



*A.I.S. Inc. Protected Species Observer
Final Report
2018/2019 BOEM Lease OCS-A
0486*

Prepared by: A.I.S. Inc.

Prepared for: Deepwater Wind New England, LLC and CSA Ocean Sciences Inc.

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1.0 Introduction

Deepwater Wind New England, LLC, an affiliate of Ørsted Wind Power North America, LLC, is proposing to develop the Revolution Wind (REV) and South Fork Wind (SFWF) projects, two offshore wind energy projects within the Bureau of Ocean Energy Management (BOEM) Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0486) and export cable routes (Figure 1). This report summarizes the site investigation surveys conducted under the Incidental Harassment Authorization (IHA) issued to Deepwater Wind New England, LLC (DWW) by the National Marine Fisheries Service effective between 14 June 2018 and 13 June 2019.

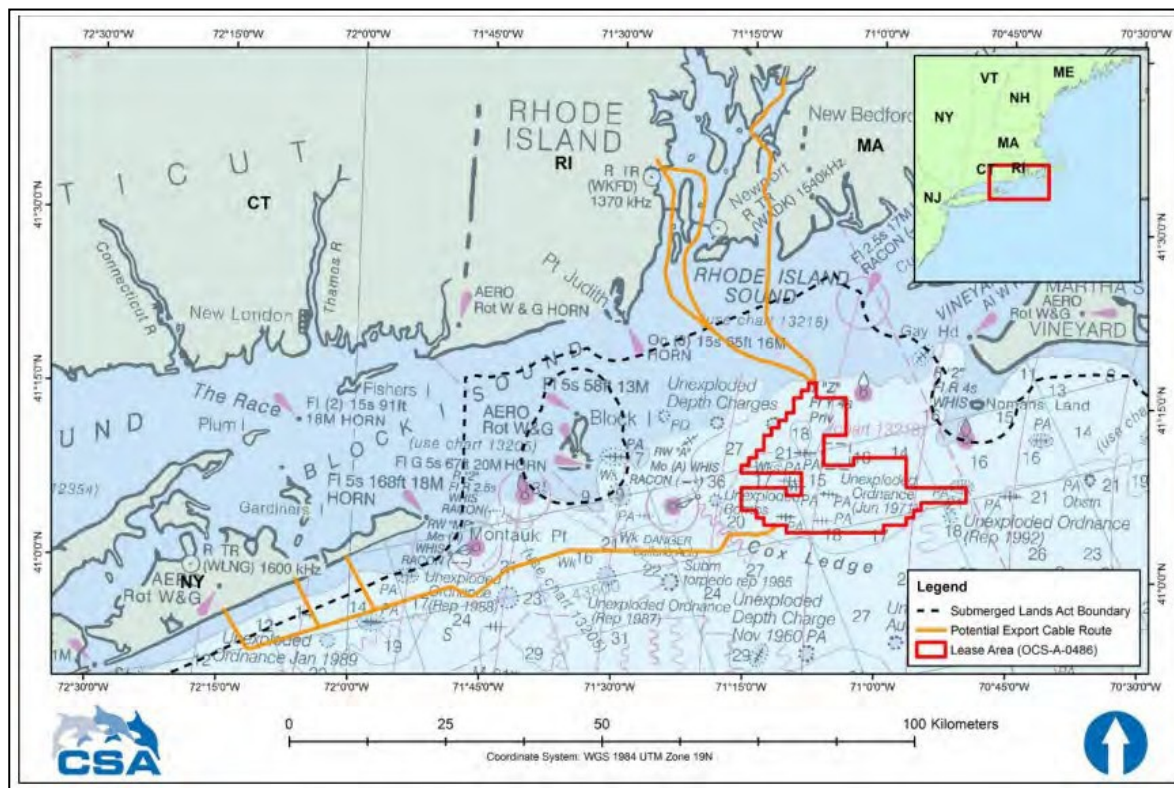


FIGURE 1 LOCATION OF LEASE AREA OCS-A-0486 AND ASSOCIATED EXPORT CABLE ROUTES.

The report summarizes protected species observation activities during geotechnical and geophysical (G&G) surveys conducted by DWW and subsequently Ørsted North America (Ørsted). Under the IHA, mitigation and monitoring of marine mammals was required during operation of geophysical sources with frequency outputs below 200 kHz. Final reporting to NMFS regarding marine mammal observations and an assessment of potential *take* as defined

under the Marine Mammal Protection Act as well as an assessment of monitoring efficacy are included in this report as required under the terms and conditions of the IHA.

Geotechnical investigations were also conducted during the surveys but are not required to have an IHA because no harassment to marine mammals is expected. However, BOEM Lease stipulations for G&G surveys require mitigation and monitoring for marine mammals and sea turtles for both geophysical and geotechnical investigations. Therefore, results from both geophysical and geotechnical surveys are summarized in this report.

The Lease protocols are summarized and approved in survey plans submitted to BOEM prior to survey commencement. Survey plans implemented for Lease OCS-A 0486 include:

- 2018 South Fork Wind Farm Geotechnical Survey
- 2018 South Fork Wind Farm Acoustic Coring Survey
- 2018 South Fork Wind Farm Expansions Area Survey
- 2018 Revolution Wind Farm Survey
- 2019 Revolution Wind Farm Survey Amendment¹

Due to the overlap in survey activities conducted by various vessels, and to maintain clear records, a vessel-specific 90-day survey report was produced for each survey plan. The 90-day summary reports are provided as Appendices to this report.

2.0 Summary of Geotechnical and Geophysical Site Assessment Surveys

Protected Species Observers (PSOs) were deployed aboard six different vessels which were used to implement the G&G operations conducted by Fugro N.V. from August 5th, 2018 through March 3rd, 2019. Due to the 24 hour nature of the survey work, the teams of PSOs aboard the survey vessels worked in shifts to conduct mitigation monitoring. Depending on the operations and associated equipment, different mitigation measures were applied for each vessel or survey. **Table 1** provides a summary of the survey activities and corresponding mitigation measures.

¹ Only a portion of the 2019 Revolution Wind survey was covered under the 13 June 2018 IHA. While the data from the portion of the survey covered by the IHA is included in this report, the remainder of 2019 survey report is not included in this document.

Table 1. Summary of operations and protected species mitigation zones for individual surveys within Lease OCS-A-0486 conducted between July 2018 and March 2019.

Parameter	South Fork Wind Farm Geotechnical Survey (Deep Bore)	South Fork Wind Farm Acoustic Coring Survey	South Fork Wind Farm Expansion Area Survey		Revolution Wind Farm Survey (2018 and 2019)	
Dates	Aug. 5 – Sept. 6, 2018	Oct. 6-23, 2018	Oct. 15, 2018 –Feb. 23, 2019		Oct. 10, 2018 – Mar. 3, 2019	
Geotechnical (GT) Survey	Yes	Yes ¹	Yes		Yes	
High resolution geophysical (HRG) Survey	No	Yes ¹	Yes		Yes	
Operating Vessels	Seacor Supporter (GT)	M/V Commander (GT)	M/V Conti (GT); M/V Discovery (HRG)		M/V Conti (GT); M/V Westerly (HRG); M/V Discovery (HRG); M/V Megan Miller (HRG)	
Maximum Output HRG	N/A	Pangeo Acoustic Corer	AA Dura-spark operating at 1000J		AA Dura-spark operating at 1000J	
IHA Level B	N/A	8m	447m		447m	
Pre-start clearance	60 minutes for all marine mammals and sea turtles	60 minutes for all marine mammals and sea turtles	60 minutes for all marine mammals and sea turtles		60 minutes for all marine mammals and sea turtles	
Mitigation Zones						
			GT	HRG	GT	HRG
North Atlantic Right Whale ²	200m	500m	200m	500m	200m	500m
Other whales	200m	200m	200m	500m	200m	500m
Harbor porpoise	N/A	200m	25m	500m	25m	500m
Dolphins	N/A	200m	N/A	500m with Exception ³	N/A	500m with Exception ³
Seals	N/A	200m	N/A	500m	N/A	500m
Sea Turtles	200m	200m	50m	500m	50m	500m

GT = Geotechnical HRG = high resolution geophysical; IHA = Incidental Harassment Authorization; m= meters; M/V – marine vessel; N/A = not applicable to survey

¹ The geotechnical survey used an acoustic corer which operates with geophysical “chirp” and sonar sources.

²Any acoustic detection of a North Atlantic right whale, regardless of distance, resulted in an equipment shutdown.

³ Dolphin exceptions allowed no equipment shutdown if lead observer determined entry into exclusion zone was voluntary.

3.0 Protected Species Monitoring Methods

To fulfill the protected species monitoring requirements of the BOEM-issued lease, DWW/Ørsted contracted AIS, Inc. (AIS) to provide PSOs and PAM Operators to monitor for marine mammals and sea turtles during geotechnical and geophysical survey operations. Each PSO was approved by National Marine Fisheries Service (NMFS) and BOEM prior to the survey and were cross-trained as Passive Acoustic Monitoring (PAM) operators. All PSOs and PAM Operators worked in shifts to ensure that each individual did not exceed four consecutive hours of watch and received a two-hour break for every four hours of watch. Best efforts were made to ensure that no individual worked more than 12 hours in a 24-hour period. In accordance with the Survey Plan, visual observers maintained a constant watch of the exclusion zone surrounding

the vessel during daylight hours. For nighttime operations, PSOs monitored the exclusion zone via a combination of vessel-mounted thermal imaging cameras and a PAM system deployed from the sound source. As needed, hand-held night vision equipment was used to support other monitoring tools and provide additional redundancies. Details of the nighttime observation equipment is provided in the individual survey reports in the Appendix.

Mitigation zones were established based on the equipment being operated, BOEM Lease requirements, and NMFS issued IHA requirements. A 60-minute clearance period for all marine mammals and sea turtles was conducted prior to starting any equipment. While none of the individual geotechnical or geophysical equipment were capable of a ramp up, equipment would be started sequentially with other operations when possible. If animals entered the designated exclusion zone, all equipment was shutdown. The only exceptions to equipment shutdown were:

1. During geotechnical boring when there was a potential loss of the borehole if equipment stopped entirely (in these cases, the drill was kept active but was not advanced); and
2. In the case of dolphins voluntarily encroaching the migration zone (in these cases, if dolphins were observed in the exclusion zone, no action was taken until there has been a 10-minute observation period by the PSO). Equipment was not shutdown or powered down while the 10-minute observation period was being conducted.
 - a. If dolphins left the exclusion zone after 10 minutes, no further action was taken.
 - b. If dolphins were voluntarily entering the exclusion zone on a trajectory toward the vessel, bow riding, or otherwise engaging the equipment and vessel (as determined by the PSO), no further action was taken.

PSOs and PAM Operators recorded data on standard observation forms including details on survey operations, observer effort and protected species sightings and incidents. PSOs regularly checked the Right Whale Sighting Advisory System (RWSAS) for recent north Atlantic right whale sightings and established DMAs in the survey area. For each shift, a designated Lead PSO was responsible for communicating the presence of protected species and for communicating and enforcing the appropriate mitigation actions. PAM operators communicated nighttime detections to the lead PSO on duty to ensure the implementation of the appropriate mitigation measure.

Details of the monitoring and mitigation activities are provided in the individual survey reports in the Appendix.

4.0 Protected Species Survey Results

4.1 Observer Effort

Daytime operations were monitored by PSOs conducting visual watches and with PAM during daytime fog conditions when the full exclusion zone could not be monitored visually. During nighttime operations, the combination of PAM and thermal imaging camera monitoring were the main observation methods. Additionally, night vision devices (NVD) were used to help in the monitoring effort. **Table 2** provides a summary of PSO effort by monitoring method.

Table 2. Level of effort (in hours and minutes) by monitoring type and vessel during all surveys conducted on Lease OCS-A-0486 in 2018 and 2019¹.

Survey Vessel	Effort Hours (hh:mm)				
	Daytime Visual	Daytime PAM	Thermal camera	NVD	Nighttime PAM
<i>Geophysical</i>					
Megan	295:12	4:48	-	80:09	12:36
Westerly ²	250:45	0:00	0:00	0:00	0:00
Discovery	549:42	52:06	682:12	143:12	494:30
Enterprise	295:36	22:36	78:48	6:18	48:30
Subtotal	1391:15	79:30	761:00	229:39	555:36
<i>Geotechnical (including acoustic corer)</i>					
Seacor Supporter	599:18	0:00	0:00	0:00	275:54
Conti	313:06	0:18	399:00	0:30	328:06
Commander ³	150:58	-	150:58	-	139:36
Subtotal	1063:22	0:18	549:58	0:30	743:36
SUM	2454:37	79:48	1310:58	230:09	1299:12

¹ Summary table provided by CSA Ocean Sciences, Inc.

² HRG Surveys aboard the M/V Westerly were conducted during daylight hours only. All other vessels conducted 24-hour surveys

³ Data entry software did not record visual effort type or time properly on the M/V Commander; therefore, visual monitoring was split evenly between daytime visual and thermal camera assuming equal time monitoring during day and night.

4.2 Sighting and Detection

Most of the protected species detections (57.5%) occurred during daylight hours. **Table 3** provides a summary of species detections by method, and is divided per survey type.

Table 3. Marine mammal and sea turtle detections by monitoring type and family. The table reflects total number detections (does not account for the animal count)¹.

Family	Total number of detections recorded by Protected Species Observers (PSOs)				
	Daytime Visual	Daytime PAM	Thermal camera	NVD	Nighttime PAM
<i>Geophysical</i>					
Balaenopteridae	48	0	4	0	0
Balaenidae	0	0	0	0	0
Unidentified. Large whale	7	0	1	0	0
Delphinidae	44	2	6	9	3
Phocoenidae	0	0	0	0	0
Phocidae	9	0	0	0	0
Cheloniidae	0	0	0	0	0
Dermochelyidae	0	0	0	0	0
Subtotal	108	2	11	9	3
<i>Geotechnical (including acoustic corer)</i>					
Balaenopteridae	41	0	2	0	0
Balaenidae	2	0	0	0	3
Unidentified large whale	5	0	2	0	0
Delphinidae	21	0	15	0	92
Phocoenidae	0	0	1	0	0
Phocidae	7	0	0	0	0
Cheloniidae	1	0	0	0	0
Dermochelyidae	0	0	0	0	0
Subtotal	77	0	20	0	95
SUM	185	2	31	9	98

¹ Summary table provided by CSA Ocean Sciences

Geotechnical operations were stationary during each survey station while geophysical surveys are conducted aboard a vessel moving at roughly 4-5 knots. Detections per Unit (hour) of Effort (d/hr.) are presented in **Table 4**. Detections per unit of effort (DPUE) were highest for Delphinidae PAM detections at 0.075 detections per hour of effort (d/hr.). Daytime PAM also produced a high DPUE for delphinids at 0.35 d/hr. Daytime visual detection rates were highest for Balaenopterid whales (0.40 d/hr.) and dolphins (0.30 d/hr.). Daytime visual detection rates were similar for Balaenopterid whales for both geophysical and geotechnical surveys (0.035 d/hr. and 0.039 d/hr. respectively) while dolphin detection rates were more frequent during geophysical surveys (0.032 d/hr.) versus geotechnical surveys (0.020 d/hr.). Phocidae daytime

visual detection rates were low for both survey types (0.0086 d/hr. for geophysical and 0.007 d/hr. for geotechnical). Phocidae detection rates were 0.00 d/hr. for all other monitoring types.

The most common species encountered was the common dolphin, *Delphinus delphis*, which were reported on nearly every vessel. Only three (3) North Atlantic right whale detections were made and all three of these were acoustic detections that were recorded from the stationary geotechnical lift boat between August 8th and August 24th. The PAM operator reported these as gunshot calls; no distance could be determined and no verification of the detections were made outside the PAM operator on duty.

Table 4. Detections per Unit of Effort (DPUE) marine mammal groups for each monitoring type¹.

Family	Detections Per Unit of Effort (DPUE) by monitoring type				
	Daytime Visual	Daytime PAM	Thermal camera	NVD	Nighttime PAM
<i>Geophysical</i>					
Balaenopteridae	0.035	0	0.005	0	0
Unidentified large whale	0.005	0	0.001	0	0
Delphinidae	0.032	0.025	0.008	0.039	0.005
Phocidae	0.006	0	0	0	0
Geophysical DPUE	0.07	0.025	0.012	0.039	0.004
<i>Geotechnical (including acoustic corer)</i>					
Balaenopteridae	0.039	0	0.004	0	0
Balaenidae	0.002	0	0	0	0.004
Unidentified large whale	0.005	0	0.004	0	0
Delphinidae	0.02	0	0.027	0	0.124
Phocoenidae	0	0	0.002	0	0
Phocidae	0.007	0	0	0	0
Geotechnical DPUE	0.072	0	0.036	0	0.128
Overall DPUE	0.071	0.025	0.022	0.039	0.075

¹ Summary table provided by CSA

² The DPUE comparisons in **Table 4** do not fully account for species availabilities within specific distances which will affect detection rates.

Animal Closest Point of Approach (CPA) during the HRG surveys varied by group (**Table 5**); whale species, on average, were detected at greater distances than other species groups during operational and non-operational periods. Harbor porpoise and seals had the smallest average CPAs for both operational conditions. Dolphin species, as a group, had closer average CPAs

during source operations than during non-operational conditions; however, the common dolphin had closer average CPAs during non-operations than during source operations (**Table 5**).

Table 5. Average Closest Point of Approach (CPA) for marine mammal species during active and non-active source operations.

Species	Average of CPA without HRG sources operating (m)	Average of CPA with HRG sources operating (m)
Dolphin spp.	805	263
Common dolphin	64	169
Large whale spp.	786	1624
Fin whale	1187	2742
Humpback whale	1545	2094
Minke whale	253	376
Harbor porpoise	30	30
All Seals	46	132

¹ Summary table provided by CSA

5.0 Exposure Assessment

The IHA, effective 13 June 2018 through 12 June 2019, assessed all potential geophysical sources operating on the lease. The distances to regulatory acoustic thresholds were calculated to determine the distance at which potential marine mammal may be exposed to sound pressure levels (SPLs) at which permanent threshold shifts (Level A) or behavioral disturbance (Level B) could occur. No Level A exposures were predicted by the calculations. Level B threshold distances differed by source (**Table 6**). Not each source was used during 100% of the surveys, therefore, at the time of a detection, PSOs recorded the sources operating at the time of the detection. When the source in operation was unknown, PSOs assumed the highest power source that produced the largest threshold distance. The area of water encompassing the threshold distance around a geophysical source is considered the Level B exposure zone.

Table 6. Estimated distances to Level B threshold isopleths produced by geophysical sources during surveys¹.

Source	Estimated Distance to Level B Threshold
Teledyne Benthos chirp	71
Edgetech chirp	6
Applied Acoustics boomer	6
Applied Acoustics S-boom	141
Fugro bubble gun	63
800J sparker	141
Acoustic corer	8
Applied Acoustics Dura-Spark	447

¹ Summary table provided by CSA

Based on these distances and the detection records, animals reported by the PSOs as within each specified Level B zone while these sources are active would be considered taken by Level B harassment under the Marine Mammal Protection Act (MMPA). Because specific sources could not be reliably recorded, the maximum distance of 447m was used for take estimates (**Table 7**). However, in reality, not all these animals would have been exposed to the SPLs necessary to trigger a behavioral response. Additionally, PSOs implemented shutdowns of geophysical sources in some instances (as seen in Table 1); therefore, these results are considered an over-estimate of the actual number of individuals prompted to a behavioral reaction or incurring a temporary hearing threshold shift due to the surveys.

Table 7. Authorized marine mammal takes, maximum estimated exposure, and the percent of population exposed during surveys conducted under the Incidental Harassment Authorization issued on 13 June 20181.

Common Name	Species	Authorized Takes	Estimated Exposure	Percentage of stock exposed
Sperm Whale	<i>Physeter macrocephalus</i>	1	0	0%
Atlantic White-sided Dolphin	<i>Lagenorhynchus acutus</i>	357	0	0%
Atlantic Spotted Dolphin	<i>Stenella frontalis</i>	50	0	0%
Bottlenose Dolphin	<i>Tursiops truncatus</i>	318	0	0%
Killer Whale	<i>Orcinus orca</i>	1	0	0%
Long-finned Pilot Whale	<i>Globicephala melas</i>	32	0	0%
Risso's Dolphin	<i>Grampus griseus</i>	30	0	0%
Common Dolphin	<i>Delphinus delphis</i>	910	395	0.56%
Fin Whale	<i>Balaenoptera physalus</i>	42	0	0%
Sei Whale	<i>Balaenoptera borealis</i>	2	0	0%
Minke Whale	<i>Balaenoptera acutorostrata</i>	9	0	0%
Blue Whale	<i>Balaenoptera musculus</i>	1	0	0%
Humpback Whale	<i>Megaptera novaengliae</i>	29	2	0.22%
North Atlantic Right Whale	<i>Balaena glacialis</i>	3	0	0%
Harbor Porpoise	<i>Phocoena phocoena</i>	501	0	0%
Gray Seal	<i>Halichoerus grypus</i>	2792	2	< 0.01%
Harbor Seal	<i>Phoca vitulina</i>	1285	3	0.01%
Dolphin spp. ²	n/a	259	-	
Whale spp.	n/a	1	-	
Seal spp.	n/a	1	-	

¹ Summary table provided by CSA

² Dolphin spp. were a combination of unidentified dolphins using visual monitoring methods and unidentified dolphins detected with Passive Acoustic Monitoring (PAM). Because localization and enumeration from PAM detections are challenging and not always reliable, these numbers are highly estimated.

6.0 Assessment of Monitoring Methods

Overall, the thermal imaging camera system, Passive Acoustic Monitoring system and night vision provided effective means for the team to efficiently monitor the exclusion zones for encroaching animals during nighttime hours and periods of reduced visibility. Marine mammals were detected by numerous methods at distances more than sufficient to implement the appropriate mitigation measure such as shutdowns of acoustic sources <200 kHz as well as vessel strike avoidance measures.

PAM is widely used to monitor mitigation zones around vessels and other platforms during survey and installation activities that could negatively impact marine mammals. The priority of mitigation monitoring is the ability for compliance personnel to detect and spatially localize marine mammals such that a mitigation decision can be made in a matter of minutes. The complexity of acoustic detection and localization is further hindered by practical operational conditions that are common for mitigation monitoring. The ability to detect a marine mammal call using PAM systems commonly deployed for HRG surveys is hindered by vessel noise and masking of marine mammal signals.

The thermal imaging camera system and the PAM system both had regular detections, although not as many or as detailed as visual detections. The thermal cameras were installed by technicians and worked reasonably well.

Nearly all (97%) of acoustic detections were of dolphins. However, because there was variability in operator call identification and limited post-processing, acoustic detections of dolphins were categorized as 'Unidentified Dolphin'. No baleen whale detections occurred on the towed PAM systems during the geophysical surveys. The only baleen whale detections on PAM were from geotechnical surveys that used a stationary PAM deployment, and all were during periods of no geotechnical operations.

The PSO/PAM team encountered one challenge with PAM during the geotechnical survey that resulted in a minor delay in operations. There was a PAM equipment damage occurrence on January 17th, 2019, where the PAM cable became entangled in the bow thruster which resulted in the PAM cable being severed and approximately 3m of cable was lost. The severed cable was

recovered, and the cable replaced with the spare hydrophone array that the PSO team had aboard the vessel. Based on depths in the survey area and vessel equipment, the PAM hydrophones are unable to be deployed deep enough or far enough behind the vessel to avoid some interference.

71% of dolphin or porpoise detections and 29% of large whale detections occurred using thermal imaging cameras. The thermal imaging cameras appear to be effective in complementing PAM, especially for large whale detections. PSO teams working at night were confident in the detection ability and range of visibility with the cameras even when some of the camera features were not fully operational. Only one significant loss of function occurred when the pan/tilt unit for a port side camera stopped working from September 29th through October 23rd, 2018. To mitigate the situation, in addition to monitoring the stationary port cameras, additional PSOs monitored the port side with night vision devices until the vessel went into port and the camera issue was resolved.

Species identification, particularly for small dolphins, is still a challenge with the thermal camera but it is anticipated that evolution of thermal imaging and image processing technology will successfully address these issues in the future.

The night vision devices (monocular and goggles) were least used and were also the least effective due to limited range of visibility. Their range of visibility reaches only very close to the vessel even with the spotlight. Night vision devices were utilized during nighttime hours for strike avoidance of protected species and to supplement acoustic monitoring during survey operations. This supplemental use resulted in the detection rates being higher because the PAM operator alerted the PSO to a detection. Night vision devices were aimed away from vessel flood lights to prevent damage and maintain effectiveness of the equipment. Vessel flood lights reduced the effectiveness of the night vision devices at close range; however, safety of the crew working on deck took precedence. Based on the number of detections utilizing the night vision devices, it is recommended that efforts to minimize lighting be implemented when utilizing night vision devices. It is also recommended that distance estimation features be more reliable with hand-held night vision devices.

**APPENDIX A. *MV BHC COMMANDER* – SOUTH FORK WIND FARM GEOTECHNICAL SURVEY
PROTECTED SPECIES OBSERVER REPORT**



South Fork Wind Farm Lease OCS-0486
BHC Commander Geotechnical Survey 2018
Protected Species Observer Combined 90-Day and Final Report

Prepared by: A.I.S. Inc.

Prepared for: Deepwater Wind New England, LLC
and CSA Ocean Sciences Inc.

Submittal Date: December 15, 2018

This report is being submitted to satisfy the following lease stipulations:

BOEM Lease OCS-A 0486; Section 4.4 Reporting Requirements

4.4.3 Report of Activities and Observations

The Lessee must provide the Lessor and NMFS within 90 calendar days following the commencement of HRG survey activities that includes a summary of survey activities, and an estimate of the number of listed marine mammals and sea turtles observed and/or Taken during these survey activities.

4.4.4 Report Information

Data on all protected species observations must be recorded based on standard marine mammal observer collection data by the PSO. This information must include: dates, times, and locations of survey operations; time of observation, location, and weather; details of marine mammal sightings (e.g., species, number, behavior); and the details of any observed Taking (e.g., behavioral disturbances or injury/mortality).

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1 INTRODUCTION

Deepwater Wind South Fork, LLC (Deepwater Wind), an affiliate of lease holder Deepwater Wind New England, LLC is proposing to develop the South Fork Wind Farm (SFWF) project, an offshore wind energy project within the Bureau of Ocean Energy Management (BOEM) Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf, OCS-A 0486 (Lease), interconnecting with the Long Island Power Authority transmission system on Long Island, New York.

This report documents the complete results of the protected species detections from the 2018 geotechnical surveys conducted by PanGeo aboard the MV BHC Commander for Deepwater Wind. A summary of the data collected and, the number of animals detections are included in this report. Protected Species Observer (PSO) methodology and monitoring protocols are discussed, however, a detailed description is provided in the Alternative Monitoring Plan (AMP). An assessment of effectiveness of PSO monitoring and future recommendations is provided in the final section of the report.

2 SUMMARY OF GEOTECHNICAL SURVEY ACTIVITIES

Deepwater Wind completed site characterization surveys in the lease area consisting of geotechnical sampling surveys between October 6th through 23rd, 2018. Both visual and Passive Acoustic Monitoring (PAM) observers were aboard the vessel during survey activities in accordance with the Construction and Operations Plan (COP).

3 PROTECTED SPECIES OBSERVATION METHODS

In order to comply with the lease protected species monitoring requirements issued by BOEM, Deepwater Wind contracted A.I.S. Inc. (AIS) to provide PSO and PAM operators to monitor for marine mammals and sea turtles during geotechnical survey operations. These monitoring activities were completed in accordance with the BOEM approved SFWF COP Survey Plan and AMP.

Protected species monitoring occurred at all times during this geo-tech survey, in anticipation of geotechnical operational activities, as well as during the transit to and from survey sites to avoid any potential protected species ship strikes. Visual monitoring occurred for a total of 302 hours, and acoustic monitoring during 139.6 hours.

3.1 PROTECTED SPECIES OBSERVER TRAINING AND COMPLIANCE

All PSO and PAM operators who monitored during this survey attended the Permit and Environmental Compliance (PECP) Training compiled and presented by Deepwater Wind and CSA. Additionally, all PSO and PAM operators received project specific training that covered the following topics:

- Permits and plans relevant to the project
- Environmental compliance requirements
- Health and safety requirements
- PSO/PAM operator requirements and scheduling

- Protected species mitigation methods
- Communication
- Authorized takes
- Data form
- PSO and PAM equipment, use, and maintenance
 - 7 X 50 Waterproof binoculars with reticles
 - Rangefinders
 - Gen 3 Night vision monoculars
 - High Definition/Thermal imaging cameras
 - PAM equipment
- Protected species identification review

All PSO and PAM operators who participated in the survey were approved by BOEM, per lease stipulation 4.3.4. All PSO and PAM staff were required to comply with PanGeo operating standards, possess fit for sea duty medical clearance and offshore safety training.

Detailed PSO methodology and monitoring protocols are provided in the AMP. An assessment of effectiveness of PSO monitoring and future recommendations is provided in the final section of the report.

3.2 PROTECTED SPECIES OBSERVATION DATA

PSO and PAM entries and mitigation summaries were recorded on data sheets, which were provided to CSA and Deepwater Wind on a daily basis via Mysticetus reports. Attached are summaries of the detections from PSO/PAM data for the MV BHC Commander in relation to specific survey activities (Attachment 1). Summary details provided include:

- Dates, times
- Species encountered
- Initial detection method
- Location
- Group Size (Minimum, Maximum, Best)
- Description of the observed behaviors (in both the presence and absence of activities)
- A summary of event details
- Description of survey activities at the time of sighting/detection
- Approximate closest point of approach
- Mitigation Measures Taken

4 GEOTECHNICAL SURVEY DATA SUMMARY

4.1 Geotechnical Survey – Sighting/Detection Data

There were a total of 6 visual sighting events, 11 thermal imaging/infrared sighting events and 32 acoustic detections made during the geotechnical survey. Nine of the acoustic detections were paired with a visual/IR sighting (28%). Table 1 provides the total number (best estimate) of individuals by species

visually sighted and/or acoustically detected (all double entries were discounted). A summary of the details associated with these sightings can be found in Attachment 1.

20% of the sightings/detections occurred during daylight, between the hours of 6:00 AM (sunrise) and 7:00PM (sunset), and the other 80% occurred during nighttime hours.

