustic detections of protected species:

I. Date, time of first and last detection, operator on duty, if the detection was linked to a visual sighting, vessel information (e.g. position, speed, heading), water depth, and acoustic source activity (e.g. volume and number of active elements).
II. Species (if determinable), group size, methods/modules on which vocalizations were detected during the event, and vocalization characteristics (e.g. signal type, frequency and amplitude range, inter-click interval, patterns, etc.)
III. Determinable bearings (to the hydrophones, vessel and source), estimated and/or attempted localizations and any ranges determined, type and time of any implemented mitigation actions and any resulting production loss.

2.3.1 Passive Acoustic Monitoring Parameters

A passive acoustic monitoring system designed to detect most species of marine mammals was installed on board the *Shearwater*. The system was developed by *Seiche Measurements Limited* and consisted of the following main components: a 250 meter hydrophone cable (configured as a separate 230 meter steel-reinforced tow cable and detachable 20 meter hydrophone array); a 100 meter deck cable; a rack-mounted electronic processing unit (EPU) that incorporated a buffer unit, a RME Fireface 800 unit, and a computer; two desktop monitors; acoustic analysis software package; and headphones for aural monitoring. A spare hydrophone cable, deck cable, rack-mounted DPU and computer, monitors, and headphones were also present on board in the event

the main system components became damaged or inoperable. The diagram in Figure 4 is a simplified depiction of the PAM system installed on the *Shearwater.* Further PAM system specifications can be found in Appendix D.

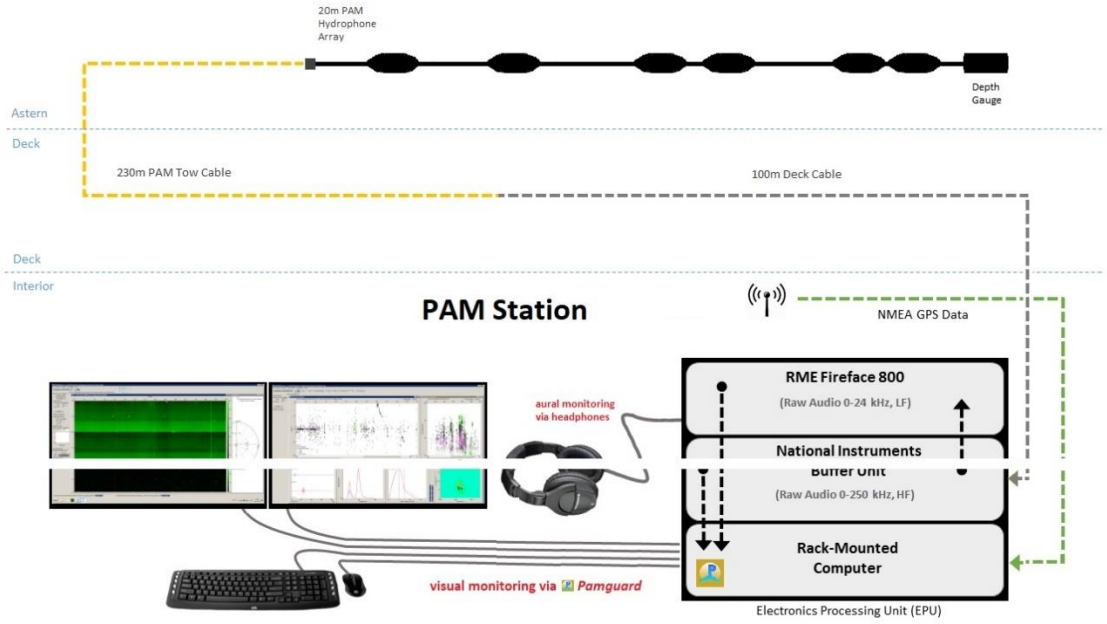

Figure 4: Simplified pathway of data through the PAM system on board the Shearwater.

The 20-meter linear hydrophone array attachment cable contained six individual hydrophone elements spaced eight meters, two meters and 0.25 meters apart, as well as a depth transducer (Figure 5). The forward hydrophone pair (H1, H2) was used to analyze and record low frequencies (10 – 24,000 Hz); the middle hydrophone pair (H3, H4) was used to analyze and record middle frequencies (200 – 200,000 Hz), and the trailing hydrophone pair (H5, H6) was used to analyze and record high frequency sound (2,000 – 200,000 Hz). The hydrophone array cable was attached to the 230-meter heavy-duty tow cable and manually deployed from the port-side on the back deck. The connector end of the tow cable was attached to the 100-meter deck cable located on sheltered section at the port stern of the vessel. The deck cable was secured with cable ties to hand rails that led it from port to starboard side of the vessel and into the instrument room, where the PAM station was located.

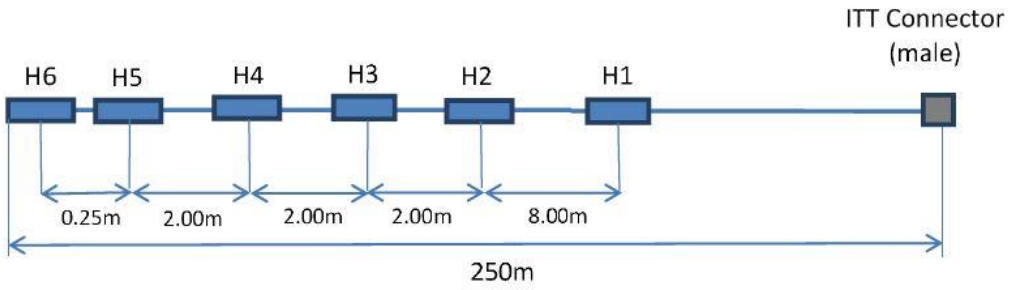

Figure 5: Diagram of hydrophone element separation on 250m hydrophone cable.

The deck cable interfaced between the hydrophone cable installed on the back deck of the vessel and the electronics processing unit (EPU) located in the main survey lab. The rack-mounted EPU was set up with the two pre-installed, wall-mounted monitors, keyboard, mouse and headphones. The EPU contained a buffer unit with Universal Serial Base (USB) output, an RME Fireface 800 ADC unit with firewire output, and a rack-mounted computer. A Global Positioning System (GPS) feed of GNGGA strings was supplied from the ship's navigation system and routed to the computer, reading data every 20 seconds. Data from the hydrophone cable's depth transducer was routed through the buffer unit to the computer, via USB connection. *Pamguard Beta* versions 1.15.11 and 1.15.13 were the software versions utilized for monitoring during the survey.

Raw feed from hydrophone elements H5 and H6 was digitized in the buffer unit using an analogue-digital National Instruments data acquisition (DAQ) soundcard at a sampling rate of 500 kilohertz. The output was filtered for high frequency (HF) content and visualized using the *Pamguard* software. A sixth order Butterworth high-pass digital pre-filter of 30 kilohertz and a high-pass trigger filter of 40 kilohertz were applied. *Pamguard* used the difference between the time that a signal arrived at each of the two hydrophones to calculate and display the bearing to the source of the signal. A scrolling bearing/time module displayed the filtered data in real time, allowing for the detection and directional mapping of click trains. Additional components of the HF click detector system in *Pamguard* were an amplitude/time display that registered click intensity data in real time, as well as click waveform, click spectrum, and Wigner plot displays, providing the PAM operator immediate review of individual click characteristics in the identification process. One of the two monitors were designated for displaying *Pamguard* HF click detector and sound recorder modules.

Raw feed from the MF and LF hydrophone elements (H1, H2, H3, H4) was routed from the buffer unit to the RME Fireface 800 unit, where it was digitized at a sampling rate of 48 kilohertz. The relatively low frequency (LF) output was further processed within *Pamguard* by applying Engine Noise Fast Fourier Transform (FFT) filters, including click suppression and spectral noise removal filters (e.g. median filter, average subtraction, Gaussian kernel smoothing and thresholding). Filtered LF content was visualized in two spectrograms, one displaying two channel feeds at frequency ranges of three to 24 kilohertz, and another displaying one channel feed at a frequency range of zero to three kilohertz. LF click detector modules allowed for review of individual click characteristics as well as the detection and tracking of click trains.

A map module on the LF system interfaced with GPS data provided by the vessel to display the vessel location and could be used to determine range and bearing estimates based on clicks tracked in the click detector module. *Pamguard* contains a function for calculating the range to vocalizing marine mammals based upon the least squares fit test. This method is most effective with animals that are relatively stationary in comparison to the moving vessel, such as sperm whales. The mathematical function estimates the range to vocalizing marine mammals by

calculating the most likely crossing of a series of bearing lines generated from tracked clicks or whistles and plotted on a map display. Additionally, the bearings of detected whistles and moans were 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.

Additional modules displayed on the LF monitor included an LF sound recorder and clip generator. The clip generator module within *Pamguard* could also be used to generate short sound clips in response to either an automatic detection or the operator manually selecting a portion of the spectrogram display. This module was useful in the event that the whistle-and-moan detector falsely triggered and identified a non-biological sound (i.e. echosounder) or if it missed detecting tonal signatures that the operator determined to be vocalizations.

2.3.2 Hydrophone Deployment

The hydrophone cable was deployed manually from the starboard stern of the vessel's rescue deck. One deck cable was installed along the deck running from the starboard stern to the main survey lab. The hydrophone cable was attached via Chinese finger to the Starboard side rescue deck railing to assist in keeping the cable towing away from other towed equipment. The end of the deployed hydrophone cable was approximately 55 meters from the starboard stern of the vessel.

PAM system specifications can be found in Appendix D, and a more detailed description of the hydrophone deployment method can be found in Appendix E.

3 Survey Operations and Monitoring Effort

3.1 Survey Operations Summary

3.1.1 General Survey Parameters

Operations for the survey began with the *Shearwater* doing source calibrations in Jersey City, NY on 19 April 2019 at 12:39 UTC. Acquisition continued according to the survey plan, with survey operations briefly suspended when necessary for weather, equipment maintenance or port calls for provisions and crew change, as outlined in Table 2. The *Shearwater* concluded operations on 23 May 2019, with the vessel arriving in port at 16:47 UTC.

Table 2: Transits of the *Shearwater* during Equinor Wind, US, Survey 2018/19

Date Depart	Date Arrive	Description of Transit
19-04-2019	19-04-2019	Transit from the port of Jersey City to the bay for source calibrations.
21-04-2019	21-04-2019	Transit from the port of Jersey City to the bay for source calibrations.
22-04-2019	26-04-2019	Vessel went to anchor due to bad weather.
28-04-2019	04-05-2019	Transit to port for vessel maintenance and provisions.
08-05-2019	12-05-2019	Transit to port due to inclement weather.
14-05-2019	20-05-2019	Transit to port due to inclement weather.
21-05-2019	23-05-2019	Transit to port after the survey was completed.

After demobilization of the equipment from the Shearwater, the *Henry Hudson* began the inshore part of the survey on 12 June 2019 at 17:33 UTC. Acquisition continued according to the survey plan, with the vessel leaving and returning to port every day, suspending survey operations when necessary for weather or equipment maintenance. The *Henry Hudson* concluded the survey on 22 July 2019, with the vessel arriving in port at 20:30 UTC.

