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ATTENTIVE ENERGY 2023 RECONNAISSANCE GEOPHYSICAL SURVEY 2022 IHA CLOSE OUT PROTECTED SPECIES OBSERVER FINAL REPORT

Prepared for: Attentive Energy LLC

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Report Reviewer	
Name	Date of Review
Jason Dean	18 July 2023

Final Report Approval	
Name	Stephanie Milne
Title	Senior Environmental Manager
Signature	*DocuSigned by:* Stephanie Milne 6312C0728E234BC...
Date	Sep 20, 2023

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Prepared by: **Ben Finkes**

Prepared for:

RPS

Attentive Energy LLC

575 N Dairy Ashford
Suite 700
Houston, TX, 77079

12 E 49th Street
13th Floor
New York, NY 10017

T   +1 470 446 1410
E   ben.finkes@rpsgroup.com

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List of Acronyms

BMP – Best Management Practice

BOEM – Bureau of Ocean Energy Management

CZ – Clearance Zone

CPA- Closest point of approach

DSLR – Digital Single Lens Reflex

DMA – Dynamic Management Area

EMP- Environmental Management Plan

EOL – End of line

EPU – Electronic processing unit

EZ – Exclusion zone

ESA - Endangered Species Act

GPS – Global Positioning System

GRAD – Gradiometer

Hz - Hertz

HF – High frequency

HRG- High resolution geophysical

IHA – Incidental Harassment Authorization

IR- Infrared

kHz- Kilohertz

km – Kilometer

LF – Low Frequency

MBES – Multibeam Echo Sounder

m – Meter

NMFS- National Marine Fisheries Service

NOAA- National Oceanographic and Atmospheric Administration

NJ – New Jersey

NY – New York

NVD- Night-vision device

NARW – North Atlantic Right Whale

OPR – Office of Protected Resources

OCS – Outer Continental Shelf

PAM – Passive Acoustic Monitoring

PDC – Project Design Criteria

PSO – Protected Species Observer

QMA – Qualified Marine Archaeologist

QC – Quality Control

R/V – Research Vessel

SSS – Side Scan Sonar

S-UHRS – Single-channel Ultra High Resolution Seismic

SOL – Start of line

SBP – Sub Bottom Profiler

USB – Universal serial bus

UTC – Universal Coordinated Time

1 EXECUTIVE SUMMARY

This is the close out Protected Species Report for the Attentive Energy LLC (Attentive Energy) High Resolution Geophysical (HRG) Survey under the National Marine Fisheries Service (NMFS) 2022 Incidental Harassment Authorization (IHA), hereafter referred to as the Geophysical Survey, which was conducted within federal waters off the coasts of New York and New Jersey within Attentive Energy's Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS) OCS-A 0538 (Lease) by TDI-Brooks International, Inc. (TDI-Brooks) the offshore engineering contractor for the project.

High resolution geophysical survey data acquisition was conducted by TDI-Brooks within the parameters defined in the approved survey plan. Survey acquisitions were undertaken by one survey vessel, the *Research Vessel (R/V) Miss Emma McCall.* Protected species monitoring was conducted in accordance with Bureau of Ocean Energy Management (BOEM) and NMFS standards as described in the Project Design Criteria of the programmatic consultation completed by NMFS' Greater Atlantic Regional Fisheries Office on June 29, 2021 (revised September 2021), pursuant to section 7 of the Endangered Species Act (ESA) programmatic consultation issued on 29 June 2021 and as revised on 22 November 2021, stipulations within the Lease, and Attentive Energy's approved IHA. NMFS signed Attentive Energy's 2022 IHA on 16 August 2022 (Appendix A) which was originally issued for the period of 15 September 2022 through 14 September 2023. NMFS signed Attentive Energy's 2023 IHA on 20 June 2023 which was issued for the period of 21 June 2023 through 20 June 2024. Survey operations were conducted under the 2022 IHA in two phases. The 2022 Reconnaissance Geophysical Survey began on 29 September 2022, concluded on 09 April 2023, and was submitted to regulators in a separate final report. The 2023 Geophysical Survey began on 15 April 2023 and operated through 20 June 2023 under the 2022 IHA and is ongoing. This report covers all activities of the 2023 geophysical survey which occurred under the 2022 IHA prior to the authorization of the 2023 IHA.

TDI-Brooks acquired geophysical data utilizing multibeam echo sounder (MBES) bathymetry and backscatter, high-frequency side scan sonar (SSS), sub-bottom profiler (SBP), and gradiometer (GRAD), and single-channel ultra-high resolution seismic (S-UHRS) sparker equipment. Protected species monitoring and mitigation measures, as outlined in the lease conditions were during the use of sparker equipment.

Six dual role PSOs and Passive Acoustic Monitoring (PAM) Operators, provided by RPS, were on board the *R/V Miss Emma McCall* to undertake visual and acoustic observations and implement mitigation protocols in accordance with the requirements in the approved permitting conditions. Mitigation protocols for this survey included establishment of pre-start clearance zones (CZ) and exclusion zones (EZ) around the sparker, implementation of delay to initiation of and shutdowns of the active sparker, and strike avoidance maneuvering for marine mammals and other protected species including sea turtles.

Visual observations were conducted by PSOs for a total of 1208 hours and 31 minutes. Acoustic monitoring was conducted by PAM operators for 373 hours and 4 minutes during periods of reduced visibility including nighttime as the vessel undertook 24-hour survey operations.

A total of 188 detection events of protected species were made during the survey: 175 were visual detections and 13 were acoustic only detections.

Visual detections of cetaceans consisted of two whale species, three delphinid species, and one pinniped species. Whale species observed consisted of humpback whales (*Megaptera novaeangliae*) and fin whales (*Balaenoptera physalus*). Delphinids observed included bottlenose dolphins (*Tursiops truncatus)*, common dolphins (*Delphinus delphis*), and Atlantic spotted dolphins (*Stenella frontalis*). There were also additional unidentified whales and delphinids observed.

There were no sightings of pinnipeds.

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There were 12 sightings of loggerhead sea turtles (*Caretta caretta*).

No Atlantic sturgeon, sawfish, or giant manta rays were sighted during any of the survey activities.

There were no sightings of dead or injured species during this survey period.

There were 69 mitigation actions implemented for the sparker, which consisted of a delay to activation and shutdowns of the sparker which resulted in a total of 75 hours and 44 minutes of mitigation downtime. There were 112 strike avoidance maneuvers for protected species during the program. There were 90 strike avoidance maneuvers for delphinids, 14 for whales, and eight for sea turtles.

2 INTRODUCTION

The following report summarizes protected species monitoring and mitigation procedures undertaken throughout the geophysical survey. Attentive Energy selected TDI-Brooks to conduct a geophysical survey in the Lease Area (Figure 1). The geophysical survey was conducted off the coasts of New York (NY) and New Jersey (NJ).

During the 2023 survey TDI-Brooks collected data along 30m infill lines between the previously collected 150m spaced reconnaissance lines during the 2022 survey.
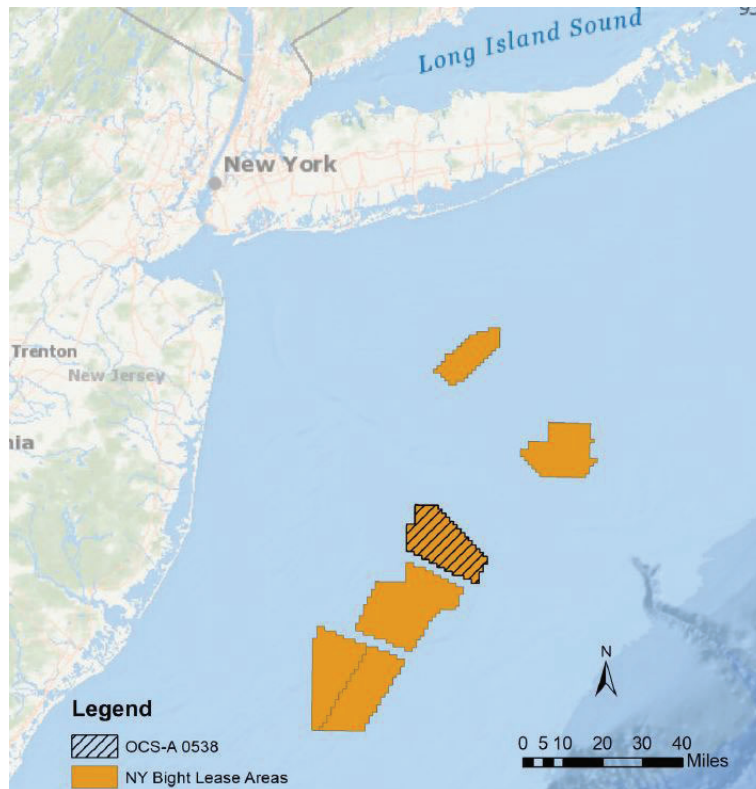
Figure 1: Planned Survey Operations Area within Lease OCS-A 0538.

NMFS and BOEM have advised that sound-producing survey equipment operating in the hearing range of marine species (less than 200 kilohertz (kHz)) has the potential to cause acoustic harassment to marine mammals. Protected species monitoring was conducted in accordance with BOEM and NMFS standards.

Attentive Energy was responsible for contracting PSOs and PAM Operators through a third-party provider to conduct monitoring and mitigation for protected species, including marine mammals, sea turtles, and other protected species, during their activities where RPS was contracted to fulfill this scope of work.

2.1 BOEM Reporting Requirements

This report summarizes the information required by the BOEM Lease OCS-A 0538, the BOEM/NMFS PDCs and BMPs, and the IHA identified in Table 1. A copy of the BOEM Lease OCS-A 0538 and the NMFS IHA are in Appendix A.

An Environmental Management Plan (EMP) prepared by RPS and reviewed by Attentive Energy and BOEM containing the monitoring, mitigation and reporting procedures that were adhered to throughout the survey is in Appendix B.

Table 1: Reporting requirements per BOEM Lease OCS-A 0538, the NMFS 2022 IHA, and PDC/BMPs and the location within this technical report.