Table 1 Species and Number if Individuals Sighted or Detected during Geotechnical Survey

Species	Number of Individuals Sighted/Detected
Dolphin, Short-Beaked Common	149
Unidentified dolphin/porpoise	51

4.2 Geotechnical Survey – Mitigation Activities

There were no mitigation activities taken during this survey, due to the closest point of approach of any animals remaining outside the 200m exclusion zone while the sound source was active.

4.3 Geotechnical Survey – Dead or Injured Marine Mammal or Sea Turtles

There were no dead or injured marine mammals or sea turtles reported during this survey.

5 CHALLENGES/RECOMMENDATIONS

There were no performance issues with either the HD/Thermal Imaging cameras or PAM equipment during the survey. Overall, the PSO team, thermal camera system and passive acoustic array provided effective means for the team to efficiently monitor the exclusion zone for encroaching animals, with enough time to make appropriate mitigation decisions. The PSO/PAM team only encountered a few challenges during this survey; however these challenges did not result in any major delays in operations.

One challenge was that, the stationary nature of the work vessel required the passive acoustic monitoring equipment be statically deployed off the side of the vessel, in a vertical orientation, while the vessel was raised in working position. The vertical orientation of the equipment limited the localizing capabilities of the hydrophones, resulting in many ‘not able to determine’ (NAD) detections. This resulted in the PAM operators relying on frequency content and/or signal to noise ratio (SNR) to estimate the animal(s) distance from the sounds source.

The majority of the PAM detections were delphinid in nature, but species could only be identified via visual confirmation from PSO on deck using night vision (this only occurred twice throughout the survey).

Similarly, while the Seiche thermal imaging cameras greatly improve the PSO team detection ability at night (by increasing their field of view and distance of detections in comparison to handheld night vision), however identifying some species was, at times, problematic. The majority of the animals detected via thermal imaging were delphinids, and species was not possible to identify based on the vague silhouettes provided by the thermal imaging equipment. The animals also never approached the vessel close enough to allow for a visual confirmation via night vision.

Attachment 1

MV BHC Commander Detection Summary

Detection Method	Sighting#	EDT	Sgt Distance	Species	Species Reliability	Travel Direction	Min Count	Max Count	Best Count	Behavior	Behav Reaction	Mit Request	Mit Response	Notes	GPS Pos	Vessel Activity	Mit Source Status	Source Freq
PAM	1	10/08/2018 00:56	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	High frequency clicks detected during survey operations. No bearing distinguishable due to static deployment. No visual confirmation was achieved. - Multiple high frequency click trains observed on HF click detector module while the source was retrieved onboard for maintenance. - High frequency click trains observed on the HF click detector module while the AC is on deck. -	-41 06 40.7 N 71 09 3.0 W	Station keeping (DP)	Off	Below 200khz
PAM	2	10/09/2018 00:42	NAD	Unid dolphin	Sure					1 Clicks		None	n/a		41 06 48.7 N 71 08 51.2 W	Station keeping (DP)	Off	None
PAM	3	10/09/2018 03:36	NAD	Unid dolphin	Sure					1 Clicks		None	n/a		41 06 49.0 N 71 08 50.8 W	Station keeping (DP)	Off	None
PAM	4	10/09/2018 04:37	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	High Frequency click trains observed on click detector from 08:34-08:45 in clicks reaching up to 160 dB. Another quick click train was observed at 08:51 and again at 08:59. Last time of sighting was 09:05. This detection corresponded with a visual dolphin sighting on the thermal camera. AC still on deck for repair.	41 06 48.6 N 71 08 50.9 W	Station keeping (DP)	Off	None
Thermal	5	10/09/2018 04:54	100	Unid dolphin	Sure	No clear direction / not able to determine	3	5		Mill, Feeding on 3 observed fish	None	None	n/a	At least 3 small falcate dorsal fins seen approximately 100 m off the starboard bow. Dolphins appeared to be feeding on small fish near the surface of the water. Therefore, the direction of travel was difficult to determine. The dolphins were last seen heading towards the stern of the vessel. Dolphins were detected by PAM operator shortly before sighting. Dolphins only briefly spotted on IR, about 15 seconds. Therefore, there was no recording made. This sighting corresponds with the PAM sighting at 04:37 - EST (08 - :37 UTC). - -	41 06 48.8 N 71 08 50.9 W	Station keeping (DP)	Off	None
PAM	6	10/09/2018 05:44	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	High Frequency clicks observed on click detector from 09:44-09:53, with multiple click clusters reaching above 160 dB, indicating animals most likely within 200 m of the hydrophones. AC unit still on deck for repair at time of detection.	41 06 48.9 N 71 08 51.1 W	Station keeping (DP)	Off	None
Visual	7	10/09/2018 15:59	879	Common dolphin	Best Guess	Towards bow	10	15		Surface-Active Travel, 12 Porpoising	None	None	n/a	Numerous dolphins were sighted at approximately 345 degrees in relation to the vessels bow and - at a distance of approximately 900 meters. They were traveling perpendicular to the vessels heading of 144 degrees. - The dolphins were porpoising and traveling and after approximately two minutes of observing them they changed direction and began moving away from the vessels trajectory and disappeared from sight. - High frequency clicks observed on the HF module in Pamguard.	41 06 45.8 N 71 08 55.2 W	Retrieving equipment	Off	None
PAM	8	10/09/2018 20:01	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	-	41 06 49.7 N 71 08 50.7 W	Station keeping (DP)	Off	None

Detection Method	Sighting#	EDT	Sgt Distance	Species	Species Reliability	Travel Direction	Min Count	Max Count	Best Count	Behavior	Behav Reaction	Mit Request	Mit Response	Notes	GPS Pos	Vessel Activity	Mit Source Status	Source Freq
PAM	9	10/09/2018 22:08	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	High Frequency click trains observed on amplitude display reaching 158 dB, from 02:07-02:08. Acoustic corer still on deck	41 06 49.1 N 71 08 51.4 W	Station keeping (DP)	Off	None
PAM	10	10/09/2018 22:27	NAD	Unid dolphin	Sure					1 Clicks, Whistles		None	n/a	Multiple High Frequency clicks were observed consistently on the amplitude display from 02:25-02:38 and again from 02:49-02:51. Majority of click trains had peak amplitudes of 160-163 dB. Upsweep and downsweep whistles were visible on the spectrogram display and audible to PAM operator at 02:27, 02:29, 02:34, and 02:40, ranging from 9.45-10.22 kHz. This detection correlated with a dolphin sighting on the thermal camera. AC unit on deck.	41 06 49.1 N 71 08 51.5 W	Station keeping (DP)	Off	None
Thermal	11	10/09/2018 22:36	316	Unid dolphin	Sure	Away from bow	3	15		Surface-Active Travel, 5 Porpoising	None	None	n/a	Approximately 3-15 dolphins were observed swimming at a bearing of approximately 2:00 from the bow of the vessel. - They were moving in a direction approximately perpendicular to the vessels heading which was 181 degrees. The dolphins were initially detected on the PAM by Cara.	41 06 49.1 N 71 08 51.4 W	Station keeping (DP)	Off	None
PAM	12	10/09/2018 23:20	NAD	Unid dolphin	Sure					1 Clicks, Whistles		None	n/a	Consistant HF clicks were observed on the amplitude display from 03:19-03:37, reaching peak amplitudes of 160 dB. LF downsweep whistles ranging from 9.84-9.96 kHz were visible on spectrogram display and audible to PAM operator at 03:24	41 06 49.2 N 71 08 51.7 W	Station keeping (DP)	Off	None
Thermal	13	10/09/2018 23:23	150	Unid dolphin	Sure	No clear direction / not able to determine	3	15		Surface-Active Travel, 3 Porpoising	None	None	n/a	Initially detected in the area with PAM - At least three individuals porpoising and causing splashing at the sea surface at a heading of approx 2:00 from the bow; moving about at an indeterminable direction - High frequency delphinid click trains observed on the HF module in Pamguard. Amplitudes of 150 to 155 dB reached. Frequencies of analyzed clicks ranged from 45 to 95 kHz. - -	41 06 49.4 N 71 08 51.6 W	Station keeping (DP)	Off	None
PAM	14	10/10/2018 00:15	NAD	Unid dolphin	Sure					1 Clicks		None	n/a		41 06 49.3 N 71 08 52.6 W	Station keeping (DP)	Off	None

Detection Method	Sighting#	EDT	Sgt Distance	Species	Species Reliability	Travel Direction	Min Count	Max Count	Best Count	Behavior	Behav Reaction	Mit Request	Mit Response	Notes	GPS Pos	Vessel Activity	Mit Source Status	Source Freq
PAM	15	10/10/2018 01:57	NAD	Common dolphin	Sure					1 Clicks		None	n/a	Multiple high frequency click trains observed on Pamguard's high frequency click detector. Analyzed clicks ranged in frequency from 25 to 95 kHz at amplitudes from 135 to 160 dB. Visual confirmation was given through IR observation and when the PAM operator stepped outside to confirm common dolphins with the naked eye. The pod was swimming multi-directional around the vessel. Two individuals were observed breaching completely 5 meters from the port and starboard beam. All detectable signals ceased at 04:26 UTC. - -	41 06 49.2 N 71 08 52.1 W	Station keeping (DP)	Off	None
Thermal	16	10/10/2018 02:18	5	Common dolphin	Most Likely	Variable, rapid changes of direction	5	20		Surface-Active 10 Mill, Breach	None	None	n/a	Initially detected with pam and then seen with IR and naked eye. Swimming about in various directions around the stern and back sides of the vessel. Not swimming in any distinct direction. Remained around stern end of the ship for 10-15 minutes before detection ended. ID made with eye visual, sleek body shape with distinctive black back saddle and tan sides. PAM last detection at 06:26 UTC. - - -	41 06 49.3 N 71 08 52.2 W	Station keeping (DP)	Off	None
PAM	17	10/10/2018 02:51	NAD	Common dolphin	Sure					1 Clicks		None	n/a	Common dolphins return a short time later with multiple click trains on the high frequency click detector. - -	41 06 49.2 N 71 08 52.3 W	Station keeping (DP)	Off	None
Thermal	18	10/10/2018 02:57	100	Unid dolphin	Sure	Variable, rapid changes of direction	1	20		Surface-Active 10 Mill, Breach	None	None	n/a	Detected with PAM. Closest approach detected with IR about 100 m off from the ship. sighting lasted around 5 minutes before end of detection - Splashing at surface and moving about in various directions. Not able to see with naked eye so no specific ID but based on recent previous sightings was most likely again common dolphins. Last detected by PAM at 07:29 UTC. - -	41 06 49.2 N 71 08 52.5 W	Station keeping (DP)	Off	None
PAM	19	10/10/2018 05:19	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	Multiple high frequency clicks observed on amplitude display from 09:19-09:40 UTC - , ranging from 135-160 dB.	41 06 49.3 N 71 08 52.1 W	Station keeping (DP)	Off	None
PAM	20	10/10/2018 06:04	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	Observed brief high frequency click train that lasted one minute at 10:04 UTC. Clicks ranged from 130 - 160 dB Ongoing dolphin detection since midnight UTC. Problems with computer prevented a beginning start of detection entry. -	41 06 49.3 N 71 08 52.7 W	Station keeping (DP)	Off	None
PAM	21	10/13/2018 20:23	NAD	Unid dolphin	Sure					1 Clicks		None	n/a		41 06 51.5 N 71 08 55.1 W	Station keeping (DP)	Off	None

Detection Method	Sighting#	EDT	Sgt Distance	Species	Species Reliability	Travel Direction	Min Count	Max Count	Best Count	Behavior	Behav Reaction	Mit Request	Mit Response	Notes	GPS Pos	Vessel Activity	Mit Source Status	Source Freq
PAM	22	10/13/2018 21:29	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	Very likely the same pod of dolphins that has been hanging around all night. High frequency click trains observed on HF module. Low frequency whistles were observed aurally and - on the spectrogram as sinusoidal waves and a brief downswoops and upswoops. -	- 41 06 51.7 N 71 08 55.0 W	Station keeping (DP)	Off	None
PAM	23	10/13/2018 22:03	NAD	Unid dolphin	Sure					1 Whistles, Clicks		None	n/a	Upsweep and downswEEP whistles with a frequency range of 8-20 kHz observed on the spectrogram display and audible to PAM operator from 02:03-02:09. Large swath of high frequency click trains, peaking at over 160dB appeared on amplitude display from 02:04 to 02:08. Activity stopped until 02:26 when more HF clicks between 140-162 dB appeared on the amplitude display, then quickly died down again. Another large swath of clicks appeared at 02:30 and again, consistently, between 02:32-02:42. Clicks were observed on the amplitude display from 02:07-02:09 between 130-160 dB. Clicks disappeared and came back again from between 02:12-02:30 with no more than 30 second intervals between click trains and most click trains peaking at over 160 dB. Visual confirmation (using night vision) occurred at 02:26, where two dolphins were seen porpoising on the port side at 9 o'clock. There was a brief period of silence on the amplitude display between 02:30-02:50, followed by multiple click trains at 02:50 between 140 and 163 dB. HF clicks were observed consistently, with less than 30 second click intervals from 02:50 to 03:17. Between 03:03 and 03:16 low frequency whistles were observed on spectrogram display and audible to PAM operator.	41 06 51.7 N 71 08 55.1 W	Station keeping (DP)	Off	None
PAM	24	10/14/2018 18:08	NAD	Unid dolphin	Sure					1 Clicks, Whistles		None	n/a	Dolphin patterns were identified on the PAM. I could not locate them on the IR camera's. I did a visual check outside and noticed two dolphins were porpoising at approximately 9:00 on the port side and traveling in the same direction as the vessel at a distance of approximately 3 meters.	41 06 52.2 N 71 09 7.6 W	Station keeping (DP)	Off	Below 200khz
Thermal	25	10/14/2018 18:27	300	Common dolphin	Best Guess	Parallel in same direction as boat	2	4		Surface-Active 2 Travel	None	None	n/a		41 06 52.4 N 71 09 7.5 W	Coring	On	Below 200khz

Detection Method	Sighting#	EDT	Sgt Distance	Species	Species Reliability	Travel Direction	Min Count	Max Count	Best Count	Behavior	Behav Reaction	Mit Request	Mit Response	Notes	GPS Pos	Vessel Activity	Mit Source Status	Source Freq
Thermal	26	10/14/2018 19:06	300	Common dolphin	Best Guess	Variable, rapid changes of direction	4	7		10 Porpoising	None	None	n/a	First identified with PAM, most likely a common dolphin based upon previous sightings. Identified on IR by splashing at surface of the water. Continued on to outside and was able to locate with night vision and naked eye. Seen on IR first near stern of the vessel moving parallel to stern in the direction of 9:00 then with the naked eye and IR again about 2 meters from the side/bow of the vessel. Not moving in any distinct direction, just splashing about on surface. ID as common dolphin by distinctive black back and saddle like shape. - - -	41 06 52.3 N 71 09 7.4 W	Coring	On	Below 200khz
PAM	27	10/14/2018 23:22	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	High frequency click train observed on amplitude display ranging from 145-160 dB between 03:22-03:26. Clicks stopped after 03:26, but came back again reaching over 160 dB between 03:51-03:57.	41 06 51.9 N 71 08 55.4 W	Station keeping (DP)	Off	None
PAM	28	10/15/2018 01:15	NAD	Common dolphin	Sure					5 Clicks		None	n/a	High frequency click trains were observed on the HF click detector module in Pamguard while the AC was active at full volume in production. Analyzed clicks were shown to have frequencies ranging from 33 to 41 kHz at amplitudes from 135 to 160 dB. Shortly after visual confirmation of common dolphins was given by the visual PSO using infrared technology. -	41 06 52.5 N 71 09 7.6 W	Coring	On	Below 200khz
Thermal	29	10/15/2018 01:19	300	Common dolphin	Most Likely	No clear direction / not able to determine	5	8		5 Porpoising	None	None	n/a	First detected on PAM and then confirmed with night vision monocular. Seen about 10m off the port/bow at about 10:00. Identified as most likely common dolphin by black back and saddle shape on dorsal side of body. There was at least one calf that could be seen swimming along side another grown individual. Swimming towards the vessel at first and then changing course to swim parallel while also changing direction several times before visual was lost. -	41 06 52.4 N 71 09 7.6 W	Coring	On	Below 200khz
PAM	30	10/15/2018 02:48	NAD	Common dolphin	Sure					1 Clicks		None	n/a	High frequency click trains observed in Pamguard. Analyzed clicks showed frequencies ranging from 40 to 95 kHz at amplitudes reaching 160 dB. The source was active at full power during the detection. No mitigation action was necessary because the dolphins approached voluntarily.	41 06 52.5 N 71 09 7.6 W	Coring	On	Below 200khz
PAM	31	10/15/2018 03:14	NAD	Common dolphin	Sure					1 Clicks		None	n/a	Dolphins returned. -	41 06 52.3 N 71 09 7.6 W	Coring	On	Below 200khz

Detection Method	Sighting#	EDT	Sgt Distance	Species	Species Reliability	Travel Direction	Min Count	Max Count	Best Count	Behavior	Behav Reaction	Mit Request	Mit Response	Notes	GPS Pos	Vessel Activity	Mit Source Status	Source Freq
Thermal	32	10/15/2018 04:12	5	Unid dolphin	Sure	No clear direction / not able to determine	3	3		Surface-Active Travel, 3 Porpoising	None	None	n/a	First detected on the stern IR camera. Several splashes seen approximately 300 m off vessel's stern, or about 5 meters away from the sound source. Dolphins direction was highly variable, changing directions frequently. Dolphins detected by PAM at 08:11 UTC, and last seen on IR camera at 08:12 UTC - -	41 06 52.5 N 71 09 7.5 W	Coring	On	Below 200khz
PAM	33	10/15/2018 04:31	NAD	Unid dolphin	Sure					1 Clicks, Whistles		None	n/a	High frequency clicks observed on amplitude display between 08:11-08:20, with most click trains between 140-150 dB. At 08:24 low frequency downsweep whistles were observed on the spectrogram display and aurally with frequency ranges of 5.098-14 kHz. At the same time multiple clusters of high frequency clicks appeared on the amplitude display, with most peaks over 160 dB. More upsweep downsweep, and sinusoidal whistles occurred from 08:26-08:28. HF click trains continued until 08:50. Click trains returned at 08:57. Peak activity occurred at 09:30, which coincided with a visual detection at 09:33 using night vision goggles. HF click trains continued until 10:03	41 06 52.4 N 71 09 7.7 W	Coring	On	Below 200khz
Visual	34	10/15/2018 05:03	525	Common dolphin	Sure	Toward stern	10	30		Surface-Active Travel, 15 Porpoising	Direction of travel	None	n/a	A pod of common dolphins were observed at a bearing of 3:00 from the starboard side of the vessel at a distance of approximately 500 meters. The dolphins had distinctive black back and cape with V-shaped saddle and hourglass pattern on sides with tan patch forward and gray patch aft in addition to a large falcate dorsal fin. The pod was porpoising at the surface in a direction heading from 3:00 to around 5:30 toward the mitigation source. The dolphins made an abrupt turn away from the mitigation source and vessel at a distance of approximately 500 meters off the stern of the vessel and were last seen at approximately 3:00 off the starboard side. -	41 06 53.7 N 71 09 8.3 W	Coring	On	Below 200khz

Detection Method	Sighting#	EDT	Sgt Distance	Species	Species Reliability	Travel Direction	Min Count	Max Count	Best Count	Behavior	Behav Reaction	Mit Request	Mit Response	Notes	GPS Pos	Vessel Activity	Mit Source Status	Source Freq
Thermal	35	10/15/2018 05:33	300	Common dolphin	Most Likely	No clear direction / not able to determine	5	15		8 Porpoising	Surface-Active Travel, None	None	n/a	First detected on PAM and then visual confirmation made with night vision monocular. Most likely common dolphins again based upon coloration and shape of color patterns. First seen on port/bow of vessel travelling toward the ship and then swimming under to the starboard side, not swimming in any distinct direction, just around and back and fourth. At least one adult was accompanied by a calf, swimming side by side.	- 41 06 52.2 N 71 09 7.5 W	Coring	On	Below 200kHz
Thermal	36	10/15/2018 06:49	300	Common dolphin	Most Likely	No clear direction / not able to determine	3	10		6 Porpoising	Surface-Active Travel, None	None	n/a	First detected on PAM then confirmed with IR camera and night vision monocular. ID most likely common dolphin as indicated by far black dorsal coloration and saddle like shape. Swimming in no specific direction but mostly remaining parallel to vessel until near end of detection. First spotted at about 10:00 off the bow of the vessel. (POD, 100m from vessel, Kelly) off the bow of the vessel at a distance of about 100m and a heading of 1:00 headed towards the boat in the heading of 3:00. Looking to be around 12 individuals porpoising in various directions and distances from the vessel with the closest point of approach being at a heading of 3:00 about 2m from the vessel at approximately 12:15UTC (about 300m from sound source AC). Identified as common dolphins based on dark black/brown dorsal coloration with saddle like shape and tan and white patches of coloration. Sighting and species ID additionally verified by PSO2 (Shelby Joyce). Seen heading both parallel (in the direction opposite to the bow of the vessel) and perpendicularly away from the vessel with their final sighting at 12:18UTC.	41 06 52.4 N 71 09 7.6 W	Coring		
Visual	37	10/15/2018 08:10	300	Common dolphin	Sure	Parallel in opposite direction as boat	5	20		12 Porpoising	Surface-Active Travel, None	None	n/a	Brief high frequency click trains observed on Pamguard's HF click detector module. Analyzed clicks ranged in frequency from 40 to 118 kHz reaching amplitudes of 160 dB. The detection ended at 06:11 UTC when all detectable signals ceased. No mitigation was necessary.	41 06 52.2 N 71 09 7.7 W	Coring	On	Below 200kHz
PAM	38	10/17/2018 02:09	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	Pod of dolphins likely detected earlier (AD 20) - Due to the short time period passing from last detection this is likely the same pod of dolphins from AD 20 returning.	41 05 2.0 N 71 08 1.6 W	Coring	On	Below 200kHz
PAM	39	10/17/2018 02:39	NAD	Unid dolphin	Sure					1 Clicks		None	n/a		41 05 1.8 N 71 08 1.5 W	Coring	On	Below 200kHz
PAM	40	10/17/2018 03:03	NAD	Unid dolphin	Sure					1 Clicks		None	n/a		41 05 1.8 N 71 08 1.1 W	Coring	On	Below 200kHz

Detection Method	Sighting#	EDT	Sgt Distance	Species	Species Reliability	Travel Direction	Min Count	Max Count	Best Count	Behavior	Behav Reaction	Mit Request	Mit Response	Notes	GPS Pos	Vessel Activity	Mit Source Status	Source Freq
Visual	41	10/18/2018 09:08	519	Common dolphin	Sure	Towards bow	40	50		Bow Riding, 45 Porpoising	None	None	n/a	Distinctive black back and cape that form a V-shaped saddle. Hourglass pattern on sides with a tan patch forward and gray patch aft. Large and tall falcate dorsal fin located mid back.	- 41 26 55.4 N 71 22 18.8 W	Transit	Off	None
Visual	42	10/18/2018 14:45	2	Common dolphin	Sure	Towards bow	5	10		Surface-Active Travel, 8 Porpoising	None	None	n/a	Distinctive black back and cape that form a V-shaped saddle. Hourglass pattern on side with tan patch forward and gray patch aft. Tall falcate dorsal fin.	41 05 15.4 N 71 09 2.6 W	Ramp up	On	Below 200khz
PAM	43	10/18/2018 23:49	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	Multiple click trains observed on amplitude display frm '40-162 dB.	41 05 18.7 N 71 09 10.4 W	Coring	On	Below 200khz
PAM	44	10/19/2018 04:30	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	Observed multiple click train over 160 dB on the amplitude display. Clicks disappeared after a minute, but came back again at 08:39, and stayed consistently until 08:47 -	41 05 18.4 N 71 09 10.3 W	Coring	On	Below 200khz
PAM	45	10/19/2018 06:03	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	Click trains observed on amplitude display between - 140-163 dB from 10:01-10:03. After 10:03 clicks were still present, but more sporadic, most reaching peaks of 148-150 dB in amplitude.	41 05 18.0 N 71 09 10.5 W	Coring	On	Below 200khz
Visual	46	10/21/2018 08:39	10	Common dolphin	Sure	Toward midship	2	10		Surface-Active Travel, 7 Porpoising	None	None	n/a	Black back and cape that form a V-shaped saddle. Hourglass pattern on sides. Tan patch forward and gray patch aft. Tall and falcate dorsal fin. -	41 06 8.9 N 71 11 12.9 W	Station keeping (DP)	Off	None
PAM	47	10/21/2018 23:11	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	High frequency dolphin clicks appeared on amplitude display at 03:11 with amplitudes ranging from 138-161 dB. Detection lasted less than a minute. Low frequency upsweep and downsweep delphinid whistles were observed on the spectrogram display and aurally at 07:55. High frequency click trains were visible on the spectrogram display from 07:55-07:57.	41 06 15.9 N 71 11 24.0 W	Coring	On	Below 200khz
PAM	48	10/22/2018 03:55	NAD	Unid dolphin	Sure					1 Clicks		None	n/a		41 06 15.9 N 71 11 23.7 W	Coring	On	Below 200khz
PAM	49	10/22/2018 05:49	NAD	Unid dolphin	Sure					1 Clicks		None	n/a	Multiple high frequency click trains observed on amplitude display from 09:49-09:51. Click trains ranged from 143-161 dB	41 06 15.9 N 71 11 23.7 W	Coring	On	Below 200khz

APPENDIX B. *MV CONTI* – SOUTH FORK WIND FARM GEOTECHNICAL SURVEY PROTECTED SPECIES OBSERVER REPORT



Protected Species Observer Combined 90-Day and Final Report

South Fork Wind Lease

BOEM Lease OCS-A 0486

MV Conti

Prepared by: A.I.S. Inc.

Prepared for: Deepwater Wind New England, LLC
and CSA Ocean Sciences Inc.

Submittal Date: March 20, 2019

This report is being submitted to satisfy the following lease stipulations:

BOEM Lease OCS-A 0486; Section 4.4 Reporting Requirements

(4.4.3) Report of Activities and Observations

The Lessee must provide the Lessor and NMFS within 90 calendar days following the commencement of HRG survey activities that includes a summary of survey activities, and an estimate of the number of listed marine mammals and sea turtles observed and/or Taken during these survey activities.

(4.4.4) Report Information

Data on all protected species observations must be recorded based on standard marine mammal observer collection data by the PSO. This information must include: dates, times, and locations of survey operations; time of observation, location, and weather; details of marine mammal sightings (e.g., species, number, behavior); and the details of any observed Taking (e.g., behavioral disturbances or injury/mortality).

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1 INTRODUCTION

Deepwater Wind South Fork, LLC (Deepwater Wind), an affiliate of lease holder Deepwater Wind New England, LLC, is proposing to develop the South Fork Wind Farm (SFWF) project, an offshore wind energy project within the Bureau of Ocean Energy Management (BOEM) Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0486). Located approximately 35 miles east of Montauk Point, SFWF will ultimately provide the town of East Hampton, NY with renewable energy generated by up to 15 offshore wind turbines.

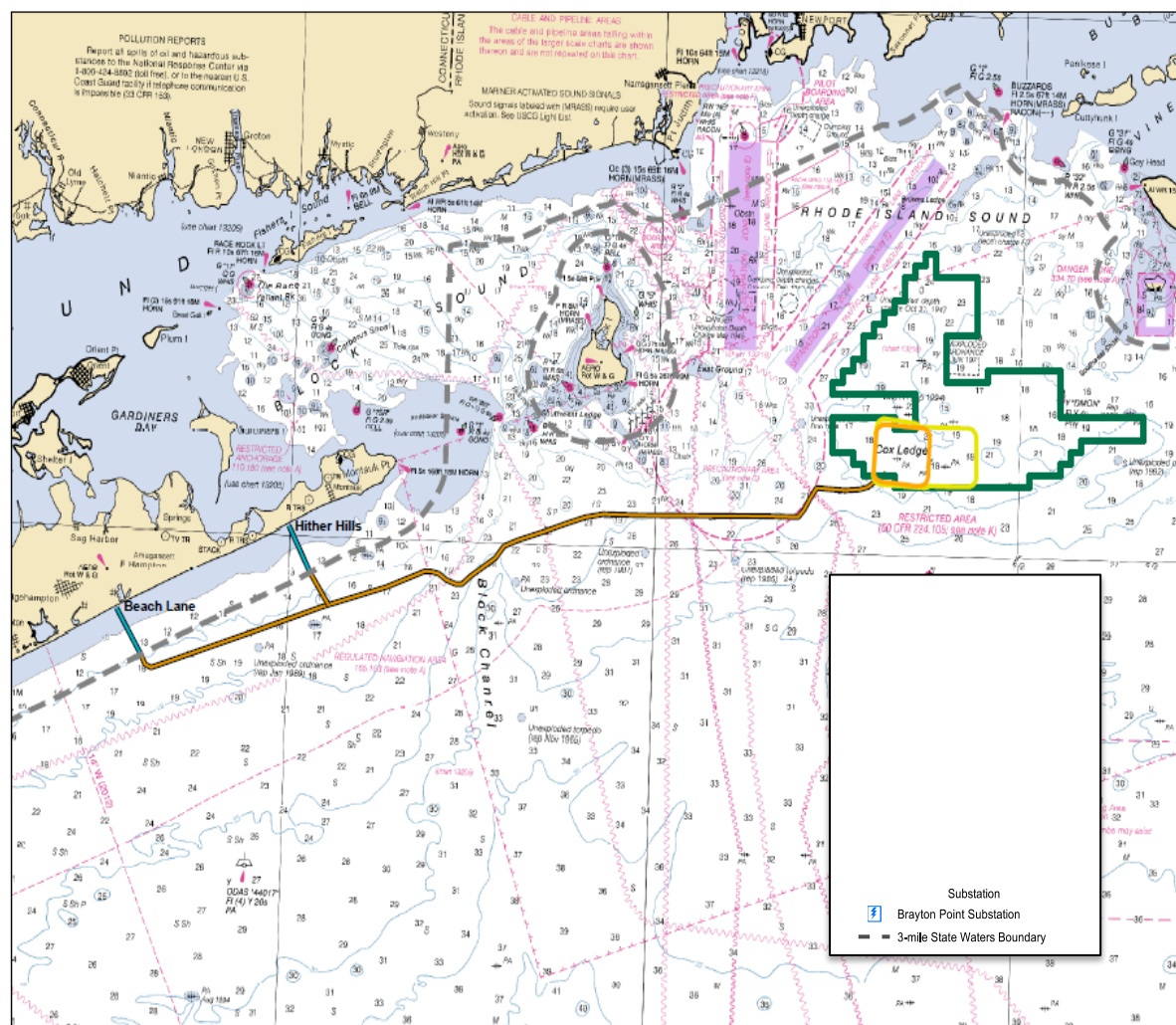


Figure 1 Lease Area (OCS-A 0486) and associated export cable routes

This report documents the complete results from the 2019 geotechnical surveys, conducted from January 10th through February 23rd, aboard the MV Conti by Fugro for Deepwater Wind. A summary of the survey operations, observer effort, visual and acoustic detections of protected species and mitigation actions are included in this report. There were no observed incidents with protected species throughout the survey timeframe. Protected Species Observer (PSO) methodology and monitoring protocols are summarized and a detailed description may be referenced in the Alternative Monitoring Plan (AMP). An assessment of the effectiveness of alternative monitoring methods and future recommendations is provided in the final section of this report.

