ATLANTIC SHORES OFFSHORE WIND GEOPHYSICAL SURVEY PROTECTED SPECIES OBSERVER REPORT

Prepared for: Fugro on behalf of Atlantic Shores Offshore Wind

Interim Report
December 15, 2020

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BOEM Lease No.: OCS-A-0499
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Contents

Tables

Figures

Appendices

List of Acronyms

ASOW- Atlantic Shores Offshore Wind

BOEM – Bureau of Ocean Energy Management

BZ – Buffer zone

CPA- Closest point of approach

COP – Construction and Operations Plan

dB - decibel

DMA – Dynamic Management Area

DSLR – Digital Single Lens Reflex

ECR – Export Cable Route

EMP- Environmental Management Plan

EOL – End of line

EPU – Electronic processing unit

EZ – Exclusion zone

ESA - Endangered Species Act

G&G – Geophysical and geotechnical

GPS – Global Positioning System

GRAD - Gradiometer

HF – High frequency

HRG- High resolution geophysical

IHA- Incidental Harassment Authorization

IR- Infrared

kHz- Kilohertz

km - Kilometer

LF – Low Frequency

LLC- Limited Liability Corporation

MAG - Magnetometer

MBES – Multibeam Echo Sounder

MUHRS – Multi Channel Ultra High Resolution Seismic

M/V – Marine Vessel

NARW – North Atlantic Right Whale

NJ- New Jersey

m - Meter

NM – Nautical Miles

NMFS- National Marine Fisheries Service

NOAA- National Oceanographic and Atmospheric Administration

NVD- Night-vision device

OCS – Outer Continental Shelf

PAM – Passive Acoustic Monitoring

PSO – Protected Species Observer

Rms – root mean square

SAP- Site Assessment Plan

SBP – Sub Bottom Profiler

SOL – Start of line

SSS – Side Scan Sonar

SUHRS – Single Channel Ultra High Resolution Seismic

TOAD - Time-of-Arrival-Distance

TVG- Transverse gradiometer

USB – Universal serial bus

USBL – Ultra Short Baseline

USFWS - United States Fish and Wildlife Service

1 EXECUTIVE SUMMARY

This is the interim report for the Atlantic Shores 2020 Offshore Windfarm High Resolution Geophysical (HRG) Survey, which was conducted within state and federal waters off the coast of New Jersey (NJ), by Atlantic Shores Offshores Wind LLC, the offshore engineering, procurement, and construction contractor for the project. High resolution geophysical survey data acquisition was conducted by Fugro on behalf of Atlantic Shores within the parameters defined in the Atlantic Shore Offshore Windfarm (ASOW) 2020 Survey Plan. Survey acquisition were undertaken by three survey vessels (*Fugro Brasilis, Fugro Enterprise,* and *Splash)* in the renewable energy lease OCS-A 0499. Protected species monitoring was conducted in accordance with Bureau of Ocean Energy Management (BOEM) and National Marine Fisheries Service (NMFS) standards, as well as Geophysical Survey Plan Approval Conditions for Lease Outer Continental Shelf (OCS)-A 0499.

Fugro acquired geophysical data within Lease Area OCS-A 0499 utilizing multibeam echo sounder (MBES) bathymetry and backscatter, high-frequency side scan sonar (SSS), sub-bottom profiler (SBP), magnetometers (MAG) arranged in a gradiometer (GRAD) array, and multichannel and single channel ultra-high-resolution seismic (MUHRS & SUHRS) along all primary track lines. Protected species monitoring and mitigation measures, as outlined in the NMFS Incidental Harassment Authorization (IHA) and the BOEM OCS-A 0499 lease conditions were required for equipment operating below 200 kilohertz (kHz).

Six protected species observers (PSOs) and Passive Acoustic Monitoring (PAM) Operators, provided by RPS were on board the *Fugro Brasilis* and *Fugro Enterprise* to undertake visual and acoustic observations and implement mitigation protocols in accordance with the requirements in the IHA and the BOEM OCS A 0499 lease conditions. There were two protected species observers onboard the *Splash* that conducted daytime only survey operations. Mitigation protocols for this survey included establishment of buffer zones (BZ) and exclusion zones (EZ) around the low-frequency (LF) sound sources, implementation of delay to initiation of and shutdowns of active LF sound sources, and strike avoidance maneuvering for marine mammals and other protected species including sea turtles.

This is interim report covers the period of time from the start of survey operations through 31 October 2020 operations where operations are still ongoing to date. A final report will be prepared upon conclusion of survey activities. Visual observations were conducted by PSOs for a total of 5561 hours and 30 minutes. Acoustic monitoring was conducted by PAM operators for 1425 hours and 28 minutes during periods of reduced visibility including nighttime on the vessels undertaking 24-hour survey operations.

A total of 223 detection events of protected species were made during the survey: 203 visual sightings, 19 acoustic detections and one event that consisted of a correlated visual and acoustic detection of the animals. Visual detections of cetaceans consisted of four delphinid species and three whale species. Whale species observed included fin whales (*Balaenoptera physalus*), sei whales (*Balaenoptera borealis*), and humpback whales (*Megaptera novaeangliae*). Delphinids observed included an Atlantic white-sided dolphin (*Lagenorhynchus acutus*) common dolphins (*Delphinus delphis*), bottlenose dolphins (*Tursiops truncatus*) and a Risso's dolphin (*Grampus griseus*). There were also additional unidentified whales and unidentified delphinids observed.

There were 73 sightings made of sea turtles that included leatherback sea turtles (*Dermochelys coriacea*), loggerhead sea turtles (*Caretta caretta)* and a green sea turtle (*Chelonia mydas*). Additional unidentified shelled sea turtles were also observed.

There were sightings made of an injured marine mammal and an entangled sea turtle. In each sighting event, the animal was observed to be injured or in distress, but there were no indications that the ASOW survey activities had caused or contributed to the injury or entanglement of the animal and the events were reported to NMFS and BOEM as described further in this report and as required by the Lease and IHA.

In accordance with stipulations set forth in BOEM Lease OCS-A 0521 and the NMFS IHA conditions, a total of 35 mitigation actions were implemented for the HRG sound sources including shutdowns of the acoustic sources (34 times) and delays to activation of the acoustic sources (one time). On five occasions strike avoidance maneuvers were executed during protected species detections, three times for leatherback sea turtles, once for an unidentified whale and once for a loggerhead sea turtle.

NMFS issued an IHA authorizing 9,937 level B takes for 15 species of marine mammals, including seven whale species, five delphinids, two pinniped species and one porpoise species. No level A takes were authorized for any species.

A total of 161 marine mammals from three species were observed within the predicted 160 decibel radius (where there is a potential for a behavioral response) while an HRG source was active, constituting potential Level B takes so far during the survey. Potential level B takes included two humpback whales, 148 bottlenose dolphins, and six common dolphins. An additional five unidentified dolphins were observed inside the predicted level B take zone but that could not be identified to species level.

2 INTRODUCTION

Atlantic Shores Offshore Wind Geophysical Survey selected Fugro to conduct a geophysical survey in the Atlantic Shores Lease Area. The geophysical survey was conducted off the coast of NJ on the Outer Continental Shelf (OCS-A 0499). This is interim report covers the period of time from the start of survey operations through 31 October 2020 operations where operations are still ongoing to date. A final report will be prepared upon conclusion of survey activities.

The objectives for this survey required for survey acquisition to be undertaken in three areas: the offshore Lease Area (Figure 1), and the export cable route (ECR) areas, Cardiff (Figure 2) and the Larrabee (Figure 3).

The HRG survey was acquired by the *Fugro Enterprise*, with some lines acquired by the *Fugro Brasilis*, and it was comprised of 150 MUHRS main lines with a length of 2,097 km with a space of 150 meters between lines; 480 SUHRS main lines with a length of 6,731 km and a spacing of 30 meters between lines, and 58 MUHRS tie lines with a length of 1,597 km, and a space of 500 meters between lines.

The Cardiff ECR survey was acquired by the *Fugro Enterprise (WD>10m) and Aqueos Splash (WD <10m)* and it was comprised of 194 SUHRS main lines with a length of 794 km, a spacing of 15/30 meters between lines, and 39 SUHRS tie lines with a length of 55 km, and a spacing of 500 meters between lines. The Larrabee ECR survey was acquired by the *Fugro Enterprise (WD>10m) and Aqueos Splash (WD <10m)* and it was comprised of 292 SUHRS main lines with a length of 2,115 km, and a spacing of 15/30 meters between lines, and 96 SUHRS tie lines with a length of 148 km, and a spacing of 500 meters between lines.

The shallow-water (WD<10m) nearshore portion of the ECR survey was conducted by the survey vessel *Splash* and survey operations with the low-frequency sources were only undertaken during day light hours.

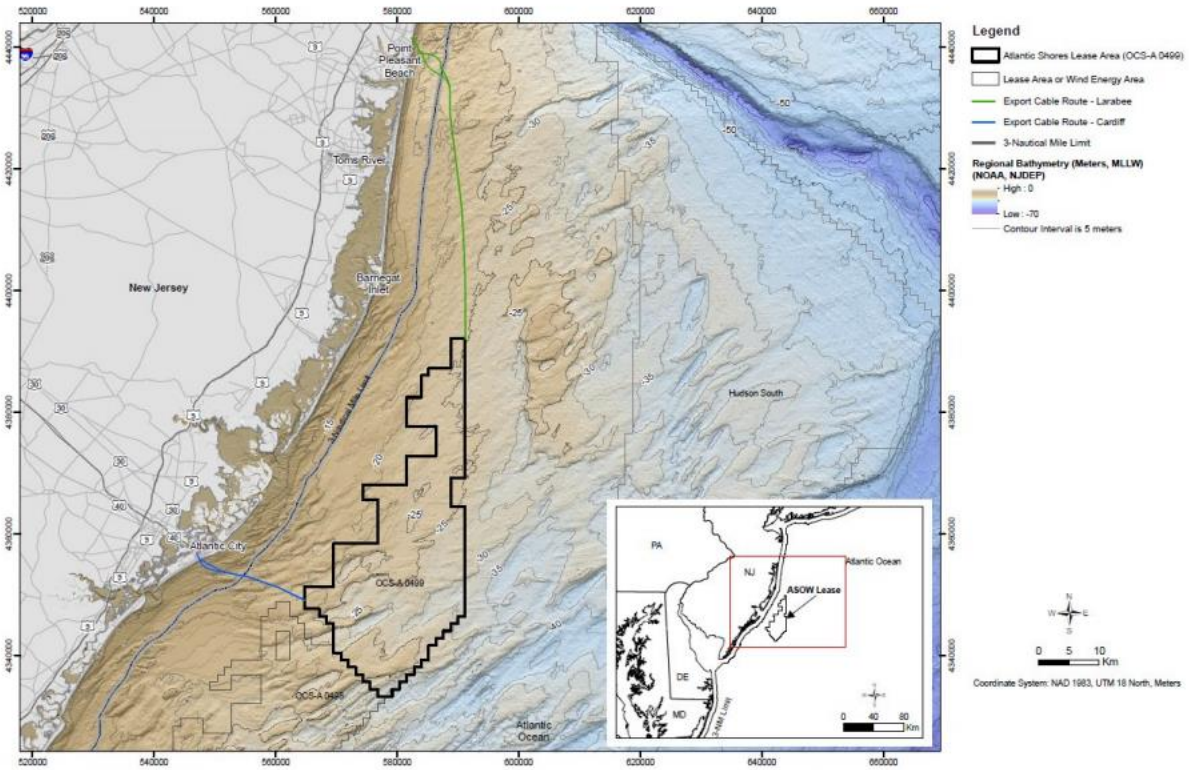

Figure 1: ASOW 2020 survey areas in the BOEM lease (OCS - A 0499)

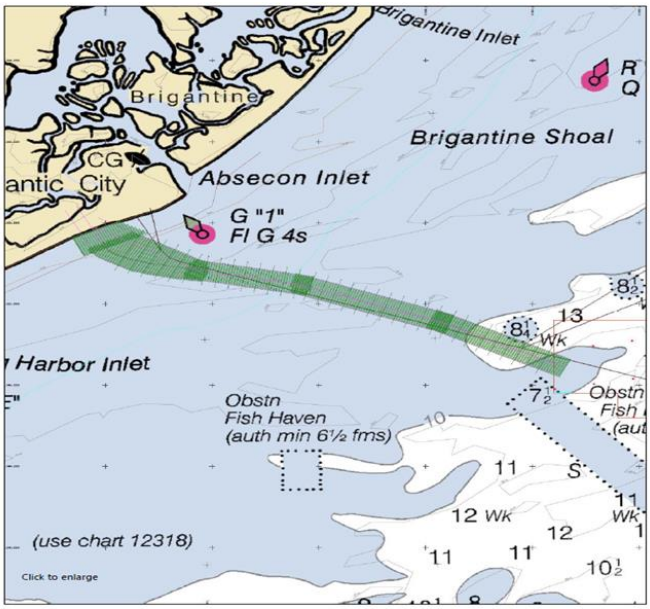

Figure 2: Cardiff ECR survey area

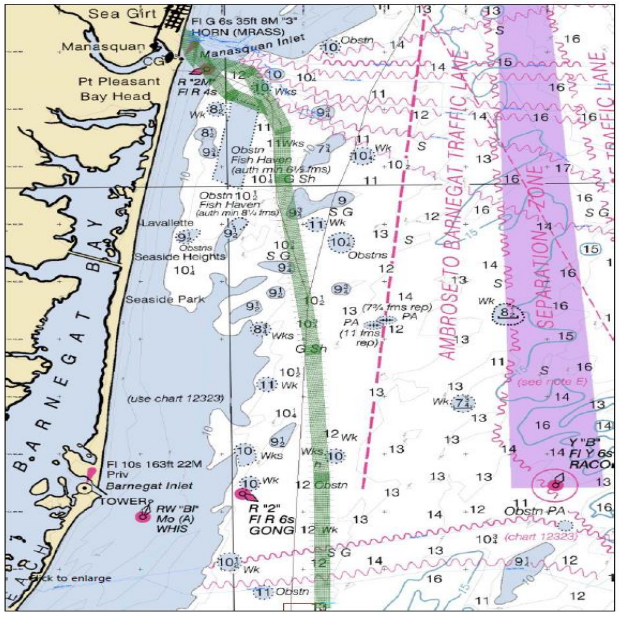

Figure 3: Larrabee ECR survey area

NMFS and BOEM have advised that sound-producing survey equipment operating in the hearing range of marine species (less than 200 kHz) has the potential to cause acoustic harassment to marine mammals. Protected species monitoring was conducted in accordance with BOEM and NMFS standards, as well as the Atlantic Shores Geophysical and Geotechnical (G&G) 2020 Survey Plan.