3.1.2 HRG survey equipment operations

The *Shearwater* was engaged in source operations for a total of 446 hours and 45 minutes during the survey. The *Henry Hudson* was engaged in source operations for a total of 140 hours and 27 minutes during the survey. This total included source operations on a survey line, source operations not on a survey line, ramp up and source testing. A breakdown of source operations for each vessel can be found in (Table 3).

On the *Shearwater*, four devices were operated below 200kHz and tracked for the purpose of protected species mitigation. These included the single-beam echo sounder, the ultra-short baseline (USBL), the sub-bottom profiler and the sparker. The *Henry Hudson* operated two of these four devices at frequencies below 200kHz, including the sub-bottom profiler and the sparker. The USBL was not utilized on the *Henry Hudson* and although a single beam echo-sounder was used, it was not operated at frequencies lower than 200kHz and therefore not tracked for the purpose of mitigation.

On the *Shearwater*, a ramp-up of each acoustic source was not technically feasible, however, the devices were activated one by one over a 20-minute interval to gradually introduce sound in the

water. The single beam eco-sounder was first activated, followed by the USBL after 10 minutes. At the 15-minute mark, the sub-bottom profiler was activated and lastly, at the 20-minute mark, the sparker was activated.

On the *Henry Hudson*, the sub-bottom profiler was activated first at 20% of its maximum operational ping rate. This rate was then gradually increased every five minutes over a 20-minute period until the desired operational ping rate was reached. At this point the sparker was then activated constituting full volume and official acquisition could begin.

Table 3: Acoustic Source Operations during Equinor Wind, US, Survey

Acoustic Source Operations	Duration HH:MM	
	R/V Shearwater	Henry Hudson
Source Tests	10:10	00:55
Ramp Up	13:27	11:21
Source Activity on a Survey Line	256:40	89:09
Source Activity not on a Survey Line	166:28	39:02
Total Time Acoustic Sources Were Active by Vessel	**446:45**	**140:35**
Total Time Acoustic Sources Were Active	**587:20**	

3.2 Visual Monitoring Survey Summary

3.2.1.1 *Shearwater* visual monitoring effort

Visual monitoring during the survey program was conducted day and night by one PSO, starting when the vessel left the dock and terminating upon return to port. Visual observations were suspended only while the vessel was dockside in port or anchor due to bad weather. When visual monitoring was suspended, low-frequency source operations were also suspended.

The PSOs conducted visual observations for a total of 580 hours and 30 minutes over a period of 35 days. Of this total visual monitoring effort, 382 hours and 24 minutes was accumulated during daylight hours and 198 hours and 06 minutes was undertaken at night using night vision monitoring equipment.

Of the overall total visual monitoring effort, 80.9% (469 hours and 59 minutes) was undertaken while the acoustic sources were active, and 19.1% (110 hours and 31 minutes) was undertaken while the acoustic sources were silent. Visual monitoring while the acoustic source was silent was mainly conducted during the transits to and from the survey sites, and during equipment deployment, recovery and maintenance.

Table 4 details visual monitoring with acoustic source operations throughout the survey program.

Table 4: Total Visual Monitoring Effort on R/V Shearwater

Visual Monitoring Effort	Duration (hh:mm)	% of Overall Visual Monitoring Effort

Total monitoring while acoustic source active	469:59	80.9%
Total monitoring while acoustic source silent	110:31	19.1%
Total monitoring effort	580:30	**100%**
Total monitoring during daylight	382:24	65.9%
Total monitoring during reduced visibility	198:06	34.1%
Total monitoring effort	**580:30**	**100%**

3.2.1.2 *Henry Hudson* visual monitoring effort

Visual monitoring during the survey program was conducted during daylight hours by PSO, starting when the vessel left the dock and terminating upon return to port. Visual observations were suspended only while the vessel was dockside in port.

The PSOs conducted visual observations for a total of 308 hours and 15 minutes during daylight hours only over a period of 41 days.

Of the overall total visual monitoring effort, 45.6% (140 hours and 35 minutes) was undertaken while the acoustic sources were active, and 54.4% (167 hours and 40 minutes) was undertaken while the acoustic sources were silent. Visual monitoring while the acoustic source was silent was mainly conducted during the transits to and from the survey sites, and during equipment deployment, recovery and maintenance.

Table 5 details visual monitoring with acoustic source operations throughout the survey program.

Table 5: Total Visual Monitoring Effort on R/V Henry Hudson

Visual Monitoring Effort	Duration (hh:mm)	% of Overall Visual Monitoring Effort
Total monitoring while acoustic source active	140:35	45.6%
Total monitoring while acoustic source silent	167:40	54.4%
Total monitoring effort	**308:15**	**100%**
Total monitoring during daylight	308:15	100%
Total monitoring during reduced visibility	00:00	0%
Total monitoring effort	**308:15**	**100%**

3.3 Acoustic Monitoring Summary

Acoustic monitoring during the survey was conducted aboard the *Shearwater* continuously throughout acoustic source operations and to the maximum extent possible while the acoustic source was silent during all periods of reduced visibility, including night, beginning on 22 April 2019.

Throughout the survey program onboard the *Shearwater*, acoustic monitoring was conducted on 32 days for a total of 195 hours and 39 minutes. Of the overall total acoustic monitoring effort, 94.6% (185 hours and 14 minutes) was undertaken while the acoustic source was active, and 5.4% (10 hours and 25 minutes) was undertaken while the acoustic source was silent. Acoustic

monitoring while the acoustic source was silent was mainly conducted during the periods of time between recovery/deployment of the seismic gear.

Acoustic monitoring was conducted during daytime when there was reduce visibility due to fog, totaling 15 hours and 11 minutes of daytime acoustic monitoring.

Table 6 details acoustic monitoring with acoustic source operations throughout the Equinor Wind, US, survey program.

Table 6: Total Acoustic Monitoring Effort during the Equinor Wind, US, Survey Program

Acoustic Monitoring Effort	Duration (hh:mm)	% of Overall Visual Monitoring Effort
Total monitoring while acoustic source active	185:14	94.6%
Total monitoring while acoustic source silent	10:25	5.4%
Total acoustic monitoring effort	**195:39**	**100%**
Total monitoring occurring with concurrent visual monitoring	195:39	100%
Total monitoring occurring as PAM only	00:00	0%
Total acoustic monitoring effort	**195:39**	**100%**

Visual observers and PAM Operators simultaneously monitored the exclusion zone and surrounding areas for 195 hours and 39 minutes during the survey. This is equal to the total time of acoustic monitoring.

3.4 Environmental Conditions

3.4.1.1 Environmental conditions on the *Shearwater*

Environmental conditions can have an impact on the probability of detecting protected species in a survey area. The environmental conditions present during visual observations undertaken during this survey program were mild to moderate.

Visibility was classified as ‘excellent’ if it extended to five kilometers or greater, ‘moderate’ if it was between two to five kilometers, and ‘poor’ if it was less than two kilometers. Visibility conditions were excellent for 32.7% of the overall visual monitoring effort onboard the *Shearwater*, totaling 189 hours and 36 minutes. Visibility conditions were moderate for 22.3% of the overall visual monitoring effort, totaling 129 hours and 27 minutes. Poor visibility conditions occurred for 45% of the overall visual monitoring effort, totaling 261 hours and 27 minutes. Poor visibility consisted of periods of rain or fog, the brief periods of reduced lighting before sunrise and after sunset, as well as night-vision monitoring (Table 7).

Table 7: Summary of Visibility during Visual Monitoring on R/V Shearwater

Visibility	Duration (hh:mm)	% of Overall Visibility
Excellent (Greater than five kilometers)	189:36	32.7%
Moderate (two to five kilometers)	129:27	22.3%
Poor (less than two kilometers)	261:27	45.0%
Total Visual Monitoring Effort	**580:30**	**100%**

*Total hours of poor conditions include night-vision monitoring

The Beaufort sea state recorded during visual monitoring ranged from level one to level six onboard the *Shearwater* over the course of the survey program. A total of 446 hours and 37 minutes (76.9%) of visual observations were undertaken in conditions where the Beaufort state was level three or less, which were considered good conditions for the detection of protected species. Beaufort sea states of four to six were recorded for a total of 133 hours and 53 minutes, comprising 23.1% of all visual monitoring observations (Table 8).

Table 8: Summary of Beaufort sea state during Visual Monitoring on R/V Shearwater

Beaufort Sea State	Duration (hh:mm)	% of Overall Visibility
B1	45:08	7.8%
B2	229:41	39.5%
B3	171:48	29.6%
B1 through B3	**446:37**	**76.9%**
B4	48:06	8.3%
B5	70:27	12.2%
B6	15:20	2.6%
B4 through B6	**133:53**	**23.1%**

Swell heights during visual observations were generally low, with swells of less than two meters recorded for 518 hours and 13 minutes or 89.3% of the total visual effort onboard the *Shearwater* during the survey program. Swells between two and four meters were recorded for 62 hours and 17 minutes or 10.7% of the total visual effort. Swells did not exceed four meters during the survey (Table 9).

Table 9: Summary of Swell Height during Visual Monitoring on R/V Shearwater

Beaufort Sea State	Duration (hh:mm)	% of Overall Visibility
Less than 2 meters	518:13	89.3%
2 to 4 meters	62:17	10.7%

3.4.1.2 Environmental conditions on the *Henry Hudson*

Visibility conditions on the *Henry Hudson* were excellent for 78.4% of the overall visual monitoring effort, totaling 241 hours and 42 minutes. Visibility conditions were moderate for 20.4% of the overall visual monitoring effort, totaling 62 hours and 43 minutes. Poor visibility conditions occurred for 1.2% of the overall visual monitoring effort, totaling 03 hours and 50 minutes. Poor visibility consisted of periods of rain or fog (Table 10).

Table 10: Summary of Visibility during Visual Monitoring on R/V Henry Hudson

Visibility	Duration (hh:mm)	% of Overall Visibility
Excellent (Greater than five kilometers)	241:42	78.4%
Moderate (two to five kilometers)	62:43	20.4%
Poor (less than two kilometers)	03:50	1.2%
Total Visual Monitoring Effort	**308:15**	**100%**

The Beaufort sea state recorded during visual monitoring ranged from level one to level four onboard the *Henry Hudson* over the course of the survey program. A total of 282 hours and 41 minutes (91.7%) of visual observations were undertaken in conditions where the Beaufort state was level three or less, which were considered good conditions for the detection of protected species. Beaufort sea states of four were recorded for a total of 25 hours and 34 minutes, comprising 8.3% of all visual monitoring observations (Table 11).

Table 11: Summary of Beaufort sea state during Visual Monitoring on R/V Henry Hudson

Beaufort Sea State	Duration (hh:mm)	% of Overall Visibility
B1	20:27	6.7%
B2	111:13	36.1%
B3	150:41	48.9%
B1 through B3	**282:41**	**91.7%**
B4	25:34	8.3%
B5	00:00	0.0%
B6	00:00	0.0%
B4 through B6	**25:34**	**8.3%**

Swell heights during visual observations were generally low, with swells of less than two meters recorded for all 308 hours and 15 minutes of the visual effort onboard the *Henry Hudson* during the survey program (Table 12).