Required Content	Source Reference	Location Addressed in Technical Report
A monitoring report must be provided to NMFS within 90 days after completion of survey activities. The report must fully document 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, assesses, and compares the effectiveness of monitoring and mitigation measures.	NMFS IHA Section 6(a) PDC 8.2	This technical report
The report must fully document the methods and monitoring protocols	PDC 8.2	Section 4 Appendix B
The report must summarize the data recorded during monitoring	PDC 8.2	Section 6
The report must estimate the number of listed species that may have been taken during survey activities	PDC 8.2	Section 6.4.2
The report must describe, assess and compare the effectiveness of mitigation and monitoring measures.	PDC 8.2	Section 7.2
The report must include any photos or videos taken by PSOs	PDC 8.2	Appendix I
The report must include any factors that may be contributing to impaired observations during active surveys, such as environmental conditions or equipment malfunctions	PDC 8.2	Section 6.3
PSO datasheets or raw sightings data must also be provided with the draft and final monitoring report. The draft report shall also include geo-referenced, time-stamped vessel tracklines for all time periods during which acoustic sources were operating.	NMFS IHA Section 6(a)	Appendix G
If a North Atlantic right whale (NARW) is observed at any time by PSOs or personnel on any project vessels, during surveys or during vessel transit, Attentive Energy must immediately report sighting information to the NMFS North Atlantic Right Whale Sighting Advisory System: (866) 755-6622. North Atlantic right whale sightings in any location may also be reported to the U.S. Coast Guard via channel 16.	NMFS IHA Section 6(d)(i) BMP 8.3.1	Section 6.4.3
In the event that personnel involved in the survey activities covered by the authorization discover an injured or dead marine mammal, Attentive Energy must report the incident to the National Oceanographic and Atmospheric Administration (NOAA) Fisheries Office of Protected Resources (OPR) (301-427-8401), and to the NOAA Fisheries New England/Mid-Atlantic Regional Stranding Coordinator (978-282-8478) as soon as feasible.	NMFS IHA Section 6(e)(i) BMP 8.5	Section 6.4.4
In the event of a vessel strike of a marine mammal by any vessel involved in the activities covered by the authorization, the Attentive Energy must report the incident to NOAA Fisheries OPR (301-427-8401) and to the NOAA Fisheries New England/Mid-Atlantic Regional Stranding Coordinator (978-282-8478) as soon as feasible.	NMFS IHA Section 6(e)(ii) BMP 8.4	Section 6.4.4

3 PROGRAM OVERVIEW

Attentive Energy contracted TDI-Brooks to conduct a geophysical survey within the Lease area commencing April 2023 off the coast of NY/NJ.

The vessel's dates of operations are summarized in Table 2. A high-level overview of survey events for each vessel is outlined in Table 3.

Table 2: Summary of vessels and dates on project for the survey.

Vessel Name	Dates on Project
R/V Miss Emma McCall	15 April 2023 – Ongoing

Table 3: Summary of key survey events by vessel on the survey.

Event	*R/V Miss Emma McCall*
PSO team mobilizes	14 April 2023
Kick-off meetings	13 April 2023
Vessel departs dock. PSO effort begins.	15 April 2023
Sparker operations begin.	16 April 2023
Sparker operations complete.	Ongoing
Data acquisition complete.	Ongoing
PSO monitoring complete.	Ongoing

3.1 Vessel and Geophysical Equipment Specifications

The Survey was undertaken by the *R/V Miss Emma McCall*. Specifications of the vessel are provided in Table 4 and a photo of the vessel is included below in Figure 2.

Table 4: Vessel specifications.

Vessel Name	Length	Speed	Vessel Configuration description
R/V Miss Emma McCall	46.6 m	10 knots (Transit) 4-5 knots (Survey)	Multi-role survey vessel for coastal and offshore survey areas

Figure 2: *R/V Miss Emma McCall.*

3.2   Summary of Geophysical Survey Equipment Used

The survey equipment operated on the vessel is summarized in Table 5. Monitoring, and mitigation were conducted in order to minimize potential impacts to protected species from the only regulated sound source on this project, the sparker. Other equipment that either did not produce sound or produced sound outside of the hearing range of protected species and, as such, not regulated by BOEM or NMFS, was operated by the survey vessels but it is not considered further in this technical report.

Table 5: Summary of geophysical equipment used during the survey.

R/V Miss Emma McCall		
Energy Source	**Frequency/Energy Specifications**	**Regulated**
Deep Penetrating Geo-Spark w/ Geo-Sense 8-element streamer S-UHRS Sparker	0.3 Hertz (Hz) – 1.2 kHz	Yes
Shallow Innomar SES 2000 Parametric SBP	85 Hz – 115 kHz	No
Geometrics G882 GRAD	200 kHz	No
EdgeTech 4205 Tri Frequency SSS	230 - 540 kHz	No
Dual Head Norbit Winghead MBES	200 - 700 kHz	No

4 MITIGATION AND MONITORING METHODS

The PSO monitoring programs on the *R/V Miss Emma McCall* were established to meet the standards approved in the survey plan and in line with the IHA and PDC/BMPs. 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 to meet these objectives.

- Visual observations were conducted day and night while geophysical operations took place, and during transit for strike avoidance, to provide real-time sighting data, allowing for the implementation of mitigation procedures as necessary.
- A PAM system was operated continuously at night and during other periods of reduced visibility, while geophysical operations took place.
- Species-specific exclusion zones (EZs) were established around the sparker in accordance with the 2022 IHA where delays to initiation and shutdowns of the sparker were implemented when protected species were detected inside.

4.1 Monitoring: Protected Species Observers and PAM Operators

Six trained, experienced dual role PSOs and PAM Operators were on board the survey vessel during activities to conduct monitoring for protected species, record and report detections, and request mitigation actions in accordance with the established regulatory requirements and monitoring plan.

RPS, the PSO Provider, was responsible for ensuring that each PSO deployed met the minimum requirements set forth by in the permit stipulations and by other regulatory best practices. The PSO requirements include training in protected species identification and behavior in addition to field experience in protected species observation in the Atlantic Ocean or the Gulf of Mexico.

RPS was responsible for the provision of training certifications and CVs to be reviewed and approved prior to deployment on the vessel.

RPS was responsible for providing the PSOs with vessel-specific and survey contractor-specific training, and environmental project inductions specific to Attentive Energy. These were provided by RPS, TDI-Brooks and Attentive Energy during project kick-off meetings, conducted prior to the start of survey operations.

4.2 Visual Monitoring: Protocols and Methods

A team of dual role PSOs and PAM operators were deployed on the survey vessel in sufficient numbers to meet the monitoring requirements of that vessel as outlined in Table 6. PSOs monitored while the vessel was in transit and prior to and during all sparker operations conducted by the vessel. Visual monitoring was also conducted during the day between sparker activities in order to collect additional protected species data. PSOs rotated monitoring shifts as needed to maximize concentration and to meet the watch requirements of the permits (watch periods not to exceed four hours without a minimum two-hour break, and a maximum duration or 12 hours in a 24-hour period).

Visual monitoring locations on the *R/V Miss Emma McCall* were selected in consideration of the following factors:

1. To afford PSOs a 360-degree viewpoint around the vessel and the sparker, such that the EZs around the sparker and the strike avoidance separation distances could be simultaneously monitored,

2. Provide the highest vantage point possible so as to allow for monitoring out to the greatest distances ahead and around the vessel,

3. Provide shelter from inclement weather, as needed,

4. Provide real-time communication with vessel and HRG equipment operators.

PSOs conducted their visual monitoring by actively scanning with the naked eye out to the furthest observation points visible, methodically sweeping areas closer to the vessel, focusing on the CZs and EZs and ahead of the vessel. PSOs conducted regular sweeps of the surrounding areas using magnification devices as described below. PSOs monitored for cues that might indicate the presence of protected species including but not limited to splashing, footprints, blows, and presence of other marine species (diving seabirds, fish feeding activity).

Table 6: Visual monitoring methodology on *R/V Miss Emma McCall*.

	R/V Miss Emma McCall
# of PSOs on Watch - Day	1
Visual monitoring equipment- Day	Reticle binoculars 10x50 & 7x50 magnification
Sparker Operations Conducted at Night	Yes
Passive Acoustic Monitoring	Yes Seiche 6H system
# of PSOs on Watch at Night	2
Visual monitoring equipment- Night	Night Vision Devices (NVD) and Infrared Thermal Scopes
Range Estimation	Calibrated Reticle Binoculars
Primary Monitoring Location	Bridge wings Bridge

Displays inside the bridge showed current information about the vessel (e.g., position, speed, heading, etc.), sea conditions (e.g., water depth, sea temperature, etc.), and weather (e.g., wind speed and direction, air temperature, etc.). Environmental conditions, along with vessel and sparker activity, were recorded at least once an hour, or every time there was a change of one or more of the variables.

4.2.1   Daylight Visual

The PSOs on board were equipped with reticle binoculars (7x50 and 10x magnification), as well as digital single lens reflex (DSLR) cameras with 200mm and 300mm zoom lens to aid in visual monitoring watches conducted during the day. PSO teams used field notebooks to record data while on watch and laptops were used to enter data.

Range estimates were made by comparison to object of known distance, as well as with reticle binoculars. Reticle binoculars were calibrated whenever possible to ensure accuracy of distance data. These reticle calibration tables are provided in Appendix D.

4.2.2   Nighttime and Reduced Visibility Visual Observations

Two PSOs conducted visual monitoring during all nighttime operations, utilizing night vision devices (NVD) and infrared thermal scopes, whenever the vessel was not in port or at anchor. If visibility became reduced (largest EZ was not fully visible). Specifications for the night monitoring equipment can be found in Appendix E.

4.3 Monitoring: Passive Acoustic Monitoring Protocols and Methods

Passive Acoustic Monitoring (PAM) was used during the M-UHRS operations to augment visual monitoring efforts in the detection, identification, and locating of marine mammals. Acoustic monitoring was conducted continuously during all reduced visibility geophysical operations and to the maximum extent possible, during periods of reduced visibility, including nighttime, when no operations were being undertaken.

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 two-hour break.

The PAM system was located in the winch booth onboard the *R/V Miss Emma McCall*, which provided space for the system, allowed for quick communication with the HRG equipment operators, and provided access to the vessel's instrumentation screens. Information about the vessel (e.g., position, heading, and speed), water depth, geophysical activity, 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 baleen whale vocalizations, were visualized in PAMGuard's spectrogram modules. Odontocete clicks were visualized in low frequency (LF) and high frequency (HF) click detector modules. Settings adjustments to amplitude range, amplitude triggers, and spectral content filters, among others, were made in PAMGuard's spectrogram. Click detector modules to maximize the distinction between cetacean vocalizations and ambient signal were used. The map module within PAMGuard was utilized to attempt to localize the position and range of vocalizing marine mammals. Sound recordings were made using the HF and LF sound recording modules when potential marine mammal vocalizations were detected, or when the operator noted unknown or unusual sound sources.