2 SUMMARY OF GEOTECHNICAL SURVEY ACTIVITIES

SFWF geotechnical surveys were conducted by Fugro for Deepwater Wind from January 10th through February 23rd, 2019. The MV Conti was utilized to complete these surveys.

Offshore site characterization surveys in the SFWF lease area consisting of geotechnical operations aboard the MV Conti occurred January 10th through 17th, January 26th through 27th, and February 15th, 22nd and 23rd, 2019. Due to the 24-hour operations schedule, both PSOs and Passive Acoustic Monitoring (PAM) Operators were aboard the vessel during all survey activities in accordance with the Construction and Operations Plan (COP). The equipment associated with the geotechnical survey for which mitigation measures were implemented (ie. operating frequency <200kHz) were the dynamic positioning (DP) thrusters used by the vessel for maintaining station. All geotechnical operations on board the MV Conti were conducted according to the mitigation protocols. Records of operations data for each type of equipment utilized during the survey were kept in accordance with the reporting requirements.

3 PROTECTED SPECIES OBSERVATION METHODS

To fulfill the protected species monitoring requirements of the BOEM-issued lease, Deepwater Wind and CSA Ocean Sciences Inc. (CSA) contracted A.I.S. Inc. (AIS) to provide PSOs and PAM Operators to monitor for marine mammals and sea turtles during geotechnical survey operations. These monitoring activities were completed in accordance with the NOAA Fisheries IHA, the BOEM Lease OCS-A 0486, and the BOEM-approved SFWF COP and AMP.

3.1 Protected Species Observer Training and Compliance

All PSOs and PAM Operators, who participated in the survey, were approved by NMFS/BOEM, per the applicable lease stipulation. All PSO and PAM Operator staff were required to comply with Fugro operating standards, possess fit-for-sea duty medical clearance and offshore safety training.

All PSOs and PAM Operators, who monitored during this survey, attended the Permit and Project Environmental Compliance Plan (PECP) training compiled and presented by Deepwater Wind and CSA. Additionally, all PSOs and PAM Operators received project specific training that covered the following topics:

- Permits and plans relevant to the project
- Environmental compliance requirements
- Health and safety requirements
- PSO/PAM Operator requirements and scheduling
- Protected species mitigation methods
- Communication
- Authorized takes
- Data forms
- Use and maintenance of PSO and PAM equipment:
- Protected species identification review

3.2 Monitoring Methods and Equipment

Protected species monitoring methods included visual observations, as well as alternative monitoring for observations during nighttime hours and periods of reduced visibility. Alternative monitoring methods consisted of night vision devices (night vision monoculars and a thermal camera system), and acoustic observations utilizing PAM equipment.

The following visual PSO equipment was utilized during surveys:

- 7 X 50 waterproof binoculars with reticles;
- rangefinders.

The following PSO and PAM alternative monitoring equipment was used for surveys:

- Gen 3 night vision monoculars;
- high definition thermal imaging cameras;
- PAM equipment.

There were two PSOs and three PAM Operators aboard the MV Conti to fulfill protected species monitoring and mitigation requirements. All PSOs and PAM Operators worked in shifts to ensure that each individual did not exceed four consecutive hours of watch and received a two-hour break for every four hours of watch. Best efforts were made to ensure that no individual worked more than 12 hours in a 24-hour period.

During daylight hours, PSOs scanned the strike avoidance and exclusion zones for protected species with the naked eye and with reticle binoculars. Visual observations took place from a high vantage point allowing for a 360-degree view of the exclusion zone. PSOs estimated distance utilizing both reticle binoculars and rangefinders. During nighttime hours and periods of reduced visibility the PSOs scanned the strike avoidance and exclusion zones for protected species with night vision monoculars and a thermal camera system. PSOs remained on watch 24-hrs per day aboard the MV Conti to implement strike avoidance measures during vessel transits and to enact mitigation protocols for protected species during geotechnical operations. In addition, PAM Operators aboard the MV Conti acoustically monitored the exclusion zone for protected species during nighttime/reduced visibility geotechnical operations.

The PAM system consisted of an array of hydrophones with two broadband hydrophones (sampling mid-range frequencies of 2 to 200 kHz) and two low-frequency hydrophone (sampling range frequencies of 75 Hz to 30 kHz). The PAM operators monitored acoustic signals in real-time both aurally (using headphones) and visually (via sound analysis software).

PSOs and PAM Operators recorded data on standard observation forms including details on survey operations, observer effort and protected species sightings and incidents. PSOs regularly checked the whale alert app and the Right Whale Sighting Advisory System (RWSAS) for recent north Atlantic right whale sightings and established DMAs in the survey area. For each shift, a designated Lead PSO was responsible for communicating the presence of protected species and for communicating and enforcing the appropriate mitigation actions. PAM operators communicated nighttime detections to the lead PSO on duty to ensure the implementation of the appropriate mitigation measure.

Detailed PSO methodology and monitoring protocols are provided in the AMP. An assessment of effectiveness of alternative monitoring methods and future recommendations is provided in the final section of the report.

3.3 Mitigation Requirements

Mitigation activities vary per species and survey activity. According to the IHA, mitigation for DP thrusters was not necessary due to a determination by NMFS that the sound produced was not likely to result in harassment of marine mammals in the project area. The DP thrusters referenced in the IHA fall in the range of 0.1 to 10kHz, which can potentially result in Level B harassment of certain protected species.

According to section 4.1.1 of the lease, any vessel in transit is required to implement strike avoidance measures for marine mammals and sea turtles. Vessel operators are required to stop, alter course or slow the vessel to avoid striking marine mammals and sea turtles. These measures require maintaining a minimum separation distance of 500m from north Atlantic right whales, 100m from other non-delphinoid cetaceans and 50m from delphinoid cetaceans, seals and sea turtles. The vessel must slow speed and shift to neutral for any non-delphinoid cetacean within 100m. In addition, vessel operators must comply with 10-knot speed restrictions in any DMA, and vessels greater than or equal to 65ft in length must operate at speeds of 10-knots or less from November 1st through July 31st. In regard to delphinoid cetaceans, the vessel must avoid excessive speed or abrupt changes in direction until the animals have moved beyond 50m and/or abeam of the underway vessel. The vessel should reduce speed to 10 knots or less when pods (including mother/calf pairs) or large assemblages of delphinoid cetaceans are observed.

According to section 4.3.7 of the lease, the implementation of mitigation measures is required for geotechnical surveys. During geotechnical operations, the following exclusion zones apply: 500m from North Atlantic Right Whales and 200m from all non-delphinoid cetaceans; 50m for sea turtles, and 25m for all delphinoid cetaceans and pinnipeds. A 60-minute pre-survey of the exclusion zone and surrounding area is required prior to the start of operations. Any delays to the start of operations or shutdowns should occur for any marine mammal or sea turtle within the exclusion zone. A 60-minute clearance period is necessary after any shut down of operations for protected species or pauses in operations (not concerning protected species) greater than 20 minutes. For pauses (not concerning protected species) less than 20 minutes, the equipment may be restarted at operational level as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of protected species.

According to section 4.4, any injury or mortality of a protected species should be reported to both BOEM and NMFS within 24 hours. In addition, any incidents with protected species, not resulting in injury or mortality should be reported to BOEM and NMFS within 48 hours. Furthermore, sightings of north Atlantic right whales should be reported to NMFS and a follow-up report should be provided to BOEM. A more detailed description of the mitigation measures applied to this survey can be found in the COP and AMP.

3.4 Protected Species Observation Data

PSO and PAM entries and mitigation summaries were recorded on data sheets, which were provided to CSA and Deepwater Wind on a daily basis via email. Observer effort, record of operations and sighting data were all recorded in standardized forms.

According to lease stipulation 4.4.4, data collected by PSOs based on standard MMO collection data included:

- dates, times, locations of survey operations;
- time of observation, location and weather;

- details marine mammal sightings (species, #, behavior);
- details of any observed taking (behavioral disturbances or injury/mortality).

Attached are summaries of the detections from PSO/PAM data for the MV Conti in relation to specific survey activities in the SFWF Lease Area. There were no confirmed sightings of north Atlantic right whales throughout the survey period. Summary details provided include:

- Dates and times of each detection
- Species encountered
- Initial detection method
- Group Size
- Description of the observed behaviors (in both the presence and absence of activities)
- A summary of event details
- Description of survey activities at the time of sighting/detection
- Estimated number of individuals within Mitigation Zone during survey activities
- Approximate Closest Point of Approach
- Mitigation Measures Taken

4 GEOTECHNICAL SURVEY PSO DATA SUMMARY

4.1 Observer Effort

Protected species monitoring occurred at all times during geotechnical survey operations, in anticipation of geotechnical operational activities, as well as during the transit to and from survey sites to avoid any potential ship strikes. Total hours of visual and acoustic monitoring during the geotechnical survey periods aboard the MV Conti are summarized in Table 1.

Table 1 Total Hours Visual and Acoustic Monitoring during Geotechnical Survey Periods

Survey Vessel	Visual Monitoring (hh:mm)	Acoustic Monitoring (hh:mm)
MV Conti	264:23	105:39

At no point during this survey were the weather conditions such that they inhibited visual monitoring.

4.2 Geotechnical Survey Operations

The DP thrusters referenced in the IHA fall in the range of 0.1 to 10kHz, which can potentially result in Level B harassment of certain protected species. Figure 2 summarizes the total hours that the dynamic positioning (DP) thrusters were active.

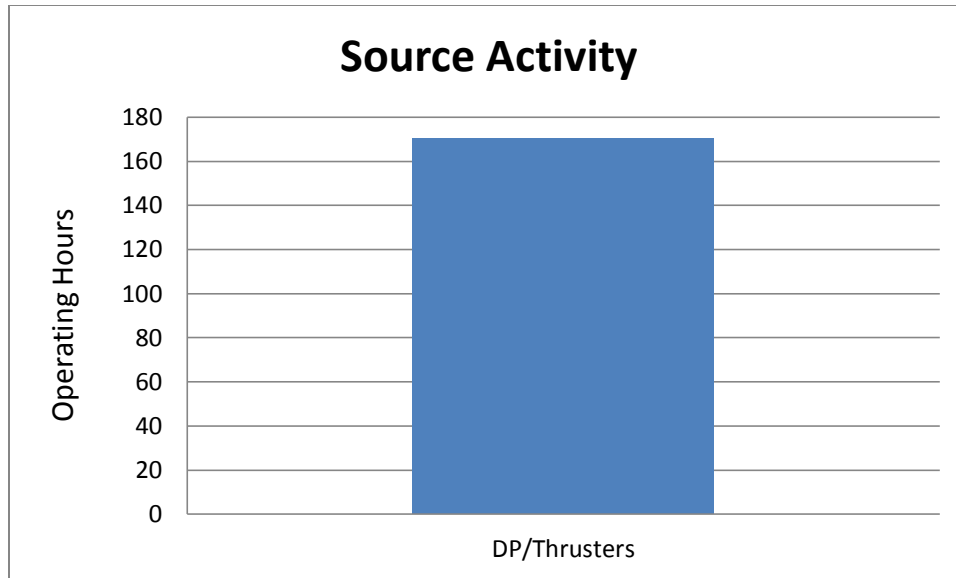


Figure 2 Total operating hours of the mitigating source aboard MV Conti

4.3 Sighting/Detection Data

There were a total of 18 visual sighting events, three of which were captured using the thermal imaging cameras, and 19 acoustic detections during the geotechnical survey. Only one of the acoustic detections was paired with a visual sighting using the thermal imaging camera. Table 2 provides the total number (best estimate) of individuals by species. A summary of the details associated with these sightings can be found in Attachment 1.

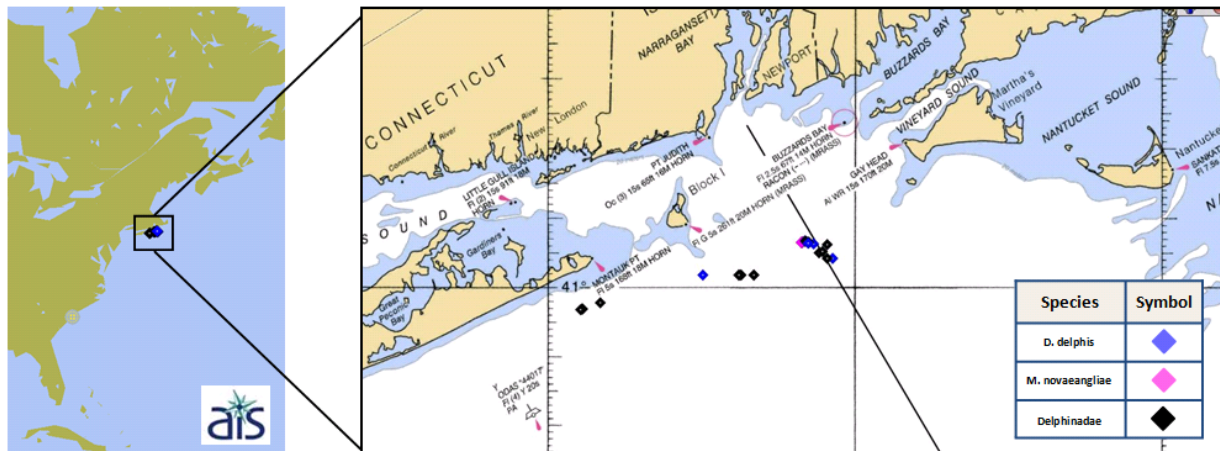


Figure 3 Locations of animal detections aboard the MV Conti by species

Forty-one percent of the sightings/detections occurred during daylight, between the hours of 6:00 AM EST (sunrise) and 5:00 PM EST (sunset), and the other fifty-nine percent occurred during nighttime hours.

Table 2 Species and Number of Individuals Sighted or Acoustically Detected during SFWF Geotechnical Survey

Common Name	Species	Number of Sightings/Detections	Number of Individuals Sighted/Detected
Dolphin, Short-Beaked Common	<i>Delphinus delphis</i>	5	28
Unidentified dolphin	Delphinidae	22	58
Whale, Humpback	<i>Megaptera novaeangliae</i>	10	13

With regards to Figure 4, only three of the 22 unidentified dolphin detections are displayed as the other 19 were acoustic detections for which the PAM team was unable to detect distance.

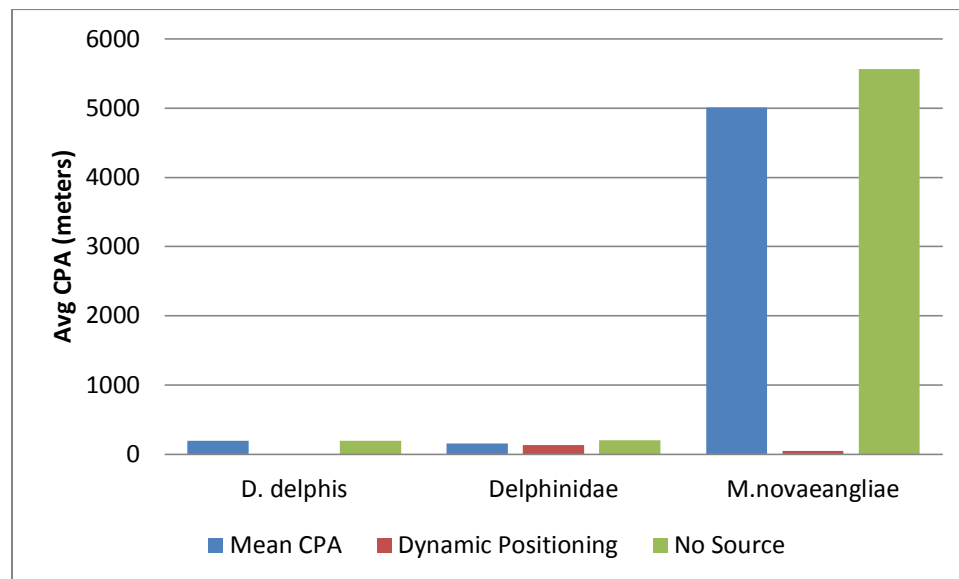


Figure 4 Summary for closest point of approach (CPA) of species detected during MV Conti geotechnical survey

4.4 Mitigation Activities

Mitigation was initiated when marine mammals or sea turtles were sighted within their respective exclusion zone while DP thrusters were operating or while the vessel was in transit (outlined in Section 3.3). Of the sightings/detections outlined in Section 4.3, mitigation measures were implemented for the species presented in Table 3 along with the total duration of these events.

Table 3 Summary of Mitigation Events during SFWF Geotechnical Survey

Common Name	Species	Number of Mitigation Events	Total Mitigation Time (hh:mm)
Dolphin, Short-Beaked Common	<i>Delphinus delphis</i>	2	01:18
Whale, Humpback	<i>Megaptera novaeangliae</i>	1	00:49

4.5 Dead or Injured Marine Mammals or Sea Turtles

There were no dead or injured marine mammals or sea turtles recorded during the SFWF geotechnical surveys aboard the MV Conti.

5 ALTERNATIVE MONITORING EFFECTIVENESS/RECOMMENDATIONS

Overall, the night vision monoculars, thermal camera system, and PAM system provided effective means for the team to efficiently monitor the exclusion zones for encroaching animals during nighttime hours and periods of reduced visibility, with enough time to make appropriate mitigation decisions on the MV Conti.

Table 4 Total Protected Species Detections according to Monitoring Method

PAM Detections	Night Vision Monocular Detections	Thermal Camera Detections	Visual Detections during Daylight
19	0	3	15

No protected species were observed using the night vision monoculars. The lack of detections utilizing the night vision monoculars may have been due to the limited range of visibility. The thermal camera system had three protected species detections and the PAM system had 19 protected species detections. The results show that the PAM system had a higher detection rate than the thermal camera system, suggesting that PAM is a more effective tool for detecting protected species during reduced visibility. The higher detection rate of protected species utilizing the PAM system may be due to limited surface activity and increased vocalizations of the animals during the periods of reduced visibility.

All together, 59.5 percent of the protected species detections occurred utilizing both the night vision devices and PAM equipment, compared to a daylight visual detection percentage of 40.5. Therefore, the combined use of night vision devices and PAM equipment was highly effective in monitoring and mitigating for protected species during periods of reduced visibility.

Night vision devices were utilized during nighttime hours for strike avoidance of protected species and to supplement acoustic monitoring during survey operations. Night vision devices were aimed away from vessel flood lights to prevent damage and maintain effectiveness of the equipment. Vessel flood lights reduced the effectiveness of the night vision devices at close range; however, safety of the crew working on deck took precedence. Based on the number of detections utilizing the night vision devices, it is recommended that efforts to minimize lighting be implemented when utilizing night vision devices. It is also recommended that distance estimation features be more reliable with hand-held night vision devices.

The PAM detections aboard the MV Conti were delphinid in nature, but the team was unable to identify the animals to species as there was no opportunity to confirm the species visually. The PAM technology does not currently allow for species identification without the utilization of post-processing software; therefore, any acoustic detections of dolphins were categorized as ‘Unidentified Dolphin.’ The higher occurrence of delphinid detections was expected based on the estimated delphinid populations in the survey area (IHA, 2018). The lack of low-frequency cetacean detections may be due to vessel noise or ambient noise level in the survey area. Based on depths in the survey area and vessel equipment, the PAM hydrophones are unable to be deployed deep enough or far enough behind the vessel to avoid interference. It is recommended that measures be taken to allow for the optimum positioning of the hydrophone array in order to obtain the most accurate acoustic detection data. However, the PAM system allowed for the most accurate distance estimates based on the time of arrival of the signal received at each hydrophone.

The PSO/PAM team aboard the MV Conti only encountered one challenge during the geotechnical survey that resulted in a minor delay in operations. There was an incident on January 17th where the PAM cable became entangled in the bow thruster which resulted in the PAM cable being severed and approximately 3m of cable was lost. The severed cable was recovered, and the cable replaced with the spare hydrophone array that the PSO team had aboard the vessel. Survey operations were paused for 3 hours and 49 minutes in order to re-rig the cable and conduct the appropriate pre-watch to restart geotechnical operations. This incident was likely the result of a combination of currents and deployment proximity to the thruster. The deployment logistics were discussed with the captain, the drogue was removed, and the length of the cable deployed was reduced from 20m to 15m. No future incidents occurred.

Attachment 1

MV Conti –South Fork Wind Farm Geotechnical Survey Detection Summary

Project Detection Number	Date			Primary Detection Method (how was animal first detected)	Time at first encounter (UTC)	Total Encounter Time		Ship Position - Latitude	Ship Position - Longitude	Water depth (metres)	Family	Genus	Species	Description of Animal(s)	Total number			Best Number of adults (visual sightings only)	Best Number of juveniles (visual sightings only)	Best Number of calves (visual sightings only)	Behaviour (visual sightings only)	Direction of travel (relative to ship)	Source activity	Vessel Activity	CPA to active source	MITIGATION MEASURES										Time of equipment restart	Estimated Loss of Production		
																										What action requested?	Was action implemented	What source(s) were involved in the action was taken	Bearing to animal at time of action (clockface with bow = 1200)	Range to animal at time of action	Duration of power down and/or shut-down	Duration of start up delay							
	YYYY	MM	DD	codes	HH:MM	HH	MM	degrees	degrees						Max	Min	Best								metres	Codes	Y / N				minutes	HH	MM	HH	MM				
1	2019	1	11	Daylight Visual	12:25	0	2	41.1097	-71.1530	32	Delphinidae	Delphinus	delphis	hourglass pattern on their sides, tan front and grey back with a saddle patch below the dorsal fin, and long beaks	6	4	5	5	0	0	Swimming	Toward midship	On Deck	Drifting	20	Ramp Up Delay	Y	DP Thrusters	unknown	20	n/a	18	n/a	n/a	0	18			
2	2019	1	11	Daylight Visual	12:43	0	5	41.1075	-71.1367	32	Delphinidae	Delphinus	delphis	Small body, falcate dorsal with light patch, hourglass pattern along side	6	4	5	5	0	0	Bow Riding	Towards bow	On Deck	Drifting	0	Ramp Up Delay	Y	DP Thrusters	unknown	0	n/a	60	n/a	n/a	1	0			
500	2019	1	11	Nighttime PAM	22:16	0	15	41.1100	-71.1525	unk	Delphinidae			2-3 click trains	3	2	3			n/a		DP running	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
501	2019	1	12	Nighttime PAM	0:22	0	15	41.1100	-71.1525	unk	Delphinidae			Dense click trains, 4 distinct animals	4	2	4			n/a		DP running	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
502	2019	1	12	Nighttime PAM	1:19	1	19	41.1100	-71.1525	36	Delphinidae			Dense click trains, 5 distinct animals	8	5	5			n/a		DP running	Station keeping (DP)	130	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
3	2019	1	12	Thermal Camera	1:22	0	1	41.1100	-71.1525	36	Delphinidae			small body, pointed rostrum	1	1	1	1	0	0	Breach	Toward midship	Full Power	Station keeping (DP)	130	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	0		
503	2019	1	12	Nighttime PAM	3:48	1	12	41.1107	-71.1547	36	Delphinidae			Dense click trains & distinct animals, LF whistles	6	4	6	6		n/a		DP running	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
504	2019	1	12	Nighttime PAM	8:22	0	20	41.1133	-71.1622	36	Delphinidae			Whistles observed on LF spec	1					n/a		DP running	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
505	2019	1	12	Nighttime PAM	9:03	1	0	41.1133	-71.1622	36	Delphinidae			Whistles, LF spec	4	2	4			n/a		DP running	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
4	2019	1	12	Daylight Visual	15:25	0	25	41.1135	-71.1645	32	Balaenopteridae	Megaptera	novaeangiae	Dark grey body, small stubby dorsal, wide knotted fluke	1	1	1	1	0	0	Surface Active	Parallel in same direction as boat	DP running	Station keeping (DP)	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5	2019	1	12	Daylight Visual	15:34	0	1	41.1135	-71.1645	32	Delphinidae	Delphinus	delphis	Small body, falcate dorsal with light patch, hourglass pattern along side	10	5	8	8	0	0	Swimming	Variable	DP running	Station keeping (DP)	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
6	2019	1	12	Daylight Visual	16:05	0	3	41.1118	-71.1710	32	Balaenopteridae	Megaptera	novaeangiae	2 whales, multiple blows within a minute and then both animals dove	2	2	2	2	0	0	Swimming	Parallel in same direction as boat	Full Power	Translating	n/a	n/a	N	DP Thrusters	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
7	2019	1	12	Daylight Visual	16:43	0	44	41.1115	-71.1745	32	Balaenopteridae	Megaptera	novaeangiae	2 whales swimming in same direction as ship on starboard side, multiple blows and flukes	2	2	2	2	0	0	Swimming	Parallel in same direction as boat	Full Power	Station keeping (DP)	50	Shutdown	Y	DP Thrusters	3	50	30	30	17	32	0	49			
8	2019	1	12	Daylight Visual	18:05	0	1	41.1113	-71.1750	32	Balaenopteridae	Megaptera	novaeangiae	1-2 whale(s) swimming perpendicular to port off bow, 2 blows then went out of sight	2	1	1	1	0	0	Swimming	Towards bow	Full Power	Station keeping (DP)	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
9	2019	1	12	Daylight Visual	18:28	0	15	41.1113	-71.1748	32	Balaenopteridae	Megaptera	novaeangiae	1-2 whales with dark bodies, crooked dorsal fins, and white underside on tails	2	1	2	2	0	0	Swimming	Away from bow	Full Power	Station keeping (DP)	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
10	2019	1	12	Daylight Visual	19:12	0	1	41.1113	-71.1748	32	Balaenopteridae	Megaptera	novaeangiae	Dark grey body, stubby dorsal fin with broad base	2	1	1	1	0	0	Swimming	Away from bow	Full Power	Station keeping (DP)	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
11	2019	1	12	Daylight Visual	14:42	0	1	41.1113	-71.1748	32	Balaenopteridae	Megaptera	novaeangiae	Dark grey body, stubby dorsal fin with broad base	1	1	1	1	0	0	Surface Active	Away from bow	DP running	Station keeping (DP)	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
12	2019	1	12	Daylight Visual	15:09	0	9	41.1115	-71.1768	32	Balaenopteridae	Megaptera	novaeangiae	Dark grey body, stubby dorsal fin with broad base	1	1	1	1	0	0	Surface Active	Away from bow	DP running	Station keeping (DP)	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
13	2019	1	12	Daylight Visual	15:33	0	1	41.1115	-71.1768	32	Balaenopteridae	Megaptera	novaeangiae	Dark grey body, stubby dorsal fin with broad base	1	1	1	1	0	0	Surface Active	Away from bow	DP running	Station keeping (DP)	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
14	2019	1	12	Daylight Visual	15:33	0	1	41.1115	-71.1768	unk	Balaenopteridae	Megaptera	novaeangiae	Dark grey body, stubby dorsal fin with broad base	1	1	1	1	0	0	Surface Active	Away from bow	DP running	Station keeping (DP)	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
506	2019	1	13	Nighttime PAM	0:38	0	1	40.9662	-71.8304	unk	Delphinidae			HF click train, single click train	1					n/a		DP running	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
507	2019	1	13	Nighttime PAM	2:18	0	10	41.0329	-71.3300	43	Delphinidae			HF click train	6	3	3			n/a		Full Power	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
508	2019	1	13	Nighttime PAM	3:24	0	2	41.0329	-71.3300	43	Delphinidae			HF click train	4	2	2			n/a		Full Power	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
15	2019	1	13	Thermal Camera	8:33	0	1	41.0323	-71.3722	41	Delphinidae			Small body, pointed rostrum	1	1	1	1	0	0	BR	Towards bow	Full Power	Station keeping (DP)	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
509	2019	1	13	Nighttime PAM	8:26	0	3	41.0323	-71.3722	41	Delphinidae			Whistles observed on LF spec	1					n/a		DP running	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
510	2019	1	13	Nighttime PAM	8:52	0	1	41.0324	-71.3801	41	Delphinidae			Dense click trains, 2 animals	1					n/a		On Deck	Translating	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
16	2019	1	13	Thermal Camera	9:49	0	2	41.0322	-71.4973	43	Delphinidae	Delphinus	delphis	Hourglass pattern on sides - tan front, grey back, long beak, saddle patch on back	6	4	4	4	0	0	Porpoising	Away from stern	DP running	Station keeping (DP)	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
511	2019	1	13	Nighttime PAM	9:19	0	9	41.0324	-71.3801	43	Delphinidae			LF whistle, no aural detection	1					n/a		DP running	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
512	2019	1	13	Nighttime PAM	10:33	0	55	41.0325	-71.3800	41	Delphinidae			LF, loud whistles	4	2	4			n/a		On Deck	Translating	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
513	2019	1	14	Nighttime PAM	2:37	0	1	40.9507	-71.8892	38	Delphinidae			HF click train	4	2	2			n/a		On Deck	Translating	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
514	2019	1	14	Nighttime PAM	3:53	0	1	40.9507	-71.8899	38	Delphinidae			HF click train	3	2	2			n/a		Full Power	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
515	2019	1	15	Nighttime PAM	6:45	0	1	40.9494	-71.8961	28	Delphinidae			HF click train	2	2	2			n/a		Full Power	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
516	2019	1	16	Nighttime PAM	1:56	1	11	41.0854	-71.1174	35	Delphinidae			HF click train	8	6	6			n/a		Full Power	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
517	2019	1	16	Nighttime PAM	3:46	0	52	41.0884	-71.1075	35	Delphinidae			HF click train	4	3	3			n/a		Full Power	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
518	2019	1	16	Nighttime PAM	7:01	0	34	41.1052	-71.0919	35	Delphinidae			HF click train	2	2	2			n/a		Full Power	Station keeping (DP)	NAD	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
17	2019	1	17	Daylight Visual	17:55	0	9	41.0728	-71.0750	33	Delphinidae	Delphinus	delphis	Hourglass pattern on sides - tan front, grey back, long beak, saddle patch on back	8	5	6	6	0	0	Porpoising	Parallel in same direction as boat	Full Power	Station keeping (DP)	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
18	2019	1	17	Daylight Visual	19:07	0	1	41.0723	-71.0908	33	Delphinidae			Did not show body, just saw dorsals	4	2	3	3	0	0	Milling	No clear direction	Full Power	Station keeping (DP)	n/a	n/a	N	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Project Detection Number	Date			Time at first encounter (UTC)	PAM DETECTIONS												
					Call Type	Call Characteristics	Frequency range (kHz)	Primary Frequency (kHz)	Amplitude (dB)		Bearings obtained?	Distance estimated?	How was distance estimated?	Was visual confirmation made?	Visual ID	Visual Range to animals	Visual Bearing to animals
	YYYY	MM	DD	HH:MM					Max	AVE							
500	2019	1	11	22:16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	NAD	N	N	n/a	n/a
501	2019	1	12	0:22	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	NAD	N	N	n/a	n/a
502	2019	1	12	1:19	Click tran	Click tran	150-200	150	160	138	n/a	Y	Signal strength	Y	Y	130	unknown
503	2019	1	12	3:48	Click train, whistle	Whistles sinusoidal, upsweeping	6-24, 110-200	110	158	140	n/a	Y	Signal strength	N	N	n/a	n/a
504	2019	1	12	8:22	Whistles	Whistles	6.0-21.0	21	140	135	n/a	N	NAD	N	N	n/a	n/a
505	2019	1	12	9:03	Whistles	Whistles	10.0-14.0	13.7	90	85	n/a	N	NAD	N	N	n/a	n/a
506	2019	1	13	0:38	Whistle, click train	Click train (HF)	unknown	unknown	unknown	unknown	unknown	N	NAD	N	N	n/a	n/a
507	2019	1	13	2:18	click train	Click train (HF)	50-100	100	158	148	n/a	<500m	Signal strength	N	N	n/a	n/a
508	2019	1	13	3:24	click train	Click train (HF)	50-150	100	161	160	n/a	<500m	Signal strength	N	N	n/a	n/a
509	2019	1	13	8:26	Whistle, click train	4 whistles: 3 downsweeps, 1 sinusoidal; HF click	11.90-14 kHz	13.27	160.56	unknown	n/a	N	NAD	Y	N	n/a	n/a
510	2019	1	13	8:52	click train	3-4 HF click trains	unk	unknown	160	unknown	n/a	N	NAD	N	N	n/a	n/a
511	2019	1	13	9:19	Sinusoidal, HF click LF, whistle	train, upsweep	12-15 kHz	13.4	156	unknown	n/a	N	NAD	N	N	n/a	n/a
512	2019	1	13	10:33	LF whistles, aural	Upsweeps, plateaued	9.98-19.6 kHz	11.5	133	unknown	n/a	Y	Signal strength	N	N	n/a	n/a
513	2019	1	14	2:37	click train	2 HF click trains	100-150	100	137	137	n/a	Y	Signal strength	N	N	n/a	n/a
514	2019	1	14	3:53	click train	2 HF click trains	150-200	175	135	135	n/a	Y	Signal strength	N	N	n/a	n/a
515	2019	1	15	6:45	click train	2 HF click trains	42-94	90	155	145	n/a	Y	Signal strength	N	N	n/a	n/a
516	2019	1	16	1:56	click train	6 HF click trains	50-187	170	158	125	n/a	Y	Signal strength	N	N	n/a	n/a
517	2019	1	16	3:46	click train	4 HF click trains	100-200	187	143	125	n/a	Y	Signal strength	N	N	n/a	n/a
518	2019	1	16	7:01	click train	2 HF click trains	30.45-200	150	125	135	n/a	Y	Signal strength	N	N	n/a	n/a