The survey company conducting operations, Fugro, was responsible for contracting Protected PSOs and PAM Operators through a third-party provider to conduct monitoring and mitigation for protected species, including marine mammals, sea turtles, and Atlantic sturgeon, during their activities where RPS was contracted to fulfill this scope of work. Monitoring and mitigation procedures that were implemented during the 2020 surveys are described in Section 4 of this report.

2.1 BOEM Reporting Requirements

This interim report summarizes the information required by the BOEM Lease OCS-A 0499 and the IHA identified in Table 1. A copy of the BOEM Lease OCS-A 0499 and the NMFS IHA are located in Appendix A.

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

Table 1: BOEM reporting requirements per BOEM Lease OCS 0499 and the NMFS IHA location within this technical report

Required Content	Source Reference	Location Addressed in Technical Report
The Lessee must ensure that sightings of any dead or injured protected species (e.g., marine mammals, sea turtles, or sturgeon) are reported to the Lessor, NMFS, and the NMFS Greater Atlantic (Northeast) Region's Stranding Hotline (866-755-6622) within 24 hours of sighting, regardless of whether the injury is caused by a vessel. In addition, if the injury or death was caused by a collision with a project-related vessel, the Lessee notify the Lessor of the strike within 24 hours. The Lessee must use the form included as Appendix A to Addendum "C" to report the sighting or incident. If the Lessee's activity is responsible for the injury or death, the Lessee must ensure the vessel assist in any salvage effort as requested by NMFS.	BOEM Lease Section 4.5.1	Section 6.4.5
The Lessee must report any observed takes of listed marine mammals, sea turtles, or sturgeon resulting in injury or mortality within 24 hours to the Lessor and NMFS	BOEM Lease Section 4.5.2.1	Section 6.4.3
The Lessee must report any observations concerning any impacts on Endangered Species Act listed marine mammals, sea turtles or sturgeon to the Lessor and NMFS Northeast Region's Stranding Hotline within 48 Hours.	BOEM Lease Section 4.5.2.2	Section 6.4.5
The Lessee must ensure that the protected species observers record all observations of protected species using standard marine mammal observer data collection protocols. The required elements are Vessel name, Observers' name and affiliations, date, time and latitude/longitude when daily visual survey began, time and latitude/longitude when daily visual survey ended, Average environmental conditions (wind speed, wind direction, sea state, swell, overall visibility), species, certainty of identification, total number of animals, number of juveniles, characteristic description, direction of animal's travel relative to the vessel, behavior of animals, and activity of vessel when sighting occurred.	BOEM Lease Section 4.5.3	Section 6
Each report must include a summary of survey activities.	BOEM Lease Section 4.5.4	Section 6.1
Each report must include a summary of all protected species observers	BOEM Lease Section 4.5.4	Appendix C
Each report must include an estimate of the number of listed marine mammals and sea turtles observed and/or taken during these activities.	BOEM Lease Section 4.5.4	Section 6.4, 6.4.3, and 6.5

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)	To be provided upon completion of the survey activities under the IHA
PSO datasheets or raw sightings data must also be provided with the draft and final monitoring report.	NMFS IHA Section 6 (a)	Appendix I
If a North Atlantic right whale is observed at any time by PSOs or personnel on any project vessels, during surveys or during vessel transit, Atlantic Shores 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 (b) (i)	Section 6.4.4
In the event that personnel involved in the survey activities covered by the authorization discover an injured or dead marine mammal, Atlantic Shores must report the incident to the 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. The report must include the following information: Time, date, location, species identification or description of the animal, condition of the animal(s), observed behaviors (if alive), photographs or video footage, and general circumstances under with the animal(s) was discovered.	NMFS IHA Section 6 (c) (i)	Section 6.4.5
In the event of a vessel strike of a marine mammal by any vessel involved in the activities covered by the authorization, the Atlantic Shores 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. The report must include the following information: Time, date, location, species identification or description of the animal(s), vessel's speed during and leading up to the incident, vessel's course/heading and what operations were being conducted, status of all sound sources in use, description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken to avoid strike, environmental conditions, estimated size and length of animal that was struck, description of behavior of the marine mammal immediately preceding and following the strike, estimated fate of the animal and photographs or video footage.	NMFS IHA Section 6 (c) (ii)	Section 6.4.5

3 PROGRAM OVERVIEW

Atlantic Shores contracted Fugro to conduct an HRG survey of renewable Energy Lease Number OCS-A 0499 and proposed ECRs commencing April 2020 off the coast of New Jersey. The data collected will inform Atlantic Shore's technical design envelope planning and be used to support the information requirements for a Construction and Operations Plan (COP) for Energy Lease Number OCS-A 0499. The HRG surveys as described below will support the preliminary characterization of seabed conditions:

- Bathymetry (multibeam depth sounder) to determine water depths and general bottom topography;
- Magnetic intensity measurements (gradiometer) for detecting local variations in regional magnetic field from geological strata and potential ferrous objects on and below the bottom;
- Seafloor imaging (side-scan sonar survey) for seabed sediment classification purposes, to identify natural and man-made acoustic targets resting on the bottom as well as any anomalous features;
- Shallow penetration sub-bottom profiler to map the near surface stratigraphy (top zero to 5 m soils below seabed); and
- Medium penetration sub-bottom profiler (Sparker and Single channel/Multi-channel streamer) to map deeper subsurface stratigraphy as needed (soils down to 75 m to 100 m below seabed).

The export cable route survey activities conducted to support the preliminary characterization of seabed conditions are:

- Bathymetry (multibeam depth sounder) to determine water depths and general bottom topography;
- Magnetic intensity measurements (gradiometer) for detecting local variations in regional magnetic field from geological strata and potential ferrous objects on and below the bottom;
- Seafloor imaging (side-scan sonar survey) for seabed sediment classification purposes, to identify natural and man-made acoustic targets resting on the bottom as well as any anomalous features;
- Shallow penetration sub-bottom profiler (pinger /chirp) to map the near surface stratigraphy (top zero to 5 m soils below seabed); and
- Medium penetration sub-bottom profiler (Sparker and Single channel/Multi-channel streamer) to map deeper subsurface stratigraphy as needed (soils down to 15 m below seabed).

The *Fugro Brasilis* conducted data acquisition for the survey from 03 May to 21 July 2020, before handing over operations within the lease area to the *Fugro Enterprise*. The *Fugro Enterprise* started data acquisition within the ECR corridors on 13 May 2020 and concluded ECR acquisition on 08 July 2020. Both the *Fugro Brasilis* and *Fugro Enterprise* transited to and from Atlantic City and Elizabeth, NJ. The *Splash* began acquisition 25 June 2020. The crew mobilized each day from Atlantic City and concluded operations 22 August 2020. This reporting period covers operations and data collection from the beginning of the survey until 31 October 2020.

Each vessel's dates of HRG 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 ASOW HRG Survey

Vessel Name	Dates on Project
Fugro Brasilis	15 April – 21 July 2020
Fugro Enterprise	04 May – Ongoing*
Splash	18 June – 24 August 2020

**Fugro Enterprise* is still conducting survey operations in the ASOW HRG Survey.

Table 3: Summary of key survey events by vessel on the ASOW HRG Survey

Event	*Fugro Brasilis*	*Fugro Enterprise*	*Splash*
PSO team mobilizes	15 April 2020	04 May 2020	18 June 2020
Kick-off meetings	20 April 2020	06 May 2020	25 June 3030
Vessel departs dock. PSO effort begins.	21 April 2020	11 May 2020	25 June 2020
Data acquisition complete.	20 July 2020	Ongoing*	23 August 2020
PSO monitoring complete	21 July 2020	Ongoing*	24 August 2020

**Fugro Enterprise* has not completed data acquisition for this survey

3.1 Vessel and Geophysical Equipment Specifications

The ASOW HRG Survey was undertaken by the *Fugro Brasilis, Fugro Enterprise* and *Splash*. Specifications of each vessel are provided in Table 4 and photos of each vessel are included in Appendix D.

Table 4: Vessel specifications

Vessel Name	Length	Speed	Vessel Configuration description
Fugro Brasilis	65 m	10 knots (Transit) 3–5 knots (Survey)	Multi-role survey vessel for coastal and offshore survey areas
Fugro Enterprise	52 m	10 knots (Transit) 3-5 knots (Survey)	Multi-role survey vessel for coastal and offshore survey areas
Splash	27.4 m	Less than 10 knots (Transit) 3-5 knots (Survey)	Shallow draft multi-role survey vessel for inland waters and shallow coastal zones

3.2 Summary of Geophysical Survey Equipment Used

The survey equipment operated on each vessel is summarized in Table 5. Low-frequency sources (operating below 200 kHz), for which monitoring, and mitigation were conducted in order to minimize potential impacts to protected species, are hereafter referred to as the regulated sound sources. 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 ASOW Survey.

Fugro Brasilis	
Energy Source	**Frequency/Energy Specifications**
Multibeam Echo Sounder	400kHz
Side Scan Sonar	300/600 kHz (600 kHz primary)
High Resolution Sub-Bottom Profiler	10 kHz
Medium Penetrating Dual Seismic Sparker	.2 to 4 kHz
Fugro Enterprise	
Energy Source	**Frequency/Energy Specifications**
Multibeam Echo Sounder	400kHz
Side Scan Sonar	300/600 kHz (600kHz primary)
High Resolution Sub-Bottom Profiler	10 kHz
Medium Penetrating Dual Seismic Sparker	0.2 to 4 kHz
Splash	
Energy Source	**Frequency/Energy Specifications**
Multibeam Echo Sounder	400 kHz
Side Scan Sonar	300/600 kHz (600 kHz primary)
High Resolution Sub-Bottom Profiler	10 kHz
Medium Penetrating Dual Seismic Sparker	0.2 to 4 kHz

4 MITIGATION AND MONITORING METHODS

The PSO monitoring programs on the *Fugro Brasilis, Fugro Enterprise and Splash* were established to meet the standards approved by BOEM in the Geophysical Survey Plan. 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.

Fugro Brasilis* and *Fugro Enterprise

- 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 at night and during other periods of reduced visibility to augment visual observations and provide additional marine mammal detection data.
- Species-specific exclusion zones (EZs) were established around the regulated HRG sound sources where delays to initiation and shutdowns of active sources were implemented when protected species were detected inside.

Splash

- Visual observations were conducted daily to provide real-time sighting data, allowing for the implementation of mitigation procedures as necessary.
- Species-specific buffer zones (BZs) exclusion zones (EZs) were established around the regulated HRG sound sources where delays to initiation and shutdowns of active sources were implemented when protected species were detected inside.

The EMP may be found in Appendix B.

4.1 Monitoring: Protected Species Observers and PAM Operators

There were trained and experienced PSOs and PAM Operators on board each survey vessel during survey 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 BOEM in Lease stipulations and by NMFS. NMFS issued approval notifications for each PSO to deployed on an offshore wind farm and BOEM were required to review and approve each PSO prior to their deployment as an observer on the ASOW Lease. BOEM and NMFS 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.

The PSO Provider was responsible for the provision of training certifications, NMFS approval notifications and CVs to be reviewed and approved by ASOW and BOEM prior to deployment on the vessel.

The Provider was responsible for providing the PSOs with vessel-specific and survey contractor-specific training, and environmental project inductions specific to ASOW. These were provided by RPS, Fugro and ASOW during project kick-off meetings, conducted prior to the start of survey operations and prior to scheduled crew changes.

All PSOs and PAM Operators who were deployed during the ASOW geophysical survey operations are listed in Appendix C.