4.3.1 Passive Acoustic Monitoring Parameters

A passive acoustic monitoring system designed to detect most species of marine mammals was installed on the *R/V Miss Emma McCall.* The system developed by Seiche Measurements Limited consisted of the following main components: a hydrophone cable (configured as a separate steel-reinforced tow cable and detachable hydrophone array section), a deck cable, a rack-mounted electronic processing unit (EPU) that included multiple sound cards and a computer, two desktop monitors, acoustic analysis software package, and headphones for aural monitoring. A spare of every component was also present on board in the event the main system components became damaged or inoperable. The diagram in Figure 3 is a simplified depiction of the PAM system installed on the vessel.
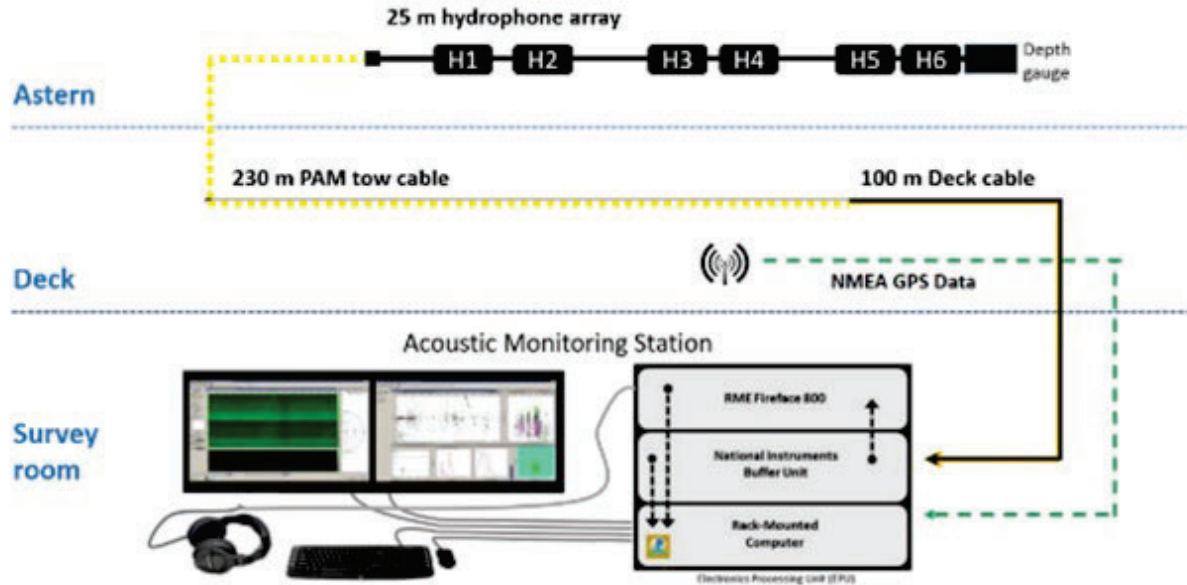
Figure 3: Simplified pathway of data through the installed PAM system.

The 25-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 4). The forward hydrophone pair (H1, H2) was used to analyze and record LF (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 HF sound (2,000 – 200,000 Hz). The hydrophone array cable was attached to the tow cable and manually deployed from the back deck of the vessel.
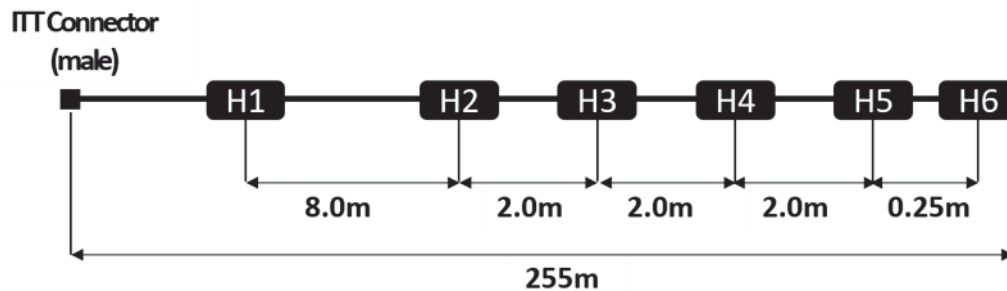
Figure 4: Diagram of hydrophone element separation.

The deck cable interfaced between the hydrophone cable and the electronic processing unit (EPU). The EPU contained a low and mid-frequency sound card, a high frequency sound card, and a P.A Global Positioning System (GPS) feed supplied by the vessel was connected to the PAM system using a universal serial bus (USB) port. Data from the hydrophone cable's depth transducer was routed through the buffer unit to the computer via USB connection. Data from the hydrophones and the GPS and depth transducer were displayed in the acoustic monitoring software (Pamguard).

Raw feed from hydrophone elements H5 and H6 was digitized in the buffer unit using an analogue-digital National Instruments data acquisition soundcard at a sampling rate of 500 kilohertz. The output was filtered for HF content and visualized using the PAMGuard software. 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 mid-frequency 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 LF output was further processed within PAMGuard and 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 vessels to display the vessel location and could be used to determine range and bearing estimates based on vocalizations tracked in the detector modules.

4.3.2   Hydrophone Deployment

On the *R/V Miss Emma McCall*, the hydrophone cable was deployed manually astern from the port side of the vessel. The 100-meter deck cable was run from the port stern along and secured to the port side railing, under the processing van, and then into the winch booth through the window, which was secured with tape to prevent the cable from moving, the window from closing, and water from entering the small window opening. When deployed, the array cable was approximately 50 meters astern from the port side of the vessel.

PAM system specifications for the *R/V Miss Emma McCall and* a more detailed description of the hydrophone deployment method can be found in Appendix F.

4.4   Monitoring: Data Collection

4.4.1   Estimating and Recording number of Potential Marine Mammal Exposures

NMFS defines a Level B harassment, or a "take by harassment," for marine mammals as any exposure to sound levels that could potentially result in temporary threshold shift (TTS) or a behavioral disturbance to the animals (NMFS 2018). NMFS considers a Level B take to occur at anthropogenic sound levels greater than or equal to 120 dB re 1 µPa m RMS for continuous sound and 160 dB re 1 µPa m RMS for intermittent sound that is either impulsive or non-impulsive. The sparker was the only HRG sound source operating below 200 kHz used during the survey determined to have the potential to result in Level B harassment.

Level A take is defined as injury or mortality to marine mammals and occurs at higher acoustic thresholds than Level B harassment, which also vary by species based on their hearing sensitivity (NMFS 2018). The maximum estimated Level A harassment isopleth was less than less than 1 m (cumulative sound exposure level) for all cetacean hearing groups (Advisian 2022, Advisian 2023). Thus, the risk of Level A exposure from active HRG equipment of any kind was considered highly unlikely. Level A take is not typically authorized by NMFS for HRG survey activities and it is assumed that project mitigation measures will protect marine mammals from Level A exposures as well as the vast majority of potential Level B exposures. Furthermore, what does or does not rise to the level of take is assessed and determined solely by NMFS on a case-by-case basis. Therefore, only potential Level B exposure estimates are reported in this report.

Distances to the Level A and Level B exposure thresholds for equipment meeting or exceeding NMFS exposure guidelines were calculated on behalf of Attentive Energy by Advisian in the Application for Incidental Harassment Authorization for the Non-Lethal Taking of Marine Mammals: Site Characterization

Surveys (Advisian, 2022, Advisian 2023). The Level B isopleth was modeled to 141 m for the sparker system. The Level B harassment zones were modeled for all HRG survey equipment below 200 kHz, however only non-parametric SBPs, boomers and sparkers were expected to result in Level B exposures.

Number of potential exposures were based on direct observations of protected species within this 141 m Level B isopleth of the sparker when in operation. The estimated number of animals detected within this distance were considered potential exposures.

4.4.2   Data Collection Requirements & Methods

Data was collected to meet the requirements of BOEM and NMFS as summarized in Table 1 of this report.

PSOs and PAM Operators collected data in handwritten notepads or on portable / tablet devices during watches. During watch breaks and at the end of daylight hours, data was compiled in proprietary data forms on laptop computers and backed up on portable hard drives.

During or immediately after each sighting event, the PSOs recorded the detection details in a standardized detection datasheet provided to them by RPS. Excel data forms included tabs for project data, monitoring effort data, geophysical operations data, and protected species detection data. RPS supplied a set of standardized variables for specific data fields that were to be implemented on the data form provided to their PSOs.

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 DSLR cameras that had telephoto lenses. Marine mammal identification manuals were consulted, and photos were examined during observation breaks to confirm identifications.

While acoustic monitoring does not allow assessment of group size with the same level of precision as by visual observation, the low frequency and high frequency click detector modules in PAMGuard allow PAM Operators to identify when multiple animals are vocalizing simultaneously or in very close succession. Click detectors present cetacean click trains on computer displays, spatially differentiated by relative bearings to the hydrophone array, so when multiple click trains occur simultaneously or in close succession, and the click trains come from different bearings, the PAM Operator knows the click trains originate from different animals. While this does not allow the PAM Operator to estimate a total group size, it does provide the PAM Operator an estimate for the minimum group size.

4.4.3   NARW External Sighting Monitoring Protocol

PSOs and operators monitored for Dynamic Management Areas (DMA) in their permitted survey area and surrounding areas regularly:

1. Lead PSOs checked the NMFS website for new DMAs at the start of each day.

2. PSOs used mobile devices to check the web application Whale Alert

3. RPS project managers were signed up to receive automatic notifications of DMAs and NARW sightings throughout survey operations.

4.5   Mitigation Methodology

The PSO monitoring and mitigation program implemented on the survey vessels was established to meet the BOEM Lease (OCS-A 0538), PDC/BMP, and IHA requirements and to minimize potential impacts of the survey activities on marine mammals and sea turtles.

These mitigation measures include implementing exclusion zones (EZs), visual monitoring by approved PSOs/PAM Operators, delays to initiation of sound sourcing and shutdown of the active sparker for protected species detections, and vessel strike avoidance procedures.

Mitigation actions to be undertaken were summarized in a flow chart that was provided to each PSO team and is included in Appendix B.

4.5.1   Mitigation Zones - Geophysical

Marine Mammal Monitoring Zone – PSOs must establish and monitor a marine mammal monitoring zone that represents 500 m from survey equipment.

Establishment of Pre-Start Clearance Zones (CZs) around the geophysical equipment during search periods prior to activation of the LF HRG equipment:

- 500 m CZ: North Atlantic right whales, ESA-listed whales, unidentified large whales, sea turtles
- 100 m CZ: All other marine mammals except small delphinids and seals
- 141 m: Potential Level B harassment zone for marine mammals (delays to initiation of the sparker are required at this distance for marine mammals where take has not been granted or where the authorized takes have been met)

Establishment of EZs around the active LF HRG equipment:

- 500 meters: North-Atlantic right whales and unidentified large whales
- 100 meters: All other marine mammals except small delphinids and seals
- 100 meters: sea turtles
- 141 m: Potential Level B harassment zone for marine mammals (shutdowns of the sparker are required at this distance for marine mammals where take has not been granted or where the authorized takes have been met)

Separation distances established when the vessel was underway between long transits:

- 500 meters: North-Atlantic right whales, ESA-listed whales, and unidentified large whales
- 100 meters: Other whales
- 50 meters: Delphinoid Cetaceans, pinniped, and sea turtles
- Forward path any distance: Sea turtles and giant manta rays

Search periods of 30 minutes conducted visually (daytime) or visually and acoustically (all periods of reduced visibility, including night) prior to the initiation of geophysical operations.