Project Detection Number	Date			Time at first encounter (UTC)	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding; as explicit and detailed as possible; note any observed change in behavior)
	YYYY	MM	DD	HH:MM	
1	2019	1	11	12:25	A group of 4-6 common dolphins came swimming toward the midshipbow, then began bowriding for around 5 minutes. Believed to be the same as the group in the next sighting.
2	2019	1	11	12:43	A group of 4-6 common dolphins came swimming toward the bow, then began bowriding for around 5 minutes. They were last seen at 12:48. ID'd as common dolphins based on their hourglass pattern on the sides, tan front and grey back with a saddle patch below the dorsal fin, and long beaks.
500	2019	1	11	22:16	n/a
501	2019	1	12	0:22	n/a
502	2019	1	12	1:19	HF clicks observed on the HF click detector at an amplitude of 138dB peaking at 160dB. 5 distinct click trains were observed simultaneously on the bearing display, no LF whistles observed, although there were short burst of LF clicks at 1:23 UTC. Peak frequency at 200kHz. Thermal Camera correlated detection at 1:22 UTC with animals coming toward vessel at a distance of 130m. Last observed clicks at 2:38UTC, and no mitigation action necessary.
3	2019	1	12	1:22	Observed one dolphin porpoising at 01:22 on the starboard thermal camera, appeared to be traveling quickly toward the vessel, midship. PSO tried manually panning and tilting thermal camera, but dolphin was not seen again. Sighting was too quick to determine species or to capture a recording or screen shot.
503	2019	1	12	3:48	HF clicks observed in up to 6 distinct click trains at 3:51 3:52UTC, LF whistles observed between 3:50-3:52 UTC with frequencies between 6-24kHz although was not audible. HF clicks were observed from 1 to 200kHz with most at 110kHz, and amplitudes from 140-158dB. Last observed HF clicks with amplitudes ranging from 135-145 dB occurred between 04:58 and 4:59 UTC.
504	2019	1	12	8:22	HF whistles observed at 8:22, 2 sinusoidal and 1 down sweep. Peak frequency at 21 kHz. Last detection at 8:42. At time of detection, vessel was station keeping (DP) so no mitigation was required. At 8:42 2 more whistles were detected, both up sweeps with a peak frequency of 13.78 kHz. Vessel was station keeping (DP) so no mitigation was required.
505	2019	1	12	9:03	Continuation of previous detection.
4	2019	1	12	15:25	Animal was observed blowing only 2 times, big bushy blows, and was observed rounding back and diving while displaying fluke
5	2019	1	12	15:34	Behaviors: Porpoising, swim at surface, milling. 1 calf with 3 adults, (poss juvenile). Dolphins were observed porpoising and travelling quickly from stern to bow, displaying full bodies out of water. Quickly lost sight of animals travelling off bow.
6	2019	1	12	16:05	2 whales at 10:00 to bow, 600m away, moving perpendicular to bow towards port. Both dove around 16:08
7	2019	1	12	16:43	2 whales at 5:00 to bow, reticle 45. Seen at 16:58 at 3:00 to bow, 40 ret, moving parallel with boat. Got within 50 meters at 3:00 to bow at 17:01, shutdown. Seen again at 2:00 to bow, 10 ret, at 17:21, heading away. Both last seen at 17:27, 5 ret, 2:00 to bow still moving away. DP restarted at 17:32
8	2019	1	12	18:05	2 blows within 1 minute of each other off bow at 5-10 reticle. First seen at 1:00 to bow, then at 12:00 moving to port. Not seen after that.
9	2019	1	12	18:28	1 whale was seen approximately 2480 m ahead of the boat, swimming perpendicular of the boat toward the west. 2 blows were seen before the animal did a rolling dive. Whale reappeared with another whale 13:41, both continuing to swim toward the west. I observed 3 blows from one whale before it fluked, and 2 blows from the second whale before it dove after the first whale. ID'd as humpback whales based on the dark grey coloration, crooked dorsal fin, and the white underside of their tails. Whales last seen at 18:43
10	2019	1	12	19:12	2 blows within 1 minute off bow at 12:00, right below reticle 1. Not seen after
11	2019	1	12	14:42	1 whale seen about 10,000 m ahead of the boat, swimming perpendicular of the boat toward the west. Only 1 blow was seen, did not see whale dive. No mitigation necessary.
12	2019	1	12	15:09	1 whale seen about 10,000 m ahead of the boat, swimming perpendicularly away from the boat. Saw it blow 3 times before it dove. Seen again at 20:18, this time swimming parallel to the boat in the same direction but further away at about 12,000 m. Saw it blow 8 times and not seen after. No mitigation necessary
13	2019	1	12	15:33	1 whale seen about 1,240 m ahead of boat, swimming perpendicular to the boat toward the port side. 2 blows seen, then the animal was not seen again. No mitigation required.
14	2019	1	12	15:33	1 whale seen about 12,000 m ahead of bat, swimming perpendicular to the boat toward the port side. 2 blows seen, then the animal was not seen again. No mitigation required.
506	2019	1	13	0:38	Single click train observed over 2-3 seconds, no other acoustic events
507	2019	1	13	2:18	Clicks trains were first observed on the HF amplitude display with at least 3 distinct click trains observed. Amplitude peaked at 2:19 UTC at 158dB, average amplitude around 140-148dB. Animals were last observed at 2:8 UTC.
508	2019	1	13	3:24	Clicks trains were observed on the HF amplitude display up to 161dB with 2 distinct click trains. Animals quickly lost signal strength with a single click train observed at 3:26 at an amplitude of 140dB.
15	2019	1	13	8:33	Observed one dolphin jump on the starboard thermal camera. Animal appeared to be traveling quickly toward the bow, but was not sighted again. Sighting was too quick to determine species. Sighting correlated with acoustic detection 509.
509	2019	1	13	8:26	Whistles detected on LF spectrogram at 8:21. 3 down sweeps, 1 sinusoidal. Peak Frequency at 14 kHz. Last detection at 8:29, whistles also accompanied by HF clicks observed in 2-3 click trains (Peak Frequency: 95 KHz; amp: 160.56 dB). At time of detection, vessel was station keeping (DP) so no mitigation was required

Project Detection Number	Date			Time at first encounter (UTC)	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding; as explicit and detailed as possible; note any observed change in behavior)
	YYYY	MM	DD	HH:MM	
510	2019	1	13	8:52	HF clicks observed in 3, possibly 4 click trains at 8:52. Possibly 2 animals clicking at the same time. Click trains were strong with amp around 160 dB. There was one long click train for 12 seconds, followed by click trains about 2-3 seconds long. At the time of detection, vessel was transiting so no mitigation was required.
16	2019	1	13	9:49	A group of 4-6 common dolphins were seen swimming behind the stern. One was porpoising, the others swam at the surface. They swam toward the port side of the stern and then swam away from the boat they were not seen again. Because we were on location (DP), no mitigation was necessary
511	2019	1	13	9:19	Single LF whistle observed on spectrogram, not audible, followed by HF click train, tight clicks and strong signal, clicks continued with peak frequency of 95kHz, last detection occurred at 09:28 with a faint, audible whistle and accompanying sinusoidal waveform on the LF spectrogram
512	2019	1	13	10:33	Loud whistles detected and accompanying waveforms on the LF spectrogram, whistles continued with burst pulses also observed in association with tight, strong HF click trains, clicks were 10-12 seconds in duration with shorter click trains throughout the detection. Faint LF upsweeps continued as the detection progressed between 11:15 and 11:28. The last detection was a loud LF whistle at 11:28 UTC.
513	2019	1	14	2:37	2 Click trains on the HF amplitude display up to 137dB. Clicks quickly dissipated to single click train at 130dB, and last observed at 2:38 UTC
514	2019	1	14	3:53	2 Click trains briefly observed on the HF amplitude display up to 135dB
515	2019	1	15	6:45	2 simultaneous, parallel click trains observed briefly on the amplitude display at 06:45. Clicks ranged from 135-155 dB and frequency range of 42-92 kHz. Clicks were not seen again past 06:45
516	2019	1	16	1:56	Distinct click trains observed on the HF bearing display consistently with amplitudes around 125dB and averaging 175kHz or higher on the wigner plot. At 2:49 UTC up to 6 distinct simultaneous click trains were observed with amplitudes up to 158dB until 2:52 UTC when amplitudes went back to 125dB with only 2 to 3 click trains observed. Animals remained at low amplitudes until last observed at 3:07 UTC when vessel began slow transit to next sight.
517	2019	1	16	3:46	Distinct click trains observed on the HF bearing display consistently with amplitudes around 125dB and averaging 187kHz on the wigner plot. Click trains remained at low amplitudes for duration of detection. . 4:38 UTC up to 4 distinct click trains were observed before losing signal on the HF displays during transit to next sight.
518	2019	1	16	7:01	2 parallel click trains observed on amplitude display starting at 07:01 with a frequency range of 167.14-200 kHz and amplitudes of 125-130 dB. Clicks disappeared right after 07:01, but came back briefly at 07:11, then again at 07:35 with a frequency range of 30.45-168.56 kHz and amplitudes ranging from 130-135 dB.
17	2019	1	17	17:55	2 groups of common dolphins were seen swimming parallel to the boat; the first group 200 m off the port side, then ahead of the bow of the boat. They were swimming parallel to the boat in the same direction and consisted of 3-5 individuals. The second group had 2 individuals that first appeared about 50 m in front of the port side bow. These dolphins were swimming in variable directions ahead of the boat and were last seen at 13:04 as they swam under the bow and toward the stern. The larger group of dolphins was also last seen at 13:04, still swimming ahead of and in the same direction as the boat.
18	2019	1	17	19:07	2-3 dolphins seen at 3:00 to bow, reticle 35 (500m). Looking down dorsal, so either facing away or towards ship. No body shown. Seem to be milling with no clear movement or direction. Last seen 1 minutes later at 3:00 to bow, reticle 60 (207m) with 1 individual moving slowly parallel to ship towards stern. Still no body seen other than dorsal. No definite species ID since I couldn't see the body, but likely Common dolphins and possibly same individuals from previous detection.

APPENDIX C. *MV FUGRO DISCOVERY* – SOUTH FORK EXPANSION AND REVOLUTION WIND FARM GEOPHYSICAL SURVEY PROTECTED SPECIES OBSERVER REPORT



Protected Species Observer Combined 90-Day and Final Report Fugro Discovery 2018

**Skipjack Wind Lease OCS-A 0482 and South Fork Wind Farm Expansion and Revolution
Wind Lease OCS-A 0486**

Prepared by: A.I.S. Inc.

Prepared for: Deepwater Wind New England, LLC
and CSA Ocean Sciences Inc.

Submittal Date: January 19, 2019

This report is being submitted to satisfy the following lease stipulations:

BOEM Lease OCS-A 0482; Section 4.5 Reporting Requirements
BOEM Lease OCS-A 0486; Section 4.4 Reporting Requirements

(4.5.3 and 4.4.3) Report of Activities and Observations

The Lessee must provide the Lessor and NMFS within 90 calendar days following the commencement of HRG survey activities that includes a summary of survey activities, and an estimate of the number of listed marine mammals and sea turtles observed and/or Taken during these survey activities.

(4.5.4 and 4.4.4) Report Information

Data on all protected species observations must be recorded based on standard marine mammal observer collection data by the PSO. This information must include: dates, times, and locations of survey operations; time of observation, location, and weather; details of marine mammal sightings (e.g., species, number, behavior); and the details of any observed Taking (e.g., behavioral disturbances or injury/mortality).

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1 INTRODUCTION

Deepwater Wind South Fork, LLC (Deepwater Wind), an affiliate of lease holder Deepwater Wind New England, LLC is proposing to develop the Skipjack Wind Farm (SJWF), South Fork Wind Farm (SFWF), and Revolution Wind Farm (REV) projects, all offshore wind energy projects within the Bureau of Ocean Energy Management (BOEM) Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf. SJWF (Lease OCS-A 0482) will ultimately provide wind energy to the State of New Jersey. SFWF and REV (OCS-A 0486) will interconnect with the Long Island Power Authority transmission system on Long Island, New York, and Connecticut, respectively.

This report documents the complete results from the 2018 geophysical surveys conducted by Fugro aboard the MV Fugro Discovery for Deepwater Wind. A summary of the data collected and, the number of sightings and acoustic detections are included in this report. PSO methodology and monitoring protocols are discussed, however detailed description is provided in the Alternative Monitoring Plan (AMP). An assessment of the effectiveness of PSO monitoring and future recommendations is provided in the final section of the report.

2 SUMMARY OF GEOPHYSICAL SURVEY ACTIVITIES

Deepwater Wind completed site characterization surveys in the lease area consisting of geophysical surveys for each of the wind lease areas as follows: SJWF from September 27th through October 11th, 2018; SFWF October 12th through December 30th, 2018; and REV December 28th through December 31st, 2018. Both Protected Species Observers (PSO) and Passive Acoustic Monitoring (PAM) operators were aboard the vessel during all survey activities in accordance with the COP Survey Plan.

3 PROTECTED SPECIES OBSERVATION METHODS

In order to comply with the lease's protected species monitoring requirements issued by BOEM, Deepwater Wind and CSA contracted A.I.S. Inc. (AIS) to provide PSO and PAM operators to monitor for marine mammals and sea turtles during geophysical survey operations. These monitoring activities were completed in accordance with the BOEM approved SFWF COP Survey Plan and AMP.

Protected species monitoring occurred at all times during this geophysical survey, in anticipation of geophysical operational activities, as well as during the transit to and from survey sites to avoid any potential protected species ship strikes. Total hours of visual and acoustic monitoring, per lease area, are broken down in Table 1.

Table 1 Total Hours Visual and Acoustic Monitoring per Wind Farm Lease Area

Lease Area/Wind Farm	Visual Monitoring (hours)	Acoustic Monitoring (hours)
Skipjack	320	104.6
South Fork	1211	518.5
Revolution	63.7	28.1

3.1 PROTECTED SPECIES OBSERVER TRAINING AND COMPLIANCE

All PSO and PAM operators who monitored during this survey attended the Permit and Environmental Compliance (PECP) Training compiled and presented by Deepwater Wind and CSA. Additionally, all PSO and PAM operators received project specific training that covered the following topics:

- Permits and plans relevant to the project
- Environmental compliance requirements
- Health and safety requirements
- PSO/PAM operator requirements and scheduling
- Protected species mitigation methods
- Communication
- Authorized takes
- Data form
- PSO and PAM equipment, use, and maintenance
 - 7 X 50 Waterproof binoculars with reticles
 - Rangefinders
 - Gen 3 Night vision monoculars
 - High Definition/Thermal imaging cameras
 - PAM equipment
- Protected species identification review

All PSO and PAM operators who participated in the survey were approved by BOEM, per appropriate lease stipulation. All PSO and PAM staff were required to comply with Fugro operating standards, possess fit for sea duty medical clearance and offshore safety training.

Detailed PSO methodology and monitoring protocols are provided in the AMP. An assessment of effectiveness of PSO monitoring and future recommendations is provided in the final section of the report.

3.2 PROTECTED SPECIES OBSERVATION DATA

PSO and PAM entries and mitigation summaries were recorded on data sheets, which were provided to CSA and Deepwater Wind on a daily basis via email. Attached are summaries of the detections from PSO/PAM data for the MV Fugro Discovery in relation to specific survey activities, per Lease Area. Summary details provided include:

- Dates, times
- Species encountered
- Initial detection method
- Group Size
- Description of the observed behaviors (in both the presence and absence of activities)
- A summary of event details
- Description of survey activities at the time of sighting/detection
- Estimated number of individuals within Mitigation Zone during survey activities
- Approximate closest point of approach
- Mitigation Measures Taken

4 GEOPHYSICAL SURVEY DATA SUMMARY

4.1 SJWF Geophysical Survey – Sighting/Detection Data

There were a total of 22 visual sighting events, one of which was captured using night vision, and 0 acoustic detections occurred during the geophysical survey. None of the visual sighting events were paired with acoustic detections. Table 2 provides the total number (best estimate) of individuals by species. A summary of the details associated with these sightings can be found in Attachment 1.

95% of the sightings/detections occurred during daylight, between the hours of 6:00 AM (sunrise) and 7:00 PM (sunset), and the other 5% occurred during nighttime hours.

Table 2 Species and Number of Individuals Sighted or Detected during SJWF Geophysical Survey

Species	Number of Individuals Sighted/Detected
Dolphin, Short-Beaked Common	31
Whale, Minke	1
Whale, Humpback	10
Unidentified sea turtle	5
Sea Turtle, Loggerhead	8
Sea Turtle, Leatherback	1

4.2 SFWF Geophysical Survey – Sighting/Detection Data

There were a total of 113 visual sighting events, 14 thermal imaging/infrared sighting events and 82 acoustic detections made during the geotechnical survey. Two of the visual sighting events were paired with acoustic detections (2%), and one thermal imaging/infrared sighting was paired with an acoustic detection (7%). Table 3 provides the total number (best estimate) of individuals by species visually sighted and/or acoustically detected (all double entries were discounted). A summary of the details associated with these sightings can be found in Attachment 2.

53% of the sightings/detections occurred during daylight, between the hours of 6:00 AM (sunrise) and 7:00PM (sunset), and the other 47% occurred during nighttime hours.

Table 3 Species and Number of Individuals Sighted or Detected during SFWF Geophysical Survey

Species	Number of Individuals Sighted/Detected
Dolphin, Short-Beaked Common	585
Unidentified dolphin/porpoise	419
Whale, Fin	18
Whale, Humpback	55
Unidentified whale	9
Seal, Grey	2
Seal, Harbor	1
Unidentified seal	1

4.3 REV Geophysical Survey – Sighting/Detection Data

There were a total of 2 visual sighting events, 2 thermal imaging/infrared sighting events and 0 acoustic detections made during the geotechnical survey. 0 of the visual sighting events were paired with acoustic detections (0%), and 0 thermal imaging/infrared sightings were paired with acoustic detections (0%).

Table 4 provides the total number (best estimate) of individuals by species visually sighted and/or acoustically detected (all double entries were discounted). A summary of the details associated with these sightings can be found in Attachment 3.

50% of the sightings/detections occurred during daylight, between the hours of 6:00 AM (sunrise) and 7:00PM (sunset), and the other 50% occurred during nighttime hours.

Table 4 Species and Number of Individuals Sighted or Detected during REV Geophysical Survey

Species	Number of Individuals Sighted/Detected
Unidentified dolphin/porpoise	44

5 Geophysical Survey – Mitigation Activities

5.1 SJWF Geophysical Survey – Mitigation Activities

Mitigation activities were initiated when marine mammals or sea turtles were sighted within the 500 meter exclusion zone while geophysical equipment was engaged. Of the sightings/detections outlined in Section 4.1.1, 6 of the detections resulted in mitigation activities. Table 5 summarizes the number of mitigation events per species as well as the amount of time delays created by the events. There were a total of 5 hours and 27 minutes of mitigation, approximately 55 minutes of delay per event.

Table 5 Summary of Mitigation Events during SJWF Geophysical Survey

Species	Number of Mitigation Events	Total Mitigation Time (hh:mm)
Unidentified sea turtle	1	1:00
Sea Turtle, Leatherback	1	1:00
Sea Turtle, Loggerhead	4	3:27

5.2 SFWF Geophysical Survey – Mitigation Activities

Mitigation activities were initiated when marine mammals or sea turtles were sighted within the 500 meter exclusion zone while geophysical equipment was engaged. Of the sightings/detections outlined in Section 4.1.2, 6 of the encounters resulted in mitigation activities. Table 6 summarizes the number of mitigation events per species as well as the amount of time delays created by the events. There were a total of 3 hours and 54 minutes of mitigation, approximately 39 minutes of delay per event.

Table 6 Summary of Mitigation Events during SFWF Geophysical Survey

Species	Number of Mitigation Events	Total Mitigation Time (hh:mm)
Dolphin, Short-Beaked Common	1	1:00
Seal, Harbor	1	0:30
Seal, Grey	1	0:25
Unidentified seal	1	0:15
Whale, Humpback	2	1:45

5.3 REV Geophysical Survey – Mitigation Activities

There were no mitigation activities required during the REV surveys aboard the MV Fugro Discovery.

6 Geophysical Survey – Dead or Injured Marine Mammal or Sea Turtles

There were no dead or injured marine mammals or sea turtles recorded during the SJWF, SFWF or REV surveys.

7 CHALLENGES/RECOMMENDATIONS

There were some performance issues with the HD/Thermal Imaging cameras as well as the PAM equipment during the survey. Overall, the PSO team, thermal camera system and passive acoustic array provided effective means for the team to efficiently monitor the exclusion zone for encroaching animals, with enough time to make appropriate mitigation decisions. The PSO/PAM team only encountered a few challenges during this survey; however these challenges did not result in any major delays in operations.

While the thermal imaging cameras were deployed aboard the Fugro Discovery, the ‘pan tilt unit’ for the port side camera stopped working, which limited its capabilities as a thermal imaging tool during non-daylight hours. In an effort to mitigate the loss of the field of view during night time visual observations on the port side of the vessel, one PSO monitored the functioning camera and a second PSO monitored the rest of the field of view using hand held night vision. This method of night time observation continued until the camera issue was resolved and full use of the cameras reinstated.

During the SJWF geophysical surveys there was an incident where the PAM cable became entangled in the magnetometer. All of the equipment was recovered and the entanglement was addressed. This resulted in a pause in survey operations in the amount of 2.5 hours. This was likely the result of a combination of currents and deployment proximity to the magnetometer. The deployment logistics were discussed, the length of the cable deployed was reduced, and no future incidents occurred.

The majority of the PAM detections were delphinid in nature, but species could only be identified via visual confirmation from PSO on deck using night vision (this only occurred twice throughout the survey).

Similarly, while the Seiche thermal imaging cameras greatly improve the PSO team’s detection ability at night (by increasing their field of view and distance of detections in comparison to handheld night vision),

identifying some species was, at times, problematic. The majority of the animals detected via thermal imaging were delphinids, and species was not possible to identify based on the vague silhouettes provided by the thermal imaging equipment, due to the great distance of the animals from the vessel. The animals rarely approached the vessel close enough to allow for a visual confirmation via night vision.

Lastly, there were some communication issues at the beginning of the project between the survey crew and PSO team with regards to magnetometer operations. The issues were quickly resolved via affirmation of relaying all survey operations to the PSO team. The PSO team communicated very effectively with the geophysical survey crew overall.