Table 12: Summary of Swell Height during Visual Monitoring on R/V Henry Hudson

Beaufort Sea State	Duration (hh:mm)	% of Overall Visibility
Less than 2 meters	308:15	100.0%

4 Protected Species Detection Results

There were 21 detection events of protected species during the duration of this survey. Eight of these detections occurred onboard the *Shearwater* and 13 detections occurred onboard the *Henry Hudson*. There were no acoustic detections; all detections were made visually.

4.1 Protected Species Detections

There were 21 detection events of protected species onboard the *Shearwater* and *Henry Hudson*, which consisted of two species of whales (humpback and fin whales), one species of dolphin (common bottlenose dolphins), one species of pinnipeds (grey seal), and one species of sea turtle (green sea turtle) that were identified to species level (Table 13). There were also two detections of whales and three detections of dolphins not identifiable to species level.

Table 13: Number of detection records collected for each protected species during the survey program.

Species	Total Number of Detection Records	Total Number of Visually Detected Animals Recorded
Whales		
Fin whale	2	2
Humpback whale	7	7
Unidentifiable whale	2	2
Dolphins		
Common Bottlenose dolphin	5	27
Unidentifiable dolphin	3	18
Pinnipeds		
Gray seal	1	1
Sea Turtles		
Green sea turtle	1	1
Total	**21**	**58**

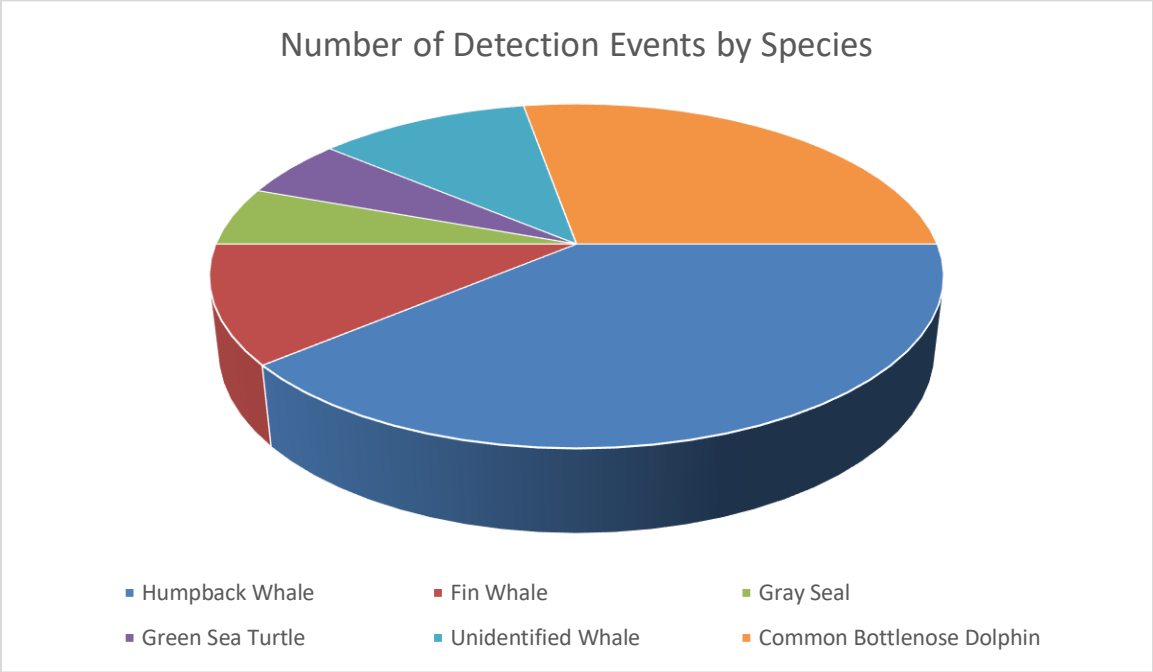

Figure 6: Number of detection events by species group during the Equinor Wind, US, survey program

Of the total marine mammal detections, seven detections were first made while the survey LF sound sources were active and 14 detections were first made while the LF sound sources were inactive. The average closes approach of each species to each vessel while the low frequency sources were active and inactive are provided in Table 14 and Table 15.

Table 14: Average Closest Approach of Protected Species to the Acoustic LF Source deployed from R/V *Shearwater*

Species Detected	Active LF Source		Inactive LF Source	
	Number of detections	Average closest approach to source (meters)	Number of detections	Average closest approach to source (meters)
Fin whale	2	283		
Humpback whale			2	500
Unidentifiable whale	2	600		
All Whale Species	**4**	**441.5**	**2**	**500**
Unidentifiable dolphin	1	1000		
All Dolphin Species	**1**	**1000**		
Gray seal			1	0
All Pinniped Species			**1**	**0**

Table 15: Average Closest Approach of Protected Species to the Acoustic LF Source deployed from *Henry Hudson*

Species Detected	Active LF Source		Inactive LF Source	
	Number of detections	Average closest approach to source (meters)	Number of detections	Average closest approach to source (meters)
Fin whale				
Humpback whale			5	Not deployed
Unidentifiable whale				
All Whale Species			**5**	Not deployed
Common Bottlenose dolphin	1	100	4	500
Unidentifiable dolphin			2	Not deployed
All Dolphin Species	**1**	**100**	**6**	**500**
Green sea turtle	1	15		
All Turtle Species	**1**	**15**		

4.1.1 Protected Species Detection Summary

A total of eight marine mammal detection events were recorded onboard the *Shearwater*. All of the detections were made visually by the PSOs. One of the eight detections occurred at night. The acoustic sources were not active at the time of this detection and the passive acoustic monitoring equipment was not required to be deployed.

All 13 of the detection events recorded onboard the *Henry Hudson*, 12 of which were marine mammals and one of a sea turtle, were made visually during the day. The vessel did not operate at night, and acoustic monitoring was not used.

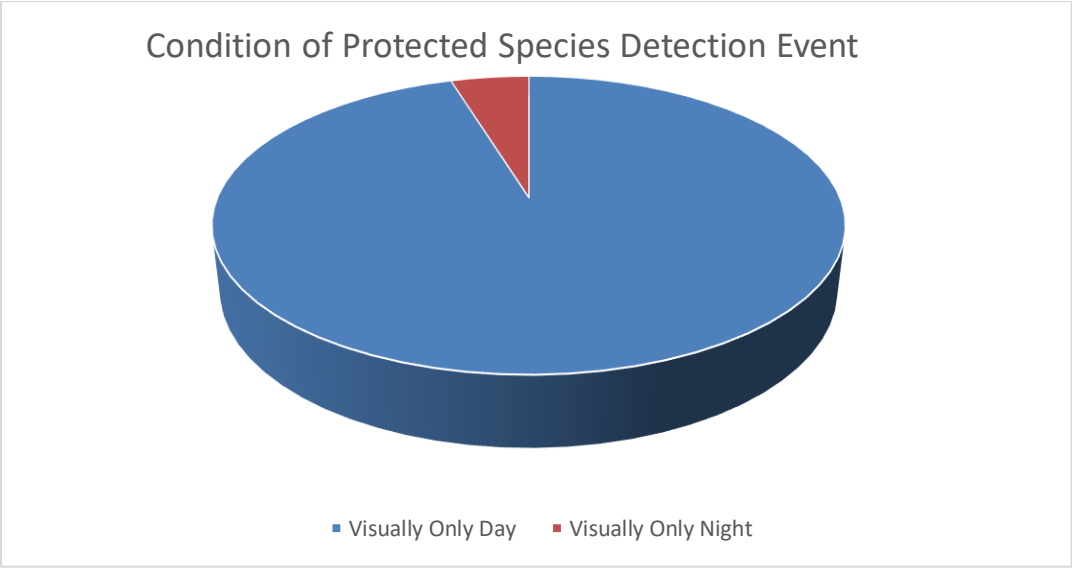

Figure 7: Detection Method of Protected Species Detection Events during Survey

When factoring in visual and acoustic monitoring effort to calculate the protected species detection rate during the survey, the overall visual detection rate is significantly higher than the acoustic detection rate (Table 16).

Table 16: Detection Rate of Protected Species Detections for Visual and Acoustic Monitoring during the Survey Program

Monitoring method	Number of detections made	Monitoring Effort (HH:MM)	Monitoring Effort (Decimal)	Detection rate (Dets/hour effort)
Visual monitoring	21	888:45	888.75	0.024
Acoustic monitoring	0	195:39	195.65	0.000

Five different protected species, including two whale species, one dolphin species, one pinniped species and one sea turtle species were identified during the survey. There were two sightings of fin whales, seven sightings of humpback whales, five sightings of common bottlenose dolphins, one sighting of a grey seal and one sighting of a green sea turtle. Two sightings of whales and three of dolphins were also made that were not identified at the species level.

Detections of protected species that were not identified at the species level were due either to the brevity of the sighting event, the visual conditions at time of the detection, or the distance of the sighted mammals from the vessel. More detail is provided for detection events by species in Sections 4.1.1.1 through 4.1.1.7. The location of each protected species detection event is shown in Figure 8.