4.2 Visual Monitoring: Protocols and Methods

A team of PSOs or dual role PSO/PAM were deployed on each survey vessel in sufficient numbers to meeting 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 LF sound source operations conducted by the vessel. Visual monitoring was also conducted during all periods between LF sound source 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 Lease and IHA (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 each vessel were selected to maximize and consideration of the following factors:

1. To afford PSOs a 360-degree viewpoint around the vessel and acoustic sources, such that the EZs around the sound sources 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 LF 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 BZs 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 each survey vessel

	Vessel		
	Fugro Brasilis	***Fugro Enterprise***	***Splash***
# of PSOs on Watch - Day	1	1	1
Visual monitoring equipment- Day	Reticle binoculars 7x50 & 10x50 magnification	Reticle binoculars 10x50 & 7x50 magnification	Reticle binoculars 7x & 10x magnification
LF Source Operations Conducted at Night	Yes	Yes	No Vessel docked at night
Passive Acoustic Monitoring	Yes Seiche 6H system	Yes Seiche 6H system	No
# of PSOs on Watch at Night	2	2	N/A
Visual monitoring equipment- Night	Night Vision Goggles and Infrared Thermal Scopes	Night Vision Goggles and Infrared Thermal Scopes	N/A
Range Estimation	Calibrated Reticle Binoculars	Calibrated Reticle Binoculars	Calibrated Reticle Binoculars
Primary Monitoring Location	Bridge wings Bridge	Bridge wings Bridge	Front or back deck

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 acoustic source 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 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 E.

4.2.2 Nighttime and Reduced Visibility Visual Observations

Fugro Brasilis* and *Fugro Enterprise

Two PSOs conducted visual monitoring during all nighttime operations, whenever the vessel was not in port or at anchor. If visibility became reduced (largest EZ was not fully visible). PSOs on the *Fugro Enterprise* and *Fugro Brasilis* 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 F.

Splash

No equipment was utilized to augment visual monitoring during periods of reduced visibility during the daytime. During periods of reduced visibility when EZs were obscured to a sufficient degree to prevent the PSOs from being confident in their ability to detect protected species inside those respective EZs, LF sound source operations were disabled. The *Splash* did not conduct any nighttime LF source operations.

4.3 Monitoring: Passive Acoustic Monitoring Protocols and Methods

Passive Acoustic Monitoring (PAM) was used 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 survey lab onboard the *Fugro Enterprise* and the *Fugro Brasilis*, which provided space for the system, allowed for quick communication with the visual PSOs and HRG equipment operators, and provided access to the vessel's instrumentation screens. Information about the vessel (e.g. position, heading, and speed), water depth, geotechnical 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 sperm whale clicks and baleen whale vocalizations, could be visualized in PAMGuard's

spectrogram modules. Odontocete clicks could also be 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, could be 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 could be utilized to attempt localizing the position and range of vocalizing marine mammals. Sound recordings could be 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 *Fugro Brasilis* and *Fugro Enterprise*. The system was developed by Seiche Measurements Limited and 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 4 is a simplified depiction of the PAM system installed on the vessels.

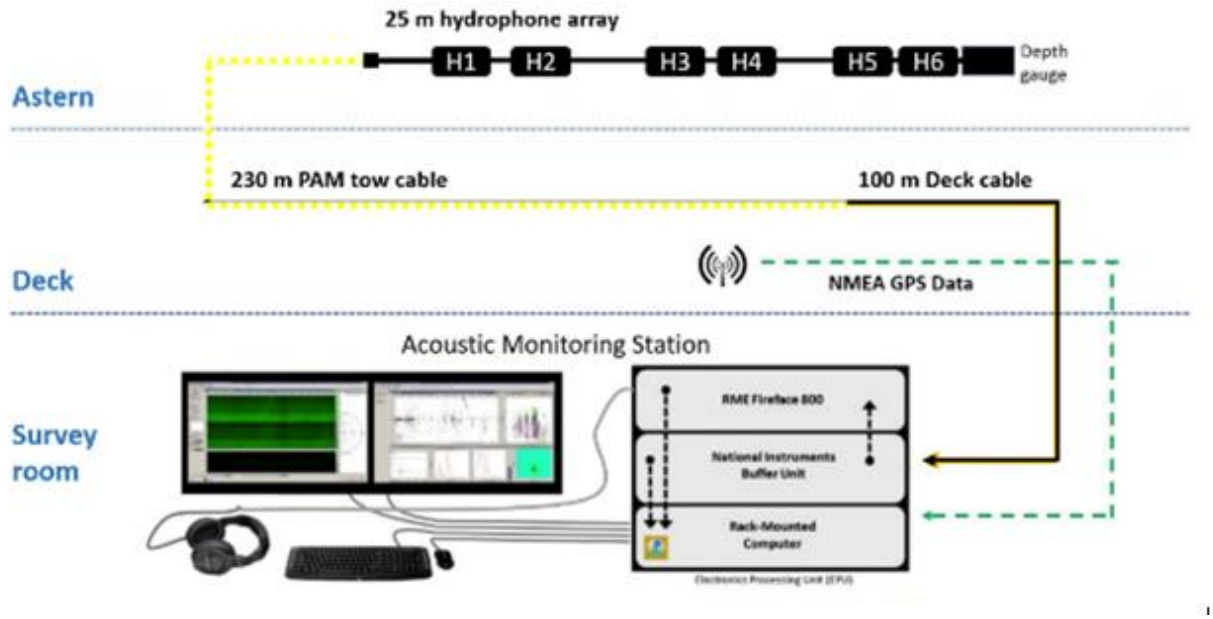

Figure 4: Simplified pathway of data through the PAM system installed

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 5). 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 each vessel.

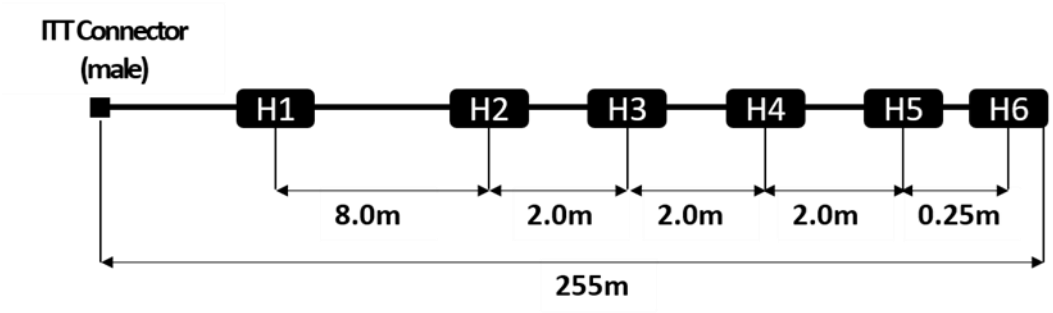

Figure 5: Diagram of hydrophone element separation

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 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 (DAQ) 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 *Fugro Brasilis,* the hydrophone cable was deployed manually from the starboard stern of the vessel. The deck cable was installed along the back deck running from the starboard to the vessel's survey room, where it was fed through a penetration point in the bulkhead to the main survey room where the PAM system was installed and monitored. When deployed, the array section was approximately 80 meters from the starboard stern of the vessel.

On the *Fugro Enterprise*, the hydrophone cable was deployed manually from the starboard quarter of the vessel. The deck cable was installed along the back deck running from the starboard quarter to the vessel's workshop where it was fed through a penetration point in the bulkhead and through a floor panel into an office adjacent to the main survey room where the PAM system was installed and monitored. Three foam cylinders were attached to the tow cable to provide additional buoyancy and assist in

reducing the risk of entanglement with other towed equipment. When deployed, the array cable was approximately 95 meters astern from the starboard quarter of the vessel.

PAM system specifications for the *Fugro Brasilis* and *Fugro Enterprise* and a more detailed description of the hydrophone deployment methods on both boats can be found in Appendix G.

4.4 Monitoring: Data Collection

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, geotechnical 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.

4.4.1 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.

4.4.2 Methods of Cross-Vessel Detection Coordination

Protected species detections were communicated to other ships on the project by email and by portable device messenger applications. RPS project managers coordinated these communications between vessel teams and monitored them in real time throughout the project, assisting in disseminating the information when necessary.

4.4.3 North Atlantic Right Whale 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 *Fugro Brasilis, Fugro Enterprise and Splash* was established to meet the BOEM Lease (OCS A-0499) 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 active sound sources 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 H.

4.5.1 Mitigation Zones

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

Establishment of Buffer zone (BZs) around the geophysical equipment during search periods prior to activation of the LF HRG equipment:

- 200 m BZ: All marine mammals
- BZ is not applicable when the Exclusion Zone (EZ) is greater than 100 m
- 370 m: Level B harassment zone for marine mammals (delays to initiation of the LF sound sources 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
- 100 meters: All other marine mammals with the exception of voluntarily approaching delphinids
- 50 meters: Sea turtles
- 370 m: Level B harassment zone for marine mammals (shutdowns of the active LF sound sources 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
- 100 meters: Non-delphinoid cetaceans (baleen whales, beaked whales, sperm whales)
- 50 meters: Delphinoid Cetaceans, 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 geophysical operations.

Delays to the initiation of the sound sources 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 small cetaceans (porpoises and dolphins), pinnipeds
  - 30 minutes for large whales including NARW
  - 60 minutes for sea turtles

Shut down of the survey equipment operating below 200kHz is required for any marine protected species sighted at or within its EZ. The vessel operator must comply immediately with any shutdown request made by a PSO or PAM Operator. Any discussion can occur only after the shutdown has been implemented. Once the operation had been shut down for a protected species detection, operations would not resume until a specific had passed following the last detection of the animal(s) or once the animal had exited the EZ: 15 minutes for porpoises, dolphins and pinnipeds, 30 minutes for large whales including NARW, and 60 minutes for sea turtles. If delphinids voluntarily approach the vessel (e.g. to bow ride) when the sound sources are at full operating power, those sources can continue to operate; a shutdown is not required. The determination of whether the animal has “voluntarily” approached will be made by the PSO on watch.

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

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 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 would also prepare a written report in accordance with NMFS standard reporting guidelines and using the template provided by BOEM in the lease, which would be submitted to ASOW for submittal to the agencies.

4.6.2 NARW Sightings

Reporting of NARW sightings to external monitoring resources was conducted voluntarily as requested and approved by Atlantic Shores and Fugro.

PSOs were to use the following applications to report any NARW sightings made during survey operations as described below:

1. To the RPS PSO Project Manager who would inform the ASOW Permitting Team.
2. PSOs would then prepare a sighting report including a description of the detection event including date, time, distance to vessel, vessel and geophysical equipment activity, observed behaviors and any photographs or screenshots taken during the sighting.

4.6.3 Final Report

RPS have prepared this Interim Technical Report to be consistent with the BOEM lease and NMFS IHA 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 DATA RECORDS AND ANALYSIS METHODS

5.1 Operation Activity

PSOs and PAM operators collected the regulated HRG equipment's operational status each day that they were deployed on the vessel.

All 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 due to mitigation actions. These entries were made for each regulated source or for combinations of regulated sources (for example, sub-bottom profiler and sparker).

5.2 Monitoring Effort

PSOs and PAM operators 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. Where the monitoring effort entry did not also indicate the source status for that monitoring period, source data was cross referenced during analysis to calculate the duration of monitoring conducted while regulated sources were on and off.

Visual monitoring while the acoustic source 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

Each PSO monitoring effort data form included environmental conditions present during that watch period. Environmental variables were recorded every 30 to 60 minutes or when conditions changed.

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

Table 7: Beaufort sea state scales

Beaufort number	Description	Wave height	Sea conditions
0	Calm	0 m	Sea like a mirror
1	Light air	0–0.3 m	Ripples with appearance of scales are formed, without foam crests
2	Light breeze	0.3–0.6 m	Small wavelets still short but more pronounced; crests have a glassy appearance but do not break
3	Gentle breeze	0.6–1.2 m	Large wavelets; crests begin to break; foam of glassy appearance; perhaps scattered white horses
4	Moderate breeze	1–2 m	Small waves becoming longer; fairly frequent white horses

Beaufort number	Description	Wave height	Sea conditions
5	Fresh breeze	2–3 m	Moderate waves taking a more pronounced long form; many white horses are formed; chance of some spray
6	Strong breeze	3–4 m	Large waves begin to form; the white foam crests are more extensive everywhere; probably some spray
7	High wind,	4–5.5 m	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 m	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 m	High waves; dense streaks of foam along the direction of the wind; sea begins to roll; spray affects visibility
10	Storm	9–12.5 m	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 m	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 m	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 across vessels 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 closest point of approach and the source status at the closes point of approach.

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.

5.3.3 Behavior and behavior change

The PSO protected species detection template included an initial behavior and initial pace field for the detection. It included the direction of travel relative to the vessel at initial detection, pace and direction of travel at final detection and other behaviors documented throughout the event. Where these data points were not included as specific entries in the data form, the information was sometimes available in a detection summary.

Protected species detection events were reviewed and categorized as having exhibited a change in behavior state or no observed change in behavior state.

The variables utilized to analyze change in behavior state are provided in Table 8.