Attachment 1

MV Discovery - Skipjack Wind Farm Detection Summary

A.I.S. Inc Protected Species Observer Data - MV Fugro Discovery
2018 Skip Jack Wind Farm (OCS-A 0482)

Project Detection Number	Date			Primary Detection Method (how was animal first detected)	Time at first encounter (UTC)	Total Encounter Time		Ship Position latitude decimal degrees	Ship Position longitude decimal degrees	Water depth (metres)	Family	Genus	Species	Description of Animal(s)	Total number			Best Number of adults (visual sightings only)	Best Number of juveniles (visual sightings only)	Best Number of calves (visual sightings only)	Behaviour (visual sightings only)	Direction of travel (relative to ship)	Source activity	Vessel Activity	CPA source meters	MITIGATION MEASURES											
															What action requested?	Was action implemented?	source(s) involved in the action was taken (list all that apply)									Bearing to animal at time of action (clockface with bow = 1200)	Range to animal at time of action	Duration of power-down and/or shut- down	Duration of start up delay	Time of equipment restart		Estimated Loss of Production					
	HH	MM	HH			MM	HH																							MM							
001	2018	9	28	Daylight Visual	19:00	0	24	41.0690	-71.4298	40.0	Delphinidae	Delphinus	delphis	Dark body, cream/yellow colored flank and dark rostrum	10	8	10	8	2	0	Surface-active travel	Towards bow	Silent in water	Transit	2	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
002	2018	9	29	Daylight Visual	12:33	0	3	38.5388	-74.4630	35.0	Cheloniidae			Dark carapace, rectangular head	1	1	1	1	0	0	Surfacing	Stationary - toward midship	Silent in water	Transit	300	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
003	2018	9	29	Daylight Visual	13:43	0	2	38.5977	-74.5617	29.2	Cheloniidae	Caretta	caretta	Orange/brown head & carapace	1	1	1	1	0	0	Surfacing		Silent in water	Transit	10	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
004	2018	10	1	Daylight Visual	14:56	0	1	38.6095	-74.6744	30.0	Cheloniidae	Caretta	caretta	Orange/brown head & carapace; barnacles present on carapace	1	1	1	1	0	0	Surfacing	Parallel in opposite direction as boat	Full Power	Other	20	None	N	Multibeam sounder	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
005	2018	10	2	Daylight Visual	14:45	0	1	38.6119	-74.7489	17.0	Cheloniidae	Caretta	caretta	Orange/brown head & carapace; barnacles present on carapace	1	1	1	1	0	0	Surfacing	Parallel in opposite direction as boat	Silent in water	Other	25	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
006	2018	10	2	Daylight Visual	21:17	1	20	38.6894	-74.6195	17.5	Balaenopteridae	Megaptera	novaeangliae	Black dorsal color; large body approx 15m length; white flippers, broad black flukes w/white patches and jagged edge; small dorsal relative to body size; highly arched back when diving - broad bushy blows approx 2-4m height	1	1	1	1	0	0	Surface Active	Parallel in opposite direction as boat	Silent in water	Other	613	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
007	2018	10	3	Daylight Visual	17:20	0	1	38.6054	-74.6595	19.8	Cheloniidae			Shell ~1 m in front to back	1	1	1	1	0	0	Swim	Parallel in opposite direction as boat	Silent in water	Other	10	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
008	2018	10	3	Daylight Visual	20:24	0	1	38.5848	-74.6610	30.0	Cheloniidae	Caretta	caretta	Orange brown head	1	1	1	1	0	0	Swim	Parallel in opposite direction as boat	Silent in water	Equipment Test	487	RD	Y	Sparkler, Chirper, Multibeam Sounder	9:00	487	0	0.27	21	53	0	27	
009	2018	10	3	Daylight Visual	20:51	0	1	38.5799	-74.6353	28.0	Cheloniidae	Caretta	caretta	Orange/brown head & carapace; barnacles present on carapace	1	1	1	1	0	0	Swim	Parallel in opposite direction as boat	Silent in water	Equipment Test	45	RD	Y	Sparkler, Chirper, Multibeam Sounder	7:00	50	0	1.00	21	53	1	0	
010	2018	10	4	Daylight Visual	17:37	0	1	38.6149	-74.5168	35.0	Dermochelyidae	Dermochelys	coriacea	Dark shell with ridges, large head, dark with white throat	1	1	1	1	0	0	Surfacing	Parallel in opposite direction as boat	Full Power	Operational	75	Shut down - mitigation	Y	Chirper, Multibeam Sounder	3:00	50	1.00	0	18	37	1	0	
011	2018	10	7	Daylight Visual	18:40	0	1	38.6158	-74.6753	25.0	Cheloniidae			shell brownish; brown marks on head	1	1	1	1	0	0	Surfacing	Stationary	Full Power	Surveying/Operational	800	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
012	2018	10	8	Daylight Visual	13:02	0	3	38.6100	-74.6407	32.0	Cheloniidae			Obvious sea turtle, too distant to identify	1	1	1	1	0	0	Surfacing	Milling	Full Power	Surveying/Operational	800	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
013	2018	10	8	Daylight Visual	16:15	0	1	38.6123	-74.5910	33.0	Cheloniidae	Caretta	caretta	Rusty, orange/brown carapace observed at 600m, turtle's head seen after initial sighting, before the animal dove.	1	1	1	1	0	0	Surfacing	Stationary	Full Power	Surveying/Operational	800	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
014	2018	10	9	Night Vision	2:10	0	1	38.5974	-74.6587	32.0	Cheloniidae	Caretta	caretta	Jagged edged carapace, no distinct pattern apparent on carapace.	1	1	1	1	0	0	Surfacing	Parallel in opposite direction as boat	Full Power	Surveying/Operational	66	Shut down - mitigation	Y	Chirper, Multibeam Sounder, USBL, Side Scan Sonar	3:00	15	1.00	0.00	3	38	1	0	
015	2018	10	9	Daylight Visual	16:40	0	1	38.6144	-74.6577	31.0	Cheloniidae			Shell algae-covered; upper part of beak did not appear to extend past lower	1	1	1	1	0	0	Surfacing	Milling	Full Power	Surveying/Operational	75	Shut down - mitigation	Y	Sparkler, Chirper, Multibeam Sounder, USBL, Side Scan Sonar	3:00	40	1.00	0	17	40	1	0	
016	2018	10	10	Daylight Visual	20:30	0	0	38.6174	-74.6845	32.0	Cheloniidae	Caretta	caretta	Orange brown head and carapace, barnacles present on carapace	1	1	1	1	0	0	Surfacing	Parallel in opposite direction as boat	Full Power	Surveying/Operational	75	Shut down - mitigation	Y	Multibeam sounder	10:00	10	1.00	0	17	30	1	0	
017	2018	10	11	Daylight Visual	11:03	0	6	39.8981	-72.9409	37.0	Delphinidae	Delphinus	delphis	dark gray dorsal surface with hourglass yellow/cream to light gray on sides; falcate dorsal fin at mid-body; long, narrow pointed beak	10	5	6	5	0	1	Wake Riding	Toward stern	On Deck	Transit	5	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
018	2018	10	11	Daylight Visual	13:58	0	1	40.3005	-72.3715	56.0	Balaenopteridae	Balaenoptera	acutorostrata	Small, robust body, falcate dorsal located 2/3 back on body	1	1	1	1	0	0	Surface Active	Unknown	On Deck	Transit	>100	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
019	2018	10	11	Daylight Visual	14:00	0	13	40.3005	-72.3715	56.0	Balaenopteridae	Megaptera	novaeangliae	Dark-colored body with white on throat and ventral surface; broad, white pectoral fins, raised hump on back with post-dorsal ridges/bumps	6	5	5	4	1	0	Surface Active	Away from bow	On Deck	Transit	500	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
020	2018	10	11	Daylight Visual	14:34	0	11	40.3848	-72.2581	56.0	Balaenopteridae	Megaptera	novaeangliae	Black dorsal color; large body approx 15m length; white flippers, broad black flukes w/white patches and jagged edge; small dorsal relative to body size; highly arched back when diving - broad bushy blows approx 2-4m height	3	3	3	3	0	0	Surface Active	Unknown	On Deck	Transit	600	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
021	2018	10	11	Daylight Visual	14:54	0	2	40.4434	-72.1782	58.0	Balaenopteridae	Megaptera	novaeangliae	Black dorsal color; large body approx 15m length; white flippers, broad black flukes w/white patches and jagged edge; small dorsal relative to body size; highly arched back when diving - broad bushy blows approx 2-4m height	1	1	1	1	0	0	Surface Active	No clear direction / not able to determine	On Deck	Transit	800	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
022	2018	10	11	Daylight Visual	17:18	0	3	40.8045	-71.6977	61.0	Delphinidae	Delphinus	delphis	dark gray dorsal surface with hourglass yellow/cream to light gray on sides; falcate dorsal fin at mid-body; long, narrow pointed beak	17	13	15	15	0	0	Porpoising	Parallel in opposite direction as boat	On Deck	Transit	600	None	N	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any observed changes in behavior)
001	Dolphins were sighted at 19:00 at approximately 800m to the port bow, 8-10 animals were observed jumping and travelling rapidly towards the vessel, the dolphins began bowriding and continued with the vessel until the last sighting at 19:24. At the time of the sighting, the vessel was transiting to the survey area.
002	Turtle was sighted approximately 600m to the stbd bow, basking at the surface. The turtle remained on the surface of the water, raising its head to breathe several times. The turtle maintained its position in the water as the vessel approached, entering the EZ at 12:34. The last sighting occurred at 12:36 when the turtle dove. At the time of the sighting, the vessel was in the survey area with no gear deployed.
003	Turtle surfaced next to the vessel, slightly forward and at 10m, it swam towards the vessel then changed course 180, swimming back the way it came, the last sighting occurred at 13:45. At the time of the sighting, the vessel was in the survey area, but no gear was deployed.
004	One individual portside from the wheelhouse travelling bow to stern; surfaced and swam away. PSOs were unaware multibeam sounder was active at the time of sighting due to miscommunication, and did not call for shutdown of the multibeam sounder. Vessel was using multibeam as depth sensor due to no single beam sounder on board. PSOs unaware the multibeam was operating below 200kHz.
005	One individual surfaced portside from the wheelhouse; the animal didn't immediately surface for air but swam about just a few inches below the surface - it appeared to be swimming in a stationary circle; after it rose to take a breath, it became apparent that there was a small shark (similar in length to the turtle) circling the turtle, within inches of it; the two circled together for a moment before both disappearing into deeper water
006	Whale first sighted by off effort PSO (TH) from bridge. Initial sighting cues were multiple broad bushy blows off the starboard bow of the Discovery. The whale was moving at a slow pace in the opposite direction of the vessel, and towards the vessel. It continued to break the surface and repeatedly blow as it approached. At 21:28, the whale was approx 813m (3 reticles TH) at bearing 02:15. At 21:30, the whale was sighted diving, and highly arched its back, exposing its dorsal fin. CPA occurred from 21:36-21:37, at bearing 03:00-03:30. At 21:37 the whale fluked prior to diving, exposing its broad fluke with white patches and a jagged trailing edge. It continued moving in the opposite direction of the Discovery, and was sighted fluking/diving again at 21:40, approximately 700m off the starboard side (3.5 reticles (TH) bearing 04:00). At 21:44 the whale was sighted again arching its back and diving (bearing 04:30) approx 700m from the vessel (3.5 reticles, TH), and again fluking diving at the same distance and bearing at 21:47. The whale continued to swim around the vessel at an approx distance of 700m (3.5 reticles, TH), and was sighted fluking/diving at 21:53 directly astern. The whale then turned and began swimming in the same direction as the Discovery off the port side, no closer than 700m, and was moving a bit faster, breaking the surface often and blowing. At 22:03 it was at 10:00 bearing (~1.2km from port bow, 2 reticles, SM), then turned and moved back to 6:00 bearing, ~1.2km (2 reticles, SM) from stern, at time of last sighting. A total of 51 blows were counted, along with multiple dives, flukes, and one flipper slap. No mitigation was required, as the whale never entered the 500m EZ. All bearings are in reference to clock face. Sighting was witnessed and documented by PSO's TH, SM, and BS, along with several crew members on the bridge. Photos taken by PSO BS.

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any observed changes in behavior)
007	At 1720, an unidentified sea turtle passed on the starboard side at a distance of ~10m, in the opposite direction of boat travel, ~1m below the surface. A photo was taken but due to the animal's depth the image was not diagnostic to species. Boat was running transects with no equipment in water at time of observation.
008	One individual swimming at the surface at the very edge of the exclusion zone - side scan was equipment being tested. No active sound source at the time of sighting. PSO notified survey to delay sound source operations for EZ clearance
009	One adult loggerhead turtle was sighted approximately 30m from the port side midship, slightly astern at 20:51. Turtle was swimming in opposite direction, parallel to the port side of the vessel. At time of sighting the sparker was deployed in the water but was inactive due to pre-clearance taking place; sparker was being deployed to conduct calibration tests. Turtle dove at 20:52 and was not seen again. Turtle was last seen within the 500m EZ at 20:52 and a delay in sparker ramp-up operations was called for.
010	One leatherback sea turtle sighted approximately 150m to the stbd bow swimming parallel, in the opposite direction of the vessel. Shutdown was called and implemented at 17:37. The turtle dove at 17:37 at its point of closest approach and was not resighted. Mitigation shutdown ended at 18:37, at which time PSO authorized survey to resume operation of sound sources.
011	At 1840, an unidentified sea turtle was sighted twice in ~10 seconds, ~800m from starboard. Turtle dived and was not seen again.
012	At 1302, an unidentified sea turtle was sighted at the 5:00 position at a reticle-determined distance of ~800m. It was in view for ~3 minutes before diving; was not seen again.
013	At 16:15, 1 loggerhead sea turtle was sighted to the stbd bow of the vessel, the shell was obvious & rusty brown in color, the turtle raised its head to breathe one time before diving again. At the time of the sighting the vessel was at full power on a survey line, no mitigation actions were required due to the distance of the animal.
014	Individual was just below the surface of the water off the starboard side of the vessel, past the bridge mid ship. The animal surfaced for a breath before diving directly down and was not seen again. PSO requested shutdown of sources upon sighting of the turtle within the exclusion zone.
015	At 16:40, presumed Green Sea Turtle detected at a visually-estimated distance of ~40m at 3:00 position from starboard. Turtle surface-breathed once, then dived and was not seen again. PSO requested shutdown of all HRG acoustic sources below 200kHz upon sighting of the turtle within the EZ.
016	One individual surfaced portside of the wheelhouse very briefly before diving. The turtle was reddish orange and brown, with barnacles on its carapace. The only source that was on during the time of the interaction was the multibeam; which was shutdown upon the request of the PSOs

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any observed changes in behavior)
017	<p>Two common dolphins were observed wake riding approximately 5m off the starboard stern of the Fugro Discovery at 11:03 UTC. A second small group of 3-4 dolphins was observed porpoising toward the stern of the Discovery at a distance of approximately 80m from the stern (distance determined by eye) shortly after the initial sighting. The common dolphins observed wake riding off the stern rapidly travelled toward mid-ship where one individual continued to wake ride off the starboard beam of the vessel (distance from vessel of approximately 3m). The second wake riding dolphin continued toward the bow. The small secondary group was observed porpoising again at 11:05 approximately 100m off the starboard bow, heading toward the bow of the Discovery. The bow of the Fugro Discovery is not clearly visible from the bridge, therefore the PSOs were not able to determine if the dolphins bow rode. The small group of common dolphins was last observed at 11:07. The lone wake riding common dolphin continued to ride the wake generated off the starboard side of the vessel until 11:09 when the dolphin was last observed heading toward the bow of the Discovery. The Discovery was transiting to Rhode Island at the time of the detection and all HRG survey equipment were inactive and on deck. Since no sources were in the water, time of CPA to inactive source and CPA to inactive source have been left blank for the sighting. The 50m strike avoidance zone for dolphins was considered the 'exclusion zone' for this sighting event.</p>
018	<p>1 minke whale surfaced to the stbd side at mid-ship, travelling rapidly and parallel to the vessel. The whale was not re-sighted following this initial encounter. The Discovery was in transit at the time of sighting, with no deployed or active HRG survey equipment. Whale did not enter the 100m strike avoidance "exclusion zone", and no mitigation action was required.</p>
019	<p>Two humpback whales were sighted at 14:00 UTC about 600m off the bow. The pair was exhibiting surface active behaviors including: breaching, tails slaps and rapid surfacings. The pair swam perpendicular to the vessel's direction of travel towards the starboard side and 3 (possibly 4) more humpback whales were spotted approximately 500m from the starboard midship at 14:04 UTC. The second group of whales also exhibited surface active behaviors (breaching, rapid surfacings) and were last seen at 14:13 at approximately 1km from the port side midship, slightly astern. At least 15-20 blows were observed at the surface from all of the individuals and there may have been a juvenile present within the pair that was initially sighted off the bow, as the one whale looked smaller than the other one. The Discovery was in transit at the time of sighting, with no deployed or active HRG survey equipment. Whales did not enter the 100m strike avoidance "exclusion zone", and no mitigation action was required.</p>
020	<p>One humpback whale sighted at approximately 800m off the bow, the whale was travelling slowly and crossed ahead of the vessel, travelling to the stbd side. The whale maintained its heading and joined another group of 2 animals. *None of the direction of travel codes available are applicable to this sighting* The Discovery was in transit at the time of sighting, with no deployed or active HRG survey equipment. Whales did not enter the 100m strike avoidance "exclusion zone", and no mitigation action was required.</p>
021	<p>One humpback whale sighted ahead of the vessel, the whale surfaced several times before arching and diving, showing its flukes. The whale was not resighted after the dive. The Discovery was in transit at the time of sighting, with no deployed or active HRG survey equipment. Whale did not enter the 100m strike avoidance "exclusion zone", and no mitigation action was required.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any observed changes in behavior)
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022	At 17:18, pod of ~15 Common Short-beaked Dolphins were detected ~600m from port at 9:00 position swimming parallel to boat in opposite direction. Animals continued in same direction, making numerous leaps, until passing from view >1km off stern at 7:00 position. The Discovery was in transit at the time of sighting, with no deployed or active HRG survey equipment. Dolphins did not enter the 50m strike avoidance "exclusion zone", and no mitigation action was required.
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Attachment 2

MV Discovery – South Fork Wind Farm Detection Summary

Project Detection Number	Date			Primary Detection Method (how was animal first detected)	Time at first encounter (UTC)	Total Encounter Time		Ship Position - latitude	Ship Position - longitude	Water depth (metres)	Family	Genus	Species	Description of Animal(s)	Total number			Best Number of adults (visual sightings only)	Best Number of juveniles (visual sightings only)	Best Number of calves (visual sightings only)	Behaviour (Visual Sightings only)	Direction of travel (relative to ship)	Source activity	Vessel Activity	CPA to Source meters	MITIGATION MEASURES													
															What action requested?	Was action implemented	What source(s) were involved in the action was taken (list all that apply)									Bearing to animal at time of action (clockface with bow = 1200)	Range to animal at time of action	Duration of power-down and/or shut-down	Duration of start up delay	Time of equipment restart		Estimated Loss of Production							
	HH	MM	HH			MM																																	
001	2018	10	16	DV	10:49	0	6	41.1352	-71.3057	54	Delphinidae	Delphinus	delphis	Yellow/cream flanks with gray capes, long rostrum	12	10	12	10	2	0	Bow Riding	Towards bow	Full power active	Other	5	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
002	2018	10	16	DV	11:04	0	8	41.1328	-71.2882	53	Delphinidae	Delphinus	delphis	Yellow/cream flanks with gray capes, long rostrum	6	6	6	6	0	0	Dolphin Feeding	Toward stern	Full power active	Other	150	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
003	2018	10	16	DV	11:39	0	11	41.1328	-71.2804	46	Delphinidae	Delphinus	delphis	dark gray dorsal surface with hourglass yellow/cream to light gray on sides; falcate dorsal fin at mid-body; long, narrow pointed beak	20	12	15	13	2	0	Bow Riding	Towards bow	Full power active	Other	5	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
004	2018	10	16	DV	12:43	0	10	41.1317	-71.2954	67	Delphinidae	Delphinus	delphis	dark gray dorsal surface with hourglass yellow/cream to light gray on sides; falcate dorsal fin at mid-body; long, narrow pointed beak	25	20	22	19	3	0	Surface Active	Towards bow	Full power active	Other	5	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
005	2018	10	16	DV	17:52	0	1	41.1395	-71.2942	64	Delphinidae	Delphinus	delphis	Dark cape, yellow/cream flanks & dark rostrum	20	10	15	18	2	0	Swim	Towards bow	Full power active	Testing	20	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
006	2018	10	16	DV	18:08	0	1	41.1384	-71.2956	66	Delphinidae	Delphinus	delphis	hourglass pattern on the side (tan patch forwards, gray patch aft); tall, falcate dorsal fin	20	12	15	15	0	0	Swim	Towards bow	Full power active	Testing	150	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
007	2018	10	16	DV	18:21	0	24	41.1334	-71.2940	64	Delphinidae	Delphinus	delphis	Dark cape, yellow/cream flanks & dark rostrum	60	40	50	50	0	0	Dolphin Feeding	Towards bow	Full power active	Testing	10	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
008	2018	10	16	DV	20:14	0	1	41.1338	-71.2943	66	Delphinidae	Delphinus	delphis	hourglass pattern on the side (tan patch forwards, gray patch aft); tall, falcate dorsal fin	12	8	10	10	0	0	Traveling	Towards bow	Full power active	Testing	150	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
009	2018	10	16	DV	21:50	0	20	41.1342	-71.2931	66	Delphinidae	Delphinus	delphis	Yellow/cream flanks with gray capes, long rostrum	80	60	70	60	10	0	Traveling	Parallel in opposite direction as boat	Full power active	Testing	5	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
010	2018	10	16	NV	23:45	0	1	41.1336	-71.2922	65	Delphinidae	Delphinus	delphis	dark dorsal cape, light colored contrasting tan patch located forward on the body; mid-body falcate dorsal fin; fusiform body	4	1	4	4	0	0	Surface-active Travel	Towards bow	On deck, being deployed/retrieved	Retrieving equipment	3	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
011	2018	10	17	NVD	4:28	0	24	41.1281	-71.2900	65	Delphinidae	Delphinus	delphis	Hourglass pattern on sides of body; 2-2.5m est length; Tall, falcate, mid-body dorsal fin; "V-shaped" pattern visible on sides below dorsal fin; pointed rostrum; slender/fusiform body shape	12	8	10	10	0	0	Porpoising	Towards bow	On deck, being deployed/retrieved	Other	5	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
012	2018	10	17	NVD	5:51	0	4	41.1334	-71.2655	65	Delphinidae	Delphinus	delphis	Dark cape, light hourglass pattern on body	2	2	2	2	0	0	Dolphin Feeding	Parallel in same direction as boat	On deck, being deployed/retrieved	Other	30	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
013	2018	10	17	NVD</																																			

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2018 Soutfork Wind Farm (OCS-A 0486)

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A.I.S. Inc Protected Species Observer Data - MV Fugro Discovery
2018 Southfork Wind Farm (OCS-A 0486)

Project Detection Number	Date			Primary Detection Method (how was animal first detected)	Time at first encounter (UTC)	Total Encounter Time		Ship Position - latitude	Ship Position - longitude	Water depth (metres)	Family	Genus	Species	Description of Animal(s)	Total number			Best Number of adults (visual sightings only)	Best Number of juveniles (visual sightings only)	Best Number of calves (visual sightings only)	Behaviour (visual Sightings only)	Direction of travel (relative to ship)	Source activity	Vessel Activity	CPA to Source meters	MITIGATION MEASURES														
															What action requested?	Was action implemented Y / N	What source(s) were involved in the action was taken (list all that apply)									Bearing to animal at time of action (clockface with bow = 1200)	Range to animal at time of action	Duration of power- down and/ or shut- down	Duration of start up delay	Time of equipment restart		Estimated Loss of Production								
	HH	MM	HH			MM	HH																							MM										
028	2018	10	19	DV	12:05	0	32	41.1333	-71.2956	62	Delphinidae	Delphinus	delphis	dark gray dorsal surface with hourglass yellow/cream to light gray on sides; falcate dorsal fin at mid-body; long, narrow pointed beak	30	15	20	18	2	0		Surface-active Travel	Away from bow	Full power active	Testing	n/a	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
029	2018	10	19	DV	17:07	0	1	41.1284	-71.3134	52	Delphinidae	Delphinus	delphis	Dark cape, cream hourglass pattern on side	3	3	3	3	0	0		Surface-active Travel	Parallel in opposite direction as boat	On deck, being deployed/retrieved	Other	n/a	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
030	2018	10	19	DV	20:40	0	1	41.2191	-71.2143	36	Delphinidae	Delphinus	delphis	Dark falcate dorsal with saddle back v pattern, tan patch along the under belly forward on the body	7	5	7	7	0	0		Surface-active Travel	Towards bow	On deck, being deployed/retrieved	Transit	n/a	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
031	2018	10	19	DV	21:18	0	7	41.3460	-71.2788	30	Delphinidae	Delphinus	delphis	Dark falcate dorsal with saddle back v pattern, tan patch along the under belly forward on the body	12	8	10	6	2	4		Traveling	Towards bow	On deck, being deployed/retrieved	Transit	n/a	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
032	2018	10	19	DV	21:48	0	4	41.3641	-71.2709	31	Delphinidae	Delphinus	delphis	Dark falcate dorsal with saddle back v pattern, tan patch along the under belly forward on the body	15	10	12	10	3	2		Traveling	Toward midship	On deck, being deployed/retrieved	Transit	n/a	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
033	2018	10	19	DV	21:56	0	11	41.3609	-71.2733	28	Delphinidae	Delphinus	delphis	Dark falcate dorsal with saddle back v pattern, tan patch along the under belly forward on the body	12	8	10	8	1	1		Wake Riding	Toward midship	On deck, being deployed/retrieved	Transit	n/a	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
034	2018	10	22	DV	10:52	0	1	41.6236	-70.9143	11.3	Phocidae	Halcoerus	grypus	long, broad rostrum; dark gray to black pig	1	1	1	1	0	0		Basking	Away from stern	Full power active	Other	60	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
035	2018	10	22	DV	14:34	0	2	41.1302	-71.1611	33	Delphinidae	Delphinus	delphis	Dark falcate dorsal with saddle back v pattern, tan patch along the under belly forward on the body	12	10	10	8	2	0		Traveling	Toward midship	Full power active	Transit	80	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
036	2018	10	23	TC	2:00	0	1	41.0942	-71.1088	36	Delphinidae	Delphinus	delphis	Pointed beak with spindle shaped body and a falcate dorsal; slender tail stock	4	3	3	3	0	0		Porpoising	Towards bow	Full power active	Testing	80	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
037	2018	10	23	TC	8:57	0	1	41.2627	-71.3601	39	Delphinidae			Fusiform body and falcate dorsal	5	5	5	5	0	0		Traveling	Towards bow	On deck, being deployed/retrieved	Transit	20	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
038	2018	10	30	DV	11:18	0	1	41.0617	-71.1177	37	Delphinidae	Delphinus	delphis	Fusiform body and with dark falcate dorsal fin, light underbelly	8	5	7	7	0	0		Traveling	Toward midship	Full power active	Testing	50	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
039	2018	11	1	DV	11:18	0	3	41.0817	-71.1400	35	Delphinidae	Delphinus	delphis	Fusiform body; dark falcate dorsal; cream colored underside; slender tail stock	8	5	6	6	0	0		Traveling	Towards bow	Full power active	Testing	150	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
040	2018	11	1	DV	11:32	0	1	41.1093	-71.1370	32	Delphinidae			Fusiform body and falcate dorsal fin	8	6	6	6	0	0		Surface-active Travel	Parallel in opposite direction as boat	Full power active	Testing	1000	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
501	2018	11	2	NP	2:45:44	0	0	41.0744	-71.0829	34	Delphinidae			upswEEP whistles 10-11.3kHz	2	1	1				n/a	Not able to determine	Full power active	Other	Not able to determine	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		

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A.I.S. Inc Protected Species Observer Data - MV Fugro Discovery
2018 Soutfork Wind Farm (OCS-A 0486)

Project Detection Number	Date			Primary Detection Method (How was animal first detected)	Time at first encounter (UTC)		Total Encounter Time		Ship Position - latitude	Ship Position - longitude	Water depth (metres)	Family	Genus	Species	Description of Animal(s)	Total number			Best Number of adults (visual sightings only)	Best Number of juveniles (visual sightings only)	Best Number of calves (visual sightings only)	Behaviour (visual Sightings only)	Direction of travel (relative to ship)	Source activity	Vessel Activity	CPA to Source meters	MITIGATION MEASURES												
																											What action requested?	Was action implemented Y / N	What source(s) were involved in the action (list all that apply)	Bearing to animal at time of action (clockface with bow = 1200)	Range to animal at time of action	Duration of power- down and/ or shut- down	Duration of start up delay	Time of equipment restart		Estimated Loss of Production			
	HH	MM	HH		MM																																		
046	2018	11	5	DP	11:43	0	6	41.0689	-71.1642	37	Delphinidae	Delphinus	delphis	Fusiform body with falcate dorsal fin; black v-back coloration with tan patch located mid-body forward; slender tail stock	10	3	10	10	0	0	Bow Riding	Towards bow	Full power active	Surveying	70	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
047	2018	11	5	DV	21:10	0	5	41.0830	-71.1330	35	Delphinidae	Delphinus	delphis	Dark dorsal surface with an hourglass pattern on the side (tan patch forwards, gray patch aft); tall, falcate dorsal fin	10	6	8	8	0	0	Swim	Towards bow	Full power active	Other	50	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
048	2018	11	6	NVD	4:06	0	0	41.0877	-71.1205	35	Delphinidae			falcate dorsal fin at mid-point on back	6	3	3	3	0	0	Traveling	Towards bow	Full power active	Other	45	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
049	2018	11	6	NVD	4:54	0	16	41.0960	-71.1051	35	Delphinidae	Delphinus	delphis	falcate dorsal fin; short, narrow, pointed beak; flank showed light/dark color gradient similar to characteristic hourglass pattern	8	2	6	5	0	1	Bow Riding	Towards bow	Full power active	Other	45	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
050	2018	11	6	DV	11:07	0	1	41.0963	-71.0959	36	Delphinidae			Dolphin like body shape; didn't break water enough to ID to species	6	6	6	6	0	0	Traveling	Away from stern	Full power active	Other	100	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
051	2018	11	6	DV	12:49	0	1	41.0827	-71.1993	35	Delphinidae	Delphinus	delphis	Dark cape; large, hourglass-shaped pale area on sides	3	3	3	3	0	0	Dolphin Feeding	Away from stern	Full power active	Other	60	None	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
509	2018	11	7	NP	3:51	0	33	41.0700	-71.1620	36	Delphinidae			whistles 6.3-13.4kHz; clicks 12-92kHz (single peaks 30-35kHz, 45-50kHz, 60-69kHz)	10	4	6				n/a	Not able to determine	Full power active	Surveying	30	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
510	2018	11	7	NP	5:35	0	16	41.0696	-71.0646	34	Delphinidae			whistles 6.9-16kHz; clicks 15-75kHz with single peak 30-35kHz	10	3	6				n/a	Not able to determine	Full power active	Surveying	Not able to determine	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
511	2018	11	7	NP	6:07	0	1	41.0712	-71.1054	35	Delphinidae			high frequency clicks 15-120kHz with single peaks 40-45kHz and 65-70kHz	6	2	4				n/a	Not able to determine	Full power active	Surveying	20	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
512	2018	11	7	NP	6:32	0	7	41.0723	-71.1377	36	Delphinidae			convex and upsweep whistles 7.5-14kHz	6	2	4				n/a	Not able to determine	Full power active	Surveying	Not able to determine	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
513	2018	11	7	NP	7:58	0	35	41.0687	-71.1180	35	Delphinidae			whistles of multiple contour types (7.5-23kHz); high frequency clicks 15-100kHz (peaks ranging 20-80kHz)	5	1	3				n/a	Not able to determine	Full power active	Surveying	Not able to determine	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
514	2018	11	7	NP	10:04	0	2	41.0711	-71.1008	35	Delphinidae			upsweep whistle 8.9-12.7kHz; high frequency clicks 15-70kHz with single peak around 32kHz	6	2	4				n/a	Not able to determine	Full power active	Surveying	Not able to determine	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
052	2018	11	7	DV	18:21	0	5	41.0734	-71.1396	36	Balaenopteridae	Megaptera	noaeae	Black dorsal color, Large bodied (10+m est length), bushy blow	1	1	1	1	0	0	Surface-active Travel	Away from bow	Full power active	Surveying	305	Shutdown	Y	Sub-Bottom Profiler, Multibeam Echosounder, USBL	9:00	305	60	n/a	19	27	1	0			