Delays to the initiation of the sparker if marine mammals or sea turtles were detected inside their respective EZ during the 60-minute search period, prior to the initiation of the operation. Delays were conducted until all marine protected species observed inside the EZ had been confirmed to exit the EZ, or until an additional time period has elapsed with no further sighting of the animal within the EZ.

- 15 minutes for harbor porpoises

- 30 minutes for all other marine mammals except small delphinids and seals, and sea turtles

Shut down of the survey equipment operating below 180kHz was required for any marine protected species sighted at or within its EZ. Once the operation had been shut down for a protected species detection, operations did not resume until a specific time period had passed following the last detection of the animal(s) or once the animal had exited the EZ.

- 15 minutes for harbor porpoises

- 30 minutes for all other marine mammals except small delphinids and seals

4.5.2 Updates to CZs and EZs

Attentive Energy's mitigation zones were updated throughout this reporting period in response to potential Level B exposures as follows:

On 05 May 2023, as a conservative measure following a potential Level B exposure of a fin whale, Attentive Energy imposed a 200 m CZ/EZ for ESA-listed whales other than NARW.

On 31 May 2023, as the potential Level B exposure limit of common dolphins was approached, Attentive Energy imposed a 141 m CZ/EZ for common dolphins.

On 02 June 2023, the potential Level B exposure limit for common dolphins was reached and Attentive Energy further imposed a 200 m CZ/EZ for this species.

4.6 Reporting

Reporting requirements of the BOEM lease and the IHA were outlined in Table 1. Both agencies require that a final survey report be prepared detailing operations, PSO effort, and measures for detection of protected species.

4.6.1 Injured or Dead Protected Species

Any injured or dead marine mammal or sea turtle observed either by a PSO on watch or by a crew member was required be reported to BOEM and NMFS as described in Table 1.

Reporting requirements included a phone notification to the NMFS Regional Stranding hotline as soon as practicably possible, made by either the Lead PSO or shore based PSO Provider, as communications permitted from the vessel.

The Lead PSO prepared a written report in accordance with NMFS standard reporting guidelines and using the template provided by BOEM in the lease, which was submitted to Attentive Energy for submittal to the agencies.

4.6.2 NARW Sightings

NARW sightings were required be reported to BOEM and NMFS as described in Table 1. Reporting requirements included a phone notification to the NMFS Regional Stranding hotline as soon as practicably possible, made by either the Lead PSO or shore based PSO Provider, as communications permitted from the vessel.

No NARW sightings occurred during the survey.

4.6.3   90 Day Close Out Report

RPS have prepared this Technical Report to meet the NMFS IHA 2022 reporting requirements outlined in Table 1 of this report and a final report in this format will be prepared upon completion of survey activities. Each of the elements required in the final PSO reporting is provided in Table 1 with the section in this report in which the element is addressed.

5 SURVEY OPERATIONS AND MONITORING EFFORT

5.1 Survey Operations Summary

PSOs collected the sparker's operational status each day that they were deployed on the vessel. At minimum, the equipment was recorded as 'on' or 'off.'

HRG vessels recorded the start of line (SOL) times and the end of line (EOL) times for the equipment during acquisition. The vessels also recorded the status of the equipment while acquisition occurred by noting full power or shutdowns/power-downs due to mitigation actions. These entries were made only for the regulated source (sparker).

Hours of regulated source activity were calculated by summing all durations that the sparker was recorded as active.

5.2 Summary of Monitoring Effort

PSOs recorded monitoring effort by entering start of watch and end of watch times into data sheets where the vessel position and environmental data was also documented for that duration.

Total monitoring effort was calculated by summing the durations of each watch period.

Visual monitoring while the sparker was off included monitoring conducted during transit to survey sites and any other recorded silent periods (mitigation action, equipment downtime, or weather standby time).

5.2.1 Summary of Environmental Conditions

Environmental conditions can have an impact on the probability of detecting protected species in a survey area. The environmental conditions present during the majority of visual observations undertaken during this survey program were mild to moderate, ranging from Beaufort Sea State 1 to 5. Therefore it is likely that the majority of protected species present at the surface within visual range of the vessel were detected.

Beaufort Sea State was recorded for each monitoring period using the accepted scale (Table 7).

Table 7: Beaufort Sea State scale.

Beaufort number	Description	Wave height (m)	Sea conditions
0	Calm	0	Sea like a mirror
1	Light air	0–0.3	Ripples with appearance of scales are formed, without foam crests
2	Light breeze	0.3–0.6	Small wavelets still short but more pronounced; crests have a glassy appearance but do not break
3	Gentle breeze	0.6–1.2	Large wavelets; crests begin to break; foam of glassy appearance; perhaps scattered white horses
4	Moderate breeze	1–2	Small waves becoming longer; fairly frequent white horses
5	Fresh breeze	2–3	Moderate waves taking a more pronounced long form; many white horses are formed; chance of some spray
6	Strong breeze	3–4	Large waves begin to form; the white foam crests are more extensive everywhere; probably some spray
7	High wind	4–5.5	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind; spindrift begins to be seen
8	Gale	5.5–7.5	Moderately high waves of greater length; edges of crests break into spindrift; foam is blown in well-marked streaks along the direction of the wind
9	Severe gale	7–10	High waves; dense streaks of foam along the direction of the wind; sea begins to roll; spray affects visibility
10	Storm	9–12.5	Very high waves with long overhanging crests; resulting foam in great patches is blown in dense white streaks along the direction of the wind; on the whole the surface of the sea takes on a white appearance; rolling of the sea becomes heavy; visibility affected
11	Violent storm	11.5–16	Exceptionally high waves; small- and medium-sized ships might be for a long time lost to view behind the waves; sea is covered with long white patches of foam; everywhere the edges of the wave crests are blown into foam; visibility affected
12	Hurricane force	>14	The air is filled with foam and spray; sea is completely white with driving spray; visibility very seriously affected

Swell heights in meters were recorded by all the vessel PSO teams. The swell heights were either provided as the actual estimated height in meters or categorized (< 2 m, 2 – 4 m, and > 4 m). To calculate the overall monitoring effort for each swell height, the data was assigned to the appropriate swell height category.

PSOs categorized visibility during monitoring effort in kilometers and/or meters where values were selected from categories.

5.3 Visual Sightings of Protected Species

PSOs used standardized reporting forms provided by RPS to record all detections of marine mammals and sea turtles made during survey operations. These records were completed any time a sighting was made, regardless of distance, not just for detections where mitigation was implemented.

Sighting ID or detection event numbers were assigned chronologically for all protected species observed on a vessel throughout that vessel's survey activity. A new detection number was assigned for a new species sighting or when enough time had passed between observations of animals of the same species such that PSOs could not be certain that they were observing the same animals previously documented. A standard duration of time was to be applied between observations: 15 minutes for delphinid and pinniped detections and 30 minutes for large whales. If there were multiple species in a single detection, the same sighting ID or detection event was used.

Protected species movement relative to the vessel, pace, and initial and subsequent behavior states were recorded for each protected species sighting where standardized categories for each were provided as controlled fields in the provided data form.

5.3.1 Closest Point of Approach

All PSOs recorded the closest point of approach (CPA) and the sparker status at the CPA.

5.3.2 Detection Rate

Detection rate was calculated using the number of protected species events per hour of monitoring effort, both visual and acoustic for all vessels. On vessels where more than one PSO was on watch simultaneously, effort was not duplicated: one hour of monitoring effort by two PSOs consisted of one hour of effort for the purpose of detection rate calculations.

5.4 Level B Take / Exposure Estimation

The ESA defines take as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

The MMPA definition of harassment refers to an act of pursuit, torment, or annoyance which: has the potential to injure a marine mammal or marine mammal stock in the wild (Level A Harassment); or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B Harassment).

NMFS considers that marine mammals that have been exposed to received sound levels of 160 dB rms have potentially been disturbed and should therefore be classified as a potential Level B take.

In the 2022 IHA issued to Attentive Energy by NMFS, NMFS defines the Level B harassment zone for marine mammals as individuals observed within 141 meters of the sparker while in use (table 2 of the IHA).

Under the MMPA and the ESA the definition of take includes "to harass", where harassment is described as disrupting or impairing behaviour patterns. In accordance with the IHA, detections of individuals sighted within the Level B harassment radius during this survey while the sparker was on are recorded within this report as potential Level B exposures. However, many species exhibited normal behaviours such as bow-riding while within the Level B take radius and therefore may not have been harassed by definition nor constitute a "take" per se.

This report provides a preliminary estimation of marine mammals which experienced potential Level B harassment due to their proximity to an active sparker.

5.5 Mitigation Measures Implemented

Mitigation measures were implemented on the vessel as previously described. The onboard PSO team communicated requested mitigation in real time to survey operators that controlled the operation of the sparker or to the vessel crew operating the vessel, depending on the type of action required. Communications were conducted in person. Implemented mitigation actions were recorded on PSO data sheets in the detection data form and in the operations activity logs.

For each mitigation action, the mitigation downtime associated with that action was calculated. Mitigation downtime was the duration of the break in sparker operations as required by the regulatory protocols: the duration of time that an animal was observed inside an exclusion zone and any additional clearance time required before the sparker could be activated.

Mitigation downtime did not include any additional downtime that a survey operator needed to resume acquisition: additional vessel maneuvering time, time to deploy or calibrate equipment etc.

5.6 Data Quality Control

The RPS data analysts reviewed all the PSO data sets received and conducted quality control (QC) as described in Table 8.

Table 8: Quality control editing performed by RPS on PSO datasets by data field.

Data type	Data field	Corrections made
Monitoring effort	Start of watch / End of watch	• Times were corrected or added where errors were evident, typically by inconsistency with adjacent times
	Daytime vs. Night-time	• Failures to adjust the time to UTC were corrected. • Times were corrected when the end of effort overlapped with the start of subsequent effort
Sparker operations	Testing	• Testing status was not used as a separate category. Based on the survey days and monitoring effort times, testing was either added to the "on" status or not included in operations totals.
Protected species detections	Position	• Positions that plotted out of place were corrected using effort positions or vessel track line positions of corresponding times, where available
	Combining Unidentified categories	• Unidentified mysticetes/delphinids/pinnipeds/sea turtles were combined within an Unidentified category for data analysis

6 RESULTS

This section of the report details sparker operations, the protected species monitoring effort, environmental conditions during monitoring effort and distribution. Also included is sighting data inside and outside the survey area during sparker operation and sparker silence.