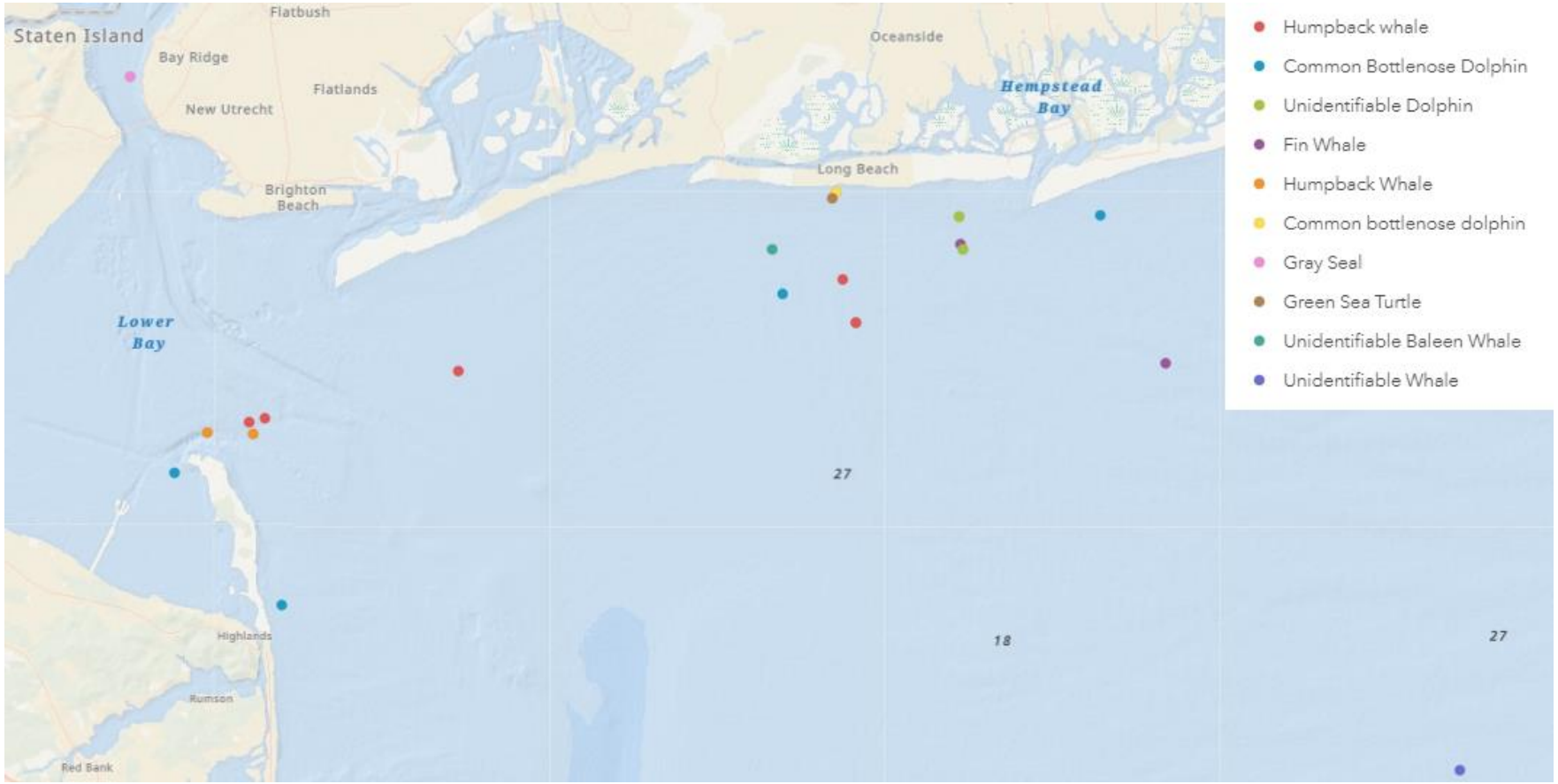

Figure 8: Location of protected species detection events in survey area

4.1.1.1 Fin whale

There were two sightings of fin whales during the survey. Both detections occurred while the LF sources were active, with a closest point of approach of 165 and 400 meters. No mitigation actions resulted from the sightings. The groups consisted of one individual each; dorsal fins and blows were visible in both sightings, with diving behaviors noted in one of the sightings.

4.1.1.2 Humpback whale

There were seven sightings of humpback whales during the survey. All detections occurred while the LF sources were inactive, with a closest point of approach of 200 meters. No mitigation actions resulted from the sightings. The groups consisted of one individual each; dorsal fins and blows were visible in all sightings. On one of the detections the whale's head emerged with its mouth open, exhibiting feeding behavior.

4.1.1.3 Common Bottlenose dolphin

There were five sightings of common bottlenose dolphins during the survey. All of the detections occurred while the LF sources were inactive with the exception of one detection which occurred during a ramp-up of the acoustic source. The animals did not enter the exclusion zone during the ramp-up and no mitigation actions were necessary. One mitigation action in the form of a delay to initiation of the acoustic source was implemented for a single common bottlenose dolphin that was observed within the relevant exclusion zone during a 60-minute pre-search period. The dolphin moved out of the area and a delay of 15 minutes was implemented prior to ramp up. The groups consisted of one to seven individuals each. Feeding, breaching and acrobatic were among the behaviors exhibited by each group.

4.1.1.4 Gray seal

There was one sighting of a gray seal during the survey. The detection occurred while the vessel was on standby and the LF sources were not deployed. The seal approached the vessel (less than one meter). No mitigation actions resulted from this sighting. The group consisted of one individual, which was observed swimming and diving.

4.1.1.5 Green Sea Turtle

There was one sighting of a green sea turtle during the survey. The detection occurred while the LF sources were active on a survey line at a closest approach of 15 meters. An immediate shutdown and 60-minute clearance period were implemented before the LF sources could be reactivated.

4.1.1.6 Unidentified whale

There were two detections of whales that were not identifiable at the species level. Both detections occurred while the LF sources were active. Closest points of approach were 400 and 800 meters. No mitigation actions, nor strike avoidance measures, were required for the sightings. Each detection consisted of one individual and blowing behaviors were observed.

4.1.1.7 Unidentifiable dolphin

There were three detections of dolphins that were not identifiable at the species level. One detection occurred while the LF source was active. The detection occurred while the acoustic source was active on a survey line. Closest point of observed approach was 1000 meters. No mitigation actions resulted from any of the sightings. The groups consisted of five to seven individuals, which were observed swimming and porpoising.

4.1.2 Acoustic Detections

There were no acoustic detections of protected species during the survey.

5 Mitigation Actions Summary

There were no mitigation actions implemented during the survey period onboard the *Shearwater*.

There were two mitigation actions implemented during the survey period onboard the *Henry Hudson*, including one delay to initiation of source activity and one shutdown of the acoustic source.

Table 17: Number and Duration of Mitigation Actions Implemented during the Survey Program

Mitigation Action	Dolphins			Sea Turtles		
	Number	Mitigation Downtime	Production Loss	Number	Mitigation Downtime	Production Loss
Delay of Source Initiation	1	00:15	00:15			
Shutdown of Active Source				1	00:60	00:60
Total Mitigation		00:15	00:15		00:60	00:60

Table 18: Mitigation Actions and Downtime Duration by Species during the Survey Program

Species	Number of Delays	Number of Shut-downs	Duration of Mitigation Downtime	Percentage of Mitigation Downtime	Duration of Production Loss	Percentage of Production Loss
Common Bottlenose dolphin	1		00:15	20%	00:15	20%
Green Sea Turtle		1	00:60	80%	00:60	80%

A summary of each mitigation action can be found in Appendix I.

5.1 Marine Mammals Known to have been Exposed to 160dB or Greater of Received Sound Levels

NMFS granted an IHA for the survey allowing for Level B harassment takes (exposure to sound pressure levels equal to or greater than 160 dB re: 1 µPa (rms) where there is a potential for behavioural changes) for 13 marine mammal species during the Equinor Wind, US, survey. For sea turtles, behavioural harassment (Level B) was expected to occur in the 175 dB zone, and PTS (Level A) was expected to occur in the 195 dB zone.

A total of 4,703 individual marine mammals from 11 species were authorized for Level B exposures in the IHA. No Level A exposures were authorized. During the survey period aboard the *Shearwater* and *Henry Hudson*, no protected species individuals were observed within the Level A or B harassment zones (Table 19).

Table 19: Number of Authorized and Potential Level A and B Exposures during the Equinor Wind, US, survey program

Species	IHA Authorized Level A Exposures	Potential Level A Exposures / PTS During the Program	IHA Authorized Level B Exposures	Potential Level B Exposures / PTS During the Program
North American right whale	0	0	7	0
Humpback whale	0	0	9	0
Fin whale	0	0	38	0
Sperm whale	0	0	2	0
Minke whale	0	0	15	0
Bottlenose dolphin	0	0	615	0
Common dolphin	0	0	668	0
Atlantic white-sided dolphin	0	0	169	0
Harbor porpoise	0	0	892	0
Harbor seal	0	0	1144	0
Gray seal	0	0	1144	0

The number of potential exposures may be an underestimation and, therefore, may be a minimum estimate of the actual number of protected species potentially exposed to received sound levels within the predicted Level A and Level B harassment zones. It is possible that the estimated numbers of animals recorded were underestimates due to some animals not being seen or having moved away before they were observed. This is most likely to have occurred with large pods of dolphins where exact number of individuals is difficult to determine.

The Beaufort sea state has a large impact on the ability to visibly detect many smaller or unobtrusive marine species such as beaked whales and sea turtles. During the survey, there were several days (18.4% of the duration of all visual monitoring) where Beaufort sea states (equal to or greater than level four) may have resulted in some missed protected species detections. However, most of all visual monitoring observations throughout the survey program (81.6%) were

conducted during Beaufort sea states of level three or less, in conditions that are considered favourable for protected species detections.

In order to increase opportunities for detections of marine mammals, passive acoustic monitoring was employed throughout this survey program during hours of reduced visibility. When acoustic monitoring is used to augment visual monitoring the likelihood of detecting marine mammals in poor visual conditions increases for many species groups.

5.2 Implementation and Effectiveness of Mitigation Protocols

To minimize the potential impacts to marine mammals and sea turtles during the Survey, PSOs were prepared to implement mitigation measures whenever protected species were detected approaching, entering, or within the exclusion zones designated in the OCS-A 0512 lease and IHA.

Mitigation measures in the IHA and OCS-A 0500 lease required:

- Establishment of Exclusion Zones around energy sources with operating frequencies below 200 kHz
    - 500-meter exclusion zone (EZ) for North Atlantic right whales.
    - 135-meter EZ for all marine mammal species with no Level B potential exposure allowances in the project IHA.
    - 100-meter EZ was implemented for Endangered Species Act (ESA) listed animals.
    - 75-meter EZ was used for harbor porpoise.
    - 50-meter EZ was implemented for sea turtles.
    - 5-meter EZ was used for all other marine mammal species with Level B potential exposure allowances in the project IHA.
- Search periods of 60 minutes conducted visually (daytime) or visually and acoustically (all periods of reduced visibility, including night) prior to the initiation of the sound sources from silence
- Delays to the initiation of the sound sources if marine mammals or sea turtles were detected inside their respective exclusion zones during the search period prior to the initiation of the source
- Shut-down of the active source upon detection of marine mammals or sea turtles inside their respective exclusion zones while a sound source with an operating frequency below 200 kHz was active and a subsequent search period of the exclusion zones
- Once the sound source had been shut down for a protected species detection, operations would not resume until a specific time had passed following the last detection of the animal(s) or once the animal had exited the EZ: 15 minutes for small delphinoid cetaceans and pinnipeds, 30 minutes for non-delphinoid cetaceans, 30 minutes for North Atlantic right whales, and 60 minutes for sea turtles.

Throughout the survey, there were two mitigation actions implemented for protected species, including one shut-down of the active source and one delay to the initiation of the source.

Shut-downs of the active sources were implemented proactively and successfully such that sources were silenced before marine mammals or sea turtles were observed inside the predicted Level A or B exposure zones. No marine mammals or sea turtles were observed inside the predicted Level A or B exposure zones during acoustic source activity.

If an injured or dead protected species was discovered during the survey, and the lead visual observer determined that the cause of death was unknown or unrelated to the activities of the vessel, the incident was to be immediately reported. There were no such observations made during the survey. If a dead protected species was observed, where the death was determined to be unrelated to the survey activities or where the Lead PSO deemed the death to be old, the carcass would be reported to the NMFS Stranding hotline, to NMFS and to BOEM within 24 hours.

Passive acoustic monitoring was conducted throughout the survey during hours of reduced visibility, with most of the acoustic monitoring undertaken while the source was active. High levels of background noise on the hydrophone cable were experienced when the vessel traveled at higher speeds (greater than six knots), which made it impractical to conduct monitoring for baseline acoustic data collection while the vessel was in transit to and from the survey site.