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Project Detection Number	Date			Primary Detection Method (how was animal first detected)	Time at first encounter (UTC)	Total Encounter Time		Ship Position - latitude	Ship Position - longitude	Water depth (metres)	Family	Genus	Species	Description of Animal(s)	Total number			Best Number of adults (visual sightings only)	Best Number of juveniles (visual sightings only)	Best Number of calves (visual sightings only)	Behaviour (Visual Sightings only)	Direction of travel (relative to ship)	Source activity	Vessel Activity	CPA to Source	MITIGATION MEASURES												
																										What action requested?	Was action implemented	What source(s) were involved in the action was taken (list all that apply)	Bearing to animal at time of action (clockface with bow = 1200)	Range to animal at time of action	Duration of power-down and/or shut-down	Duration of start up delay	Time of equipment restart		Estimated Loss of Production			
	YYYY	MM	DD			codes	HH								MM	HH	MM								meters			Y / N		HH	MM	HH	MM					
053	2018	11	8	DV	11:25	0	9	41.0863	-71.1111	35	Delphinidae	Delphinus	delphis	Spindle shaped body; with dark dorsal and black v-shaped pattern on back with tan patch forward and grey patch aft; falcate mid-body dorsal fin; pointed rostrum	15	7	10	7	2	1	Surface Active	Towards bow	On deck, being deployed/retrieved	Other	0	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
054	2018	11	8	DV	18:57	0	6	41.0658	-71.1252	35	Delphinidae			Black falcate dorsal	30	17	25	25	0	0	Traveling	Parallel in opposite direction as boat	Full power active	Retrieving equipment	2420	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
515	2018	11	9	NP	0:18	0	30	41.0654	-71.1244	37	Delphinidae			whistles 7.3-20kHz 0.5-1.5s in duration, high frequency clicks 11-123kHz with single peaks 25-35kHz and 65-70kHz	10	4	6				n/a	Not able to determine	Full power active	Surveying	35	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
516	2018	11	9	NP	2:24	0	1	41.0726	-71.1244	35	Delphinidae			upsweep whistles and downsweep whistle, 7-11kHz	1	1	1				n/a	Not able to determine	Full power active	Surveying	Not able to determine	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
517	2018	11	9	NP	3:43:05	0	0	41.0681	-71.1530	36	Delphinidae			upsweep whistle 10.3-13.5kHz	1	1	1				n/a	Not able to determine	Full power active	Surveying	Not able to determine	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
518	2018	11	9	NP	4:44	0	29	41.0654	-71.0786	36	Delphinidae			clicks 15-62kHz with single peak 35-40kHz and 60-65kHz	10	4	6				n/a	Not able to determine	Full power active	Surveying	25	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
519	2018	11	9	NP	5:37	0	23	41.0722	-71.0780	33	Delphinidae			clicks 15-73kHz with single peak 25-30kHz	10	4	6				n/a	Not able to determine	Full power active	Surveying	45	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
520	2018	11	9	NP	6:19	0	14	41.0644	-71.0618	35	Delphinidae			whistles 8-15kHz; clicks 12-119kHz with single peak 29-32kHz	8	4	6				n/a	Not able to determine	Full power active	Surveying	40	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
521	2018	11	9	NP	6:57	0	13	41.0682	-71.0751	35	Delphinidae			whistles 7.6-13.5kHz	6	2	4				n/a	Not able to determine	Full power active	Surveying	Not able to determine	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
522	2018	11	9	NP	8:40	0	3	41.0722	-71.1766	35	Delphinidae			clicks 20-110kHz	6	2	4				n/a	Not able to determine	Full power active	Surveying	Not able to determine	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
523	2018	11	9	NP	9:05	0	5	41.0707	-71.1392	36	Delphinidae			audible whistle (no features characterized); clicks 15-50kHz with single peak 35kHz	3	1	2				n/a	Not able to determine	Full power active	Surveying	Not able to determine	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
524	2018	11	9	NP	9:43	0	11	41.0691	-71.0934	34	Delphinidae			whistles 7-18kHz; clicks 18-82kHz with single peak 30-35kHz	8	2	6				n/a	Not able to determine	Full power active	Surveying	130	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
055	2018	11	10	NVD	6:39	0	8	41.0736	-71.1390	36	Delphinidae			falcate dorsal fin, spindle shaped body	6	2	4	4	0	0	Traveling	Towards bow	Full power active	Other	45	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
056	2018	11	10	NVD	10:04	0	4	41.0775	-71.1187	36	Delphinidae	Delphinus	delphis	falcate dorsal fin; short, narrow, pointed beak; flank showed light/dark color gradient similar to characteristic hourglass pattern	4	2	3	3	0	0	Traveling	Towards bow	Full power active	Other	50	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
525	2018	11	11	NP	22:06:28	0	0	41.0622	-71.0097	33	Delphinidae			downsweep whistle 19.7-11.6kHz, 0.5-1s duration	2	1	1				n/a	Not able to determine	Full power active	Surveying	Not able to determine	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

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Project Detection Number	Date YYYY MM DD			Primary Detection Method (how was animal first detected)	Time at first encounter (UTC)	Total Encounter Time		Ship Position - latitude	Ship Position - longitude	Water depth (metres)	Family	Genus	Species	Description of Animal(s)	Total number			Best Number of adults (visual sightings only)	Best Number of juveniles (visual sightings only)	Best Number of calves (visual sightings only)	Behaviour (visual Sightings only)	Direction of travel (relative to ship)	Source activity	Vessel Activity	CPA to Source meters	MITIGATION MEASURES												
															What action requested?	Was action implemented Y / N	What source(s) were involved in the action was taken (list all that apply)									Bearing to animal at time of action (clockface with bow = 1200)	Range to animal at time of action	Duration of power-down and/ or shut- down	Duration of start up delay	Time of equipment restart		Estimated Loss of Production						
																														HH	MM	HH	MM					
558	2018	11	24	NP	4:50	0	14	41.1112	-71.1813	35	Delphinidae			whistle 6.2-20.9kHz, 0.05-3s duration; high frequency clicks 12- 120kHz with single peak 32- 36kHz; echolocation terminal buzzes	20	7	15				n/a	Not able to determine	Full power active	Testing	28	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
559	2018	11	24	NP	5:51	0	1	41.1098	-71.1402	38	Delphinidae			whistle 8-15.1Hz	4	1	2				n/a	Not able to determine	Full power active	Testing	Not able to determine	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
560	2018	11	24	NP	9:25	0	47	41.0347	-71.2397	48	Delphinidae	Delphinus	delphis	whistle 6.3-23.8kHz, 0.4-1.3s duration; high frequency clicks 12- 120kHz with single peak 30- 36kHz or 75-85kHz; buzz	25	4	20				n/a	Not able to determine	Full power active	Deploying Equipment	40	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
074	2018	11	24	NP	9:47	0	9	41.0390	-71.2397	46	Delphinidae	Delphinus	delphis	Hourglass pattern on sides of body; falcate mid-body dorsal fin; pointed rostrum; 2-3m estimated length	15	10	13	10	3	0	PorpoSinking	Toward midship	Full power active	Deploying Equipment	20	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
075	2018	11	24	DV	14:50	0	13	41.0810	-71.0884	35	Balaenopteridae	Megaptera	novaeangliae	Large bodied black whale; small dorsal fin; broad bushy blows of varying height; highly arched back prior to dive	2	1	1	1	0	0	Diving	Away from bow	Full power active	Surveying	1624	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
076	2018	11	24	DV	17:59	0	0	41.0817	-71.1010	34	Balaenopteridae	Balaenoptera	physalus	Tall, column-like blow	1	1	1	1	0	0	Unknown	No clear direction	Full power active	Surveying	2424	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
077	2018	11	24	DV	20:21	0	1	41.0867	-71.1470	35	Balaenopteridae	Megaptera	novaeangliae	Large bodied black whale; small dorsal fin; broad bushy blow; broad black fluke	1	1	1	1	0	0	Diving	No clear direction	Full power active	Surveying	2436	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
078	2018	11	24	DV	21:00	0	2	41.1094	-71.1375	38	Balaenopteridae	Megaptera	novaeangliae	Large bodied black whale; small dorsal fin; broad bushy blows; broad black fluke with white patches	1	1	1	1	0	0	Diving	No clear direction	Full power active	Surveying	1218	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
561	2018	11	25	NP	3:07	0	12	41.0877	-71.1545	36	Delphinidae			whistle 9.5-14.8, 0.2-0.3s duration; high frequency clicks 20- 120kHz with single peak 24- 26kHz or 78-80kHz	4	1	2				n/a	Not able to determine	Full power active	Surveying	20	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
079	2018	11	26	DV	11:50	0	4	41.0863	-71.1456	36	Balaenopteridae	Megaptera	novaeangliae	Broad and bushy blow, dark gray body, dorsal fin (hump) small and low to back	1	1	1	1	0	0	Traveling	Towards bow	Full power active	Surveying	600	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
080	2018	11	26	DV	15:22	0	3	41.0883	-71.1342	36	Balaenopteridae			blows of variable height (no other identifying characteristics observed)	1	1	1	1	0	0	Unknown	No clear direction	Full power active	Surveying	4872	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
081	2018	11	26	DV	15:50	0	10	41.0871	-71.1004	34	Balaenopteridae	Balaenoptera	physalus	Tall elliptical shaped blows at slight angle (almost perpendicular to water surface), up to 5-m estimated height	2	1	1	1	0	0	Diving																	

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Project Detection Number	Date			Primary Detection Method (how was animal first detected)	Time at first encounter (UTC)		Total Encounter Time		Ship Position - latitude	Ship Position - longitude	Water depth (metres)	Family	Genus	Species	Description of Animal(s)	Total number			Best Number of adults (visual sightings only)	Best Number of juveniles (visual sightings only)	Best Number of calves (visual sightings only)	Behaviour (visual Sightings only)	Direction of travel (relative to ship)	Source activity	Vessel Activity	CPA to Source	MITIGATION MEASURES												
																											What action requested?	Was action implemented	What source(s) were involved in the action was taken (list all that apply)	Bearing to animal at time of action (clockface with bow = 1200)	Range to animal at time of action	Duration of power- down and/ or shut- down	Duration of start up delay	Time of equipment restart		Estimated Loss of Production			
	YYYY	MM	DD	codes	HH:MM	HH	MM									Max	Min	Best								meters		Y / N						HH	MM	HH	MM		
581	2018	12	19	NP	7:43	0	1	41.0942	-71.1452	36	Delphinidae			HF clicks up to 124 dB	2	1	1				n/a	Not able to determine	Full power active	Transit	Not able to determine	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
126	2018	12	19	DV	12:14	0	1	41.0987	-71.1457	36	Balaenopteridae	Megaptera	novaeanglae	Two bushy blows ~1km from starboard	1	1	1	NAD	NAD	NAD	Surface Active	No clear direction	Full power active	Surveying	1000	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
127	2018	12	19	DV	19:50	0	20	41.1046	-71.1923	35	Balaenopteridae	Megaptera	novaeanglae	Several bushy blows	3	2	2	NAD	NAD	NAD	Surface Active	Milling	Full power active	Surveying	1500	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
582	2018	12	20	NP	6:57	0	35	41.1101	-71.1539	37	Delphinidae			Whistles 8.3-17.5kHz in range, HF clicks forming click trains	3	1	2	NAD	NAD	NAD	n/a	Not able to determine	Full power active	Surveying	55	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
583	2018	12	20	NP	7:57	0	1	41.1047	-71.1123	38	Delphinidae			HF clicks up to 153dB, click train	2	1	1	NAD	NAD	NAD	n/a	Not able to determine	Full power active	Surveying	43	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
128	2018	12	26	DV	18:01	0	3	41.1192	-71.1067	36	Delphinidae	Delphinus	delphis	Clearly dolphins (one breached); distance inhibited positive ID, but presumably Delphinus delphis	2	1	2	NAD	NAD	NAD	Surface Active	Parallel in opposite direction as boat	Full power active	Surveying	2000	NONE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
129	2018	12	30	DV	17:48	0	5	41.1107	-71.1023	37	Phocidae	Halichoerus	grypus	Dark gray, long horse-like snout with no indentation on forehead	1	1	1	1	0	0	Feeding	Stationary	Full power active	Surveying	125	Shutdown	Y	MSES, USBL and Sub-bottom profiler	5.00	125	15	n/a	18	3	0	25			

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Project Detection Number													
	PAM DETECTIONS												
	Call Type		Frequency range (kHz)	Primary Frequency (kHz)	Amplitude (dB)		Bearings obtained?	Distance estimated?	How was distance estimated?	Was visual confirmation made?	Visual ID	Visual Range to animals	Visual Bearing to animals
					Max	AVE							
037	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
038	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
039	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
040	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
501	whistle	slight upsweep whistles, approximately 0.7s in duration, faint (low SNR)	10-11.3	10	90	85	no	no	n/a	no	n/a	n/a	n/a
041	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
042	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
043	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
044	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
045	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
502	whistle	2 constant frequency whistles 12kHz; 1 slight/gentle downsweep whistle 12.1-11.7kHz; all whistles less than 1s in duration	11.7-12	12	92	92	yes	no	n/a	no	n/a	n/a	n/a
503	click	high frequency dolphin echolocation clicks 20-100kHz with peak around 65kHz	20-100	65	160	155	yes	no	n/a	no	n/a	n/a	n/a
504	click	high frequency dolphin clicks 15-80kHz with peak around 32kHz	15-80	32	155	145	yes	no	n/a	no	n/a	n/a	n/a

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Project Detection Number													
	PAM DETECTIONS												
	Call Type	Call Characteristics	Frequency range (kHz)	Primary Frequency (kHz)	Amplitude (dB)		Bearings obtained?	Distance estimated?	How was distance estimated?	Was visual confirmation made?	Visual ID	Visual Range to animals	Visual Bearing to animals
					Max	AVE							
054	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
515	whistle, click, click train	upsweep, downsweep, and sinusoidal whistles 7-20kHz, 0.5-1.5s duration; clicks 11-125kHz with single peaks 26-35kHz or 65-70kHz; click trains with rapidly changing bearings that were tracked and localized	whistles 7.3-20, clicks 11-125	whistles 15-18, clicks 26-35 and 65-70	whistles 125, clicks 163	whistles 105, clicks 152	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
516	whistle	upsweep whistles, downsweep whistle (7.6kHz-10.8kHz, 1.0-1.7s in duration)	7.6-10.8	7.6-10.8	110	85	no	no	n/a	no	n/a	n/a	n/a
517	whistle	upsweep whistle 10.3-13.5kHz	10.3-13.5	10.3-13.5	90	90	no	no	n/a	no	n/a	n/a	n/a
518	click, click train	clicks 15-92kHz with single peak 35-40 and 60-65kHz; click trains with rapidly changing bearings that were tracked and localized	15-92	35-40, 65-70	163	155	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
519	clicks, click trains	clicks 15-73kHz with single peak 25-30kHz, single click train with gradual bearing change that was tracked and localized	15-73	25-30	148	138	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
520	whistle, click, click train	downsweep, upsweep, and concave whistles 8-15kHz, less than 1s duration; click 12-110kHz with single peak 29-32kHz; click trains with bearing changes, two of which were tracked and localized	whistle, click 12-110	whistle 10-12, click 29-32	whistle 109, click 158	whistle 98, click 138	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
521	whistle	downsweep, upsweep, and near constant frequency whistles 7.6-13.5kHz, 0.5-1.5s in duration	7.6-13.5	11 to 13	104	97	yes	no	n/a	no	n/a	n/a	n/a
522	click, click train	HF clicks 20-110kHz with peaks around 30, 50 & 80 kHz; click trains with small bearing changes (<20°)	20-110	40-80	128	161	yes	no	n/a	no	n/a	n/a	n/a

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Project Detection Number	PAM DETECTIONS												
	Call Type	Call Characteristics	Frequency range (kHz)	Primary Frequency (kHz)	Amplitude (dB)		Bearings obtained?	Distance estimated?	How was distance estimated?	Was visual confirmation made?	Visual ID	Visual Range to animals	Visual Bearing to animals
					Max	AVE							
523	whistle, click	audible whistle (no features characterized), clicks 15-50kHz with single peak 35kHz	15-50	35	138	135	yes	no	n/a	no	n/a	n/a	n/a
524	whistle, click, click train	downsweep and concave whistles 7-18kHz, clicks 18-82kHz with single peak 30-35kHz; two click trains with rapidly changing bearings, one of which provided localization	whistle 7-18, click 18-82	whistle 10-12, click 30-35	whistle 118, click 158	whistle 107, click 143	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
055	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
056	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
525	whistle	downsweep whistle 19.7-11.6kHz, 0.5-1s duration	11.6-19.7	11.6-19.7	93	88	yes	no	n/a	no	n/a	n/a	n/a
526	whistle, click	high frequency clicks 18-100kHz with single peak around 36kHz; upsweep and convex whistles 8.3-18.8kHz	whistle 8.3-18.8, click 18-100	whistle 8.3-18.8, click 35	whistle 105, click 134	whistle 96, click 130	yes	no	n/a	no	n/a	n/a	n/a
527	whistle, click, click train	upsweep, downsweep, constant frequency, and concave whistles 9-13kHz 0.5-1s in duration; clicks 15-130kHz with single peaks 30-35kHz or 65-70kHz, click trains	whistle 9-13, clicks 15-130	whistle 10-12, click 30-35 and 65-70	whistle 107, click 160	whistle 99, click 146	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
528	whistle, click, click train	upsweep whistle 10.4-18.2kHz, 1.3s duration; clicks 20-100kHz with single peak 32-36kHz	whistle 10.4-18.2, click 20-100	whistle 10-18, click 32-36	whistle 102, click 140	whistle 102, click 135	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
529	click, click train	high frequency clicks 20-138kHz with peaks approximately 20-40kHz and 80-100kHz, and 120kHz; buzzes visible on HF spectrogram	20-138	40	160	148	yes	no	n/a	no	n/a	n/a	n/a

A.I.S. Inc Protected Species Observer Data - MV Fugro Discovery
2018 Soutfork Wind Farm (OCS-A 0486)

Project Detection Number	PAM DETECTIONS												
	Call Type	Call Characteristics	Frequency range (kHz)	Primary Frequency (kHz)	Amplitude (dB)		Bearings obtained?	Distance estimated?	How was distance estimated?	Was visual confirmation made?	Visual ID	Visual Range to animals	Visual Bearing to animals
					Max	AVE							
530	whistle, click, click train	upsweep, downsweep, concave whistles 7-21kHz 0.3-1s in duration with 1st harmonic observed for selection of whistles; clicks 20-120kHz with single peak around 85kHz; single click train tracked and localized	whistle 7-21, click 20-120	whistle 14-18, click 85	whistle 112, clicks 143	whistle 99, click 137	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
531	whistle, click, click train, buzz	upsweep, constant frequency, downsweep, concave, chirp, and sinusoidal whistles 7-20.7kHz, 0.2-1s duration, up to 1st harmonic visible; clicks 15-140kHz with single peaks 25-30kHz, 32-36kHz, or 60-65kHz; several click trains, some short and some with good bearing changes for localization (1 long train); terminal buzz at end of echolocation	whistles 7-20.7, clicks 15-140	whistle 10-14, clicks 25-30, 32-36, 60-65	whistle 111, click 151	whistle 100, click 136	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
532	whistle	upsweep whistle 14.4-14.6kHz. 0.4-0.5s duration	14.4-14.6	14.5	90	85	yes	no	n/a	no	n/a	n/a	n/a
533	whistle	downsweep whistle 11.9-14.8kHz. 0.7-0.9s duration	11.9-14.8	12-14	148	142	yes	no	n/a	no	n/a	n/a	n/a
534	click, click train	clicks 15-60kHz with single peak 20-30kHz; click trains, including 4 simultaneous, with gradual and rapidly changing bearings that were tracked for localization	15-80	20-36	158	143	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
535	click, click train, buzz	two click types - 15-50kHz with single peak at 25-36kHz, 60-120kHz with single peak 88-90kHz and waveform with multiple oscillations; click trains, one suitable for tracking but no localization obtained; echolocation with a terminal buzz	15-50, 60-120	25-36, 88-90	151	140	yes	no	n/a	no	n/a	n/a	n/a

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A.I.S. Inc Protected Species Observer Data - MV Fugro Discovery
2018 Southfork Wind Farm (OCS-A 0486)

Project Detection Number	PAM DETECTIONS												
	Call Type	Call Characteristics	Frequency range (kHz)	Primary Frequency (kHz)	Amplitude (dB)		Bearings obtained?	Distance estimated?	How was distance estimated?	Was visual confirmation made?	Visual ID	Visual Range to animals	Visual Bearing to animals
					Max	AVE							
059	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
060	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
541	whistle, click, click train	upsweep whistle 8.4-13kHz, high frequency clicks 15-100kHz with single peak 25-32 or 50-55kHz, several click trains, 5 tracked and localized	whistle 8.4-13, click 15-100	whistle 10-13, click 25-32 or 50-55	whistle 104, click 158	whistle 99, click 135	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
542	whistle, click, click train	chirp, constant frequency, and downsweep whistles 9.3-15kHz, 0.2-0.5s duration; high frequency clicks 15-115kHz with peak 27-32kHz or 50-55kHz; click trains, 2 of which were tracked and localized	whistle 9.3-15, click 15-115	whistle 9.3-15, click 27-32, 50-55	whistle 113, click 146	whistle 107, click 132	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
543	whistle, click, click train, buzz	constant frequency whistle 12kHz, 0.3-0.6s duration; high frequency click 14-120kHz with single peak around 36kHz or 70-75kHz; click trains, 6 of which were tracked with 4 localizations; echolocation with terminal buzzes	whistle 12, click 14-120	whistle 12, click 36 or 70-75	whistle 102, click 156	whistle 101, click 138	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
544	whistle, click, click train, buzz	concave, convex, downsweep, upsweep, and sinusoidal whistles 6.4-18.8kHz; high frequency clicks 15-100kHz with single peak 25-35kHz; several click trains that were tracked but not localized due to lapse in GPS data; echolocation terminal buzz	whistle 6.4-18.8, click 15-100	whistle 10-14, click 25-35	whistle 117, click 162	whistle 104, click 136	yes	no	n/a	no	n/a	n/a	n/a

A.I.S. Inc Protected Species Observer Data - MV Fugro Discovery
2018 Southfork Wind Farm (OCS-A 0486)

Project Detection Number	PAM DETECTIONS												
	Call Type	Call Characteristics	Frequency range (kHz)	Primary Frequency (kHz)	Amplitude (dB)		Bearings obtained?	Distance estimated?	How was distance estimated?	Was visual confirmation made?	Visual ID	Visual Range to animals	Visual Bearing to animals
					Max	AVE							
545	whistle, click, click train	SNR 1-2 whistles 6-18.8kHz, 0.2-1.3s duration of various contours: up/downsweep, convex, concave, near constant frequency, sinusoidal; high frequency clicks 20-130kHz with peaks around 40, 80, and 100kHz	whistle 6-18.8; click 20-130	whistle 8-14; click 30-60	whistle 98; click 160	whistle 90; click 143	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
546	click, click train	high frequency clicks 20-120kHz with peaks 30-40kHz and 80-90kHz	20-120	30-40, 80-90	160	143	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
547	click, click train	high frequency clicks 15-120kHz with single peak 28-36 or 80-85kHz, short click trains, two tracked and localized	15-120	28-36, 80-85	153	139	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
061	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
062	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
063	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
548	whistle, click, click train	downsweep and constant frequency whistles 9.9-11.1kHz; clicks 15-55kHz with single peak 20-25kHz; 3 short click trains tracked and localized	whistle 9.9-11.1, click 15-55	whistle 11, click 20-25	whistle 106, click 150	whistle 104, click 134	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
549	whistle	upsweep whistle 10.7-12.5kHz, 0.5s duration	10.7-12.5	10.7-12.5	106	106	yes	no	n/a	no	n/a	n/a	n/a
550	click, click train	single click train with gradual change in bearings that was tracked and localized; clicks 20-120kHz with single peak 20-25kHz or 70-75kHz	20-120	20-25, 70-75	141	137	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a

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2018 Southfork Wind Farm (OCS-A 0486)

Project Detection Number	PAM DETECTIONS												
	Call Type	Call Characteristics	Frequency range (kHz)	Primary Frequency (kHz)	Amplitude (dB)		Bearings obtained?	Distance estimated?	How was distance estimated?	Was visual confirmation made?	Visual ID	Visual Range to animals	Visual Bearing to animals
					Max	AVE							
064	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
065	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
066	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
067	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
068	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
069	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
551	whistle	upsweep, downsweep, constant frequency, and chirp whistle types 10.1-15.4kHz, 0.4-0.6s duration	10.1-15.4	11 to 12	106	98	yes	no	n/a	no	n/a	n/a	n/a
070	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
071	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
552	whistle	constant frequency some with slight downsweep or shallow concave appearance, 11.1-12.2kHz, 0.4-0.8s duration	11.1-12.2	11.1-12.2	102	100	yes	no	n/a	no	n/a	n/a	n/a
553	whistle	upsweep, downsweep, concave whistles 10.9-17.7kHz	10.9-17.7	11 to 13	102	97	yes	no	n/a	no	n/a	n/a	n/a
554	whistle, click, click train	upsweep and constant frequency whistles 9.3- 14.3kHz, 0.2-0.8s duration; high frequency clicks 18- 140kHz with single peak 85-95kHz; single click train with gradually changing bearings over 31s manually tracked and localized	whistle 9.3- 14.3, click 18- 140	whistle 11-12, click 85-95	whistle 103, click 158	whistle 99, click 143	yes	yes	TMA (least- squares algorithm)	no	n/a	n/a	n/a

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Project Detection Number	PAM DETECTIONS												
	Call Type	Call Characteristics	Frequency range (kHz)	Primary Frequency (kHz)	Amplitude (dB)		Bearings obtained?	Distance estimated?	How was distance estimated?	Was visual confirmation made?	Visual ID	Visual Range to animals	Visual Bearing to animals
					Max	AVE							
072	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
073	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
555	whistle	upsweep, downsweep, constant frequency whistles 10-18.4kHz	10-18.4	10-18.4	98	94	no	no	n/a	no	n/a	n/a	n/a
556	click, click train	high frequency clicks 15-100kHz with single peak 35-40kHz, single click train tracked and localized	15-100	35-40	139	135	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
557	click, click train	high frequency clicks 15-100kHz with single peak 35-40kHz, click trains tracked but not localized due to lack of GPS data	15-100	35-40	139	133	yes	no	n/a	no	n/a	n/a	n/a
558	whistle, click, click train, buzz	chirp, downsweep, upsweep, sinusoidal, convex, concave, and constant frequency whistles 6.2-20.9kHz, 0.05-2s duration, up to 1st harmonic observed; high frequency clicks 12-120kHz with a single peak 32-36kHz; several click trains observed with 11 trains tracked and localized; up to 7 simultaneous click trains; terminal buzzes at end of two echolocation trains	whistle 6.2-20.9, click 12-120	whistle 12-16, click 32-36	whistle 117, click 163	whistle 103, click 146	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
559	whistle	convex, concave, constant frequency, and sinusoidal whistles 8-15.1kHz, 0.4-0.5s duration	8-15.1	8-15.1	105	103	yes	no	n/a	no	n/a	n/a	n/a

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A.I.S. Inc Protected Species Observer Data - MV Fugro Discovery
2018 Southfork Wind Farm (OCS-A 0486)

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	Call Type	Call Characteristics	Frequency range (kHz)	Primary Frequency (kHz)	Amplitude (dB)		Bearings obtained?	Distance estimated?	How was distance estimated?	Was visual confirmation made?	Visual ID	Visual Range to animals	Visual Bearing to animals
					Max	AVE							
090	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
566	click, click train, whistle	whistles (upsweep, downsweep, constant frequency) 6.2-16.8 kHz, 0.1-0.6s duration; clicks 20-100kHz (single peaks 25-30, 80-90kHz)	whistle 6.2-16.8; click 20-100	whistle 8-14; click 25-30 / 80-90	whistle 104; click 155	whistle 98; click 144	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
091	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
092	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
567	whistles	whistles (concave, upsweep, sinusoidal, constant frequency) 8.2-13.7 kHz with 2nd level harmonics, 0.1-0.6s duration	8.0 - 13.7	10.0 - 12.0	108	94	yes	no	n/a	no	n/a	n/a	n/a
568	whistles	whistles (convex ending in downsweep, downsweep) 7.8-22.8 kHz with 2nd level harmonics, 0.3-1.4s duration	7.8 - 22.8	8.0 - 14.0	110	97	yes	no	n/a	no	n/a	n/a	n/a
093	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
094	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
095	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
096	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
569	whistle, click, click train	upsweep whistle 10.4-20kHz, 0.8s duration; high frequency clicks 15-90kHz with single peak 20-25kHz; single click 5s click train tracked and localized	whistle 10.4-20, click 15-90	whistle 10.4-20, click 20-25	whistle 109, click 137	whistle 109, click 130	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a

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A.I.S. Inc Protected Species Observer Data - MV Fugro Discovery
2018 Southfork Wind Farm (OCS-A 0486)

Project Detection Number	PAM DETECTIONS												
	Call Type	Call Characteristics	Frequency range (kHz)	Primary Frequency (kHz)	Amplitude (dB)		Bearings obtained?	Distance estimated?	How was distance estimated?	Was visual confirmation made?	Visual ID	Visual Range to animals	Visual Bearing to animals
					Max	AVE							
579	whistle, click, click train	downsweep whistle 18-14.3kHz; high frequency clicks 12-110kHz with single peak 25-38kHz or 75-85kHz; numerous click trains, one of which was tracked and localized before GPS signal was lost; up to 5 simultaneous click trains were observed twice (minimum number of 10 individuals)	whistle 14.3-18, click 12-110	whistle 14.3-18, click 25-38 and 75-85	whistle 96, click 161	whistle 96, click 143	yes	yes	TMA (least-squares algorithm)	yes	<i>Delphinus delphi</i>	350	11:00
123	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
580	click, click train	high frequency clicks 12-120kHz with single peak 20-36kHz, 40-46kHz, 75-80kHz; several click trains, six of which were tracked and localized	12-120	20-36, 40-46, 75-80	158	140	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a
124	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
125	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
581	HF click	HF clicks up to 124dB	n/a	n/a	124	n/a	no	no	n/a	no	n/a	n/a	n/a
126	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
127	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
582	HF click, click train, whistles: upsweep, downsweep, constant frequency, upsweep ending in concave whistle	HF clicks up to 160dB, downsweeping whistles 9-17kHz, 0.5-1 second long upsweep whistles ranging from 8.3-17.9kHz with second harmonic reached from 18.2-23kHz.	8.3-17.9	10-12kHz	160	NAD	yes	yes	TMA (least-squares algorithm)	no	n/a	n/a	n/a