The monitoring effort, sparker operations and protected species detections for the vessel are provided as an excel dataset in Appendix G.

6.1 Operation Activity

2023 HRG survey operations began with data acquisition at planned geotechnical sample target locations, followed by data acquisition throughout the Lease area. Survey operations were briefly suspended when necessary for weather, equipment maintenance, provisions, and crew changes.

The dates of operation, total days of survey activity and hours of sparker operations by the survey vessel are provided in Table 9.

Table 9: Summary of geophysical operations on the survey vessel.

Vessel	Dates of Operation	Total Survey Days	Total Hours of Sparker Operations (HH.HH)
R/V Miss Emma McCall	15 April 2023 - 20 June 2023	61	785.7

6.2 Monitoring Effort

Visual and monitoring effort for the survey vessel during the geophysical survey is summarized in Table 10, by activity of the regulated HRG source (sparker) and by monitoring conducted during day and night.

Table 10: Summary of monitoring effort, visual and acoustic, by time of day and by sparker activity status.

Monitoring Effort	*R/V Miss Emma McCall*	
	Visual (HH.HH)	PAM (HH.HH)
Sparker active	785.70	314.55
Sparker not active	422.82	58.52
Daytime	755.33	33.5
Night-time	453.18	339.57
Total	**1208.52**	**373.07**

6.3   Environmental Conditions

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 generally mild.

The majority of the monitoring effort (59% of the overall monitoring effort) for the survey was conducted in conditions where visibility was greater than 2 kilometers (km). This combines all monitoring at nighttime or reduce visibility, which comprises acoustic monitoring, visual monitoring during transit or when the sparker was not deployed (Table 11).

Table 11: Summary of visibility conditions during the survey.

Visibility	Duration (HH.HH)	% of Overall Monitoring Effort
Greater than 5 km	620.80	51
2 to 5 km	96.13	8
Less than 2 km	491.58	41

Swell heights during monitoring were very low, with swells of less than 2 meters recorded for 99% of monitoring effort (Table 12). Swells did not exceed 4 meters during the survey.

Table 12: Summary of swell height during monitoring during the survey.

Swell Height	Duration (HH.HH)	% of Overall Monitoring Effort
Less than 2 meters	1193.22	99
2 to 4 meters	15.30	1
Greater than 4 meters	0.00	-

Monitoring effort was conducted in Beaufort Sea States ranging from Level 1 through Level 7. A significant portion of the monitoring effort was accumulated at sea states at or below Level 4, which is generally considered to be favorable conditions for monitoring for most marine mammal species. Level 4 Beaufort Sea States or below accounted for 97% of the total monitoring effort.

Table 13: Summary of Beaufort Sea State during monitoring during the survey.

Beaufort Sea State	Duration (HH.HH)	% of Overall Monitoring Effort
B1	32.18	3
B2	478.70	40
B3	477.82	40
B4	187.20	15
B0 through B4	**1175.90**	**97**
B5	24.62	2
B6	8.00	<1
B5 through B6	**32.62**	**3**

6.4   Visual Sightings

This section of the report summarizes visual sightings of protected species made during the survey, including during transits and during data acquisition. There were a total 175 protected species detection events both inside and outside the Lease Area consisting of marine mammal detections and sea turtle sightings. Cetacean detections consisted of delphinids and whales (n=114 delphinid detections and n=49 whale detections). There were no detections of pinnipeds. Detections consisted of five different marine mammal species (three delphinid species, and two whale species).

The 12 sea turtle sightings were all one species.

Of the 175 detection events, 86.3% (151 events) were of animals that were identified to the species level while the remaining animals (24 detection events) were identified to family level or a higher taxonomic level (classified as unidentified whales, dolphins, or seals). Table 14 shows the total number of detection records and the number of individuals detected for each protected species during the survey program.

Maps of the detections during the survey can be found in Figure 5 through Figure 8.

A table of all protected species detections is provided as part of an excel datasheet attachment in Appendix G.

Photographs of the identified protected species visually detected during the survey are provided in Appendix I.

Table 14: Number of detection records collected for each protected species during the survey program including during all vessel activity and sparker operation (active/inactive).

Species	Total Number of Detection Events	Total Number of Detected Animals Recorded
Whales		
Fin whale	24	44
Humpback whale	9	14
Unidentified whale	16	27
Dolphins		
Atlantic spotted dolphin	1	15
Bottlenose dolphin	5	27
Common dolphin	100	1715
Unidentified dolphin	8	20
Sea Turtles		
Loggerhead sea turtle	12	14
Total	**175**	**1876**
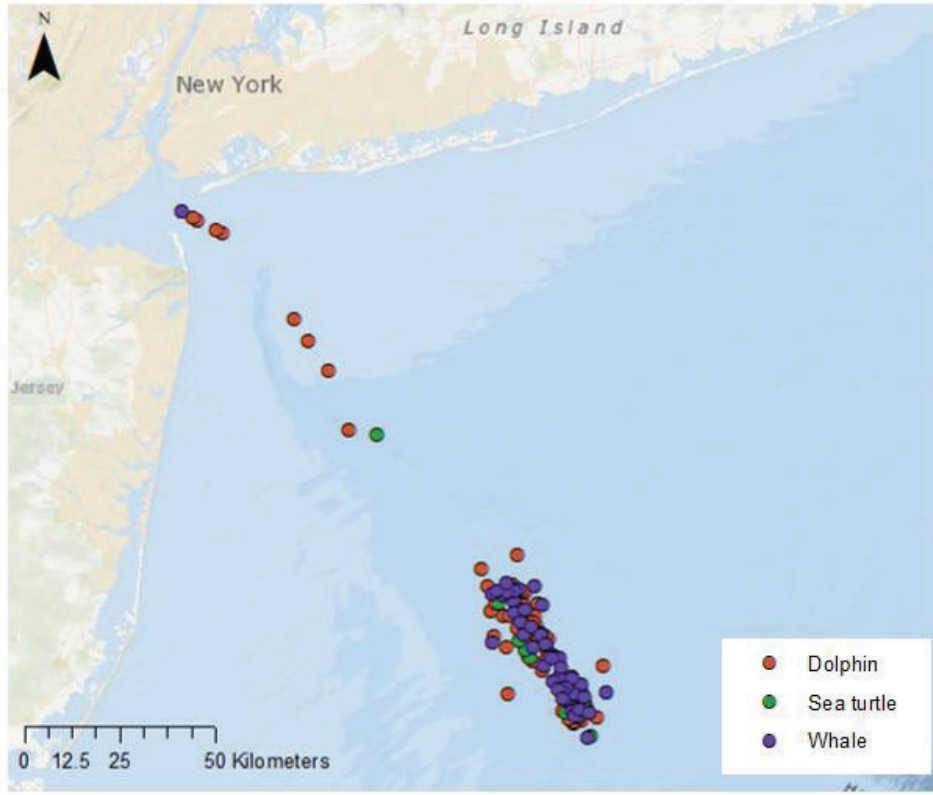
Figure 5: Map of all protected species detections during the survey by group.
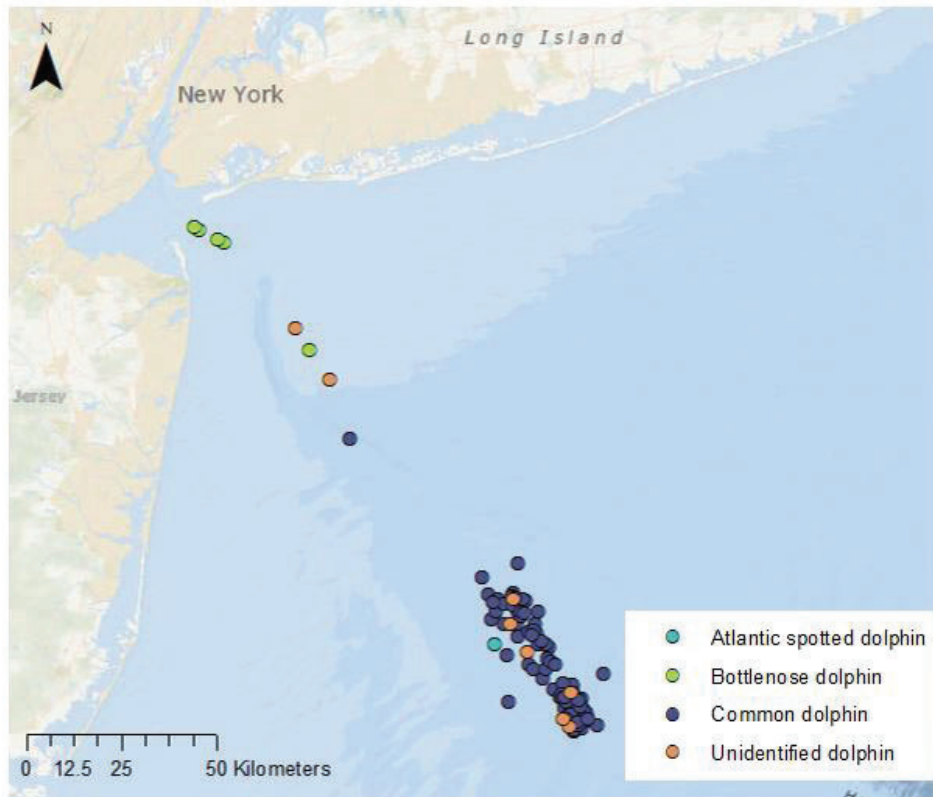
Figure 6: Map of dolphin detections during the survey.
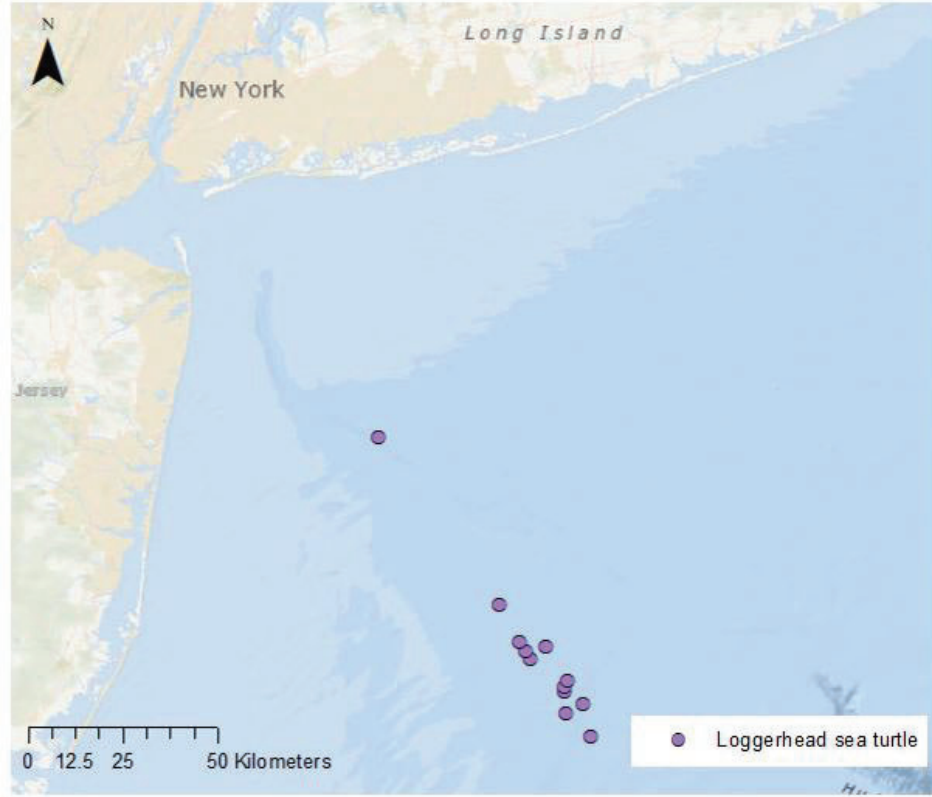
Figure 7: Map of sea turtle detections during the survey.
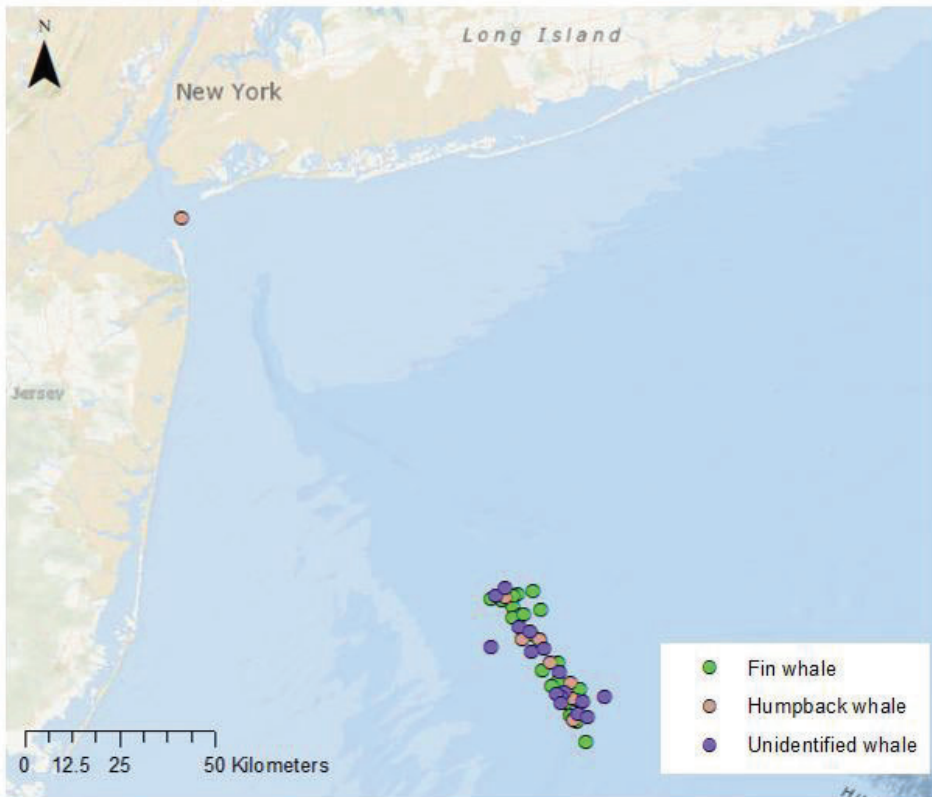
Figure 8: Map of whale detections during the survey.