A total of 4,703 individual marine mammals from 11 species (including five whale species, three delphinid species, two seal species, and the harbor porpoise) were authorized for potential sound exposures in the IHA. All 11 species were authorized for potential Level B exposures, with no authorizations for potential Level A exposures. No authorizations were specified in regard to potential sound exposure numbers for species of sea turtles. During the survey no individual protected species were observed within the predicted Level B exposure zone. No protected species was observed within the predicted Level A exposure zone.

While PSOs likely did not detect all animals present, it is highly unlikely that the actual number of animals present during survey operations reached anywhere near the fully authorized levels for all species. The combination of conservative predicted mitigation zones combined with conservative take estimation by NMFS (*i.e.,* the precautionary approach), appears for most species to have resulted in an overestimation of take and of overall impact on marine species from the activity.

The monitoring and mitigation measures required by the IHA appear to have been an effective means to protect the marine species encountered during survey operations.

APPENDICES

APPENDIX A:

Incidental Harassment Authorization

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

INCIDENTAL HARASSMENT AUTHORIZATION

Statoil Wind U.S. LLC (Statoil) 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 marine mammals incidental to marine site characterization surveys off the coast of New York in the area of the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0512) and coastal waters where one or more cable route corridors will be established, when adhering to the following terms and conditions.

1. This incidental harassment authorization (IHA) is valid for a period of one year from the date of issuance.

2. This IHA is valid only for marine site characterization survey activity, as specified in the IHA application, in the Atlantic Ocean.

3. General Conditions

   (a) A copy of this IHA must be in the possession of Statoil, the vessel operator and other relevant personnel, the lead protected species observer (PSO), and any other relevant designees of Statoil operating under the authority of this IHA.

   (b) The species authorized for taking are listed in Table 1. The taking, by Level B harassment only, is limited to the species and numbers listed in Table 1. Any taking of species not listed in Table 1, or exceeding the authorized amounts listed in Table 1, is prohibited and may result in the modification, suspension, or revocation of this IHA.

   (c) The taking by injury, serious injury or death of any species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this IHA.

   (d) Statoil shall ensure that the vessel operator and other relevant vessel personnel are briefed on all responsibilities, communication procedures, marine mammal monitoring protocols, operational procedures, and IHA requirements prior to the start of survey activity, and when relevant new personnel join the survey operations.

4. Mitigation Requirements – the holder of this Authorization is required to implement the following mitigation measures:

   (a) Statoil shall use at least four (4) NMFS-approved PSOs during HRG surveys. The PSOs must have no tasks other than to conduct observational effort, record observational data, and communicate with and instruct relevant vessel crew with regard to the presence of marine mammals and mitigation requirements. PSO resumes shall be provided to NMFS for approval prior to commencement of the survey.

   (b) Visual monitoring must begin no less than 30 minutes prior to initiation of survey equipment and must continue until 30 minutes after use of survey equipment ceases.

(c) Exclusion Zones and Watch Zone – PSOs shall establish and monitor marine mammal Exclusion Zones and Watch Zones. The Watch Zone shall represent the extent of the maximum Level B harassment zone (1,166 m) or, as far as possible if the extent of the Zone is not fully visible. The Exclusion Zones are as follows:

(i) a 50 m Exclusion Zone for pinnipeds and delphinids;

(ii) a 100 m Exclusion Zone for large whales including sperm whales and mysticetes (except North Atlantic right whales) and harbor porpoises;

(iii) a 500 m Exclusion Zone for North Atlantic right whales.

(d) Shutdown requirements – If a marine mammal is observed within, entering, or approaching the relevant Exclusion Zones as described under 4(c) while geophysical survey equipment is operational, the geophysical survey equipment must be immediately shut down.

(i) Any PSO on duty has the authority to call for shutdown of survey equipment. When there is certainty regarding the need for mitigation action on the basis of visual detection, the relevant PSO(s) must call for such action immediately.

(ii) When a shutdown is called for by a PSO, the shutdown must occur and any dispute resolved only following shutdown.

(iii) Shutdown of HRG survey equipment is also required upon confirmed passive acoustic monitoring (PAM) detection of a North Atlantic right whale at night, except in instances when the PAM detection of a North Atlantic right whale can be localized and the whale is confirmed as being beyond the 500 m EZ for right whales. The PAM operator on duty has the authority to call for shutdown of survey equipment based on confirmed acoustic detection of a North Atlantic right whale at night even in the absence of visual confirmation. When shutdown occurs based on confirmed PAM detection of a North Atlantic right whale at night, survey equipment may be re-started no sooner than 30 minutes after the last confirmed acoustic detection.

(iv) The shutdown requirement is waived for small delphinoids that approach the vessel (e.g., bow ride), as determined based on professional judgment of the PSO(s) on duty.

(v) Upon implementation of a shutdown, survey equipment may be reactivated when all marine mammals have been confirmed by visual observation to have exited the relevant Exclusion Zone or an additional time period has elapsed with no further sighting of the animal that triggered the shutdown (15 minutes for small delphinoid cetaceans and pinnipeds and 30 minutes for all other species).

(vi) If geophysical equipment shuts down for reasons other than mitigation (*i.e.*, mechanical or electronic failure) resulting in the cessation of the survey equipment for a period of less than 20 minutes, the equipment may be restarted as soon as practicable if visual surveys were continued diligently throughout the silent period and the relevant Exclusion Zones are confirmed by PSOs to have remained clear of marine mammals during the entire 20 minute period. If visual surveys were not continued diligently during the pause of 20 minutes or less, a 30

minute pre-clearance period shall precede the restart of the geophysical survey equipment as described in 4(e). If the period of shutdown for reasons other than mitigation is greater than 20 minutes, a pre-clearance period shall precede the restart of the geophysical survey equipment as described in 4(e).

(e) Pre-clearance observation – 30 minutes of pre-clearance observation shall be conducted prior to initiation of geophysical survey equipment. Geophysical survey equipment shall not be initiated if marine mammals are observed within or approaching the relevant Exclusion Zones as described under 4(c) during the pre-clearance period. If a marine mammal is observed within or approaching the relevant Exclusion Zone during the pre-clearance period, geophysical survey equipment shall not be initiated until the animal(s) is confirmed by visual observation to have exited the relevant Exclusion Zone or until an additional time period has elapsed with no further sighting of the animal (15 minutes for small delphinoid cetaceans and pinnipeds and 30 minutes for all other species).

(f) Ramp-up – when technically feasible, survey equipment shall be ramped up at the start or re-start of survey activities. Ramp-up will begin with the power of the smallest acoustic equipment at its lowest practical power output appropriate for the survey. When technically feasible the power will then be gradually turned up and other acoustic sources added in a way such that the source level would increase gradually.

(g) Vessel Strike Avoidance – Vessel operator and crew must maintain a vigilant watch for all marine mammals and slow down or stop the vessel or alter course, as appropriate, to avoid striking any marine mammal, unless such action represents a human safety concern. Survey vessel crew members responsible for navigation duties shall receive site-specific training on marine mammal sighting/reporting and vessel strike avoidance measures. Vessel strike avoidance measures shall include the following, except under circumstances when complying with these requirements would put the safety of the vessel or crew at risk:

(i) The vessel operator and crew shall maintain vigilant watch for cetaceans and pinnipeds, and slow down or stop the vessel to avoid striking marine mammals;

(ii) The vessel operator will reduce vessel speed to 10 knots (18.5 km/hr) or less when any large whale, any mother/calf pairs, whale or dolphin pods, or larger assemblages of non-delphinoid cetaceans are observed near (within 100 m (330 ft)) an underway vessel;

(iii) The survey vessel will maintain a separation distance of 500 m (1640 ft) or greater from any sighted North Atlantic right whale;

(iv) If underway, the vessel must steer a course away from any sighted North Atlantic right whale at 10 knots (18.5 km/hr) or less until the 500 m (1640 ft) minimum separation distance has been established. If a North Atlantic right whale is sighted in a vessel's path, or within 500 m (330 ft) to an underway vessel, the underway vessel must reduce speed and shift the engine to neutral. Engines will not be engaged until the North Atlantic right whale has moved outside of the vessel's path and beyond 500 m. If stationary, the vessel must not engage engines until the North Atlantic right whale has moved beyond 500 m;

(v) The vessel will maintain a separation distance of 100 m (330 ft) or greater from

any sighted non-delphinoid cetacean. If sighted, the vessel underway must reduce speed and shift the engine to neutral, and must not engage the engines until the non-delphinoid cetacean has moved outside of the vessel's path and beyond 100 m. If a survey vessel is stationary, the vessel will not engage engines until the non-delphinoid cetacean has moved out of the vessel's path and beyond 100 m;

(vi) The vessel will maintain a separation distance of 50 m (164 ft) or greater from any sighted delphinoid cetacean. Any vessel underway shall remain parallel to a sighted delphinoid cetacean's course whenever possible, and avoid excessive speed or abrupt changes in direction. Any vessel underway shall reduce vessel speed to 10 knots (18.5 km/hr) or less when pods (including mother/calf pairs) or large assemblages of delphinoid cetaceans are observed. Vessels may not adjust course and speed until the delphinoid cetaceans have moved beyond 50 m and/or the abeam of the underway vessel;

(vii) All vessels underway will not divert or alter course in order to approach any whale, delphinoid cetacean, or pinniped. Any vessel underway will avoid excessive speed or abrupt changes in direction to avoid injury to the sighted cetacean or pinniped; and

(viii) All vessels will maintain a separation distance of 50 m (164 ft) or greater from any sighted pinniped.

(ix) The vessel operator will comply with 10 knot (18.5 km/hr) or less speed restrictions in any Seasonal Management Area per NMFS guidance.

(x) If NMFS should establish a Dynamic Management Area (DMA) in the area of the survey, within 24 hours of the establishment of the DMA Statoil shall work with NMFS to shut down and/or alter survey activities to avoid the DMA as appropriate.

5. Monitoring Requirements – The Holder of this Authorization is required to conduct marine mammal visual monitoring and PAM during geophysical survey activity. Monitoring shall be conducted in accordance with the following requirements:

(a) A minimum of four NMFS-approved PSOs and a minimum of two certified PAM operator(s), operating in shifts, shall be employed by Statoil during geophysical surveys.

(b) Observations shall take place from the highest available vantage point on the survey vessel. General 360-degree scanning shall occur during the monitoring periods, and target scanning by PSOs shall occur when alerted of a marine mammal presence.

(c) PSOs shall be equipped with binoculars and have the ability to estimate distances to marine mammals located in proximity to the vessel and/or Exclusion Zones using range finders. Reticulated binoculars will also be available to PSOs for use as appropriate based on conditions and visibility to support the sighting and monitoring of marine species.

(d) PAM shall be used during nighttime geophysical survey operations. The PAM system shall consist of an array of hydrophones with both broadband (sampling mid-range frequencies of 2 kHz to 200 kHz) and at least one low-frequency hydrophone (sampling range frequencies of 75 Hz to 30 kHz). PAM operators shall communicate detections or

vocalizations to the Lead PSO on duty who shall ensure the implementation of the appropriate mitigation measure.