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Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
001	<p>Small pod of 10-12 animals observed directly at the bow, surfacing in large swell. Dolphins milled and changed direction frequently, surfing the waves along the vessel. The MBES was operational for the duration of the sighting (used by vessel for depth readings). Dolphins approach determined to be voluntary based on observed behavior, and no mitigation was required.</p>
002	<p>At 11:04, small pod of Common Dolphins detected at 4:00 face, visually estimated at ~250m from, feeding and occasionally porpoising in midst of feeding gull flock, moving perpendicular to direction of boat travel. A dolphin approach was at 11:10 when ~150m directly back of stern; by 11:12 had moved to port side of stern and were lost to view when well out of exclusion zone. The MBES was operational for the duration of the sighting (used by vessel for depth readings). No mitigation was required: sighting lasted less than 10 minutes and dolphins were sighted leaving the EZ prior to 10 minutes of observation by PSO.</p>
003	<p>A small group of approximately seven common dolphins was observed porpoising toward the Discovery's bow in a chorus line 20m off the starboard bow at 11:39 UTC. A second small group of eight to ten dolphins was observed travelling parallel to the vessel in the same direction approximately 200m off the starboard side at 11:40. The second group changed direction shortly after the initial observation and began heading toward the vessel. The dolphins were observed porpoising and wave riding in the large swell as they approached the vessel. Individuals from the first group were observed porpoising approximately 5m off the starboard side of the vessel at 11:43 (heading away from the bow). The two groups joined off the bow at 11:45 where the dolphins likely rode the bow wake for were 5 minutes. Direct observation of the bow is obstructed by the vessel's wake. It is presumed that the dolphins were bow riding based upon the movement of the dolphins toward the bow and the direction changes observed off the bow (would circle back toward the bow after surfacing). The last observed approximately 10m off the starboard bow, heading away from the vessel at 11:50. The multibeam echosounder (MBES) was active at full power (for depth readings) for the duration of the common dolphin encounter, however mitigation was not required as the dolphins were determined to have voluntarily approached the Discovery after the prescribed 10 minute observation/assessment period for dolphins. As the only source active, the mitigation zone was 200m for the event and the dolphins were observed within the mitigation zone for the entirety of the sighting. The vessel was running weather patterns at the time of the sighting. CPA values are reference to the position of the MBES.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
004	<p>A group of six to ten common dolphins was first observed porpoising toward the vessel approximately 30m off the starboard bow at 12:43 UTC. An additional 10 to 15 dolphins were observed heading toward the vessel at 12:44. The dolphins were likely bow riding from 12:44 to 12:48 and several individuals were observed within 5m off the starboard bow at 12:46. Direct observation of the bow is obstructed by the vessel, so it is presumed that the dolphins were bow riding based upon the movement of the dolphins toward the bow and the direction changes observed off the bow (would circle back toward the bow after surfacing). A few dolphins broke away from the bow riding group at 12:45 and began heading parallel in the opposite direction of the vessel toward the stern at a distance of 20m from the starboard side. The common dolphins were observed moving away from the vessel at a distance of 200m at 12:49 (last observation in the 200m exclusion zone), where the dolphins were porpoising, breaching, and making rapid direction changes, generating splashes. They were observed amongst a large group of feeding gulls at 12:49 and may have been foraging (possible evidence in the rapid direction changes and surface activity). The dolphin continued to participate in the surface active and foraging behaviors through to the last sighting at 12:53 when the dolphins were 400m (determined by reticle - 6R) off the starboard bow. The multibeam echo sounder (MBES) was active at full power (for depth) during the duration of the common dolphin encounter, however mitigation was not required as the dolphins were inside the exclusion zone for less than 10 minutes. As the MBES was the only source active, the mitigation zone was 200m for the event and the dolphins were observed within the mitigation zone for 6 minutes. The vessel was running weather patterns at the time of the sighting. CPA values are reference to the position of the sighting.</p>
005	<p>Group of ~ 20 dolphins observed to the port bow of the vessel at 50m, the group swam towards the boat and appeared to swim under the bow, continuing down the side of the vessel. The dolphins travelled at a distance of 50m as they approached and continued in their original direction. At the time of the sighting, the vessel was performing calibrations of the USBL with the pole down, no mitigation actions were performed due to the close approach of the animals. The MBES was also operating at the time of the sighting.</p>
006	<p>At 18:08 a group of ~15 common dolphins were sighted by PSO swimming towards the bow of the vessel at ~200m. Dolphins turned to the port side and closest distance to vessel was ~150m at 18:09. Dolphins were last seen at 18:09. Dolphins did not stay within the exclusion zone >10 minutes and appeared to be voluntarily approaching bow; no mitigation for MBES was called for.</p>
007	<p>At 18:21, large pod of Short-beaked Common Dolphins detected heading toward bow from port side. Entered exclusion zone (EZ) at 18:24, some briefly playing around bow. Main group passed out of EZ at 18:27, 500m away on starboard side for 14 mins. (approaching the boat and entering EZ for one minute at 18:33, then exiting). Pod approached boat again at 18:41, passed quickly through EZ (150m CPA), disappeared from port side at 18:45, ~400m away. Due to pod's voluntary approach to boat from a distance, and briefly engaging the boat, no mitigation was called for.</p>
008	<p>At 20:14 a group of 10-12 common dolphins were sighted by PSO off the starboard side bow swimming perpendicularly to the vessel's direction of travel and towards the bow. CPA was ~100m as dolphins crossed the port side of the vessel at 20:15. Dolphins were last seen at 20:15. Dolphins did not stay within the exclusion zone >10 minutes and appeared to be voluntarily approaching bow; no mitigation for MBES was called for.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
009	<p>A large, dispersed pod of common dolphins was observed travelling parallel and in the opposite direction of the vessel approximately 900m off the starboard side of the Discovery at 21:50 UTC. A small group of away and headed toward the bow of the vessel at 21:59 and were observed approximately 5m off the bow at 22:00 (closest approach). The main pod of dolphins crossed the stern from starboard to port approx from the vessel at 22:01. The dolphin were observed porpoising and breaching clear of the water as they crossed the stern. The dolphins' movement became variable at 22:04 with rapid directional changes ; splashing (possibly the result of foraging behaviors) at ranges of 350 to 500m off the port stern. The pod of dolphin began to cross astern of the vessel again, this time from port to starboard, at 22:06 roughly (determined by reticle) from the Discovery's stern. The dolphin were last observed porpoising while travelling away from the starboard stern of the vessel (perpendicular to vessel's position) at 22:10 (distance determined by reticle). The multibeam echosounder (MBES) and USBL were active at full power for the duration of the common dolphin encounter, however mitigation was not required as the dolphin were determined to voluntarily approached the vessel after the prescribed 10 minute observation/assessment period. As the MBES and USBL were the only sources active, the mitigation zone was 200m for the event and the dolphins observed within the mitigation zone for X minutes. The vessel was conducting USBL calibration tests while on DP at the time of the sighting. CPA values are reference to the position of the MBES and or</p>
010	<p>A few dolphins were spotted off the starboard bow, just forward of the bridge about 50 meters from the vessel. The animals were travelling toward the vessel, with some speed. One individual fully jumped/surfaced water as it moved toward the vessel. All dolphins sighted were observed swimming toward the vessel and under the bow. At the time of detection, the vessel was in the process of retrieving the calibration equipment associated buoy. No HRG survey equipment was powered on during the detection. Dolphins exhibited voluntary approach/vessel attraction behavior, so it was determined by the PSO that no strike avoidance measures were necessary. Exclusion zone of 50 meters is in reference to strike avoidance protocol. **Initial sighting was NV= Nighttime visual (first seen next to vessel without the aid of night vision)** Water depth reading may be erroneous (taken from NAV screen, but MBES inactive)</p>
011	<p>At 04:28, a group of dolphins was sighted off the starboard stern, swimming directly towards the vessel at a moderate pace. The dolphins swam past the starboard PSOs view at 04:30, and towards the bow where they were then sighted by the PSO stationed on the bow. The group of dolphins was seen on the port side of the vessel from 04:41-04:52, swimming and porpoising back and forth along the length of the vessel at a range of approximately 50m from the hull. At this time the hourglass and v-shaped patterns were clearly visible with the night vision unit. This behavior continued until the dolphins were last seen at 05:52, swimming away from the port side (maximum range of approximately 50m. The Discovery had completed USBL calibration operations prior to the initial sighting, and was on weather standby with no active HRG survey equipment during the detection. No mitigation was necessary, and due to the voluntary approach/vessel attraction behavior displayed, the PSO determined that no strike avoidance measures needed to be taken. Exclusion zone of 50 meters is in reference to strike avoidance protocol. Water depth reading may be erroneous (taken from NAV screen, but MBES inactive)</p>
012	<p>At 05:51, two Short-beaked Common Dolphins detected mid-ship ~50m off port side, feeding and swimming toward bow; returned to mid-ship position, continued to feed, then swam toward bow and were not sighted. The Discovery on weather standby with no HRG equipment in water; strike-avoidance zone of 50m in effect for dolphins. Dolphin approach voluntary; no strike avoidance measures necessary. Water depth reading may be erroneous (taken from NAV screen, but MBES inactive)</p>
013	<p>A few dolphins were spotted off the starboard side about mid-ship. The two individuals mid-ship did not break the surface as they travelled from about 20m out toward the vessel. There was a third individual that broke the surface closer to the bow of the vessel, starboard side that broke the surface - clearly displaying the black back and v shaped saddle; this individual also approached the vessel from the starboard side about 20m out and travelled toward the boat and under the bow. The approach was determined by the PSO to be voluntary as all dolphins sighted approached the vessel from the starboard side and swam underneath it. Discovery was on weather standby during the sighting with no active HRG equipment. 50m exclusion zone is relative to strike avoidance protocol (no action was deemed necessary as dolphins voluntarily approached the vessel)</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
014	A dolphin, most likely a common dolphin, surfaced approximately 10m off the starboard side of the Fugro Discovery at 09:18 UTC. The dolphin was travelling parallel to the vessel in the same direction and por before it was last seen at 09:19. The PSO was unable to determine if the dolphin bow rode as observation of the bow was obstructed and a high level of reflection was noted when the PSO attempted to look to through the bridge windows. The vessel was running weather patterns at the time of the sighting and all geophysical survey equipment were inactive on deck. PSOs were conducting strike avoidance watch, t exclusion zone for the sighting was 50m. Mitigation was not required. Water depth reading may be erroneous (taken from NAV screen, but MBES inactive)
015	At 14:06 a group of ~5 common dolphins were spotted by PSO ~2m off the starbord bow bowriding. At 14:09, ~10 more common dolphins were seen off the starbord side of the vessel, about 10m from the mids ~15-20 individuals total). Dolphins were swimming in the waves next to the vessel, and were last seen at 14:15 off the starboard midship at about 10m range, swimming away from vessel (as vessel turned). PSC dolphins at 14:15 due to vessel changing heading and sea conditions. The vessel was running weather patterns at the time of the sighting and all geophysical survey equipment were inactive on deck. PSOs we strike avoidance watch, therefore the exclusion zone for the sighting was 50m. Approach determined to be voluntary, and mitigation was not required.
016	One dolphin was sighted off the portside bridge, tail out of the water into a dive about 15 m from the vessel. The individual traveled toward the vessel disappearing under the bow and was not sighted again. Ap determined by observer to be voluntary; no strike avoidance measures were necessary. 50m exclusion zone is relative to strike avoidance protocol
017	12 dolphins were clearly sighted swimming beneath the surface of the water toward and under the bow of the vessel; traveling from the portside to starboard side of the vessel. Individuals were not sighted along side but were sighted riding waves and generally swimming along the vessel's portside. Dolphin approach determined to be voluntary; no strike avoidance measures necessary. 50m exclusion zone is relati avoidance protocol.
018	Individuals spotted swimming below the surface of the water on the portside by the bridge of the vessel. Occasionally they would break the surface of the water with their dorsals but primarily remained beneath Animals appeared to be riding the waves and coming up to the bow. Dolphin approach determined to be voluntary; no strike avoidance measures necessary. 50 m exclusion zone is relative to strike avoidanc At 11:40, an on-duty surveyor detected a pod of ~12 Short-beaked Common Dolphins ~400m from starboard mid-ship. They approached the ship and arrived at the bow at 11:44, then quickly crossed to the Approximately 5 dolphins surfaced approximately 3m from the port bow at 11:45. The small group of dolphins were oriented away from the bow (heading to the WSW) and were observed wave riding (swell i direction of vessel's travel at time of visual sighting). Another five common dolphins quickly followed the initial group, surfacing in roughly the same location off the port bow as the previous five individuals, headir direction away from the bow while wave riding in the swell. The dolphins appeared to have crossed back to the bow underwater out of visual detection and both bow (a few individuals were observed as far from bow as could be observed from the observer's position on the vessel) and wave rode in the large swells between 11:46 and 11:48, however the dolphin changed their direction of travel with some individuals perpendicular away from the bow and some individuals heading toward the stern of the vessel, travelling parallel and in the oposite direction of the vessel. The circling back behaviour to wave and bow ride off and starboard sides of the bow (primarily port) with variable directions of travel continued through to the end of the detection event at 12:12. During this period, the common dolphins would approach from varyi and from distances between 5 and 30m from the Discovery. The small pod was last seen collectively wave riding off the port side of the Discovery at 12:12 (10-12 individuals surfaced simultaneously on one way the WSW at a distance of 30m from the port side of the vessel. In addition to wave and bow riding, the dolphins were observed porpoising and breaching clear of the water. Discovery on weather standby wi 019 equipment in water; strike-avoidance zone of 50m in effect for dolphins. Dolphin approach voluntary; no strike avoidance measures necessary.
020	Small pod of 8-10 short-beaked common dolphins sighted to the stbd side of the vessel ~ 100m from mid-ship. The dolphins aproached the vessel, diving underneath and up to the bow, they bow rode briefly, tl alongside the port side, surfing the waves at the side of the vessel before breaking away and continuing on. Discovery was on weather standby for the duration of the sighting, with no HRG equipment deployed mitigation was required. 50m EZ is relative to strike avoidance protocol; no action taken due to voluntary approach behavior of dolphins.

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
021	A small group of about 5 dolphins were sighted about 50 m off the starboard bow traveling at the surface. The animals were traveling portside to starboard side and continued off toward the starboard side. The brief. Discovery was on weather standby for the duration of the sighting, with no HRG equipment deployed or active. No mitigation was required. 50m EZ is relative to strike avoidance protocol
022	ship, then circled around several times between bow and mid-ship. After approximately 3 minutes, the dolphins swam away from mid-ship (starboard side, 3:00) and out of view, approximately 50 meters from the ship. The observer was unable to see any patterns on the dolphins and could not determine the exact species. Dolphins were only briefly seen breaking the surface of the water during the sighting, but PSO was able to view their surface with the night vision unit (overhead view, unable to see any markings/patterns on sides of body). Based on observed behavior (swimming directly towards the bow/vessel attraction), PSO determined the approach to be voluntary, and mitigation was not required. The only active source during the sighting was the USBL (EZ= 200m).
023	Approximately six unidentified dolphins were observed 200m off the starboard bow of the Discovery at 05:10 UTC (observation made with the starboard IR camera). The dolphins were observed porpoising as they traveled toward the bow of the vessel. The small pod was last observed approximately 180m off the starboard side of the vessel at 05:11. The Discovery was conducting USBL calibrations at the time of the sighting (exclusion zone of 200m). Mitigation was not required as the dolphins were only observed within the exclusion zone for one minute and their behaviour was indicative of a voluntary approach.
024	Approximately ten unidentified dolphins were observed 200m off the starboard bow of the Discovery at 07:12 UTC (observation made with the starboard IR camera). The dolphins were observed travelling at a parallel and in the same direction as the vessel. One individual breached as it travelled with the pod. The small pod was last observed travelling along the same trajectory and at the same distance from the vessel at 07:15. The Discovery was conducting USBL calibrations at the time of the sighting (exclusion zone of 200m). Mitigation was not required as the dolphins were only observed within the exclusion zone for one minute.
025	8-12 short-beaked common dolphins sighted ~ 100m to port side, dolphins were actively feeding, fish visible through NVD, sharp movements at surface, chorus line type surfacing of dolphins also observed, and dolphins were active around the vessel for the duration of the sighting, they swam down both sides and around the vessel several times, but seemed to focus more on the stern where the light was brightest. PSO determined the approach to be voluntary based on observed behavior and no mitigation was required. The only active equipment during the sighting was the USBL (EZ= 200m)
026	The dolphins breached and porpoised as they travelled toward the bow of the vessel. The dolphins were last observed at 09:35 approximately 80m off the starboard side of the Discovery. The Discovery was conducting USBL calibrations at the time of the sighting (exclusion zone of 200m). Mitigation was not required as the dolphins were only observed within the exclusion zone for one minute and their behaviour was indicative of a voluntary approach.
027	The pod began heading toward the Discovery's starboard bow at 11:40, entering the 200m exclusion zone and made their closest pass (within 20m) along the starboard side of the vessel at 11:41. Individuals were observed breaching and tail slapping as they passed the starboard side of the vessel, while in route toward the bow. The pod crossed the bow of the vessel at 11:43 and began following the track of a fishing vessel, heading to the northeast. The pod recently passed ahead of the Discovery. The dolphins began foraging (rapid direction changes, surface activity generating large splashes, water surface agitation) approximately 300m off the port bow at 11:44. Foraging activity continued along the SW trajectory in the path of the fishing vessel (at distances ranging from 300-800m from the Discovery's port bow) until 11:52 when the pod changed directions (to the NW), heading toward a second fishing vessel that was crossing the Discovery's bow about 1km out. The dolphin began another bout of foraging activity at 11:55 (rapid direction changes, surface splashing), approximately 100m from the bow of the Discovery. Individuals were also observed breaching during the bout of foraging. Foraging bouts continued through to the last observation of the dolphins approximately 2.4km (1 reticle) from the Discovery at 12:02. The Discovery was conducting USBL calibrations at the time of the sighting (exclusion zone of 200m). Mitigation was not required as the dolphins were observed within the exclusion zone for one minute (11:40 to 11:45).

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
028	<p>At 12:05, a pod of Short-beaked Common Dolphins was detected ~100m directly in front of the bow, swimming toward port side, perpendicular to boat heading. The dolphins continued in same direction and were measured at ~1.2km, clock face 10:00, at 12:12, in the vicinity of a fishing boat. They fed there ~10 mins., then traveled toward another distant fishing boat ~1.5km from Discovery's starboard, ~1:00 position. intervals along the way, keeping a distance from Discovery of >1km, and arrived in vicinity of second fishing boat at ~12:25. They continued to feed there, at >1km from Discovery, and were last seen at 12:37. dolphins only remained within the exculsion zone (200m, USBL calibration in place, but may have been completed/USBL off prior to dolphins entering the EZ) for 3 minutes, so no mitigation was required whether USBL was active (may have been turned off already)</p>
029	<p>At 17:07, 3 Short-beaked Common Dolphins were detected ~15m off port side near rear of boat. They were travelling parallel and opposite to boat heading; disappeared lower into water and were not seen again weather lines; dolphins appeared to have voluntarily approached the boat, and were not seen again, so no strike avoidance measures necessary. (50m exclusion zone is relative to strike avoidance protocol)</p>
030	<p>A small group of approximately 7 dolphins was sighted about 80m off the portside bow heading toward the bow of the vessel. Some were sighted breaking the surface of the water, riding the wave, and a few below the surface. The dolphins dove beneath the bow of the vessel as they approached it. One individual was sighted along the portside bridge momentarily. Dolphins behavior was indicative of voluntary approach; strike avoidance measures were necessary (50m exclusion zone is relative to strike avoidance protocol)</p>
031	<p>Small group of short-beaked common dolphins sighted at 100m, they approached the bow then travelled under the vessel. The dolphins were re-sighted off the port stern, porpoising as they travelled. 50m exclusion zone relative to strike avoidance protocol. No strike avoidance was necessary as dolphins voluntarily approached the bow of the vessel.</p>
032	<p>A pod of 10-15 short-beaked common dolphins were sighted approx 200m to the starboard side of the vessel skimming the water surface and porpoising as they travelled towards the vessel. The dolphins approached the ship, then went to the bow. A smaller sub group continued to circle the vessel, riding the wake, jumping and fast swimming. 50 m exclusion zone is relative to strike avoidance protocol (no strike avoidance was necessary as dolphins approach determined to be voluntary)</p>
033	<p>A small pod of approximately 10 common dolphins was observed approaching the port side of the Discovery (at mid-ship) 50m from the vessel at 21:56. As the pod approached the vessel, they made a slight diversion toward the bow. The dolphins remained within 5 to 30m of the Discovery's bow for 10 minutes and were observed wave riding the large swells and bow riding. The dolphin was last observed 80m off the port side of the Discovery, heading away from the vessel at mid-ship at 22:07. PSOs were conducting strike avoidance watch (EZ 50m) while the vessel transited to New Bedford. Mitigation was not required.</p>
034	<p>A gray seal was basking at the surface of the water approximately 30m astern of the Discovery at 10:52 UTC. The head as well as a portion of the seal's back were observed above the water's surface. The seal swam away from and perpendicular to the stern. The seal dove and was not observed again at 10:53. The Discovery was making preparations for departure from the Marine Commerce Terminal in New Bedford where the seal was spotted. The MBES was active at full power for safety and navigational purposes at the time of the sighting (exclusion zone 200m). Mitigation was not required as the seal was observed within the exclusion zone for 10 minutes (1 minutes).</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
035	A small pod of ~ 10 short-beaked common dolphins were sighted to the port side of the vessel at 200m, approaching rapidly and porpoising. The dolphins swam parallel briefly, crossed the bow and were not re-sighted. At the time of the sighting, the vessel was transiting with the MBES active, no mitigation actions were applied, the dolphins approached voluntarily. Also, no delays to survey/equipment start was required due to the operation of the MBES at the time of the sighting.
036	A few dolphins were spotted 800m off the starboard side mid-ship/aft. They were traveling at the surface with purpose toward the vessel. Individuals were sighted porpoising out of the water as they traveled. Approach was determined to be voluntary by the observer and the dolphins clearly traveled toward the vessel. There is a video clip of the approach via the thermal camera.
037	A few dolphins were spotted about 500 m off the starboard bow travelling at the surface toward the bow of the vessel. There was not much surface activity and only a few individuals were sighted. Last sighted 100m off the bow out of frame of the thermal camera. The other PSO did not see them as they moved toward the port side. Approach was determined to be voluntary by the PSO. There is a video clip of the approach via the thermal camera.
038	About 8 individuals were sighted off the portside slightly aft of the bridge about 100 m out. They were travelling at the surface at a good pace. They headed directly toward the vessel. The group was sighted on the surface, before diving below the vessel. Approach was determined to be voluntary by the PSO and thus no mitigation action was requested. MBES, USBL, and Sub-bottom profiler active during the sighting.
039	A few dolphins were sighted about 200m from the vessel, just off the portside bow in front of the vessel. They moved a bit left before turning slightly and swimming diagonally toward the bow of the vessel; at which time they were porpoising at the surface as the dolphins rode the crest of the swell. They appeared to disappear below the boat. One or two individuals were shortly thereafter sighted off the starboard bow about 200m. The approach was determined by the PSO to be voluntary, no mitigation action was requested. MBES and Sub-bottom Profiler were active during the sighting event.
040	At 11:32, 6-8 dolphins were detected ~1km off starboard bow, swimming parallel and opposite to boat. They barely broke the surface a few times (identification not possible), and disappeared heading away from the vessel. Approach was determined to be voluntary, no mitigation necessary. MBES and Sub-bottom Profiler were active during the sighting event.
501	A brief (5 seconds) acoustic detection consisting of two faint upweep (10-11.3kHz) dolphin whistles aurally heard and visually observed on the mid-frequency spectrogram at 02:45:44 UTC. No additional whistles were detected and the hydrophone array was recovered for weather 12 minutes after the detection event. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Bearings were not determined, as the whistle/moan detector did not pick up the whistles (likely due to the low signal to noise ratio) and the operator did not select the tones quick enough to obtain bearings from the clip generated. Localization was not possible due to the lack of bearings and brevity of the detection event. Survey was in the process of recovering the magnetometer and side scan sonar at the time of the detection. The penetration sub-bottom profiler (chirper) was active at the time of the acoustic detection, as were the multi-beam echo sounder and the USBL beacon (EZ 500m). This detection was not correlated with a visual sighting on thermal cameras. Mitigation was not required.
041	At 14:40, a pod of dolphins was sighted approximately 100m off the starboard bow (animals heading ~10:30 using clockface), porpoising slightly towards the bow and moving with the vessel. After approximately 10 seconds, the dolphins dove out of sight and were not seen again. Vessel was in transit, with the Multibeam Echosounder active (for navigational purposes) for the duration of the sighting, therefore the exclusion zone was 200m. Approach was determined to be voluntary, and the sighting was less than the 10 min observation period (required prior to mitigation), so no mitigation was required.

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
042	<p>At 15:04, 2-4 dolphins were sighted 100m directly off bow, porpoising towards bow (animals heading 06:00 using clockface). Briefly lost sight of the dolphins as they approached the vessel, then sighted them at port bow within 10m of the hull. Appeared to be bow riding, and briefly circled back before returning to the bow. Lost sight of the dolphins at 15:06 off the port bow. Only the Multibeam Echosounder was active sighting (being used for navigational purposes), therefore the exclusion zone was 200m. Dolphins approach was determined to be voluntary based on observed behavior (bow riding, vessel attraction), and no m required.</p>
043	<p>At 15:35, 2-4 dolphins were sighted approximately 50m off the starboard bow, porpoising towards the vessel (animal heading ~10:00 using clockface). The dolphins then turned away from the vessel and briefly c surface approximately 50m off the starboard side. Between 15:37-15:41, the dolphins were sighted multiple times, bow riding and swimming within 10m of the hull on both port and starboard sides of the bow. T echosounder was the only active sound source during the sighting (being used for navigational purposes only), therefore the exclusion zone was 200m. Approach was determined to be voluntary based on obse (bow riding, vessel attraction), and no mitigation was required.</p>
044	<p>At 16:18 approximately 8 to 10 dolphins were sighted off the starboard side bow at the surface ~ 250m from the vessel; there was no clear direction of travel but rather they appeared to be active at the surface</p> <p>Within two minutes, direction of travel became apparent as the dolphins moved toward the bow of the vessel. They swam underneath the vessel and along side the starboard side at which point they could l porpoising out of the water, travelling parallel to the boat in the same direction. Only 4 or 5 individuals swam along side the boat and farther out off the starboard side another small group of dolphins was sighted with no clear direction of travel and only dorsal fins being visible. At 16:23, two dolphins were swimming along the starboard side porposing at the surface. At 11:25 there were 4 dolphins swimming along the s perpendicular to the bridge. No dolphins were sighted after 16:26; approach was determined by the PSOs to be voluntary, so no mitigation measures were required. Sighting occurred during transit when the m active for navigational purposes. No other equipment was deployed at the time.</p>
045	<p>Dolphins were sighted 12100 m at the surface of the water off the starboard side bow</p>
502	<p>A brief acoustic detection consisting of two faint constant frequency (12kHz) dolphin whistles aurally heard and visually observed on the mid-frequency spectrogram at 00:31 UTC, followed by a single slight downswEEPing whistles (12.1-11.7kHz). All three whistles were quite faint compared to background noise levels, with a relative received amplitude of 92dB. A single bearing of $\pm 30^\circ$ relative to the hydrophone array (ambiguity with 0° at the front of the array) was obtained for the downswEEP whistle via selection of the tone using the clip generator, which then plotted the bearing on the map display. Amplitudes provided a received amplitudes that have not been corrected by a calibration factor. Localization was not possible due to an insufficient number of bearings and the brevity of the detection event. The two sub-bottom prof and chirper) were active at the time of the acoustic detection, as was the multi-beam echo sounder (EZ 500m). This detection was not correlated with a visual sighting by PSO on thermal cameras. Mitigation was</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
503	<p>The lower frequency (<24kHz) portion of dolphin echolocation clicks were first observed on the mid-frequency spectrogram at 04:55 UTC. Presence of the clicks in the mid-frequency spectrogram then trigger operator to look for the clicks in the high frequency click detector. The clicks were not easily observed in the bearing/time display of the high frequency click detector due to high levels of false clicks, however th obvious in the amplitude/time display for the detector. Identification of the clicks in the amplitude/time display was then used to locate the corresponding clicks in the bearing/time display. An initial bearing of ± 6 ambiguity with 0° at the front of the array) was observed, with a final bearing of $\pm 75^\circ$. The change in bearings indicates a movement from ahead to behind the hydrophones, but a more specific direction of travel determined. The dolphin clicks contained energy between 20 and 100kHz, with a peak at 65kHz. Relative received click amplitudes ranged from 140-160dB (average 155dB). Amplitudes provided are relative amplitudes that have not been corrected by a calibration factor. Localization was not possible due to an insufficient number of bearings and the brevity (1 minute) of the detection event, however it is suspected they were within the exclusion zone based on the presence of click energy in excess of 80kHz. The two sub-bottom profilers (sparker and chirper) were active at the time of the acoustic detection, as was the multi-beam echosounder (EZ 500m). This detection was not correlated with a visual sighting by PSO on thermal cameras. Mitigation was not required.</p>
504	<p>High frequency dolphin clicks (15-80kHz with a peak around 32kHz) were observed on the high frequency click detector at 05:57 UTC. The lower frequency component of the clicks (<24kHz) was also observed on the frequency spectrogram. Detection of the dolphin clicks was intermittent during the 5 minute detection event, with short bouts of clicks observed. An initial bearing of $\pm 18^\circ$ (\pm left/right ambiguity with 0° at the front of all bearings relative to the hydrophone array) was observed (obtained from the bearing/time display of the high frequency click detector), with final bearings between ± 20-23°. Relative received click amplitudes ranged from 135-155dB (average 145dB). Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. A localization was not obtained for the detection event and clicks were last observed at 06:02. The shallow penetration sub-bottom profiler (chirper) and multi-beam echo sounder were active throughout the detection (EZ 500m). The sparker was briefly active from 05:58-05:59 and was shut off after 06:00. The line was aborted due to a late start in logging of the line by the survey team. This detection was not correlated with a visual sighting by PSO on thermal cameras. Mitigation was not required.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
505	<p>Dolphin whistles were aurally and visually (on the mid-frequency spectrogram display) detected at 06:26 UTC. High frequency dolphin clicks were detected approximately 30 seconds after the initial detection. A short burst pulse was observed at 06:34 and several buzzes were detected at 06:46. Whistles and clicks were near continuous throughout the 39 minute detection event (last detected at 07:17), with only short gaps between consecutive bouts of acoustic activity. Whistles ranged in frequency from 6.8 to 22kHz and were composed of numerous contour types, including: near constant frequency, upsweep, downsweep, concave, and sinusoidal. Whistle duration ranged from 0.1 to 1 second. Harmonics, up to the third harmonic, were observed for several whistles. A few concave whistles contained longer leading upsweeps with short upsweeps after the main inflection, while some convex whistles were observed with the opposite pattern with shorter leading downsweeps and longer trailing upsweeps after the main inflection point. A unique shaped sinusoidal whistle was also observed. A series of short stacked trios of chirp-like whistles was observed shortly after the sparker was activated for the start of the survey line. These chirp-like whistles were not observed at any other time during the detection. The relative received amplitude for whistles ranged from 145-158dB, with an average of 151dB. Clicks contained energy between 15 and 160kHz with individual clicks containing single peaks around 30-35kHz, 60-65kHz, and 80kHz. Click amplitudes ranged from 129-163dB with an average of 142dB. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Bearings to detected whistles were obtained using the whistle/moan detector and clip generator and bearings to detected clicks were obtained from the high frequency click detector. Initial whistles were detected at $\pm 65^\circ$ (\pm left/right ambiguity with 0° at the front of the array - all bearings relative to the hydrophone array) were observed, however bearings quickly became variable as the detection event progressed with bearings coming from ahead and behind the hydrophone array at the same time - possibly indicating a dispersed group or quick directional changes. Bearings to detected clicks were also quite variable. Initial clicks were detected from $\pm 19^\circ$ relative to the hydrophone array, however click trains from ± 115-128° were observed shortly after the initial clicks at 19° (there was no clear connection between these two sets of bearings to indicate they were from the same click train). Two simultaneous click trains were observed with rapidly changing bearings at 06:39. Bearings for these click trains began around $\pm 30^\circ$ and finished around $\pm 140^\circ$ over a 5 second period. The dolphins producing the click trains rapidly passed from ahead of to behind the hydrophone array. A localization was not obtained for the detection event, however it is suspected that the dolphins were within the exclusion zone based on the presence of click energy in excess of 80kHz and the observation of click trains with rapidly changing bearings. The shallow penetration sub-bottom profiler (chirper) and multi-beam echo sounder were active throughout the detection (EZ 500m). The sparker was active from 06:35 through to the end of the detection event. This detection was not correlated with a visual sighting by PSO on thermal cameras. No visual sightings were required. The detection event began during Rebecca Snyder's acoustic monitoring shift and ended during Trevor Horwell's shift.</p>
506	<p>High frequency dolphin clicks were first observed on the HF click detector at 08:10 UTC, at a bearing of approx $\pm 18^\circ$ (\pm left/right ambiguity, 0° at front of hydrophone array) with a click train lasting approximately 5 seconds. Additional, brief click clusters and trains were observed at 08:11 (<10 sec, observed on amplitude display but difficult to pinpoint on bearing time display due to abundance of noise/false clicks); 08:13- at least 2 click trains <5 sec at bearings of $\pm 15^\circ$-40°; 08:15- at least 2 simultaneous click trains approx 3-8 sec at bearing of $\pm 15^\circ$-40°. Frequency range of observed HF dolphin clicks was approximately 20-80kHz. Observed HF dolphin click amplitude ranged from approximately 124-141dB (avg~133dB). Amplitudes indicated are relative, and not corrected by a calibration factor. All bearings are relative to the hydrophone array. Initial dolphin whistles were aurally detected at 09:26 UTC (the whistles were not visible on the mid-frequency spectrogram). Approximately 5 minutes after the initial detection of whistles, dolphin clicks were observed on the high frequency click detector, coming from an initial bearing of $\pm 66^\circ$ (\pm left/right ambiguity with 0° at the front of the array - all bearings relative to the hydrophone array). Clicks were the dominant vocalization throughout the acoustic event. Clicks contained energy between 15 and 110kHz, with single peaks observed between 35-40kHz and 65-70kHz. Bearings to detected clicks were variable over the course of the acoustic event, with periods of activity ahead of, behind, and crossing from ahead to behind the hydrophone array. Two simultaneous click trains with rapid bearing changes ($\pm 45^\circ$-$\pm 110^\circ$) were observed at 09:52, with two additional simultaneous click trains with more gradual bearing changes ($\pm 150^\circ$-$\pm 156^\circ$) observed at 09:53. A few additional dolphin whistles were aurally and visually (on the mid-frequency spectrogram display) detected at 09:52, approximately 1 minute before the last detection of clicks at 09:53. This final bout of whistle activity was composed of seven individual whistles from three contour types (upsweep, concave, and chirp). Whistle frequency ranged from 6.2 to 23kHz. One whistle had a very high signal to noise ratio (relative received amplitude not determined). This whistle contained energy between 6.2 and 23kHz with a single harmonic. Relative received click amplitudes ranged from 129-160dB (average 144dB). Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. A localization was not obtained for the detection event, however it is suspected that the dolphins were within the exclusion zone based on the presence of click energy in excess of 80kHz and the observation of click trains with rapidly changing bearings. The two sub-bottom profilers (chirper and sparker) and multi-beam echo sounder were active throughout the detection (EZ 500m). The detection was not correlated with a visual sighting by PSO on the thermal cameras.</p>
507	