6.4.1   Detection and Distance Summaries

The number of detections, approximate number of animals observed, median group sizes, range of distances from vessel at first detection and detection rate for each species of marine mammals detected over the course of the survey is provided in this section.

The most commonly detected dolphin species was the common dolphin. Common dolphins also had the most individuals detected and had the largest mean group size. Atlantic spotted dolphins were detected closest to the vessel at first detection (Table 15).

Table 15: Detection summary of dolphins observed during the survey.

Dolphins	Atlantic spotted dolphin	Bottlenose dolphin	Common dolphin	Unidentified dolphin
Number of detection records	1	5	100	8
Estimated # of individuals detected	15	27	1715	20
Mean group size	15	5	17	3
Mean distance (m) at first detection	80	183	289	870
Detection rate	0.000827	0.004137	0.082746	0.006620

There were two different whale species detected during this survey. Fin whales were the most commonly detected and had the most detected individuals. The average distance at first detection was greater than 1000 m for all species (Table 16)

Table 16: Detection summary of whales observed during the survey.

Whales	Fin whale	Humpback whale	Unidentified whale
Number of detection records	24	9	16
Estimated # of individuals detected	44	14	27
Mean group size	2	2	2
Mean distance (m) at first detection	1166	1126	1975
Detection rate	0.019859	0.007447	0.013239

The were 12 detections of loggerhead sea turtles with a mean distance at first detection of 266 meters (Table 17).

Table 17: Detection summary of sea turtles observed during the survey.

Sea turtles	Loggerhead sea turtle
Number of detection records	12
Estimated # of individuals detected	14
Mean group size	1.17
Mean distance (m) at first detection	266
Detection rate	0.009930

There were 133 detections of protected species while the sparker was deployed, of those 82 occurred while the sparker was active and 85 occurred while the sparker was inactive. The difference between the CPA of marine mammals to the active sparker versus the inactive sparker were smaller in the case of the dolphin and sea turtle detections, and much larger for whales. Additionally, CPA was not calculated for the 42 detections which occurred during transits without the sparker deployed.

Table 18: Summary of sparker activity during protected species detections and the portion of those detections during which bow riding occurred.

Species Detected	Sparker Deployed/Active		Sparker Deployed/Inactive	
	Total number of detections (bow riding)	Mean CPA to sparker (meters)	Total number of detections (bow riding)	Mean CPA to sparker (meters)
Atlantic spotted dolphin	0	-	1	40
Common dolphin	42 (17)	252	57 (17)	71
Unidentified dolphin	5	1100	1	250
Total dolphins	**47 (17)**	**342.46**	**59 (17)**	**73.24**
Fin whale	14	1044	9	536
Humpback whale	6	1217	4	570
Unidentified whale	12	2102	5	818
Total whales	**32**	**1473.13**	**18**	**621.67**
Loggerhead sea turtle	3	250	8	105
Sea turtle	**3**	**250**	**8**	**105**
Total protected species	**82 (17)**	**780.32**	**85 (17)**	**192.36**

6.4.2   2022 Incidental Harassment Authorization (IHA) Level B Exposures

NMFS issued an IHA for the Attentive Energy 2022 survey where a total of 386 takes were authorized for 15 marine mammal species/species groups. During the previously reported 2022 survey, 99 potential Level B exposures were recorded. During the portion of the 2023 survey which occurred under the 2022 IHA, an additional 192 marine mammals from two species/species groups were observed within 141 meters of the active sparker (Table 19), constituting potential Level B exposures as defined by this IHA.

Table 19: IHA authorized Level B takes, potential Level B exposures, and the portion of potential Level B exposures during which bow riding occurred during the surveys.

Species common name	IHA Authorized Level B Takes	Total Number of Animals Observed Inside the IHA-Defined Level B Harassment Zone (bow riding) 2022 Survey (Previously Reported)	Total Number of Animals Observed Inside the IHA-Defined Level B Harassment Zone (bow riding) 2023 Survey
North Atlantic right whale	3	0	0
Humpback whale	2	0	0
Fin whale	3	0	1
Sei whale	2	0	0
Minke whale	2	0	0
Sperm whale	2	0	0
Long-finned pilot whale	15	0	0
Bottlenose dolphin	38	10	0
Common dolphin	162	86 (56)	191 (88)
Atlantic white-sided dolphin	26	0	0
Atlantic spotted dolphin	31	0	0
Risso's dolphin	9	0	0
Harbor porpoise	65	0	0
Harbor seal	13	0	0
Gray seal	13	0	0
Unidentified dolphin	N/A	3 (1)	0
Unidentified seal	N/A	0	0
Unidentified whale	N/A	0	0

6.4.3   NARW sightings reporting

There were no observations of a NARW made during survey operations.

6.4.4   Protected species incident reporting

There were no sightings of dead or injured protected species and no incidents of vessel strikes during this survey period.

6.4.5   Summary of DMAs

There were no DMAs created in the Attentive Energy Lease area or along port call transit routes during the survey period.

6.5   Acoustic Detections

There were 13 acoustic only marine mammal detections that consisted of common dolphins, unidentified dolphins, and one humpback whale during this geophysical survey period. There were 25 correlated detections that consisted of both a visual and acoustic sighting of common dolphins and unidentified dolphins by both the PSOs and PAM operators.

Screenshots of identified protected species acoustically detected during the survey are provided in Appendix J.

Table 20: Summary of acoustic only detections during the survey.

Acoustic Detection Parameters	Common dolphin	Unidentified dolphin	Humpback whale
# of Acoustic Detection Records	3	9	1
# of detections while sparker was active	2	8	1
# of detections while sparker was inactive	1	1	0
Estimated # of individuals detected	7	11	1
Detection rate	0.008041	0.024124	0.002680

During the majority of the detections, tonal sounds were detected either aurally and/or visually on the spectrogram. Most acoustic detections of common dolphins and unidentified dolphins consisted of aural and visual detections of tonal sound (Table 21).

Table 21: Initial behavior of acoustic only detections.

Species	Aural detection of tonal sounds	Visual detection of tonal sounds on spectrogram	Detection of tonal sounds by an automated Whistle Moan Detector	Aural detection of clicks or pulsed sounds	Detection of clicks on click detector
Common dolphin	2	3	2	1	2
Unidentified dolphin	7	7	1	-	2
Humpback whale	-	1	1	-	-

6.6 Summary of Mitigation Measures Implemented

Mitigation was implemented as described in previous sections of this report to minimize potential adverse impacts to protected species including physical interactions with vessels and / or towed equipment (strike avoidance mitigation) or from exposure to potentially harmful levels and frequencies of sound (delays to initiation of and shutdowns of the active sparker).

Attentive Energy's mitigation zones were updated throughout this reporting period in response to potential Level B exposures as follows:

On 05 May 2023, as a conservative measure following a potential Level B exposure of a fin whale, Attentive Energy imposed a 200 m CZ/EZ for ESA-listed whales other than NARW.