Table 8: Change in behavior state analysis variables

Data field	Variables	Analysis method
Change in Behavior	Yes	• A detection narrative was provided that described a change • Initial and final pace were provided and were different • Initial and final direction of travel relative to vessel were provided and were different
	No	• If of the above criteria for an observed behavior change were satisfied, 'No change' was selected and detection data was then evaluated to determine whether no change was in fact observed or whether there was insufficient data provided to indicate whether a behavior change had been observed
Behavior change description	Insufficient data	• Initial and final pace data fields were empty • Initial and final direction of travel relative fields were empty • No detection narrative was provided • No subsequent behaviors after initial behavior state were provided • Detection duration (difference between initial and final detection time) suggested that observations may have occurred that were not documented in the data form

Data field	Variables	Analysis method
	Other direction change	• Any direction change that could not classified as moving away or approaching
	Pace change	• Any change in pace

5.4 NARW Dynamic Management Areas (DMA)

PSOs monitored by DMAs on the NOAA website and using the Whale Alert application that could be downloaded to mobile devices.

5.5 Level B Take / Exposure Estimation

The BOEM lease defines take as “having the same meaning as the term “take” as defined in 16 U.S.C. § 1532 (19)” where take is defined as “means 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 acts that have the potential to disturb (but not injure) a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

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

In the IHA issued to ASOW by NMFS, NMFS defines the Level B harassment zone for marine mammals as individuals observed within 370 meters of active geophysical survey (section 4 (f) (viii) of the IHA).

5.6 Monitoring Tools Efficacy and Comparisons Assessment

PSOs deployed on the HRG survey vessels utilized multiple monitoring tools to support daytime visual monitoring, nighttime visual monitoring, and acoustic monitoring. Nighttime visual monitoring and acoustic monitoring were only conducted onboard *Fugro Brasilis* and *Fugro Enterprise,* the vessels that conducted 24-hour operations with the LF sound sources. The comparison of the monitoring tools efficacy will be limited to these two vessels that conducted nighttime visual monitoring and acoustic monitoring.

5.7 Mitigation Measures Implemented

Mitigation measures were implemented on each survey vessel as previously described. The onboard PSO team communicated requested mitigation in real time to survey operators that controlled the operation of the regulated sound sources or to the vessel crew operating the vessel, depending on the type of action required. Communications were conducted over handheld radios or in person.

Implemented mitigation actions were recorded on PSO data sheets in the detection data form and also 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 regulated source 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 regulated sources could be activated. Mitigation downtime did not include any additional downtime that a survey operator needed in order to resume acquisition: additional vessel

maneuvering time, time to deploy or calibrate equipment etc. Some detections included this additional downtime as a different field, production loss, but this variable was not recorded for every mitigation action taken.

5.8 Data Quality Control

The RPS data analysts reviewed all of the PSO data sets received from every vessel and conducted QC as described in Table 9.

Table 9: Quality control editing performed by RPS and 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 error was evident, typically by inconsistency with adjacent times
	Day time vs. Nighttime	Times were corrected when end of effort overlapped with start of subsequent effort
Source operations	Start / End times	Correction for inconsistencies (i.e ramp-up end times overlapping with SOL times) Mitigation action descriptions added to comments
Protected species detections	Position	Positions that plotted outside of expected boundaries were corrected using effort positions of corresponding times

6 RESULTS

This section of the report details sound source operations, protected species monitoring effort, environmental conditions during monitoring effort and distribution, and sighting data inside and outside the Lease Area during source operation and source silence.

The monitoring effort, source operations and protected species detections for each vessel are provided as an excel dataset in Appendix I.

6.1 Operation Activity

HRG survey operations began with each vessel conducting source calibrations in the survey area before proceeding to acquisition, according to the survey plan. Survey operations were briefly suspended when necessary for weather, equipment maintenance, or port calls for provisions and crew change.

The dates of operation, total days of survey activity and hours of regulated source operations by survey vessel are provided in Table 10.

Table 10: Summary of geophysical operations on each survey vessel

Vessel	Dates of Operation	Total Survey Days	Total Hours of LF Source Operations (hh.hh)
Fugro Brasilis	21 April – 21 July 2020	91	1002.10
Fugro Enterprise	11 May – 31 October 2020*	173	2310.82
Splash	25 June – 24 August 2020	60	276.53
Total		**324**	**3589.45**

**Fugro Enterprise* has not completed data acquisition for the survey. This interim report covers start of the survey through 31 October 2020.

6.2 Monitoring Effort

Visual and monitoring effort for all survey vessels during the ASOW HRG Survey is summarized in Table 11, shown by survey vessel, by activity of the regulated HRG sources and by monitoring conducted during day and night.

Table 12 provides the breakdown in visual only monitoring effort and concurrent visual and acoustic monitoring effort undertaken during day and night with source activity status.

Table 11: Summary of monitoring effort, visual and acoustic, by vessel and by source activity status.

Monitoring Effort	*Fugro Brasilis*		*Fugro Enterprise*		*Splash*
	Visual	**PAM**	**Visual**	**PAM**	**Visual**
Source active	1002.1	248.02	2310.82	929.3	276.53
Source not active	805.33	78.15	941.02	70.00	225.72
Daytime	1155.35	22.88	1955.58	49.32	502.25
Night-time	652.08	403.28	1296.25	949.98	0.00
Total	**1807.43**	**426.17**	**3251.83**	**999.30**	**502.25**

Table 12: Total monitoring effort, visual and acoustic, during day and night by source activity status

Monitoring Effort	Day			Night		
	Source Active	**Source Inactive**	**Total**	**Source Active**	**Source Inactive**	**Total**
Visual monitoring only	2311.98	1229.00	3540.98	00.15	594.92	595.07
Visual and acoustic monitoring	49.62	22.58	72.20	1227.70	125.57	1353.27
Total	**2361.60**	**2361.60**	**3613.18**	**1227.85**	**720.48**	**1948.33**

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 mild to moderate.

The majority of visual monitoring effort (54.1% of the overall visual monitoring effort) for the survey was conducted in conditions where visibility extended to 5 kilometers or greater and could be considered to be excellent conditions for the detection of protected species (Table 13).

Table 13: Summary of visibility conditions during the survey

Visibility	Duration (hh.hh)	% of Overall Monitoring Effort
Greater than 5 km	3009.72	54.1
2 to 5 km	371.93	6.7
Less than 2 km	2178.03	39.2

Monitoring effort was conducted in Beaufort Sea states ranging from Level 0 through Level 8. Just over half 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. Visual observations at Level 4 Beaufort Sea states or below accounted for 84% of the total visual monitoring effort.

Table 14: Summary of Beaufort Sea state during visual monitoring during the survey

Beaufort Sea State	Duration (hh.hh)	% of Overall Monitoring Effort
B0	129.90	2.3
B1	462.80	8.3
B2	1069.33	19.2
B3	1514.28	27.2
B4	1520.23	27.3
B0 through B4	**4696.55**	**84.4%**
B5	603.30	10.8
B6	214.88	3.9
B7	38.97	0.7
B8	06.82	0.1
B5 through B8	**863.97**	**15.6%**
Not recorded	**01.00**	**0.0**

Swell heights during visual observations were generally low, with swells of less than two meters recorded for 91.5% of visual monitoring effort (Table 15). Swells did not exceed four meters during the survey.

Table 15: Summary of swell height during visual monitoring during the survey

Swell Height	Duration (hh.hh)	% of Overall Monitoring Effort
Less than 2 meters	5090.15	91.5
2 to 4 meters	471.37	8.5
Greater than 4 meters	0.00	0.0

6.4 Visual Sightings

This section of the report summarizes visual sightings of protected species (marine mammals and sea turtles) made during the ASOW HRG survey. There were a total 204 protected species detection events both inside and outside the Lease Area, 131 marine mammal detections and 73 sea turtle sightings. Marine mammal sightings consisted of delphinids and whales (n=87 delphinid detections and n=44 whale detections). No pinnipeds were observed. Detections consisted of seven different marine mammal species (four delphinid species and three whale species).

The 73 sea turtle sightings consisted of three species.

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

Of the 204 detection events, 83% (170 events) were of animals that were identified to the species level while the remaining animals (34 detection events) were identified to family level or a higher taxonomic level (classified as unidentified delphinids, unidentified whales, and unidentified sea turtle). Table 16 shows the total number of detection records and the number of individuals detected for each protected species during the survey program.

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

The distribution of protected species detections both inside and outside the Lease Area is provided in Figure 6 through Figure 10 below. The maps include the transit detections that the *Fugro Brasilis* had on the way to New Bedford, Massachusetts. The *Fugro Enterprise* had additional detections further out to sea during weather avoidance and weather standby locations. Additional maps showing species-specific distribution inside and outside the Lease area are provided in Appendix J.

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

Table 16: Number of detection records collected for each protected species during the survey program

Species	Total Number of Detection Records	Total Number of Detected Animals Recorded
Whales		
Fin whale	4	4
Humpback whale	33	47
Sei whale	1	1
Unidentified whale	6	6
Dolphins		
Atlantic white-sided dolphin	1	1
Bottlenose dolphin	56	773
Common dolphin	13	121
Risso's dolphin	1	1
Unidentified dolphins	16	95
Sea turtles		
Green sea turtle	1	1
Leatherback sea turtle	25	25
Loggerhead sea turtle	35	35
Unidentified sea turtle	12	12
Total	**204**	**1122**

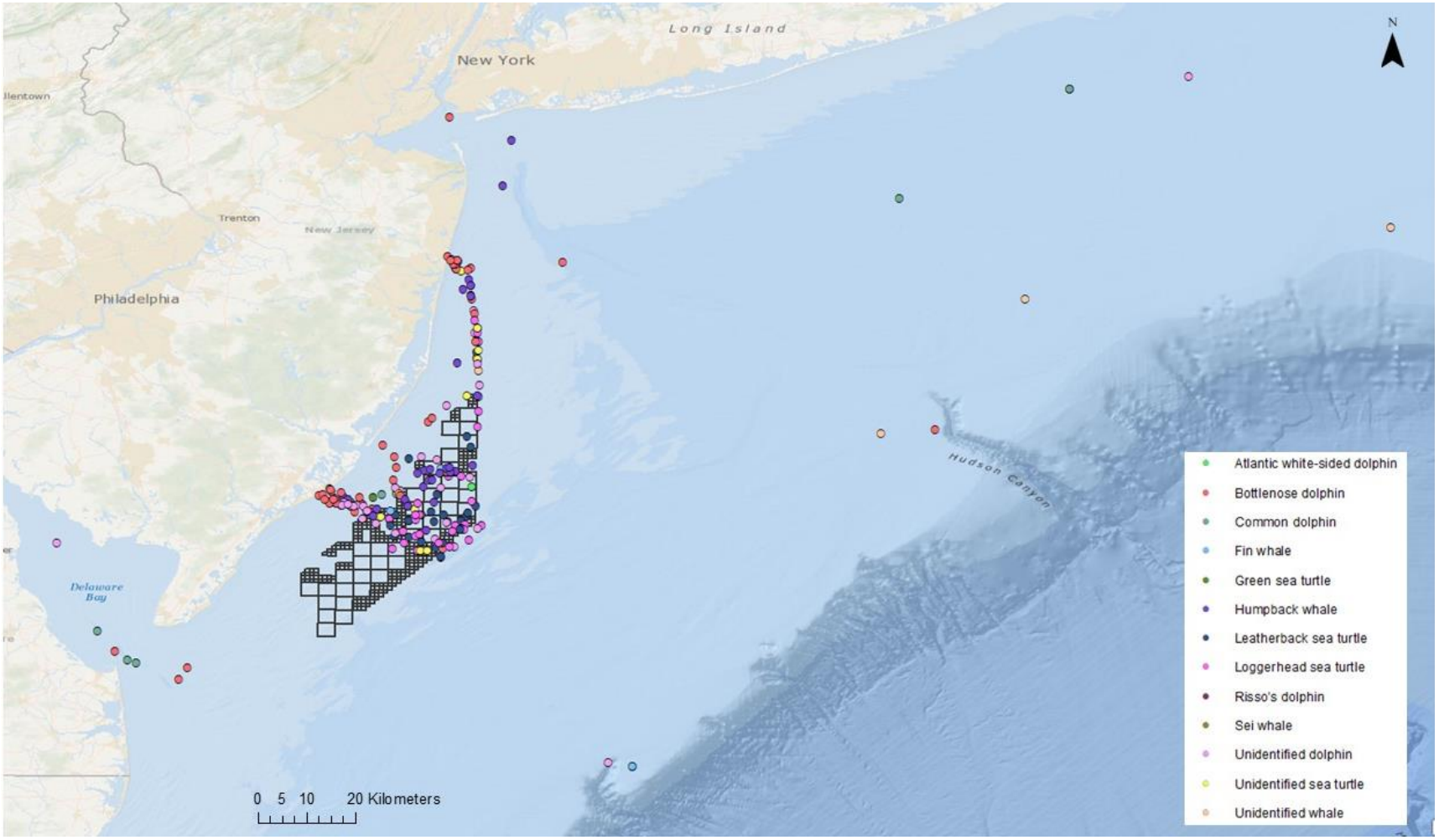

Figure 6: Distribution of all protected species detections by species during ASOW geophysical survey.