(e) During night surveys, night-vision equipment and infrared technology shall be used in addition to PAM. Specifications for night-vision and infrared equipment shall be provided to NMFS for review and acceptance prior to start of surveys.

(f) PSOs and PAM operators shall work in shifts such that no one monitor will work more than 4 consecutive hours without a 2 hour break or longer than 12 hours during any 24-hour period. During daylight hours the PSOs shall rotate in shifts of 1 on and 3 off, and during nighttime operations PSOs shall work in pairs.

(g) PAM operators shall also be on call as necessary during daytime operations should visual observations become impaired.

(h) Position data shall be recorded using hand-held or vessel global positioning system (GPS) units for each sighting.

(i) A briefing shall be conducted between survey supervisors and crews, PSOs, and Statoil to establish responsibilities of each party, define chains of command, discuss communication procedures, provide an overview of monitoring purposes, and review operational procedures.

(j) Statoil shall provide resumes of all proposed PSOs and PAM operators (including alternates) to NMFS for review and approval at least 45 days prior to the start of survey operations.

(k) PSO qualifications shall include direct field experience on a marine mammal observation vessel and/or aerial surveys.

(l) Data on all PAM/PSO observations shall be recorded based on standard PSO collection requirements. PSOs must use standardized data forms, whether hard copy or electronic. The following information shall be reported:

(i) PSO names and affiliations

(ii) Dates of departures and returns to port with port name

(iii) Dates and times (Greenwich Mean Time) of survey effort and times corresponding with PSO effort

(iv) Vessel location (latitude/longitude) when survey effort begins and ends; vessel location at beginning and end of visual PSO duty shifts

(v) Vessel heading and speed at beginning and end of visual PSO duty shifts and upon any line change

(vi) Environmental conditions while on visual survey (at beginning and end of PSO shift and whenever conditions change significantly), including wind speed and direction, Beaufort sea state, Beaufort wind force, swell height, weather conditions, cloud cover, sun glare, and overall visibility to the horizon

(vii) Factors that may be contributing to impaired observations during each PSO shift change or as needed as environmental conditions change (*e.g.*, vessel traffic, equipment malfunctions)

(viii) Survey activity information, such as type of survey equipment in operation, acoustic source power output while in operation, and any other notes of significance (*i.e.*, pre-clearance survey, ramp-up, shutdown, end of operations, etc.)

(ix) If a marine mammal is sighted, the following information should be recorded:

(A) Watch status (sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/platform);

(B) PSO who sighted the animal;

(C) Time of sighting;

(D) Vessel location at time of sighting;

(E) Water depth;

(F) Direction of vessel's travel (compass direction);

(G) Direction of animal's travel relative to the vessel;

(H) Pace of the animal;

(I) Estimated distance to the animal and its heading relative to vessel at initial sighting;

(J) Identification of the animal (*e.g.*, genus/species, lowest possible taxonomic level, or unidentified); also note the composition of the group if there is a mix of species;

(K) Estimated number of animals (high/low/best) ;

(L) Estimated number of animals by cohort (adults, yearlings, juveniles, calves, group composition, etc.);

(M) Description (as many distinguishing features as possible of each individual seen, including length, shape, color, pattern, scars or markings, shape and size of dorsal fin, shape of head, and blow characteristics);

(N) Detailed behavior observations (*e.g.*, number of blows, number of surfaces, breaching, spyhopping, diving, feeding, traveling; as explicit and detailed as possible; note any observed changes in behavior);

(O) Animal's closest point of approach and/or closest distance from the center point of the acoustic source;

(P) Platform activity at time of sighting (*e.g.*, deploying, recovering, testing, data acquisition, other); and

(Q) Description of any actions implemented in response to the sighting (*e.g.*, delays, shutdown, ramp-up, speed or course alteration, etc.) and time and location of the action.

6. Reporting – a technical report shall be provided to NMFS within 90 days after completion of survey activities that fully documents the methods and monitoring protocols, summarizes the data recorded during monitoring, estimates the number of

marine mammals that may have been taken during survey activities, describes the effectiveness of the various mitigation techniques (*i.e.* visual observations during day and night compared to PAM detections/operations), provides an interpretation of the results and effectiveness of all monitoring tasks, and includes an assessment of the effectiveness of night vision equipment used during nighttime surveys, including comparisons of relative effectiveness among the different types of night vision equipment used. Any recommendations made by NMFS shall be addressed in the final report prior to acceptance by NMFS.

(a) Reporting injured or dead marine mammals:

(i) In the event that the specified activity clearly causes the take of a marine mammal in a manner not authorized by this IHA, such as serious injury or mortality, Statoil shall immediately cease the specified activities and immediately report the incident to the NMFS Office of Protected Resources ((301) 427-8400) and the NMFS Northeast Stranding Coordinator ((866) 755-6622). The report must include the following information:

(A) Time, date, and location (latitude/longitude) of the incident;

(B) Vessel's speed during and leading up to the incident;

(C) Description of the incident;

(D) Status of all sound source use in the 24 hours preceding the incident;

(E) Water depth;

(F) Environmental conditions (*e.g.*, wind speed and direction, Beaufort sea state, cloud cover, and visibility);

(G) Description of all marine mammal observations in the 24 hours preceding the incident;

(H) Species identification or description of the animal(s) involved;

(I) Fate of the animal(s); and

(J) Photographs or video footage of the animal(s).

Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with Statoil to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. Statoil may not resume their activities until notified by NMFS.

(ii) In the event that Statoil 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 (*e.g.*, in less than a moderate state of decomposition), Statoil shall immediately report the incident to the NMFS Office of Protected Resources ((301) 427-8400) and the NMFS Northeast Stranding Coordinator ((866) 755-6622). The report must include the same information identified in condition 6(b)(i) of this IHA. Activities may continue while NMFS reviews the

circumstances of the incident. NMFS will work with Statoil to determine whether additional mitigation measures or modifications to the activities are appropriate.

(iii) In the event that Statoil 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 specified activities (*e.g.*, previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), Statoil shall report the incident to the NMFS Office of Protected Resources ((301) 427-8400) and the NMFS Northeast Stranding Coordinator ((866) 755-6622), within 24 hours of the discovery. Statoil shall provide photographs or video footage or other documentation of the sighting to NMFS.

7. This Authorization may be modified, suspended or withdrawn if the holder fails to abide by the conditions prescribed herein, or if NMFS determines the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals.

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

APR 24 2019
Date

Table 1. Numbers of Incidental Take of Marine Mammals Authorized.

Species	Level A Takes	Level B Takes	Total Takes
North Atlantic right whale	0	18	18
Humpback whale	0	23	23
Fin whale	0	96	96
Sperm whale	0	6	6
Minke whale	0	38	38
Bottlenose dolphin	0	1556	1556
Short-beaked common dolphin	0	1690	1690
Atlantic white-sided dolphin	0	427	427
Harbor porpoise	0	2259	2259
Harbor seal	0	2897	2897
Gray seal	0	2897	2897

APPENDIX B:
Reticle Binocular Calibration Table

Table B- 1: Reticule Binocular Calibration Table

Week #	Date	Observer Name	Ret. Binoc. Estimated distance (m)	True Distance from Radar (m)	Sea State (Beaufort)	Wind Force (knots)	Swell (m)
1	04/25/2019	Yessica Vicencio	750	825	2	7	<2
2	05/1/2019	Itzel Serrano	1200	1350	2	10	<2
3	05/10/2019	Pedro Westendarp	2450	2200	5	22	2-4
4	05/15/2019	Yessica Vicencio	1800	2000	2	14	<2
5	05/22/2019	Itzel Serrano	450	500	3	16	<2

***Reticule binocular calibrations were not feasible on the *Henry Hudson* as the survey areas were mostly close to shore and did not provide an unobstructed view of the horizon needed to perform calibrations.**

APPENDIX C:
Night Monitoring Equipment Specifications

Morovision PVS-7 Gen 3 PINNACLE Goggle Delta Kit

SKU MVP-MVPVS7-3DP CID 20215

MORO VISION

Review This Product
MSRP:$4,595.00
Your Price:$4,365.00
You Save:$230.00

Available: Call for availablity

Purchase PVS-7 Gen 3 PINNACLE Goggle Delta Kit

Quantity 1 Add to Cart

- Description
- Warranty

Morovision Night Vision proudly offers the PVS-7 Delta Generation 3 PINNACLE® Delta Kit. The PVS-7 goggle is standard issue goggle type supplied to the U.S. Military and its allies. Equipped with a factory new, high-performance, ITT Generation 3 PINNACLE® image intensifier tube, the PVS-7 PINNACLE® night vision goggle is designed for the most demanding of night time applications. Battle-proven technology includes Automatic Brightness Control which automatically adjusts the brightness of the image tube to achieve the highest quality image resolution under varying light conditions as well as protect the user and the system against inadvertent exposure to excessive light. In addition, a built-in infra-red illuminator with momentary or continuous switching function allows the user to operate under zero light

NIVISYS™ LLC

NIGHT VISION SYSTEMS

TACS-M™

Rev. 21 Jan 2013

Thermal Acquisition Clip-On System, Miniature

TACS-M shown here on a MUM-14.

Manufactured by OPTICS 1

SPECIFICATIONS*

Field of View	Boresight Accuracy	Magnification	F Number
20° circular (centered)	3 MOA	1X, optical unity	1.2
Sensor	**Spectral Response**	**Pitch**	**NEΔT**
320 x 240 VOx uncooled LWIR microbolometer	8-12µm	25µm	50mK
Display Brightness	**Polarity**	**Calibration**	**Display**
Adjustable	White hot/black hot	Manual	Kopin (RED)
Range (Clear)	**Range (Obscured)**	**Compatibility**	**Interface**
Detection: 300m Recognition: 260m	Detection: 250m Recognition: 210m	PVS-7, PVS-14, PVS-15, PVS-18, PVS-23, MUM-14	Standard quick connect
Battery Type	**Battery Life**	**Dimensions**	**Weight**
CR123, 3V Lithium, 1ea.	>3.0 hrs (23°C) 2.5 hrs (0°C)	(W x H x L) 38 x 64 x 89mm	166g with battery

*Specifications are subject to change without notice.

Export of the commodities described herein is strictly prohibited without a valid export license issued by the U.S. Department of State. Directorate of Defense Trade Controls as proscribed in the International Traffic in Arms Regulations (ITAR). Title 22 Code of Federal Regulation. Parts 120-130.

DISTRIBUTION: OSR 11-5-1578 Approved for public release: distribution unlimited. © 2011 Nivisys

DESCRIPTION

The Miniature Thermal Acquisition Clip-On System (TACS-M) provides the soldier with ultimate performance in technology. Low power consumption, optimal sensor technology, and high-performance optics all seamlessly integrate to provide state of the art long wave infrared (LWIR) technology.

When added to a standard image intensified system, TACS-M provides a second channel with LWIR capability, extending engagement capabilities through obscurants. The TACS-M unit along with Nivisys experience and expertise provides the best value solution for adding low light and no light performance to currently fielded night vision systems.