On 31 May 2023, as the potential Level B exposure limit of common dolphins was approached, Attentive Energy imposed a 141 m CZ/EZ for common dolphins.

On 02 June 2023, the potential Level B exposure limit for common dolphins was reached and Attentive Energy further imposed a 200 m CZ/EZ for this species.

There were 69 mitigation actions implemented for the sparker during the survey period (Table 22). These mitigation action resulted in 75 hours and 44 minutes of mitigation down time of the sparker. Mitigation accounts only for the period of time during which survey operations were shut down or delayed for the presence of a protected species inside the exclusion zone and the additional regulatory-required time period that must pass before sparker operations can resume. Additional mitigation time is frequently incurred for necessary operational activities such as gear deployment and/or repositioning the vessel.

Table 22: Number and duration of mitigation actions by species groups implemented during the survey.

Mitigation Action	Dolphins		Whales		Sea turtles		All Species	
	Number	Mitigation Downtime	Number	Mitigation Downtime	Number	Mitigation Downtime	Number	Mitigation Downtime
Delay to initiation of sparker	2	00:49	0	00:00	0	00:00	2	00:49
Shutdown of active sparker	57	71:20	4	3:20	6	00:15	67	75:55
All mitigation actions	**29**	**72:09**	**4**	**03:20**	**6**	**00:15**	**69**	**75:44**

Strike avoidance maneuvering was conducted 112 times during the survey period. In 102 of the cases speed and heading of the vessel were maintained, in the remaining 10 cases, either speed or course or both were changed to maintain a separation distance from the protected species. Strike avoidance maneuvers were implemented 90 times for delphinids, eight times for sea turtles, and 14 times for whales. (Table 23).

Table 23: Summary of strike avoidance maneuvers undertaken during the survey.

Vessel	Date	Det. number	Species	Num. of animals	Strike avoidance maneuver
R/V Miss Emma McCall	4/19/2023	1	Humpback whale	1	alter course, shift in to neutral
R/V Miss Emma McCall	4/27/2023	7	Fin whale	1	kept course, maintain speed
R/V Miss Emma McCall	4/28/2023	10	Common dolphin	4	kept course
R/V Miss Emma McCall	5/4/2023	13	Unidentified whale	2	kept course, maintain speed
R/V Miss Emma McCall	5/11/2023	21	Common dolphin	3	kept course, maintain speed
R/V Miss Emma McCall	5/12/2023	23	Common dolphin	1	kept course, maintain speed
R/V Miss Emma McCall	5/14/2023	24	Common dolphin	2	kept course, maintain speed
R/V Miss Emma McCall	5/14/2023	25	Common dolphin	2	kept course, maintain speed
R/V Miss Emma McCall	5/14/2023	28	Common dolphin	5	kept course, maintain speed
R/V Miss Emma McCall	5/14/2023	27	Unidentified whale	1	alter course
R/V Miss Emma McCall	5/14/2023	26	Unidentified whale	1	kept course, maintain speed
R/V Miss Emma McCall	5/15/2023	29	Common dolphin	3	kept course, maintain speed
R/V Miss Emma McCall	5/15/2023	30	Common dolphin	5	kept course, maintain speed
R/V Miss Emma McCall	5/15/2023	31	Common dolphin	5	kept course, maintain speed
R/V Miss Emma McCall	5/15/2023	32	Common dolphin	3	kept course, maintain speed
R/V Miss Emma McCall	5/15/2023	33	Common dolphin	7	kept course, maintain speed
R/V Miss Emma McCall	5/15/2023	34	Common dolphin	8	kept course, maintain speed
R/V Miss Emma McCall	5/15/2023	35	Common dolphin	2	kept course, maintain speed
R/V Miss Emma McCall	5/23/2023	39	Common dolphin	5	kept course, maintain speed
R/V Miss Emma McCall	5/23/2023	40	Common dolphin	3	kept course, maintain speed
R/V Miss Emma McCall	5/25/2023	41	Bottlenose dolphin	1	kept course, maintain speed
R/V Miss Emma McCall	5/27/2023	44	Common dolphin	4	kept course, maintain speed
R/V Miss Emma McCall	5/29/2023	47	Common dolphin	4	kept course, maintain speed
R/V Miss Emma McCall	5/29/2023	48	Common dolphin	12	kept course, maintain speed

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Vessel	Date	Det. number	Species	Num. of animals	Strike avoidance maneuver
R/V Miss Emma McCall	6/1/2023	49	Bottlenose dolphin	6	kept course, maintain speed
R/V Miss Emma McCall	6/2/2023	54	Common dolphin	7	kept course, maintain speed
R/V Miss Emma McCall	6/2/2023	55	Common dolphin	3	kept course, maintain speed
R/V Miss Emma McCall	6/2/2023	56	Common dolphin	22	kept course, maintain speed
R/V Miss Emma McCall	6/2/2023	59	Loggerhead sea turtle	1	kept course, maintain speed
R/V Miss Emma McCall	6/2/2023	60	Loggerhead sea turtle	1	kept course, maintain speed
R/V Miss Emma McCall	6/2/2023	61	Loggerhead sea turtle	1	kept course, maintain speed
R/V Miss Emma McCall	6/3/2023	63	Common dolphin	6	kept course, maintain speed
R/V Miss Emma McCall	6/3/2023	65	Common dolphin	15	kept course, maintain speed
R/V Miss Emma McCall	6/3/2023	62	Loggerhead sea turtle	1	kept course, maintain speed
R/V Miss Emma McCall	6/4/2023	67	Common dolphin	5	kept course, maintain speed
R/V Miss Emma McCall	6/4/2023	66	Loggerhead sea turtle	1	kept course, maintain speed
R/V Miss Emma McCall	6/7/2023	69	Common dolphin	11	kept course, maintain speed
R/V Miss Emma McCall	6/7/2023	70	Loggerhead sea turtle	1	kept course, maintain speed
R/V Miss Emma McCall	6/8/2023	72	Common dolphin	9	kept course, maintain speed
R/V Miss Emma McCall	6/8/2023	73	Common dolphin	6	kept course, maintain speed
R/V Miss Emma McCall	6/9/2023	74	Common dolphin	4	kept course, maintain speed
R/V Miss Emma McCall	6/9/2023	75	Common dolphin	13	kept course, maintain speed
R/V Miss Emma McCall	6/9/2023	76	Common dolphin	14	kept course, maintain speed
R/V Miss Emma McCall	6/9/2023	77	Common dolphin	120	kept course, maintain speed
R/V Miss Emma McCall	6/10/2023	80	Common dolphin	3	kept course, maintain speed

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Vessel	Date	Det. number	Species	Num. of animals	Strike avoidance maneuver
R/V Miss Emma McCall	6/10/2023	81	Common dolphin	95	kept course, maintain speed
R/V Miss Emma McCall	6/10/2023	82	Common dolphin	15	kept course, maintain speed
R/V Miss Emma McCall	6/10/2023	83	Common dolphin	90	kept course, maintain speed
R/V Miss Emma McCall	6/10/2023	87	Common dolphin	10	kept course, maintain speed
R/V Miss Emma McCall	6/10/2023	89	Common dolphin	13	kept course, maintain speed
R/V Miss Emma McCall	6/10/2023	91	Common dolphin	80	kept course, maintain speed
R/V Miss Emma McCall	6/10/2023	93	Common dolphin	3	kept course, maintain speed
R/V Miss Emma McCall	6/11/2023	94	Common dolphin	6	kept course, maintain speed
R/V Miss Emma McCall	6/11/2023	95	Common dolphin	4	kept course, maintain speed
R/V Miss Emma McCall	6/11/2023	96	Common dolphin	3	kept course, maintain speed
R/V Miss Emma McCall	6/11/2023	97	Common dolphin	2	kept course, maintain speed
R/V Miss Emma McCall	6/11/2023	98	Common dolphin	55	kept course, maintain speed
R/V Miss Emma McCall	6/11/2023	101	Common dolphin	60	kept course, maintain speed
R/V Miss Emma McCall	6/11/2023	103	Common dolphin	7	kept course, maintain speed
R/V Miss Emma McCall	6/11/2023	99	Fin whale	1	kept course, maintain speed
R/V Miss Emma McCall	6/11/2023	100	Fin whale	4	kept course, maintain speed
R/V Miss Emma McCall	6/12/2023	105	Common dolphin	8	kept course, maintain speed
R/V Miss Emma McCall	6/12/2023	104	Fin whale	2	kept course, maintain speed
R/V Miss Emma McCall	6/14/2023	107	Atlantic spotted dolphin	15	kept course, maintain speed
R/V Miss Emma McCall	6/15/2023	118	Common dolphin	60	kept course, maintain speed
R/V Miss Emma McCall	6/15/2023	108	Common dolphin	20	kept course, maintain speed
R/V Miss Emma McCall	6/15/2023	109	Common dolphin	14	kept course, maintain speed
R/V Miss Emma McCall	6/15/2023	110	Common dolphin	1	kept course, maintain speed
R/V Miss Emma McCall	6/15/2023	112	Common dolphin	30	kept course, maintain speed

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Vessel	Date	Det. number	Species	Num. of animals	Strike avoidance maneuver
R/V Miss Emma McCall	6/15/2023	113	Common dolphin	130	kept course, maintain speed
R/V Miss Emma McCall	6/15/2023	124	Common dolphin	8	kept course, maintain speed
R/V Miss Emma McCall	6/15/2023	114	Fin whale	6	alter course, maintain speed
R/V Miss Emma McCall	6/15/2023	119	Fin whale	2	kept course, maintain speed
R/V Miss Emma McCall	6/16/2023	126	Common dolphin	30	kept course, maintain speed
R/V Miss Emma McCall	6/16/2023	127	Common dolphin	3	kept course, maintain speed
R/V Miss Emma McCall	6/16/2023	128	Common dolphin	12	kept course, maintain speed
R/V Miss Emma McCall	6/16/2023	129	Common dolphin	10	kept course, maintain speed
R/V Miss Emma McCall	6/16/2023	130	Common dolphin	20	kept course, maintain speed
R/V Miss Emma McCall	6/16/2023	131	Common dolphin	12	kept course, maintain speed
R/V Miss Emma McCall	6/16/2023	132	Common dolphin	10	kept course, maintain speed
R/V Miss Emma McCall	6/16/2023	134	Common dolphin	3	kept course, maintain speed
R/V Miss Emma McCall	6/16/2023	138	Common dolphin	2	kept course, maintain speed
R/V Miss Emma McCall	6/16/2023	133	Fin whale	1	alter course, speed reduction
R/V Miss Emma McCall	6/17/2023	143	Common dolphin	15	alter course, maintain speed
R/V Miss Emma McCall	6/17/2023	139	Common dolphin	6	kept course, maintain speed
R/V Miss Emma McCall	6/17/2023	140	Common dolphin	13	kept course, maintain speed
R/V Miss Emma McCall	6/17/2023	141	Common dolphin	20	kept course, maintain speed
R/V Miss Emma McCall	6/17/2023	142	Fin whale	1	alter course, maintain speed
R/V Miss Emma McCall	6/18/2023	144	Common dolphin	8	kept course, maintain speed
R/V Miss Emma McCall	6/18/2023	145	Common dolphin	11	kept course, maintain speed
R/V Miss Emma McCall	6/18/2023	146	Common dolphin	15	kept course, maintain speed
R/V Miss Emma McCall	6/18/2023	148	Common dolphin	8	kept course, maintain speed
R/V Miss Emma McCall	6/18/2023	149	Common dolphin	5	kept course, maintain speed