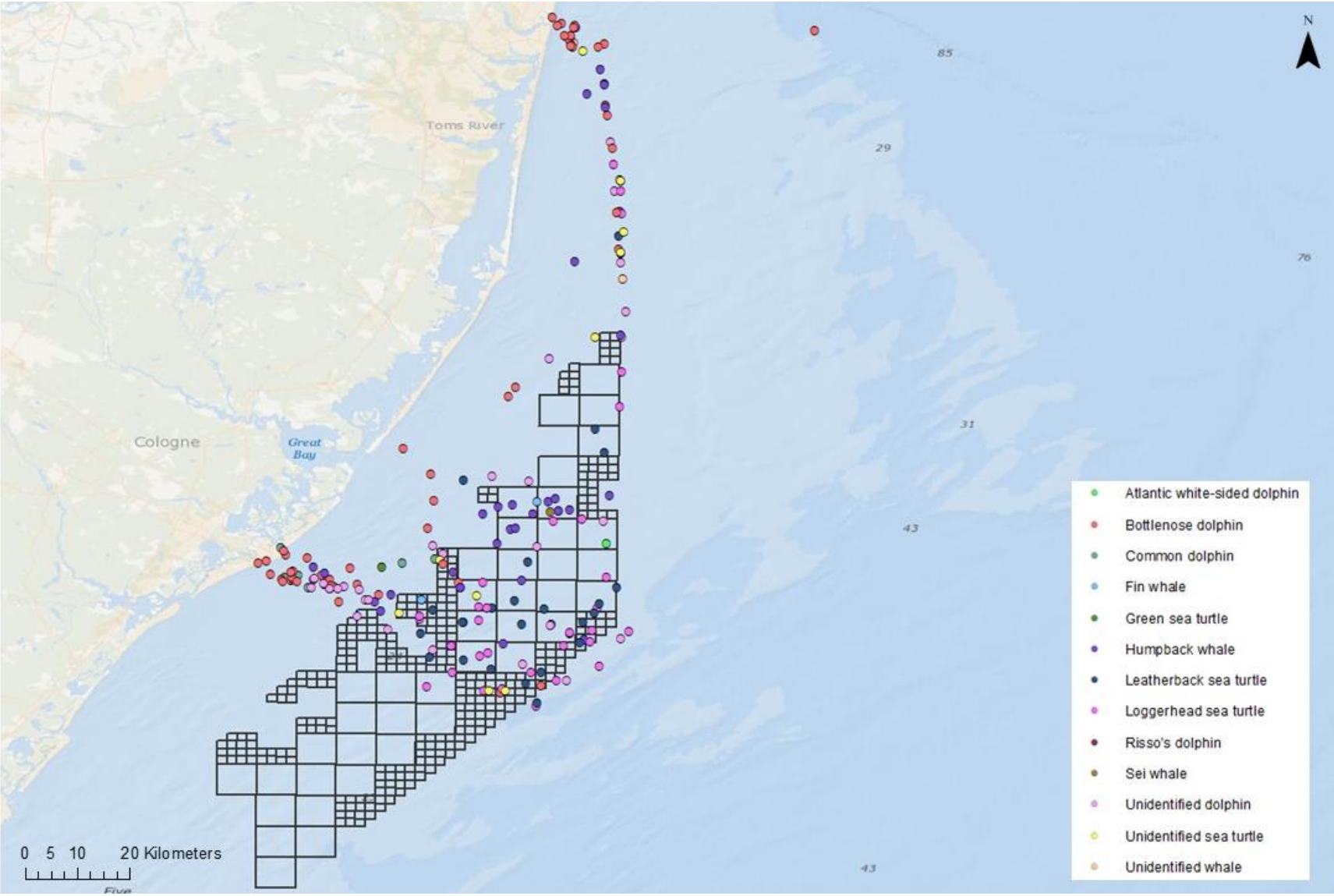

Figure 7: Distribution of protected species detections by species in the lease area during the ASOW survey.

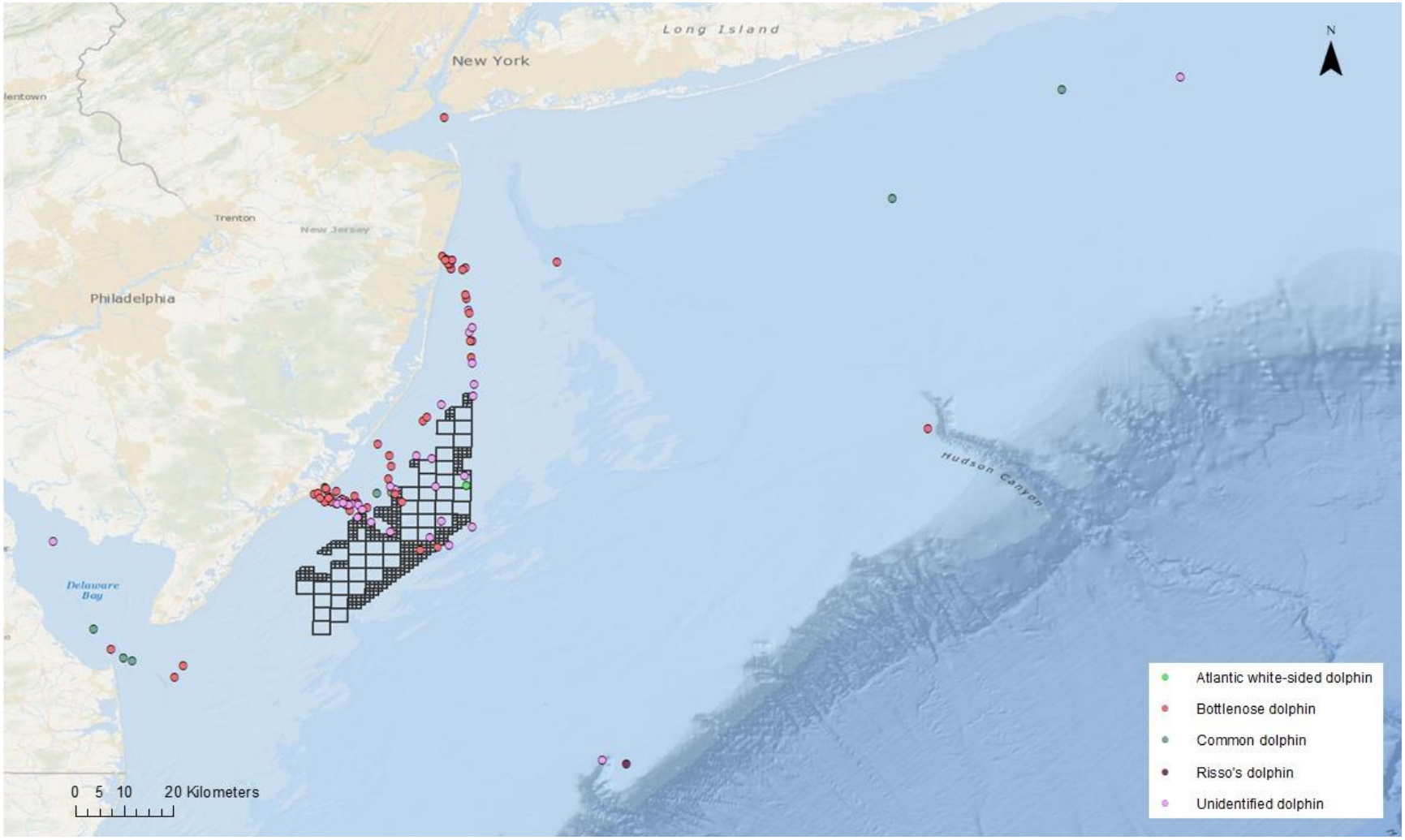

Figure 8: Distribution of delphinid detections during ASOW geophysical survey.

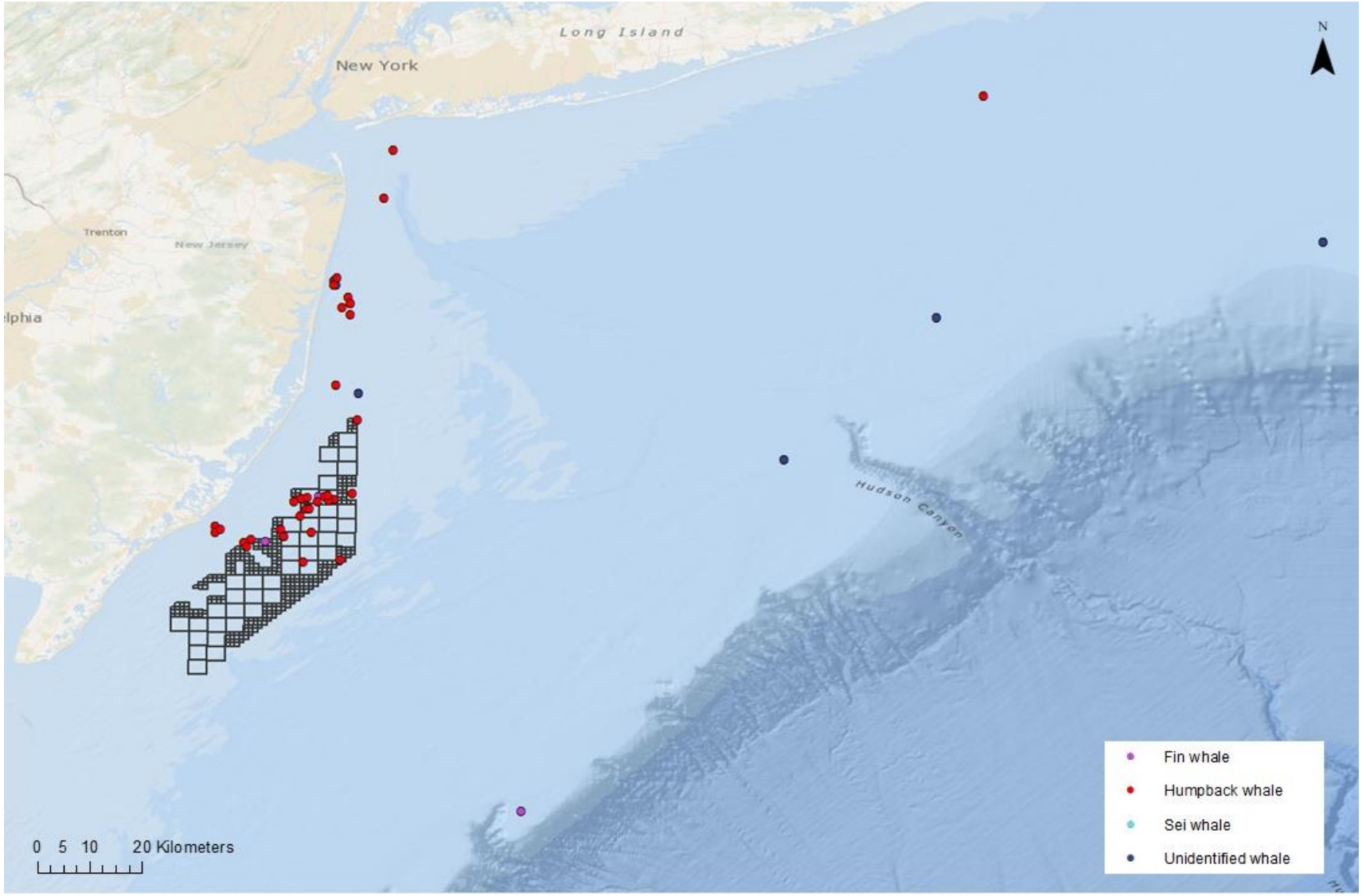

Figure 9: Distribution of whale detections during ASOW geophysical survey.