The unit's waterproof and rugged construction stands up to the harshest environments and features a red display for visual security. This multi-purpose surveillance tool uses the latest in miniature thermal sensor technology and a high resolution display to provide superior imagery in the smallest package available.

For more information on the TACS-M or other Nivisys products call (480) 970-3222 or visit us on the web at www.nivisys.com.

Made in USA

Nivisys, LLC • 400 S. Clark Drive, Suite 105 • Tempe, Arizona USA • 480.970.3222 • 480.970.3555(fax) • email: info@nivisys.com

Larson Electronics LLC www.LarsonElectronics.com
9419 E US HWY 175, Kemp, TX 75143 Phone: 903.498.3363 Fax: 903.498.3364 Email: sales@LarsonElectronics.com

Infrared LED Pistol Grip Spotlight - 15 Hour Runtime - Rechargeable Lithium Ion - 3 Watt

Part #: RL-85-3W1-IR

Buy American Compliant

The Larson Electronics RL-85-3W1-IR Infrared LED Pistol Grip Spotlight is an extremely rugged and effective IR spotlight designed to give users in operations requiring infrared illumination a powerful, durable and easy to use source of IR light. This IR spotlight produces an infrared light beam approximately 1,800' long by 175' wide in the 850 to 940 Nm range depending upon configuration, requires no tools for servicing and runs for 15 hours on a single charge.

This light weight, infrared LED spotlight is ergonomically designed to produce a well balanced and easily managed handheld infrared light source that can withstand abuse under tactical conditions and operate for 15 hours on a single charge of its integrated lithium ion battery pack. This light contains a single infrared LED which is paired with a patent pending reflector design to produce an infrared light beam that reaches 1,800 feet in length and 175 feet in width. This beam is strong enough to allow operators to read signs, license plates, addresses and other similar markings at the far end of its total range. This pistol grip spotlight is designed for durability with a handle constructed of high impact nylon and an LED fully potted within a lamp assembly constructed of machined aluminum. The LED lamp assembly is protected by a thick Lexan lens and the integral lithium ion battery pack provides long battery life rated at 1,000's of charge cycles.

This IR spotlight and the materials it is constructed from are water, UV ray, impact and vibration resistant and designed to be easily field serviceable. This unit requires no tools to remove any components and th ctors are accessed through a snap in base at the bottom of the handle.

The Larson Electronics RL-85-3W1-IR handheld infrared spotlight from Larson Electronics was chosen as an Editor's Choice product by Military Embedded Systems Magazine and is featured in the Editors Choice Products column of their July/August 2011 edition.

APPENDIX D:

Passive Acoustic Monitoring System Specifications

Seiche Marine Acoustic Solutions

Seiche Passive Acoustic Monitoring System
6 Hydrophone Array

1 Passive Acoustic Monitoring (PAM) Equipment

The PAM equipment comprises the following items:

- 250m Hydrophone Array Cable containing 2 Low Frequency hydrophones (10Hz to 24kHz), 2 Ultra Broadband hydrophones (200Hz to 200kHz), and 2 Broadband hydrophones (2kHz to 200kHz)
- 100m deck cable
- Electronic data capture and processing unit including:
  - Headphones RF transmitter
  - Fireface audio interface
  - Rackmount PC
  - Buffer interface unit
- Integral screen and keyboard
- Backup System

Figure 1 Seiche PAM System

Seiche Ltd, Bradworthy Industrial Estate, Langdon Road, Bradworthy, Holsworthy, Devon EX22 7SF United Kingdom
+44 (0) 1409 404050 info@seiche.com
Registered in England & Wales No. 347558, Registered Office: The Custom House, The Strand, Barnstaple, Devon EX31 1EU United Kingdom

APPENDIX E:
PAM Hydrophone Deployment

Hydrophone Deployment

The PAM data processing unit with dual monitors for high and low frequency modules were stationed in the survey lab located on the main deck (Figure 6). A GPS feed (GPGGA string) was provided from the vessel's GPS system and connected to the PAM system using a serial to USB adapter.

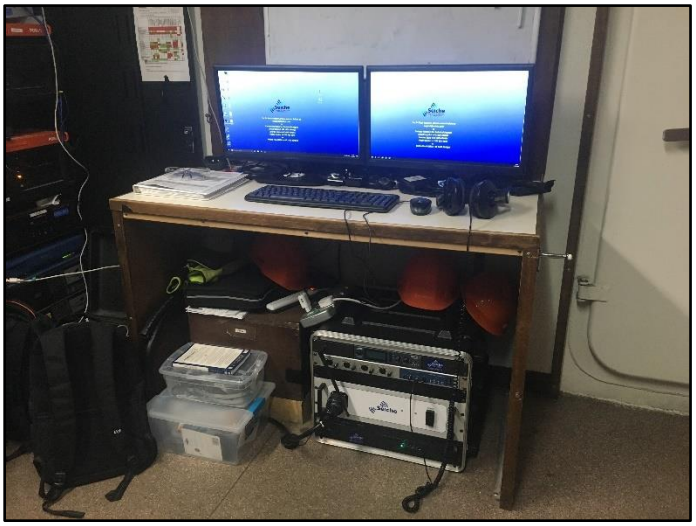

Figure 9: Passive acoustic monitoring station in the survey lab

A 100m deck cable was routed from the survey lab to the deck cable reel secured to the starboard side rescue deck, using the existing cable routes and secured with cable ties.

The cable was fed through an existing penetration point below the windows of the survey lab and then routed along the port and stern railings of the main deck to the reels located on the starboard side rescue deck. This route was chosen in order to maintain as much distance as possible between the deck cable and the high voltage sparker cable which had the potential to cause electrical interference.

The tow cable was measured and marked in 10-meter increments.

Chinese finger tow point attachments were affixed to the tow cable approximately 55m and 70m ahead of the depth gauge. The hydrophone cable was taped prior to adding the Chinese fingers to help reduce chaffing to the cable.

The system was tested and the hydrophone depth gauge calibrated.

The hydrophone array and tow cable are deployed by hand from the starboard side rescue deck of the vessel. Two foam cylinders are attached to the cable to provide additional buoyancy in the event that the survey should move to shallow areas unexpectedly. The array section is hand fed through the stern railing and tossed clear of the stern to avoid potential entanglement with starboard thruster. Remaining hydrophone cable and tow cable are manually paid out until the appropriate length is reached at which point a Chinese finger or Yale grip tow point attachment is secured to the hand railing with a short rope and shackle. The current tow-point attachment is affixed to allow a towing distance of 55 meters with an additional tow-point attachment located at

70 meters should a greater towing length be required. On average, the end of the cable tows at a depth of 3-5m.

During retrieval, the cable is slowly recovered by hand and loosely coiled around the deck cable and tow cable reels that are tightly secured to the rescue deck with rachet straps. Loose coiling allows for quick and easy deployment/retrieval and tends to reduce the amount of twists tangles that develop in the steel reinforced tow cable when attempting to coil by hand.

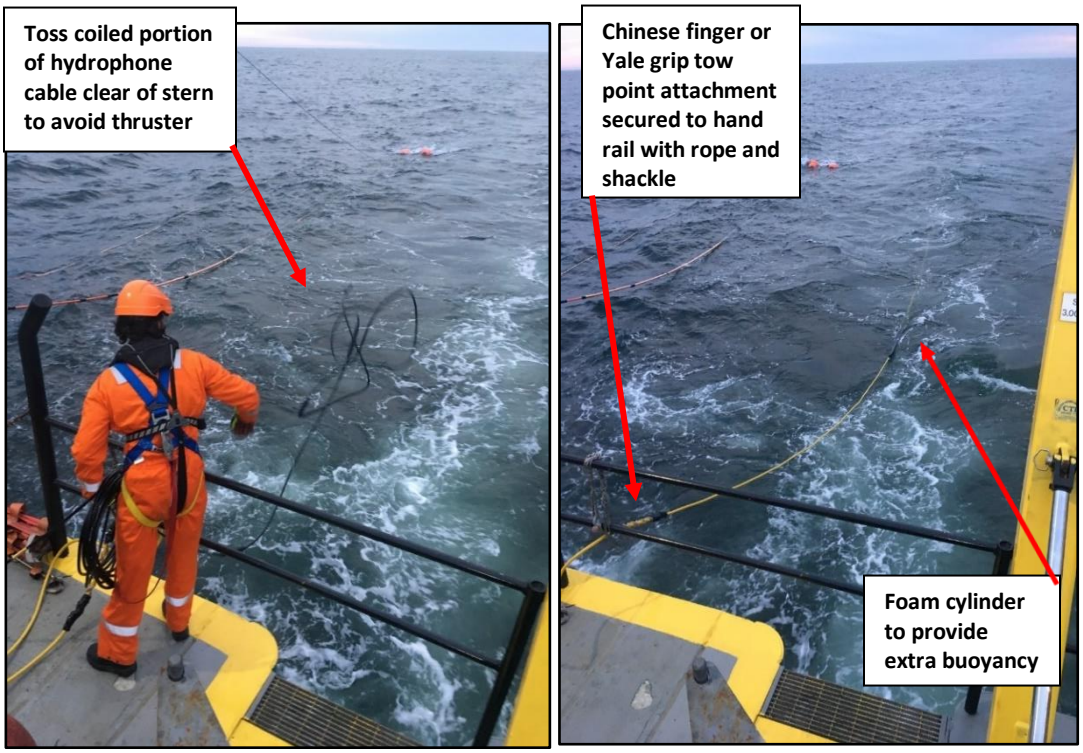

Figure 10: Hydrophone cable deployed/retrieved by hand from starboard side rescue deck (left) and secured via Chinese finger when fully deployed.