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Vessel	Date	Det. number	Species	Num. of animals	Strike avoidance maneuver
R/V Miss Emma McCall	6/18/2023	150	Common dolphin	6	kept course, maintain speed
R/V Miss Emma McCall	6/18/2023	151	Common dolphin	6	kept course, maintain speed
R/V Miss Emma McCall	6/18/2023	155	Common dolphin	13	kept course, maintain speed
R/V Miss Emma McCall	6/18/2023	156	Common dolphin	5	kept course, maintain speed
R/V Miss Emma McCall	6/18/2023	158	Common dolphin	22	kept course, maintain speed
R/V Miss Emma McCall	6/18/2023	153	Common dolphin	90	maintain speed
R/V Miss Emma McCall	6/18/2023	154	Fin whale	1	alter course
R/V Miss Emma McCall	6/18/2023	157	Loggerhead sea turtle	1	kept course, maintain speed
R/V Miss Emma McCall	6/19/2023	159	Common dolphin	6	kept course, maintain speed
R/V Miss Emma McCall	6/19/2023	160	Common dolphin	5	kept course, maintain speed
R/V Miss Emma McCall	6/19/2023	162	Common dolphin	35	kept course, maintain speed
R/V Miss Emma McCall	6/19/2023	170	Common dolphin	18	kept course, maintain speed
R/V Miss Emma McCall	6/19/2023	161	Loggerhead sea turtle	1	kept course, maintain speed
R/V Miss Emma McCall	6/19/2023	169	Unidentified whale	6	speed reduction
R/V Miss Emma McCall	6/20/2023	171	Common dolphin	15	kept course, maintain speed
R/V Miss Emma McCall	6/20/2023	172	Common dolphin	16	kept course, maintain speed
R/V Miss Emma McCall	6/20/2023	173	Common dolphin	2	kept course, maintain speed
R/V Miss Emma McCall	6/20/2023	174	Common dolphin	3	kept course, maintain speed
R/V Miss Emma McCall	6/20/2023	175	Common dolphin	20	kept course, maintain speed

7 SUMMARY

7.1 Interpretation of the Results

All the marine mammal and sea turtle species that were detected during the geophysical survey were species that occur commonly in the region and that are regularly observed by PSOs during HRG survey operations. Each species detected was observed within its predicted range with no species encounters occurring outside of that species normal range.

For all species groups, the mean distance at initial detection and at the CPA was greater when the sparker was active and during many detection events animals were observed to change their direction of travel, but it is not possible from this data to determine whether the animals were reacting to the vessel, to the sparker or to another environmental or behavioral factor. No behaviors were observed during any encounter that suggested that a protected species was exhibiting an adverse reaction to survey activities.

7.2 Effectiveness of all monitoring tasks

To minimize the potential impacts to marine mammals and sea turtles, PSOs onboard the *R/V Miss Emma McCall* were prepared to implement mitigation measures whenever protected species were detected approaching, entering, or within the designated mitigation zones. Mitigation actions for the sparker were implemented successfully during 69 detection events consisting of two delays to activation, and 67 shutdowns which resulted in 75 hours and 44 minutes of mitigation down time. PSOs searched the mitigation zones prior to activation of the sparker or deployment / retrieval of the sparker and survey crew confirmed that applicable zones were clear prior to sparker operations.

Strike avoidance maneuvering was conducted 112 times to prevent potential physical interactions between the survey vessels and marine mammals. In each case the maneuvers were executed as necessary - PSOs detected the animals in sufficient time to alert the vessel of the need for maneuvering and maneuvering was carried out successfully to avoid physical impacts to the animals. In 102 of the cases speed and heading of the vessel were maintained, in the remaining 10 cases, either speed or course or both were changed to maintain a separation distance from the protected species.

If a NARW was sighted during the survey program, separation distances were maintained. Photographs were to be taken of the whales and reported to the NMFS advisory hotline as outlined in the Attentive Energy EMP. There were no sightings of NARWs during the survey.

If a dead or injured protected species was discovered during the survey program, 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 sightings of dead or injured protected species during the survey period.
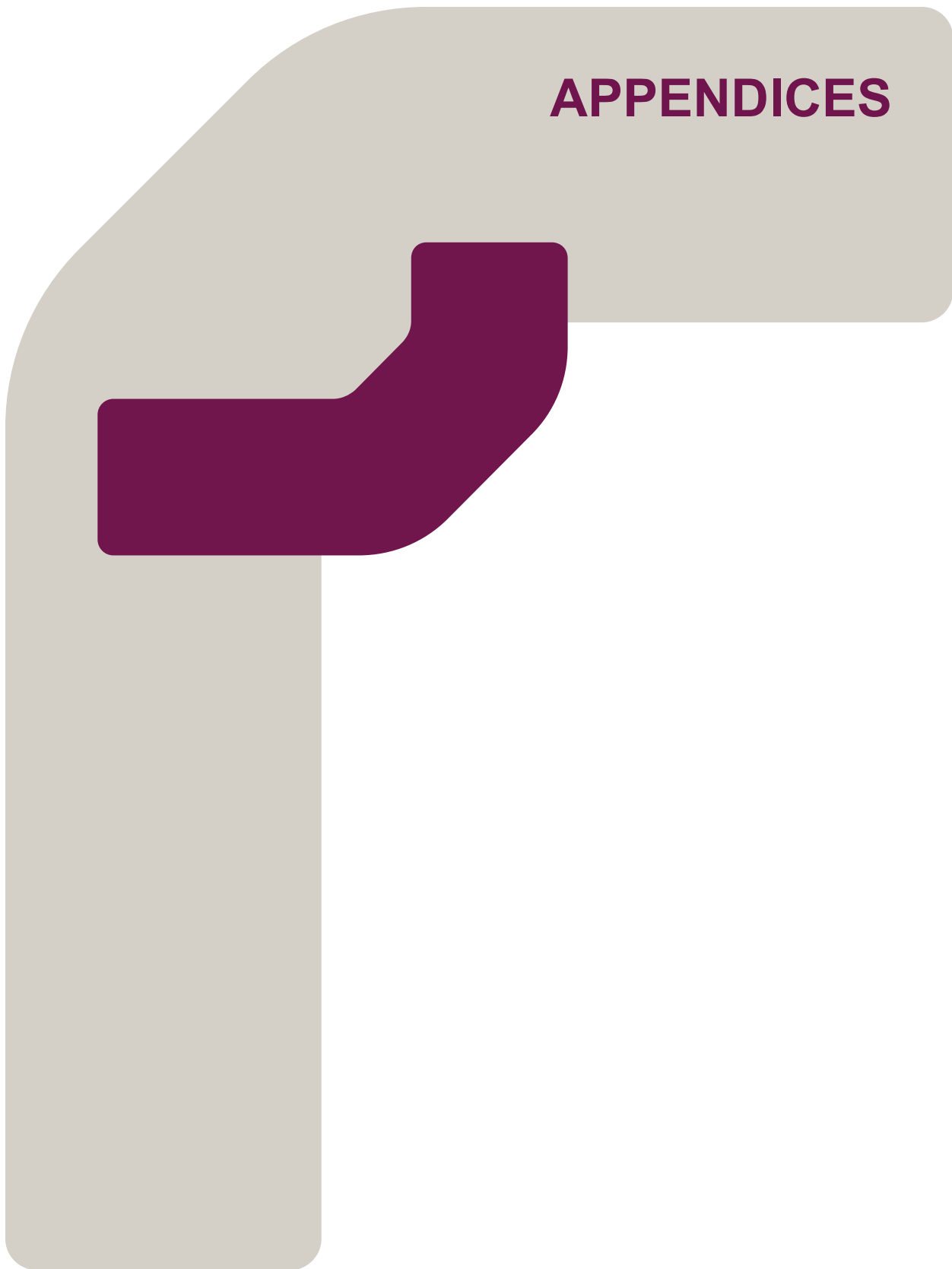
Visual observations yielded a total 175 protected species detections both inside and outside the Lease Area and included marine mammals and sea turtles. While it is likely that PSOs did not identify all the animals present in the area around the vessel, it is unlikely that protected species were not detected inside the mitigation zones since the radii were relatively small and PSOs were equipped with multiple tools to augment the efficacy of the monitoring. The environmental conditions present during visual and acoustic monitoring were generally good for detecting protected species, especially inside the mitigation zones.

The NMFS issued 2022 IHA for Attentive Energy authorized a total of 386 individual marine mammals from 15 species for Level B takes. During the previously reported 2022 survey activities, a total of 99 protected species were observed within the predicted Level B harassment radius from the sparker while it was operating. During the 2023 survey activities under the 2022 IHA an additional 192 protected species were observed within the predicted Level B harassment radius. Collectively, this total represents 78% of the authorized Level B takes for the survey program.

The combination of conservative 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 and PDC/BMP stipulations appear to have been an effective means to protect the marine species encountered during survey operations. Furthermore, towards the end of the campaign phase depicted in this report, Attentive Energy proactively extended the mitigation zones for whales other than NARW and for common dolphins and unidentified dolphins to 200 m to ensure shutdowns could occur before these species entered the zone of influence. Following this, shutdowns of the sparker were implemented during 13 detections of common dolphins consisting of 306 individuals before the animals entered the zone of influence.

APPENDICES

Appendix A : BOEM Lease OCS-A 0538 and NMFS 2022 IHA

Appendix B : Environmental Management Plans

Appendix C : Protected Species Observers and Passive Acoustic Monitors Onboard

Appendix D : Reticle Binoculars Calibration Tables

Appendix E: Night Vision Equipment Specifications

Appendix F: Passive Acoustic Monitoring (PAM) Deployment

Appendix G : Complete Survey Datasheets and Tracklines

Appendix H : Protected Species Distribution Maps

Appendix I: Photographs of Identified Protected Species Visually Detected During the Survey

Appendix J : Screenshots of the Acoustic Detections of Protected Species Observed During the Survey