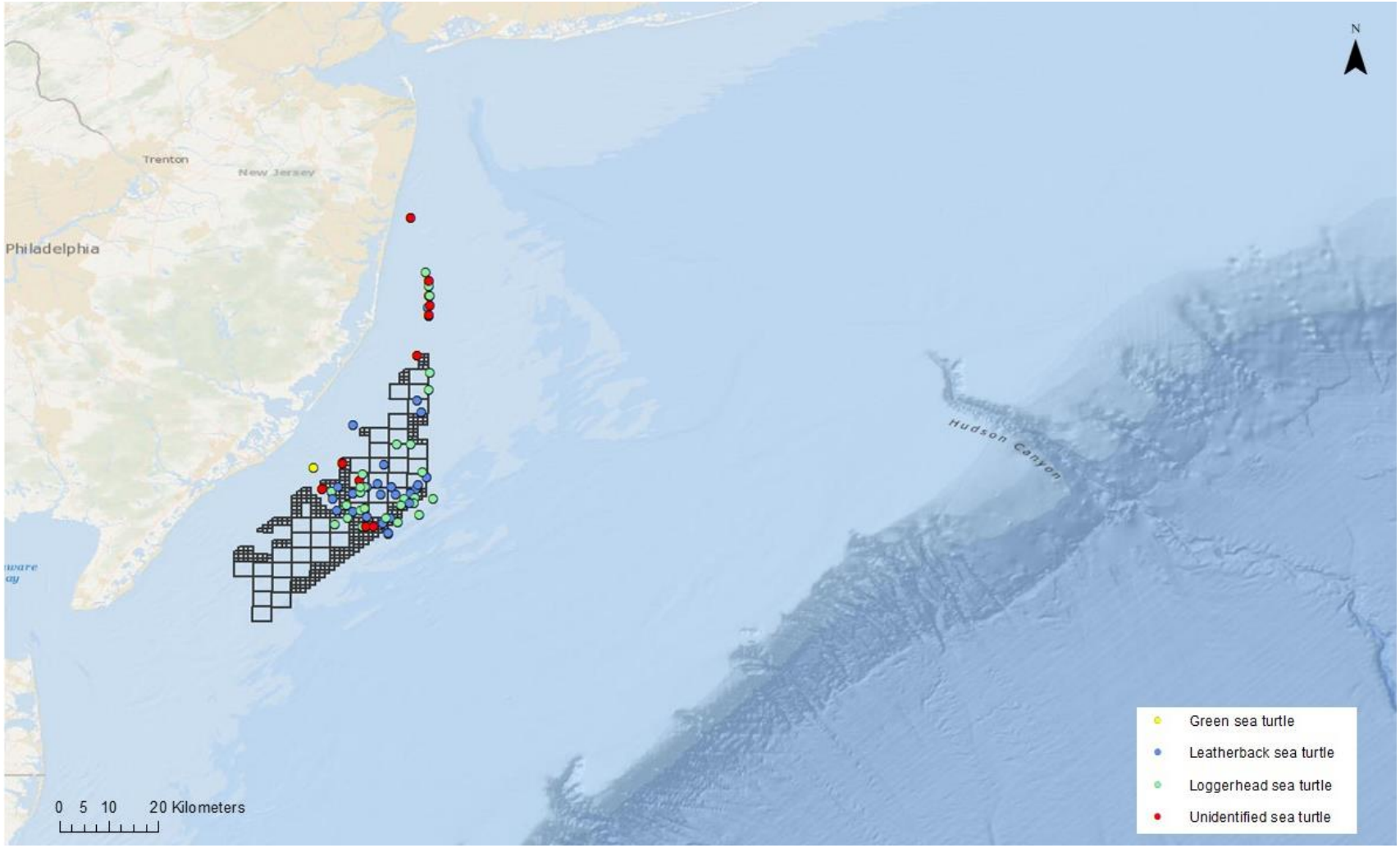

Figure 10: Distribution of sea turtle detections during ASOW geophysical survey.

6.4.1 Detection and Distance Summaries

The most commonly recorded species was the bottlenose dolphin (56 detections of an estimated 773 individuals), followed by the loggerhead sea turtle (35 detections of 35 individuals). The most commonly observed whale species was the humpback whale (n = 33 animals). The number of detection events, approximate number of animals observed, mean group size and detection rate for each species detected over the course of the Survey is provided in Table 17 through Table 19.

The humpback whale was the most observed whale species in addition to having the largest mean group size. The mean distance at first detection for all whale species were greater than 500 m.

Table 17: Visual detection summary of whales

Whales	Fin whale	Humpback whale	Sei whale	Unidentified whales
Number of detection records	4	33	1	6
Estimated number of individuals detected	4	47	1	6
Mean group size	1	1.4	1	1
Mean distance (m) at first detection	1267.5	1202.27	500	1960.83
Detection rate	0.00007	0.006	0.00001	0.0010

Bottlenose dolphins had a larger mean group size than any other dolphin species (n=13.8) followed by common dolphins (n=9.31). Bottlenose dolphins were also the most frequently sighted species during the survey (n=56 events), observed much more often than the next most observed dolphin species, common dolphins (n=13 events) There were two species of dolphins that were only observed once during the survey and each consisted of a single animal, an Atlantic white-sided dolphin and a Risso's dolphin (Table 18).

The Risso's dolphin had the closest mean detection distance at first detection at a distance of 100 meters, followed by the bottlenose dolphins and common dolphins, all species that are known to approach vessels.

Table 18: Visual detection summary for dolphins

Dolphins	Atlantic white-sided dolphin	Bottlenose dolphin	Common dolphin	Risso's dolphin	Unidentified dolphin
Number of detection records	1	56	13	1	16
Estimated number of individuals detected	1	773	121	1	95
Mean group size	1	13.8	9.31	1	5.94
Mean distance (m) at first detection	900	542	554.61	100	716.75
Detection rate	0.00001	0.0100	0.0023	0.00001	0.0029

Sea turtle detections commonly consist of one animal, and mean detection distances are typically small with sightings occurring quite close to the vessel, both trends of which can be seen in the sea turtle sighting data collected during this survey (Table 19).

Table 19: Visual detection summary for turtles

Turtles	Green sea turtle	Leatherback sea turtle	Loggerhead sea turtle	Unidentified sea turtle
Number of detection records	1	25	35	12
Estimated number of individuals detected	1	25	35	12
Mean group size	1	1	1	1
Mean distance (m) at first detection	300	139.24	93.14	137.91
Detection rate	0.00001	0.0045	0.0063	0.00001

When all species in a species group (dolphins, whales, and turtles) are grouped together to examine the mean closest approach to the active and inactive HRG sources, all marine mammal groups had closer mean closest approaches when the HRG sources were not active

Table 20. Sea turtle closest approach data is not generally considered to be relevant as sea turtles cannot sustain swimming speeds equivalent to a vessels' survey speed for a sustained period of time.

Table 20: Average closest observed approach (m) of protected species to active and inactive Geophysical operations

Species Detected	Geophysical Operations Active		Geophysical Operations Inactive	
	Number of detections	Mean closest observed approach to source	Number of detections	Mean closest observed approach to source
Fin whale	3	737	1	500
Humpback whale	19	1147	14	789
Sei whale	0	-	1	500
Unidentified whales	2	2500	4	1591
All whale species	**24**	**1208.5**	**20**	**920.50**
Atlantic white-sided dolphin	1	930	0	-
Bottlenose dolphin	21	686	35	246.26
Common dolphin	7	650	6	187
Risso's dolphin	1	100	0	-
Unidentified dolphins	6	1372	10	170
All dolphin species	**36**	**783.83**	**51**	**224.33**
Green sea turtle	1	300	0	-
Leatherback sea turtle	22	131	3	72
Loggerhead sea turtle	30	67	5	92
Unidentified sea turtle	10	153	2	100
All turtle species	**63**	**106.70**	**10**	**87.60**

6.4.2 Behavior Summary

A total of ten different behavior states were used to describe the behavior observed at the initial detection of all 87 dolphin visual sighting events. The initial behavior state is provided in Table 21: by species. The sample size for the Atlantic white sided dolphin and Risso's dolphin were too small compared to the other observed species to make any meaningful conclusions. But for bottlenose dolphins, common dolphins, and unidentified dolphins, where sample sizes were larger, swimming and surfacing were reported more often than the other behaviors (n=24 and n=19). Fast travel was reported next most frequently, especially in bottlenose dolphin sightings (n=14). Feeding and resting at the surface were observed in only two detection events.

Table 21: Behavior state at initial detection for dolphin species

Species	Blow	Diving	Fast Travel	Feeding	Jump/ Spin/ Acrobatic behavior	Resting at Surface / Logging	Porpoising	Surfacing	Swim	Swim below Surface
Atlantic white-sided dolphin	0	0	0	0	1	0	0	0	0	0
Bottlenose dolphin	4	1	9	1	4	0	6	14	16	1
Common dolphin	2	0	2	0	1	0	0	1	5	2
Risso's dolphin	0	1	0	0	0	0	0	0	0	0
Unidentified dolphin	0	1	3	0	4	1	0	4	3	0

When all delphinid species are grouped for analysis of the initial observed behavior state, it can be seen that some categorization of travel (surface travel and swimming/swimming below the surface) represented the majority of the behaviors observed (48% of events; n= 19 surface travel, n= 27 swim / swim below surface) (Figure 11).

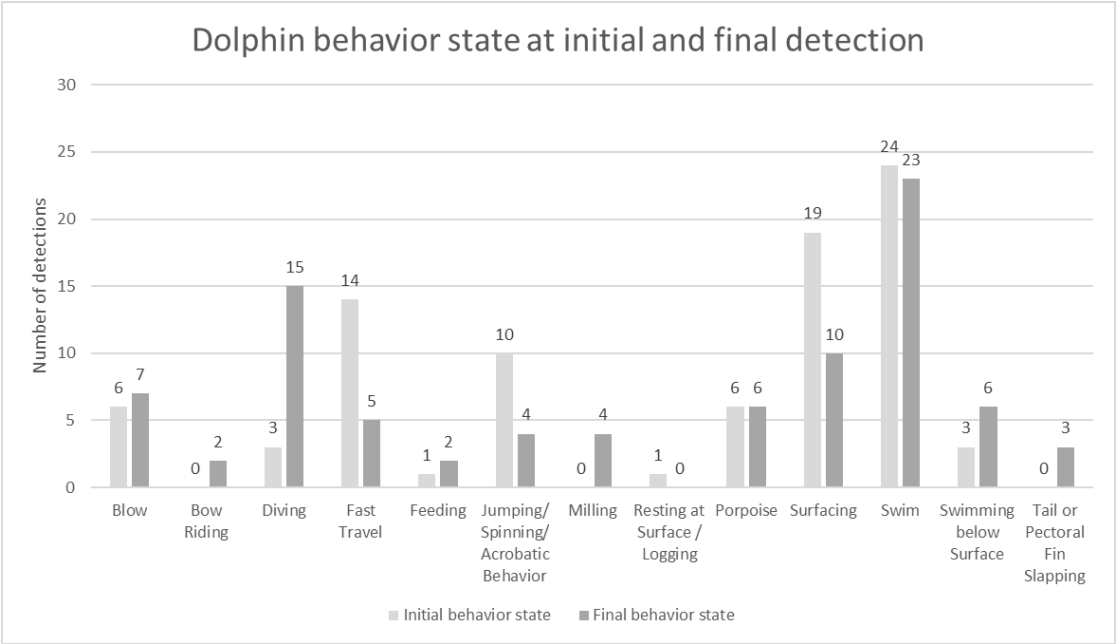

Figure 11: Behavior state at initial and final detection for all combined dolphin detections.

Pace of travel at initial detection was recorded during delphinid sightings and pace was more often described as moderate than either sedate or vigorous (Figure 12). There was no significant difference in the pace observed at initial and final observations of dolphin pods.

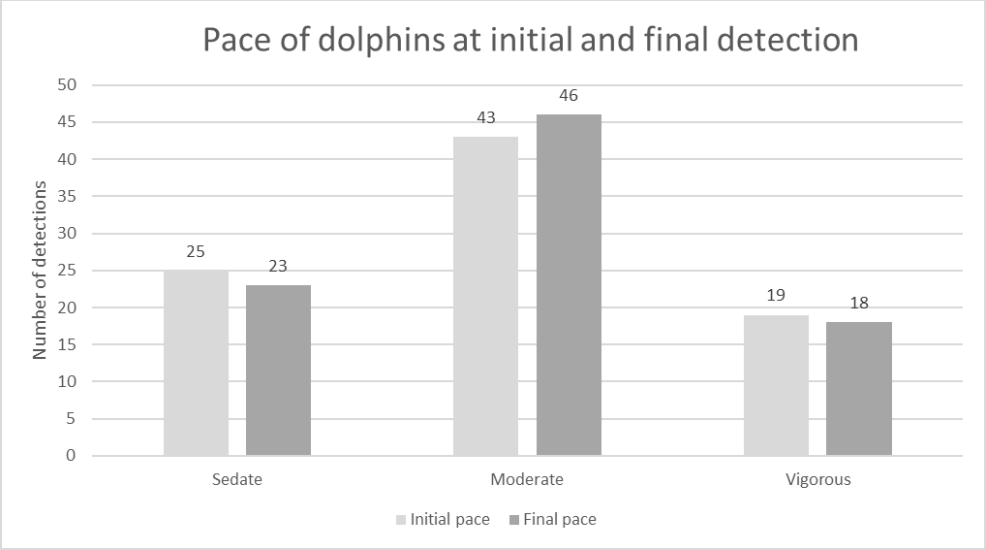

Figure 12: Pace at initial and final detection for all combined dolphin detections

When sufficient data was available, detection events were classified as showing a behavior change or no indication of behavior change. Where a behavior change was observed or documented, the type of change was described. Behavior state, pace and direction of travel were evaluated at initial detection and subsequent observations during the ongoing detection event in order to classify an event as exhibiting a behavior change.

In the 87 delphinid detection events, no change in behavior was observed in 49 of the events (56% of detection events) (Table 22). The most commonly reported behavior change was a change in the direction of travel, when there was enough data to support a noticeable behavior change.

Table 22: Change in behavior state in delphinid detections by source operational status

Change in Behavior State	All Detection Events		Source Active		Source Inactive	
	No of Detections	% of Dets	No of Detections	% of Detections	No of Detections	% of Detections
No change	49	56.3%	20	40.8%	29	29.2%
Direction change	32	36.7%	14	43.8%	18	56.3%
Pace change	3	3.4%	2	66.7%	1	33.3%
Direction and pace change	3	3.4%	0	0%	3	100%
Total number of detections	**87**	**-**	**36**	**-**	**51**	**-**

Five different behavior states were used to describe the behavior observed at the initial detection of all 44 of the whale detections. All species were observed blowing (n=34) (Table 23). Humpback whales were also observed exhibiting surface active behaviors like breaching and tail / pectoral fin slapping.