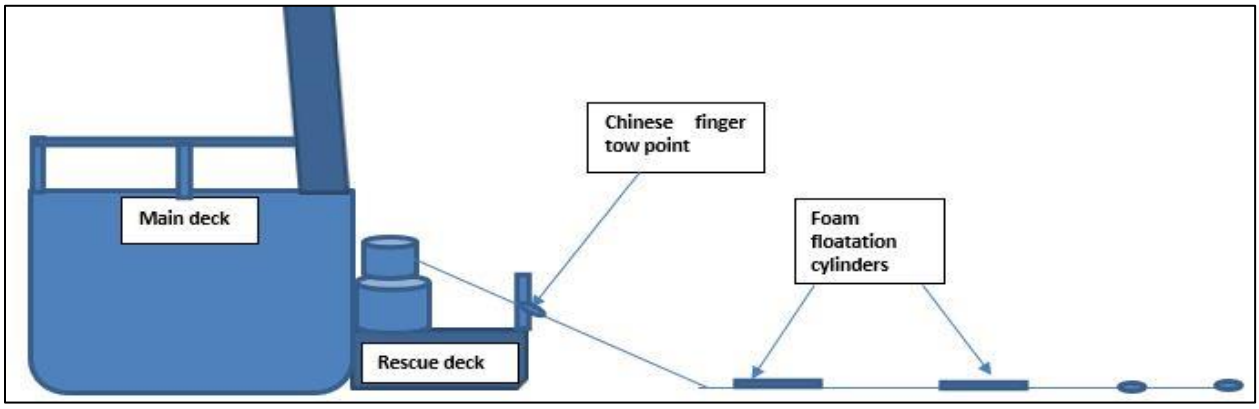

Figure 11: Sketch of the hydrophone deployment on the R/V Shearwater

APPENDIX F:

Summary of Visual Detections of Protected Species during the Survey

Table F- 1: Summary of Visual Detections of Protected Species during the Survey

Date	Visual Det. No.	Time at first visual sighting	Time at last visual sighting	Detection Cue	Water depth (m)	GIS Latitude	GIS Longitude	Common name	Certainty of Id	Total No. of animals	Initial Behavior	Subsequent behaviors	Range of animals to vessel at first detection	Range of animals to source at first detection	Animal(s) Pace at Initial Detection	Direction of travel at Initial Detection	Range of animals to vessel at last detection	Range of animals to source at last detection	Animal(s) Pace at Final Detection	Direction of travel at Final Detection	Source activity at initial detection	Source activity at final detection	Source mitigation action required
2019-04-24	1	18:19	18:27	Blow	18	40.51175	-073.50418	Fin Whale	Probable	1	Blowing	Swimming below surface/ surfacing/ diving	300	300	Sedate	Parallel in Opposite Direction as Vessel	300	365	Sedate	Crossing Astern of Vessel	Full Volume While On Survey Line	Full Volume While On Survey Line	None
2019-05-09	2	10:48	11:03	Blow	35	40.34902	-073.34946	Unidentifiable Whale	Definite	1	Blowing	Swimming	3000	3000	Sedate	Towards Vessel	800	800	Sedate	Parallel in Opposite Direction as Vessel	Full Volume While On Survey Line	Full Volume While On Survey Line	None
2019-05-10	3	19:52	20:07	Blow	15	40.55933	-073.61220	Fin Whale	Definite	1	Blowing	Surfacing	700	700	Sedate	Crossing Ahead of Vessel	900	900	Sedate	Away From Vessel	Full Volume While On Survey Line	Full Volume While On Survey Line	None
2019-05-11	4	23:05	23:06	Body	14	40.62618	-074.04777	Gray Seal	Probable	1	Surfacing	Swimming /diving	100	100	Sedate	Towards Vessel	0	0	Sedate	Towards Vessel	Source not deployed	Source not deployed	None
2019-05-19	5	21:07	21:20	Blow	17	40.55701	-073.71083	Unidentifiable Baleen Whale	Definite	1	Blowing		700	700	Sedate	Crossing Ahead of Vessel	1000	1000	Sedate	Away From Vessel	Full Volume While Not On Survey Line	Full Volume While Not On Survey Line	None
2019-05-20	6	00:58	01:00	Body	19	40.48333	-073.98333	Humpback Whale	Probable	1	Surfacing		300	300	Vigorous	Crossing Ahead of Vessel	800	800	Vigorous	Away From Vessel	Source not deployed	Source not deployed	None
2019-05-20	7	11:37	11:41	Body	24	40.48388	-074.00745	Humpback Whale	Definite	1	Feeding	Blowing/ milling	700	700	Sedate	Milling	1,000	1,000	Sedate	Milling	Source not deployed	Source not deployed	None
2019-05-22	8	18:31	18:34	Dorsal Fin	10	40.57009	-073.61255	Unidentifiable Dolphin	Definite	7	Swimming	Porpoising	1000	1000	Sedate	Parallel in Opposite Direction as Vessel	1500	1500	Sedate	Parallel in Opposite Direction as Vessel	Full Volume While On Survey Line	Full Volume While On Survey Line	None
2019-06-28	9	15:20	15:24	1	15	40.52788°N	073.66673° W	Unidentifiable Dolphin	Definite	6	Swimming	Porpoising/diving	900	900	Moderate	Crossing Ahead of Vessel	800	Source not deployed	Moderate	Parallel in Opposite Direction as Vessel	Source not deployed	Source not deployed	None

Date	Visual Det. No.	Time at first visual sighting	Time at last visual sighting	Detection Cue	Water depth (m)	GIS Latitude	GIS Longitude	Common name	Certainty of Id	Total No. of animals	Initial Behavior	Subsequent behaviors	Range of animals to vessel at first detection	Range of animals to source at first detection	Animal(s) Pace at Initial Detection	Direction of travel at Initial Detection	Range of animals to vessel at last detection	Range of animals to source at last detection	Animal(s) Pace at Final Detection	Direction of travel at Final Detection	Source activity at initial detection	Source activity at final detection	Source mitigation action required
2019-06-28	10	15:22	15:24	Dorsal Fin	15	40.52788°N	073.66673° W	Humpback whale	Definite	1	Blowing	Swimming, Tail and pectoral fin slapping, Diving	800	Source not deployed	Sedate	Parallel in Opposite Direction as Vessel	1800	Source not deployed	Moderate	Parallel in Opposite Direction as Vessel	Source not deployed	Source not deployed	None
2019-06-28	11	21:25	21:26	Breach	6	40.48817°N	073.98587° W	Humpback whale	Definite	1	Breaching / Jumping / Acrobatic behaviour		300	Source not deployed	Vigorous	Parallel in Same Direction as Vessel	300	Source not deployed	Sedate	Parallel in Same Direction as Vessel	Source not deployed	Source not deployed	None
2019-06-29	12	14:36	14:41	Dorsal Fin	3	40.57992°N	073.67728° W	Common bottlenose dolphin	Definite	1	Milling	Feeding	100	Source not deployed	Sedate	Crossing Ahead of Vessel	800	800	Sedate	Away from Vessel	Source not deployed	Source deployed but silent	Delay to ramp up
2019-07-01	13	21:08	21:10	Body	12	40.50847°N	073.87565° W	Humpback whale	Definite	1	Blowing	Surfacing, Diving with flukes	600	Source not deployed	Sedate	Parallel in Same Direction as Vessel	200	Source not deployed	Sedate	Away From Vessel	Source not deployed	Source not deployed	None
2019-07-02	14	14:30	14:32	Blow	15	40.54500°N	073.67375° W	Humpback whale	Definite	1	Blowing	Surfacing, Diving with flukes	300	Source not deployed	Sedate	Towards Vessel	200	Source not deployed	Sedate	Towards Vessel	Source not deployed	Source not deployed	None
2019-07-02	15	21:35	21:39	Blow	9	40.48996°N	073.97724° W	Humpback whale	Definite	1	Blowing	Surfacing, Diving with flukes	200	Source not deployed	Sedate	Towards Vessel	200	Source not deployed	Sedate	Towards Vessel	Source not deployed	Source not deployed	None
2019-07-03	16	16:08	16:19	Body	10	40.57070°N	073.53880° W	Common Bottlenose Dolphin	Definite	5	Swimming	Porpoising	100	100	Sedate	Crossing Ahead of Vessel	1000	1000	Moderate	Away From Vessel	Soft Start/Ramp-up	Full Volume While On Survey Line	None
2019-07-03	17	20:45	20:47	Body	16	40.53924°N	073.70530° W	Common Bottlenose Dolphin	Definite	4	Breaching / Jumping / Acrobatic behaviour	Porpoising	50	Source not deployed	Vigorous	Parallel in Same Direction as Vessel	200	Source not deployed	Moderate	Parallel in Same Direction as Vessel	Source not deployed	Source not deployed	None
2019-07-08	18	13:51	13:52	Dorsal Fin	11	40.55740°N	073.61072° W	Unidentifiable Dolphin	Definite	5	Porpoising	Surfacing, Breaching / Jumping / Acrobatic behavior	800	Source not deployed	Vigorous	Parallel in Same Direction as Vessel	800	Source not deployed	Vigorous	Parallel in Same Direction as Vessel	Source not deployed	Source not deployed	None

Date	Visual Det. No.	Time at first visual sighting	Time at last visual sighting	Detection Cue	Water depth (m)	GIS Latitude	GIS Longitude	Common name	Certainty of Id	Total No. of animals	Initial Behavior	Subsequent behaviors	Range of animals to vessel at first detection	Range of animals to source at first detection	Animal(s) Pace at Initial Detection	Direction of travel at Initial Detection	Range of animals to vessel at last detection	Range of animals to source at last detection	Animal(s) Pace at Final Detection	Direction of travel at Final Detection	Source activity at initial detection	Source activity at final detection	Source mitigation action required
2019-07-13	19	18:35	18:36	Body	7	40.57765	-073.67933	Green Sea Turtle	Probable	1	Swimming below surface	Surfacing/ Diving/	10	15	Moderate	Crossing Ahead of Vessel	20	25	Vigorous	Away From Vessel	Full Volume While Not On Survey Line	Source deployed but silent	Shutdown of Active Source
2019-07-16	20	13:41	13:46	Body	8	40.41422	-073.96808	Common Bottlenose Dolphin	Definite	5	Breaching / Jumping / Acrobatic behaviour		150	Source not deployed	Vigorous	Parallel in Same Direction as Vessel	300	Source not deployed	Vigorous	Parallel in Same Direction as Vessel	Source not deployed	Source not deployed	None
2019-07-16	21	22:08	22:14	Body	7	40.46695	-074.02430	Common Bottlenose Dolphin	Definite	12	Breaching / Jumping / Acrobatic behaviour	Porpoising	100	Source not deployed	Vigorous	Parallel in Same Direction as Vessel	300	Source not deployed	Vigorous	Parallel in Same Direction as Vessel	Source not deployed	Source not deployed	None

APPENDIX H:

Photographs of Identified Protected Species Visually Detected during the Survey

Figure H 1: Visual detection #3 (Juvenile fin whale) 10 May 2019.

Figure H 2: Visual detection #7 (Humpback whale) 20 May 2019

Figure H 3: Visual detection #8 (Unidentified dolphins) 22 May 2019

Figure H 4: Visual detection #9 (Unidentified dolphins) 28 June 2019

Figure H 5: Visual detection #10 (Humpback whale) 28 June 2019

Figure H 6: Visual detection #12 (Bottlenose dolphin) 29 June 2019

Figure H 7: Visual detection #13 (Humpback whale) 01 July 2019

Figure H 8: Visual detection #14 (Humpback whale) 02 July 2019

Figure H 9: Visual detection #15 (Humpback whale) 02 July 2019

Figure H 10: Visual detection #16 (Bottlenose dolphins) 03 July 2019

Figure H 11: Visual detection #17 (Bottlenose dolphin) 03 July 2019

Figure H 12: Visual detection #20 (Bottlenose dolphin) 16 July 2019

Figure H 13: Visual detection #21 (Bottlenose dolphins) 16 July 2019

APPENDIX J:
Summary of Mitigation Actions

Table J- 1: Summary of Mitigation Actions

Date	Visual or Acoustic Detection Number	Species	Group Size	Source Activity (initial detection)	Closest Approach to Active Source (m)	Number of animals considered to be a Level A "take"	Number of animals considered to be a Level B "take"	Mitigation Action	Total Duration of Production Loss
2019-06-29	12	Common bottlenose dolphin	1	Source not deployed	N/A	0	0	Delay to ramp up	00:15
2019-07-13	19	Green sea turtle	1	Full volume while on survey line	15	0	0	Shutdown of active source	00:60