Table 23: Behavior state at initial detection for whale species

Species	Blow	Breach	Mill	Surface	Tail /Pec fin slap
Fin whale	3	0	0	1	0
Humpback whale	26	2	1	2	2
Sei whale	1	0	0	0	0
Unidentified whales (all)	4	0	0	2	0

When all whale species are grouped for analysis of the initial and final observed behavior state it can be seen that blowing was the most frequently observed behavior state at initial detection (n=34) whereas diving with or without fluking was the most frequently observed final behavior state (n=13 events) (Figure 13).

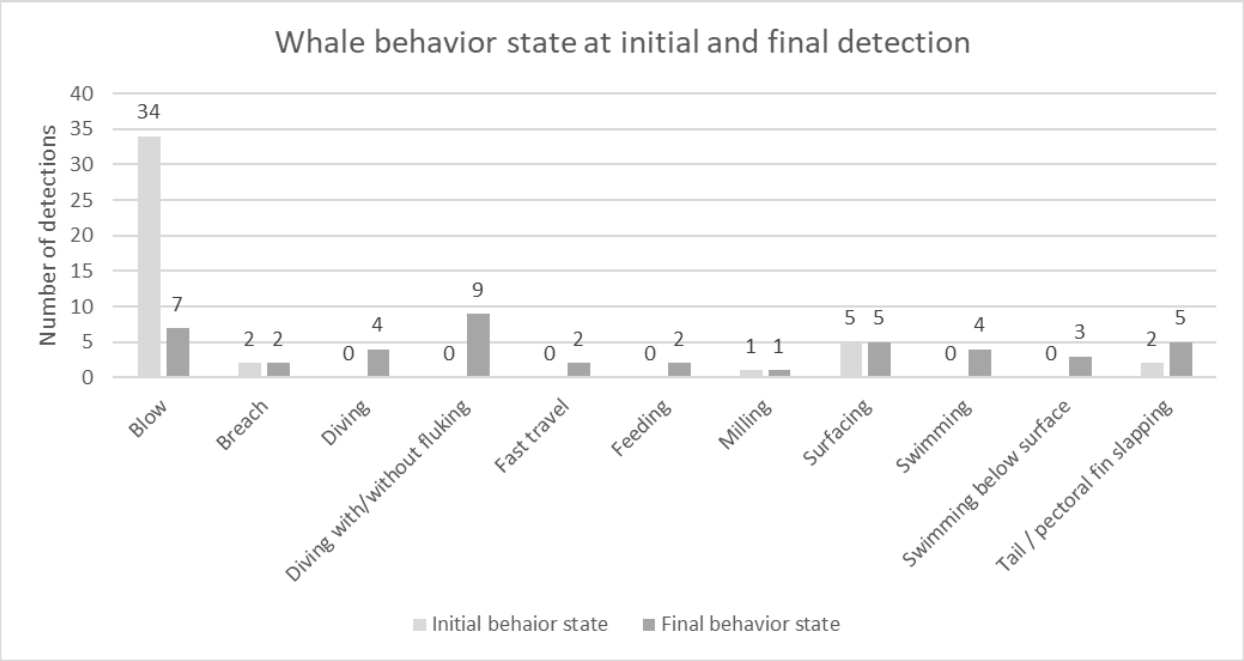

Figure 13: Behavior state at initial and final detection for whale species during the survey.

The pace of whales at initial and final detection was most frequently reported as sedate or moderate and a vigorous pace was reported in only four detection events (Figure 14).

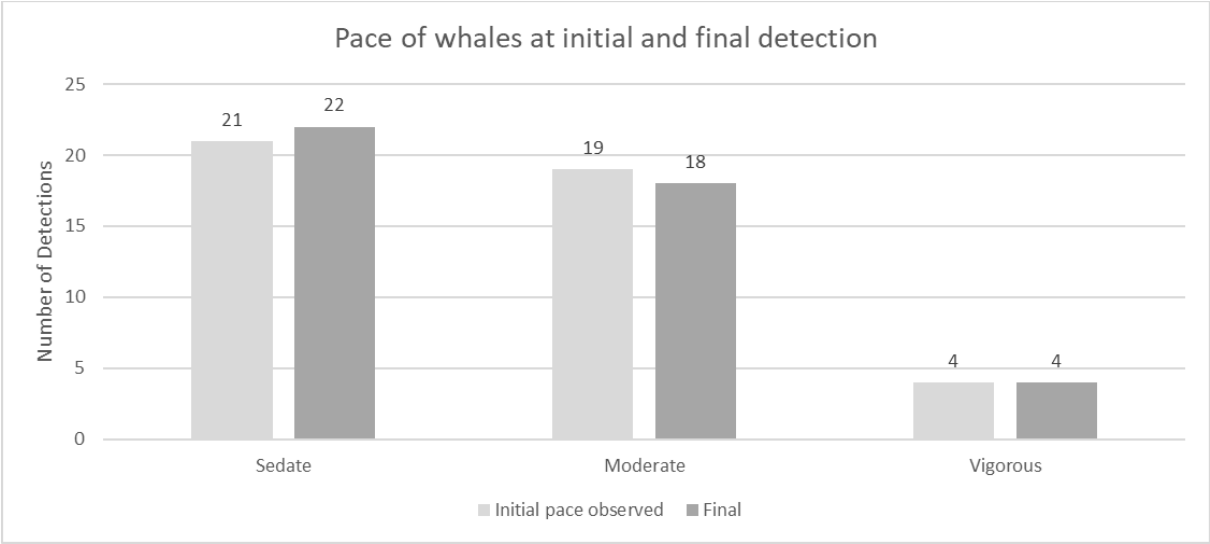

Figure 14: Pace at initial and final detection for whale species during the survey.

During the majority of whale detection events, no change in behavior was observed. A change in direction of travel was the most frequent change observed and there was no difference in the frequency that it was observed in relation to source activity since there were more observed sightings of whales when the source was active (Table 24).

Table 24: Change in Behavior state in whale detections while geophysical operations are active and inactive

Change in Behavior State	All Detection Events		Source Active		Source Inactive	
	No of Detections	% of Dets	No of Detections	% of Detections	No of Detections	% of Detections
No change	21	47.7%	12	57%	9	43%
Direction change	20	45.4%	11	55%	9	45%
Pace change	1	2.27%	1	100%	0	0%
Pace and direction change	2	4.54%	0	0%	2	100%
Total Number of Detections	44	-	41	-	38	-

If all turtle detections are grouped together to analyze behavior state, there were six different behaviors initially detected. Swimming / Swimming below the surface were the states most often reported, followed by surfacing (n=22, 23 and n=15 respectively) (Table 25). Resting/logging was the next most common reported behavior and it was observed in all turtle species.

Table 25: Behavior state at initial detection by sea turtle species

Species	Diving	Injured	Resting at Surface / Logging	Surfacing	Swimming	Swimming below Surface
Green turtle	0	0	1	0	0	0
Leatherback turtle	0	0	2	7	15	1
Loggerhead turtle	1	1	6	4	6	17
Unidentified turtle	0	0	2	4	1	5
All turtle detections	1	1	11	15	22	23

Swimming and swimming below the surface were the most common initial behavior state observed while diving was observed the most often as the final behavior state (Figure 15).

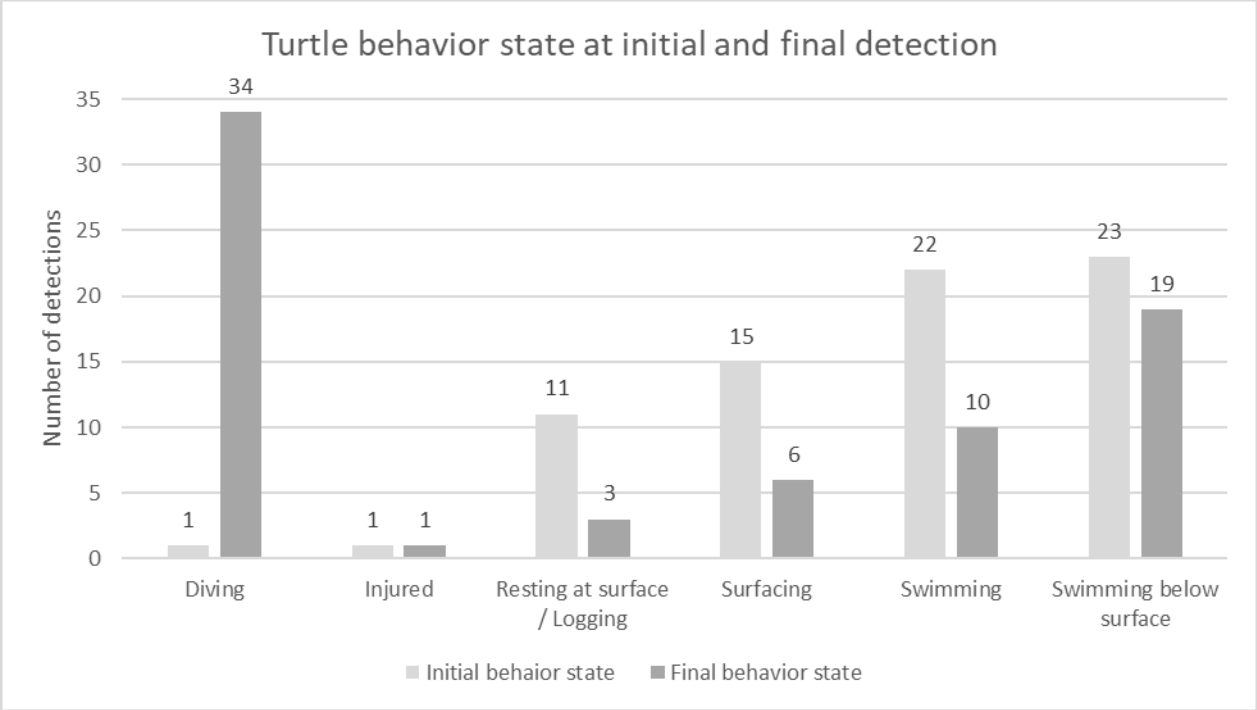

Figure 15: Behavior state at initial and final detection of turtle species during the survey.

Turtles were most frequently observed traveling at a sedate or moderate pace with a sedate pace reported slightly more frequently at initial detection and a moderate pace slightly more frequently at the final detection (Figure 16).

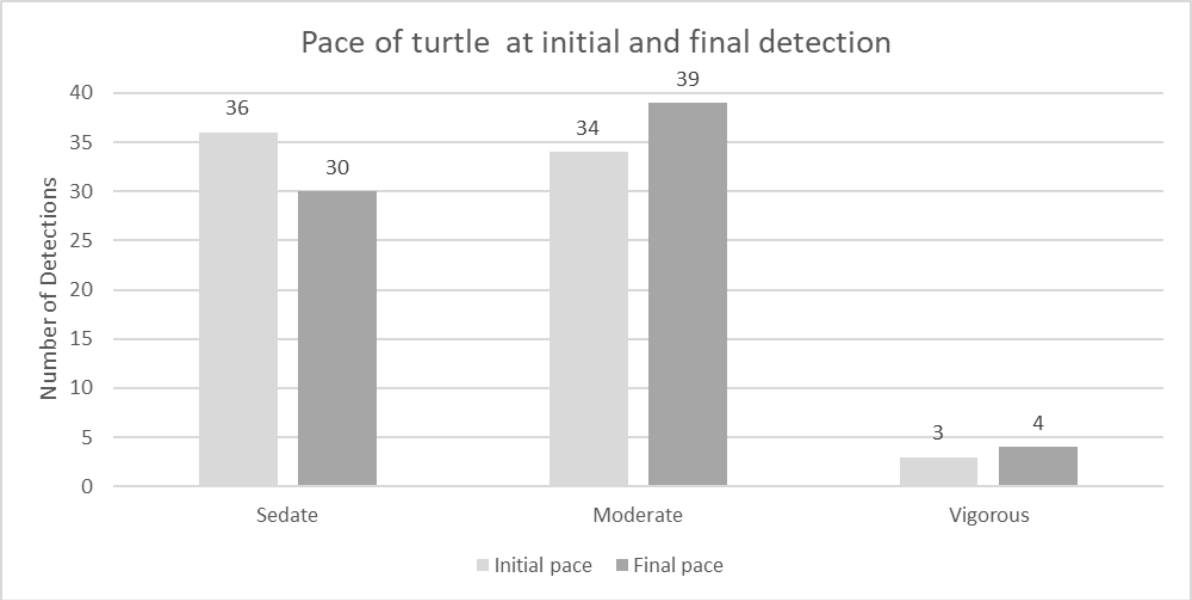

Figure 16: Pace at initial and final detection of turtles during the survey.

No change in behavior was observed in 22 events, representing 30.3% of detection events (Table 26). When a change in behavior state was observed, a change in direction of travel was the most commonly observed change.

Table 26: Change in behavior state in sea turtle detections while HRG source was active and inactive

Change in Behavior State	All Detection Events		Source Active		Source Inactive	
	No of Detections	% of Dets	No of Detections	% of Detections	No of Detections	% of Detections
No change	22	30.3%	17	77%	5	23%
Direction change	45	61.6%	41	91%	4	9%
Pace change	1	1.3%	1	100%	0	0%
Direction and Pace change	5	6.8%	4	80%	1	20%
Total Number of Detections	**73**	**-**	**63**	**-**	**10**	**-**

6.4.3 Incidental Harassment Authorization (IHA) Level B Exposures

NMFS issued an IHA for the ASOW HRG survey where a total 0f 9,937 takes were authorized for 15 marine mammal species/species groups. From the start of the survey through 31 October 2020, 161 marine mammals from three species/species groups were observed within 370 meters of the active LF sound sources (Table 27), constituting level B takes as defined by this IHA. An additional five unidentified marine mammals (all dolphins) were also observed inside the IHA-defined level B harassment zone.

Table 27: IHA authorized Level B takes and takes through 31 October 2020.

Species common name	IHA Authorized Level B Takes	Total Number of Animals Observed Inside the IHA-defined Level B Harassment Zone
North Atlantic right whale	9	0
Humpback whale	18	2
Fin whale	20	0
Sei whale	2	0
Minke whale	9	0
Sperm whale	3	0
Long-finned pilot whale	6	0
Bottlenose dolphin (W.N. Atlantic Coastal Migratory)	1102	148

Species common name	IHA Authorized Level B Takes	Total Number of Animals Observed Inside the IHA-defined Level B Harassment Zone
Bottlenose dolphin (W.N. Atlantic Offshore)	5113	0
Common dolphin	544	6
Atlantic white-sided dolphin	82	0
Atlantic spotted dolphin	100	0
Risso's dolphin	6	0
Harbor porpoise	115	0
Harbor seal	1404	0
Gray seal	1404	0
Unidentified dolphin	N/A	5
Unidentified whale	N/A	0

6.4.4 NARW sightings reporting

There were no observations of North Atlantic right whales made during survey operations undertaken during the dates included in this interim report.

6.4.5 Protected species incident reporting

There have been two observations of dead or injured protected species during the ASOW geophysical survey. Both observations were reported to the NMFS stranding hotline and all consisted of injured protected species. In both instances the PSOs concluded that there were no indication the animal's injuries were related to the ASOW geophysical survey operations.

Protected species incidents are summarized below, and the reports that were provided by ASOW to BOEM and NMFS are included in Appendix M

On 28 April 2020, a PSO on watch on the *Fugro Brasilis* observed a young adult Risso's dolphin swimming at the surface. The animal appeared to have relatively fresh/new wounds on the front of the head. The wounds appeared open with evidence of redness and scraping. There were no other indications of injuries on the animal. The dolphin remained at the surface until it dove and was not sighted again. This incident was reported to the NMFS stranding hotline within 24 hours.

On 23 September 2020, a PSO on watch on the *Fugro Enterprise* observed a sea turtle off the port side of the vessel at 800 m. The loggerhead sea turtle appeared to be attached to or entangled with a plastic bucket. The turtle was observed lifting its head above the surface and swimming slowly. This incident was reported to the NMFS stranding hotline within 24 hours.

6.4.6 Summary of Dynamic Management Areas (DMAs)

There were no DMAs created in the ASOW survey region during the time period covered by this interim report.

NMFS did report the presence of an entangled NARW in the region of the ASOW lease area during the survey period (Table 28) where vessels were requested to monitor closely for this animal and report any additional observations.

Table 28: DMAs and NARW reported observations in the ASOW lease area during survey operations

	Effective Start Date	Effective End Date	Reason for DMA	General Location	Restrictions
NARW Reporting	15 Oct 2020	TBD	NMFS reported a NARW observation of an entangled animal in poor health	New York Bight	None: Requested awareness notifications

6.5 Acoustic Detections

There were 19 marine mammal detections that consisted of an acoustic detection only during the ASOW geophysical survey (

Table 29). There was an additional detection that consisted of a correlated visual and acoustic detection where PSOs were not able to identify the species present, so the detection was classified as unidentified dolphins

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

Table 29: Summary of acoustic detections during the survey

	Unidentified dolphin	Humpback whales
# of Acoustic Detection Records	16	3
Number of detections while source was active	12	3
Number of detections while sources were inactive	4	0
Estimated # of individuals detected	29	3
Detection rate	0.011	0.002

During the detections of the humpback whales, tonal sounds were detected either aurally and/or visually on the spectrogram. The majority of acoustic detections of dolphins consisted of aural detections of tonal sound. There were also detections of aural clicks and a visual detection of tonal sounds on spectrogram (Table 30).

Table 30: Initial behavior of acoustic only detections

Species	Aural detection of clicks	Aural detection of tonal sounds	Detection of clicks on click detector	Visual detection of clicks or pulsed sounds on spectrogram	Visual detection of tonal sounds on spectrogram
Humpback whales	-	2	-	-	1
Unidentified dolphins	2	13	-	-	1

6.6 Monitoring Efficacy and Comparison Assessment

During the ASOW HRG Survey three different monitoring methods were used to detect protected species. Each method is described in detail in Section 4 Mitigation and Monitoring Methods

1. Daytime unaided eye where PSOs made regular and frequent sweeps of the surrounding area with reticle binoculars and/or big-eye reticle binoculars
2. Nighttime unaided eye where PSOs made regular and frequent sweeps of the surrounding area with NMDs that were equipped with thermal clips
3. PAM, which was used during daytime reduced visibility and at night but was always used in conjunction with visual monitoring as described above

Two of the vessels, the *Fugro Brasilis* and *Fugro Enterprise*, that conducted operations on the survey operated at night and utilized night monitoring equipment and PAM so only data from these vessels was considered when comparing the efficacy of the different monitoring methodologies.

Daytime visual monitoring where PSOs made regular sweeps with binoculars resulted in the highest detection rate for both marine mammals followed by PAM. Visual monitoring at night yielded the lowest marine mammal detection rate (Table 33). The sighting rate was sea turtles was also highest during daytime monitoring (Table 31).

Table 31: Monitoring effort, protected species detections and detections rate for each monitoring method used on the 24-hour operations vessels

	Visual Monitoring-Unaided eye with sweeps using binoculars	Visual Monitoring-Unaided eye with NVD and thermal	PAM
Monitoring effort	3110.93	1948.33	1425.47
Number of marine mammal detections	92	13	20
Detection rate	0.0296	0.0067	0.0140
Number of sea turtle detections	67	5	-
Detection rate	0.0215	0.0026	-

6.6.1 Effectiveness of Unaided Eye (day and night)

Most of the detections made occurred by unaided eye, with more occurring during daytime than at night (92 daytime sightings as compared to 13 for marine mammals and 67 sea turtles observed during the day with only 5 detected at night)

PSOs considered monitoring with the unaided eye to be the most effective method for making initial detections of all protected species (marine mammals and sea turtles) where binoculars or NVD with thermal could be used to confirm the presence of an animal following a sighting cue or to confirm a species identification. The effectiveness of the unaided eye in initial detections was attributed to the wide field of view that could be scanned as compared to the narrow view afforded by either a reticle binocular or an NVD.

The NVDs efficacy was further limited in areas like the side and stern of the vessel where there were frequently bright lights that would interfere with the view, but which were necessary for back deck operations to continue safely. Additionally, PSOs reported that NVDs were difficult to use in mid to high Beaufort Sea states and swells for more than a very short time without the PSO experiencing nausea symptoms.

6.6.2 Effectiveness of PAM

PAM had lower detection rate compared to visual monitoring, which is normal for towed systems deployed on industry vessels where many factors can limit the efficacy of the system

- The deployment configuration of a towed hydrophone cable is limited by vessel specific features such as the presence of thrusters and propeller because the PAM Operator must identify a safe location for deployment of the cable where entanglement risk for the cable is low
- Vessel noise from the propellers occurs in the low-frequency range and at high decibel levels and has the potential to mask marine mammal vocalizations, especially those of large mysticete

whales that produce calls that overlap in frequency with this vessel noise. Additional masking may occur from the vessel itself, especially for animals like dolphins that will frequently approach the front of the vessel and ride at the surface, where their highly directional vocalizations can be blocked by the hull

Additionally, PAM detections are limited to vocalizing marine mammals where many species exhibit highly variable vocalizing behavior that changes depending on behavior state, social structure factors and age and gender. Environmental conditions can also limit the efficacy of PAM where increased background noise could result in masking of vocalizations that overlap in frequency with the noise.

In spite of the limitation that exist with PAM, several acoustic detections that were made during the survey were not accompanied by visual sightings (19 events) of the marine mammals, so this monitoring method enabled the detection of marine mammals that would otherwise not have been detected visually.

6.7 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 shut downs of active LF HRG sound sources).

There were 35 mitigation actions implemented for the HRG sound sources during the survey period (Table 32). These mitigation actions resulted in 31 hours and 33 minutes of mitigation downtime. Mitigation downtime accounts only for the period of time during which survey operations were delayed or shut down for the presence of a protected species inside a buffer or exclusion zone and the additional regulatory-required time period that must pass before sound source operations can resume. Additional downtime is frequently incurred for necessary operational activities such as gear deployment and/or repositioning the vessel

Strike avoidance maneuvering was conducted five times during the geophysical survey where each event consisted of a course change to maintain or achieve a separation distance. All but one of the maneuvers were performed for sea turtles where the only other avoidance maneuvers were performed for a single unidentified whale that surfaced ahead of the *Fugro Enterprise* inside the 100 meter separation distance applicable to that species group (Table 33).

Table 32: 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 source	1	00:14	0	00:00	0:	00:00	1	00:14
Shutdown of active source	3	00:48	1	00:13	30	30:18	34	31:19
All mitigation actions	**4**	**01:02**	**1**	**00:13**	**30**	**30:18**	**35**	**31:33**

Table 33: Summary of strike avoidance maneuvers undertaken during the survey

Vessel	Date	Detection number	Species	Number of animals	CPA Distance (M)	Strike avoidance maneuver
Fugro Enterprise	2020-05-11	3	Unidentified whale	1	65	Slowed speed and course change
Fugro Enterprise	2020-08-09	87	Loggerhead sea turtle	1	35	Course change
Fugro Enterprise	2020-08-26	98	Leatherback sea turtle	1	20	Course change
Fugro Enterprise	2020-09-01	103	Leatherback sea turtle	1	5	Course change
Fugro Enterprise	2020-09-13	113	Leatherback sea turtle	1	15	Course change

7 SUMMARY

7.1 Interpretation of the Results

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

For all the marine mammal species groups (excluding sea turtles), the mean distance at initial detection and at closest approach was greater when the regulated sound sources were 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 sound source 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.

Behavior states like approaching the vessel that are less subjective and are easily determined in the field by PSOs were exhibited in the expected species like common dolphins and bottlenose dolphins. Whales were sighted exhibiting similarly expected behaviors like blowing and diving.

7.2 Effectiveness of all monitoring tasks

In order to minimize the potential impacts to marine mammals and sea turtles, PSOs onboard all the survey vessels were prepared to implement mitigation measures whenever protected species were detected approaching, entering, or within the designated mitigation zones. Mitigation actions for regulated sound sources were implemented successfully during 35 detections events. PSOs searched the buffer zones prior to activation of regulated sound sources and survey crew confirmed that applicable zones were clear prior to activating the regulated sound sources, which was then done gradually in ramp-up form wherever possible.

Strike avoidance maneuvering was conducted five 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. All of the actions were course changes and one combination of a course change with a speed reduction to achieve or maintain separation distances.

In the event that an injured or dead protected species was discovered during the course of 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 two sightings of injured protected species, both of which were reported to NMFS, but in each case, the PSOs determined that the injuries were not related to the activities of the ASOW geophysical survey.

Visual observations yielded a total 204 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 of the animals present in the area around the vessel, It is unlikely that protected species were not detected inside the buffer and exclusion 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 buffer and exclusion zones.

For the ASOW HRG survey program, a total of 9,937 individual marine mammals from 15 species (including seven whale species listed as endangered or threatened) were authorized for takes in the IHA. During the survey activities undertaken through 31 October 2020, a total of 161 protected species were observed within the predicted Level B harassment radius. This total represents only 1.62% of the

authorized Level B takes for the survey program. Although PSOs likely did not detect all of the marine mammals 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 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 Lease stipulations appear to have been an effective means to protect the marine species encountered during survey operations.

8 LITERATURE CITED

Bureau of Ocean Energy Management (BOEM) Lease OCS-A 0499

United States Fish and Wildlife Service (USFWS). 2019. Marine Mammal Protection Act (MMPA). 16 U.S.C.

APPENDICES

Appendix A
BOEM Lease OCS-A-0499 and NMFS IHA

Appendix B
Environmental Management Plan

Appendix C
Protected Species Observers Onboard

Appendix D

Vessel Photos

Appendix E
Reticle Binoculars Calibration Tables

Appendix F

Night Vision Equipment Specifications

Appendix G
Passive Acoustic Monitoring (PAM) Deployment for *Fugro Brasilis* and *Fugro Enterprise*

Appendix H
Mitigation Flow Chart

Appendix I
Complete ASOW Survey Datasheets

Appendix J
Protected Species Distribution Maps

Appendix K
Photographs of Identified Protected Species Visually Detected during the Survey

Appendix L
Screenshots of the Acoustic Detections of Protected Species observed during the Survey

Appendix M
Protected Species Injury and Entanglement Reports