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
508	<p>Dolphin clicks (10-15 Hz) with single peaks around 60 and 65 kHz were first detected on the high frequency click detector from a bearing of $\pm 67^\circ$ ($\pm 10^\circ$ right ambiguity) with 0° at the front of the array – all beam the hydrophone array) at 11:24 UTC. The lower frequency (<24kHz) component of the clicks was visible in the mid-frequency spectrogram. Clicks were detected through to the end of the acoustic event at 11:36 observed from variable bearings ($\pm 26-34^\circ$ at 11:31, from $\pm 87-101^\circ$ at 11:34, from $\pm 27-34^\circ$ at 11:36, from $\pm 119-134^\circ$ at 11:40, from $\pm 30-14^\circ$ at 11:41, and $\pm 122^\circ$ at 11:42). Relative received click amplitudes ran 159dB (average 141dB). Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. In addition to clicks, three dolphin whistles (6.4-18kHz) were observed between 11:36 and consisted of upsweep and convex whistle types. (Amplitudes and bearings were not obtained for the three whistles). A localization was not obtained for the detection event, however it is suspected they were within the exclusion zone based on the presence of click energy in excess of 80kHz (confirmed via visual observation). The detection was correlated with a visual sighting by the PSO. The PSO first observed dolphins (identified as common dolphin) bow riding off the port side of the Discovery at 11:43 UTC. The visual observer noted ranges to the dolphins of <5m (bow riding at the start of the visual sighting) to 200m. Dolphins were last observed alongside the vessel at 11:49, approximately 3 minutes after the last acoustic detection of the dolphin. The two sub-bottom profilers (chirper and sparker) and multi-beam echo sounder were active throughout the detection (EZ 500m). Mitigation was not required (dolphins voluntarily approached the vessel, as determined by the visual observer).</p>
046	<p>At 11:43, three dolphins were first sighted right next to the portside bow, bowriding and dipping under the vessel. Shortly after, 3 to 4 dolphins were sighted about 200m off the starboard bridge. A small group was seen travelling at the surface toward the vessel. At 11:46 about 7 dolphins were sighted swimming next to and parallel with the vessel - mid ship and forward to the bow. The majority of their presence next to the vessel was beneath the water or just breaking the surface, their pace slow and leisurely. At 11:48 there were 4 dolphins swimming next to the vessel in a similar fashion as described above. Dolphins were last sighted right next to the boat. Approach was determined to be voluntary by the PSO; chirper, MBES, and sparker were all active during the sighting.</p>
047	<p>Dolphins were first sighted off the starboard bow at 21:10 UTC, swimming directly towards the bow of the ship. They approached the vessel within 10m of the hull, and were seen again several times near the starboard bow. Last sight of some of the pod, and 3-4 individuals were last sighted at 21:15, swimming alongside the starboard hull from bow to approximately mid-ship (03:00 using clockface), then turned and swam away from the vessel. The Discovery was on weather standby during the sighting, and only the Multibeam Echosounder was active (used for navigational purposes only), therefore the exclusion zone was 200m. PSOs determined the behavior to be indicative of a voluntary approach, and no mitigation was required.</p>
048	<p>A single faecal dolphin dorsal fin was observed, through the night vision monocular, breaking the sea surface approximately 5m off the port bow of the Discovery at 04:06 UTC. The dolphin was perpendicular to the vessel, heading, toward the bow. Two additional dolphin surfaced, showing their dorsal surface (including dorsal fin) approximately 3m off the port bow shortly after the first. The dolphins were not observed again via the night vision monocular and the sighting was not correlated with a thermal camera sighting or an acoustic detection (PAM was on deck due to poor weather). Direct observation of the vessel's bow is obstructed from the bridge by the observer was located, therefore it was not possible to determine if the dolphins bow rode. The vessel was down for weather at the time of the sighting and all towed equipment was on deck. The multi-beam echosounder was, however, active for navigation (EZ 200m). Mitigation was not required as the dolphin were observed in the exclusion zone for less than 10 minutes and their approach was voluntary. The start and end time of the sighting is the same because the observer did not record time to the second upon making the sighting and the sighting was less than 30s in duration.</p>
049	<p>Two dolphins simultaneously broke the surface, exposing their backs and dorsal fins, while travelling toward the bow of the Discovery approximately 10m off the port bow at 04:54 UTC. Two dolphins, possibly the same as those that were observed on the initial observation, were observed riding the large swells (oriented away from the vessel) 15m off the port bow at 04:58. A third dolphin was observed surfacing approximately 2m off the port bow at 04:59. The dolphin breached clear of the water, exposing its flanks (showing a gradient of light to dark similar to the hourglass pattern of common dolphins) before circling back toward the bow, presumably to rest. Dolphins were observed wave riding the swells, as well as bow riding (evidenced by circling back towards the bow when surfacing off the port bow) for several minutes. Three to four dolphins, including one calf, were observed simultaneously at 05:09 about 5m off the port bow. One dolphin broke away and was observed swimming near the surface off the port side of the vessel heading away from mid-ship. The dolphins were last observed at 20m off the port side at 05:10. The night vision sighting was not correlated with a thermal camera sighting or an acoustic detection (PAM was on deck due to poor weather). The vessel was down for weather at the time of the sighting and all towed equipment was on deck. The multi-beam echo sounder was, however, active for navigation (EZ 200m). Mitigation was not required as the dolphins' approach was voluntary.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
050	At 11:07, 6 dolphins were detected swimming perpendicularly away from the boat, starboard side. Only the dorsal fins and a small part of the upper back broke the surface, and they were lost to view shortly after when ~150m from boat. They were not seen again, and appeared to have exited the EZ, so no mitigation necessary.
051	At 12:49, 3 Short-beaked Common Dolphins were detected swimming ~30m off the portside stern. Their motions suggested feeding. They quickly moved perpendicularly away from the boat and disappeared when the boat; were not seen again. They appeared to have exited the EZ, so no mitigation necessary. MBES was active at the time of sighting (EZ 200m), and visibility was greater than 200m prior to beginning of P, clearance was given to power on additional equipment without re-clearing the EZ following the sighting (sound source had been active for greater than 60 minutes prior to sighting, with full visibility of the EZ and/or MBES had been active prior to PAM watch for navigational purposes only.
509	A downsweep dolphin whistle (12.3-8.4kHz) was aurally and visually (on the mid-frequency spectrogram) detected at 03:51UTC from a bearing of $\pm 13^\circ$ relative to the hydrophone array. Additional whistles (downsweep 6.3kHz and upsweeps – 10-13kHz) were observed at 03:57 and 04:00 respectively, from bearings between $\pm 12^\circ$ and $\pm 20^\circ$ relative to the hydrophone array. The first harmonic was observed for a few of the whistles; amplitudes were estimated from the spectrogram amplitude color scale and ranged from 80-95dB (average 90dB). Whistles were last detected at 04:00. High frequency clicks, which were first detected at 03:51, were the dominant vocalization type recorded. The dolphin clicks (12-92kHz with single peaks between 30-35, 45-50, or 60-65kHz) were detected primarily in short click trains (<5s) from relatively consistent bearings between $\pm 23^\circ$ relative to the hydrophone array. However, one click train was longer (>20s) and exhibited a gradual change in bearings from $\pm 14^\circ$ and $\pm 45^\circ$. Clicks from the longer train were manually tracked in the high frequency bearing/time display to plot tracked click bearings which were then used to produce a localization (via target motion analysis or TMA with least squares algorithm) of $15.4m \pm 7.6m$ (perpendicular error $\pm 7.6m$ and $\pm 17.5m$) from a bearing of $\pm 74^\circ$ relative to the hydrophone array (corresponded to the 04:00/08:00 position on the clock face relative to the vessel's position) at 04:22. The relative received click amplitudes ranged from 120-142dB (average 136dB). Clicks were last detected at 04:24. The acoustic detection was not correlated with a visual sighting on the IR cameras (the dolphins were likely outside the cameras' panning range (limited by obstruction by bridge wings) with the localization indicating the dolphins were astern of the vessel). All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required. The dolphins were localized within the exclusion zone at 04:22, however the operator could not determine when the dolphins exited the zone due to difficulties in tracking other click trains which were of short duration and exhibited minimal bearing changes. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Whistle bearings were determined by selection of the tone on the clip generator and evaluation of the resulting bearing line overlay on the map display, while click bearings were obtained from the high frequency bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity.
510	Three high frequency dolphin click train composed of clicks containing energy between 15-75kHz and with a single peak 30-35kHz were observed on the high frequency click detector at 05:35 UTC. Two click trains were tracked and remained at near constant bearings of $\pm 15-20^\circ$ and $\pm 40-45^\circ$ relative to the hydrophone array, while the third exhibited a change in bearings from $\pm 17^\circ$ to 70° . Bearings to the detected clicks within the third train remained near constant around 17° for approximately 5s before they began to increase to a final bearing of $\pm 70^\circ$. Individual clicks from this train were manually tracked and bearing lines plotted, however a local maximum was produced (possibly the result of too few clicks being tracked). Click amplitudes ranged from 137 to 160dB, with an average of 145dB. No further clicks were detected after the observation of the three initial click trains. Dolphin whistles, which ranged in frequency from 6.9 to 16kHz, were first detected at 05:38. A single whistle bearing of $\pm 47^\circ$ relative to the hydrophone array was generated at 05:42. Convex, concave, upsweep, and chirp-like whistles were all detected during the detection event. Whistle amplitudes, which was estimated from the amplitude color scale on the spectrogram display, ranged from 70-95dB and averaged 80dB. Whistles were last detected at 05:51. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Whistle bearings were determined by selection of the tones using the clip generator and evaluation of the resulting bearing line overlay on the map display, while click bearings were obtained from the high frequency bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity.

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
511	<p>Three high frequency click trains with rapidly changing bearings were observed over a one minute period from 06:07 to 06:08 UTC. Clicks within the trains contained energy between 20-120kHz with single peak 45kHz or 65-70kHz and had relative received amplitudes from 124 to 158dB (average 141dB). Individual clicks for the first two click trains were tracked, with their bearings plotted on the map display to produce via target motion analysis (TMA least squares algorithm). The first click train tracked produced a localization of 6.2m \pm0.7m (perpendicular error \pm0.68m, parallel error \pm0.24m) from a bearing of 131° relative to the hydrophone array, while the second tracked click train produced a localization of 34m \pm15.2m (perpendicular error \pm15.2m, parallel error \pm1.2m) from a bearing of 162° (both at approximately 06:00 on the c). Bearings to detected clicks for the first train changed from \pm64-90° (relative to the hydrophone array) over a 15s period and bearings for the second train changed from \pm30 to 140° over a 20s period. It should be noted that both localizations were obtained from a selection of less than 20 clicks, however the rapid change in bearing observed supports a close pass of the dolphins by the hydrophone array. The acoustic detection was confirmed with a visual sighting on the IR cameras (the dolphins were likely outside the cameras' panning range (limited due to obstruction by bridge wings) with the localizations indicating the dolphins were astern of the geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity.</p>
512	<p>A series of convex dolphin whistles (15.6-8.6-13.7kHz) was aurally and visually (on the mid-frequency spectrogram) detected over a 7 minute period from 06:32 to 06:39 UTC. In addition to the convex dolphin whistles, a single upsweep (7.5-14kHz) was also observed. The first harmonic was visible for several whistles. Bearings to observed whistles were variable and ranged from \pm16-60° relative to the hydrophone array. Whistle amplitudes ranged from 110-120dB. The last few whistles were quite faint and were not visible on the spectrogram display. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided, which were estimated from the amplitude color scale in the spectrogram, are relative amplitudes that have not been corrected by a calibration factor. Whistle bearings were determined by selection of the tones using the clip generator and evaluation of the resulting bearing line overlay on the map display as well as from the whistle/moan detector. All bearings are provided as \pm some value to account for left/right ambiguity.</p>
513	<p>A few faint dolphin whistles were first detected on the mid-frequency (MF) spectrogram at 07:08, in the range of 10-18kHz. Additional intermittent whistles were detected at 08:11, 08:14-08:15, 08:17-08:19, and 08:21-08:22. Whistles were faint (SNR1), but both visible on the MF spectrogram, and audible to the operator. Upsweep, downsweep, near constant frequency, concave, convex, and stepped downsweep whistles 0.3-1.7s in duration were detected, from 7.5-23kHz (most 12-18kHz). Whistle amplitude was measured through playback in Raven, and in the range of 84-106dB (average 95dB). High frequency(HF) dolphin clicks were first detected on the HF detector between 08:05-08:06. Additional brief periods of HF dolphin click activity were detected from 08:19-08:25 (scattered intermittent clicks, no clear trains observed), 08:28-08:29, and 08:31. Three distinct click trains were detected. At 08:05: 10s click train with little change in bearing (\pm20-25°) was detected and localized within 500m. At 08:28, an 8s click train was tracked between bearing \pm70-80°, and localized within 500m. At 08:31, a 30s click train was tracked moving from aft to sideways of the hydrophone, evident by a bearing change from \pm15° to \pm85°. This click train was localized within 200m. Frequency range of observed HF dolphin clicks was variable from 15-100kHz, with observed peak frequencies 20-80kHz, primarily in the range of 30-40kHz. Amplitudes of observed HF dolphin clicks were in the range of 125-160dB, and were obtained from the amplitude display. All amplitudes listed are relative, and have not been adjusted using a calibration factor. Localizations were not performed fast enough to produce precise distances, bearings or margins of error. The operator was confident the dolphins entered the exclusion zone based on the available click train information, as well as observed HF click energy above 80kHz. All times indicated are UTC. This detection was confirmed with a visual sighting, and no mitigation was required. All bearings are listed as \pmxyz° to indicate left/right ambiguity. The Discovery was performing single channel survey lines with all HRG equipment operating (Sparker, sub-bottom profiler, MBES, USBL) active for the duration of the detection event. The detection was not correlated with a visual sighting by PSO on thermal camera watch, therefore no mitigation was required.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
514	<p>A single high frequency dolphin click train composed of clicks containing energy between 15-70kHz and with a single peak around 32kHz was observed on the high frequency click detector at 10:04 UTC. Bearin clicks within the click train ranged from ± 39 to $\pm 49^\circ$ relative to the hydrophone array. Click amplitudes ranged from 131 to 146dB, with an average of 139dB. Although clicks were tracked, a localization was not in addition to the click train, upsweep dolphin whistles (8.9-12.7) were also detected at 10:06. Whistle amplitudes and bearings were not determined. The acoustic detection was not correlated with a visual sighting cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided are relative received amplitudes that have been corrected by a calibration factor. Click bearings were obtained from the high frequency bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity.</p>
052	<p>At 18:21 (UTC) a single blow was sighted directly off the bow of the Discovery by both PSOs on watch (TH, SB), at a distance of approximately 609m (4 reticles, TH). The dorsal surface of the whale could be seen, but the dorsal fin was visible. The whale was moving perpendicular to the vessel's direction of travel (heading 09:00 using clockface). PSO's lost view of the animal a few seconds after the blow. At 18:26, the whale was sighted off the port side of the Discovery by both PSOs on watch (SB, TH), at a distance of approximately 305m (4 reticles, TH), and heading the opposite direction of the vessel (06:00 using clockface). 2 bushy blows were observed along with the whale's dorsal surface (large dark body), but no dorsal fin or other characteristics could be identified. Lead PSO immediately asked survey for a shutdown of all sources operating below 200kHz (Echosounder, Sub-Bottom Profiler, USBL active during sighting; Sparker was not powered on at the time), and survey complied immediately, with shutdown occurring at 18:27. The whale was not sighted again until 18:57 (gusts in excess of 30 kts) and beaufort sea state 6, it was difficult to make out the species identity of the whale. It was hypothesized to be a Humpback Whale based on observed information, but this could not be confirmed. Due to the possibility that it was a North Atlantic Right Whale (2nd most likely species based on observation), the lead PSO asked survey for a 60 minute clearance period prior to re-start/ ramp up of survey equipment. Lead PSO notified survey at 19:27 (after 60 minute clearance of the EZ, beginning at 18:27) that they were clear to begin ramp up procedures.</p>
053	<p>At 11:25 (UTC) a few dolphins were sighted about 60m off the starboard side, perpendicular with the bridge, heading toward the vessel. Between 10 and 15 individuals (included juveniles and calves), swam around the vessel, at times dipping under the bow. Dolphins could be seen bow riding, as well as riding through waves coming off of the vessel. Activity was just below the surface and at the surface, with little porpoising or breaching. A group stayed with the vessel circling the bow and playing in the waves for about 10 minutes at which time they were not sighted again. Approach was determined by the PSO to be voluntary. No mitigation was required. During the time of the sighting the only equipment in use was the MBES (Exclusion zone = 200m) ; all other equipment was on deck for weather standby.</p>
054	<p>At 18:57 (UTC) off the portside bridge, a pod of dolphins was sighted in the distance, approximately 2420m (1 reticle SB, TH) from the Discovery . The pod was moving quickly at the surface and maintained the same heading (animals heading was approx 06:00 using clock face) for the entirety of the sighting (about 6 minutes). The pod did not approach the vessel and no mitigation was required.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
515	<p>A faint dolphin upsweep whistle (10-15.2kHz) from a $\pm 50^\circ$ (relative to the hydrophone array) bearing was aurally and visually (on the mid-frequency spectrogram) detected at 00:18 UTC. A short click train with bearings from ± 60-65° was detected on the high frequency click detector at 00:24. Individual clicks from the click train were tracked, with their bearings plotted on the map display to produce a localization using analysis (TMA least squares algorithm) of $22.5\text{m} \pm 81.7\text{m}$ (perpendicular error $\pm 81.7\text{m}$, parallel error 40.8m) from a bearing of $\pm 152^\circ$ relative to the hydrophone array. The high error associated with the localization is the result of tracking clicks from a short click train with only a slight change in bearing. Although the localization contained high error, the most conservative range estimate (104.2m) places the dolphin within the zone. Additional clicks were detected in short bouts of activity from ± 16-20° for three minutes. Clicks along the ± 16-20° bearing were became a distinguished click train, which remained along those bearings seconds before splitting into two click trains with rapidly changing bearings at 00:28. Both trains exhibited a bearing change of at 152-156° (down to $\pm 172^\circ$) over a 5 second period, before sweeping back up to around 135°. A localization of $32.1\text{m} \pm 4.6\text{m}$ (perpendicular error $\pm 4.6\text{m}$, parallel error 1.5m) from a bearing of $\pm 69^\circ$ relative to the hydrophone array was produced for one of the two click trains. A few faint down whistles (19.7-15.8kHz) were detected amongst the clicks at 00:29. Another click train exhibiting a rapid change in bearing from ± 35-100° was observed in the high frequency click detector at 00:33. Tracking clicks within this train produced a localization of $7.5\text{m} \pm 0.8\text{m}$ (perpendicular error $\pm 0.8\text{m}$, parallel error 0.5m) from a bearing of $\pm 56^\circ$ relative to the hydrophone array. Two additional clicks with rapid bearing change were observed, one at 00:36 and the second at 00:40. A localization of $10.4\text{m} \pm 1.2\text{m}$ (perpendicular error $\pm 1.2\text{m}$, parallel error 0.8m) from a bearing of $\pm 56^\circ$ relative to the hydrophone array was generated for the first final click trains, however no localization was obtained for the second train. It should be noted that all localizations were obtained from a selection of less than 20 clicks, however the rapid change in bearings of some of the tracked trains supports a close pass of the dolphins by the hydrophone array. Short bouts of click activity were detected throughout the detection event, however these clicks did not form clear click trains and therefore not tracked to produce a localization. Click frequency ranged between 11-125kHz with single peaks observed between 26-35kHz and 65-70kHz. The lower frequency portion (<24kHz) of the dolphin clicks were visible in the mid-frequency spectrogram display. Received click amplitudes ranged from 138-163dB and averaged 152dB. Upsweep, downsweep, and sinusoidal dolphin whistles, which ranged in frequency from 10-15kHz were detected at 00:29 and between 00:47-00:48, as well as at the start of the acoustic event at 00:18. Whistles at the end of the acoustic event were quite intense, with received amplitudes greater than 120dB and 3rd harmonic visible. Overall whistle amplitudes ranged from 92-125dB, with an average received amplitude of 105dB. Dolphin vocalizations were last detected at 00:48. The acoustic detection was not correlated with a visual sighting on the IR cameras (the dolphins were likely outside the cameras' panning range (limited due to obstruction of the stern by the bridge wings) with the localizations indicating the dolphins were as far as the vessel). All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes, which were estimated from the click detector or through the spectrogram, are relative received amplitudes that have not been corrected by a calibration factor.</p>
516	<p>whistles were not determined. Whistle amplitudes ranged from 85-110dB. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided, which were estimated from the amplitude color scale in the spectrogram, are relative received amplitudes that have not been corrected by a calibration factor.</p>
517	<p>A brief detection of a single dolphin upsweep whistle (10.3-13.5kHz) at 03:43 UTC. The whistle was quite faint, with a relative received amplitude of 90dB and was less than 1 second in duration. A bearing to the dolphin was not obtained. Localization of a single whistle is not possible when using a linear towed array. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required. The amplitude provided is the relative received amplitude that has not been corrected by a calibration factor.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
518	<p>High frequency dolphin clicks containing energy between 15-32kHz and with a single peak at 25-30kHz were observed on the high frequency click detector at 04:11 UTC. Bearings to the detected clicks remained between ± 50-54° and ± 58-66° relative to the hydrophone array on first detection, with no clear click trains visible. A click train with a gradual change in bearings was identified in the bearing/time display at 04:13. The click train had an initial bearing of $\pm 91^\circ$ that gradually decreased to a final bearing of $\pm 72^\circ$ over a 20s period, indicating the dolphin was moving from near parallel to ahead of the hydrophones, possibly toward the vessel. Additional short click trains were observed at 05:12 after a 15 minute period during which clicks were intermittently detected and did not form click trains. Bearings to these four click trains were concentrated between $\pm 82^\circ$ and were observed both decreasing and increasing, possibly indicating quick directional changes. Individual clicks for the click trains were tracked, with their bearings plotted on the map display to produce localizations via target motion analysis (TMA least squares algorithm). The first tracked click train produced a localization of $55.3\text{m} \pm 25.6\text{m}$ (perpendicular error $\pm 25.6\text{m}$, parallel error $\pm 2.3\text{m}$) from a bearing of $\pm 0.5^\circ$ relative to the hydrophone array. The remaining four click trains produced localizations of: $4.3\text{m} \pm 1.8\text{m}$ (perpendicular error $\pm 1.8\text{m}$, parallel error $\pm 2.2\text{m}$) from a bearing of $\pm 21^\circ$, $23.8\text{m} \pm 19.2\text{m}$ (perpendicular error $\pm 19.2\text{m}$, parallel error $\pm 5.2\text{m}$) from a bearing of $\pm 20^\circ$, $25.1\text{m} \pm 24.2\text{m}$ (perpendicular error $\pm 24.2\text{m}$, parallel error $\pm 4.4\text{m}$) from a bearing of $\pm 14^\circ$, and $50.1\text{m} \pm 83.2\text{m}$ (perpendicular error $\pm 83.2\text{m}$, parallel error $\pm 37.8\text{m}$) from a bearing of $\pm 10^\circ$. The localizations contained high error levels in one or both directions (perpendicular and/or parallel), some with errors 50% or more than the estimated range. The high errors were likely the result of tracking only a few (10) clicks from trains of short durations and of small bearing changes. However, even the most conservative range estimates from the localizations place the dolphins within the exclusion zone. The dolphins were last detected at 05:13. Click amplitudes ranged from 130 to 163dB with an average of 155dB. The acoustic detection was not correlated with a visual sighting on the IR cameras (the dolphins were likely outside the cameras' panning range (limited due to obstruction of the stern by the bridge wings) with the localization indicating the dolphins were astern of the vessel). All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity.</p>
519	<p>High frequency dolphin clicks containing energy between 15-73kHz and with a single peak at 25-30kHz were observed on the high frequency click detector at 05:37 UTC. Bearings to the detected clicks remained between $\pm 30^\circ$ relative to the hydrophone array on first detection, with no clear click trains visible. Short bouts of click activity continued through the detection event, with most clicks observed between ± 18-24°. One series of clicks was tracked over a 40s period to produce a localization of $19.5\text{m} \pm 1.8\text{m}$ (perpendicular error $\pm 1.8\text{m}$, parallel error $\pm 2.1\text{m}$) from a bearing of $\pm 108^\circ$ (detected at 05:50). Click amplitudes ranged from 124-148dB with an average of 138dB. Dolphin clicks were last detected at 06:00. The acoustic detection was not correlated with a visual sighting on the IR cameras (the dolphins were likely outside the cameras' panning range (limited due to obstruction of the stern by the bridge wings) with the localization indicating the dolphins were astern of the vessel). The shallow penetration sub-bottom profiler (chirper), multi-beam echosounder, and USBL were active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity.</p>
520	<p>A short burst of high frequency dolphin clicks (12-110kHz, with single peak 29-32kHz) from bearings between $\pm 19^\circ$ and $\pm 25^\circ$ relative to the hydrophone array was detected on the high frequency click detector at 06:21. Faint whistles were first detected (from ± 40-50°) shortly after at 06:21. Bouts of click activity continued through to 06:29, with two clear click trains with gradually changing bearings observed, tracked, and localized. The first click train tracked produced a localization of $15.9\text{m} \pm 1.2\text{m}$ (perpendicular error $\pm 1.2\text{m}$, parallel error $\pm 0.7\text{m}$) from a bearing of 64° relative to the hydrophone array, while the second tracked click train produced a localization of $10.8\text{m} \pm 2.7\text{m}$ (perpendicular error $\pm 2.7\text{m}$, parallel error $\pm 5.2\text{m}$) from a bearing of 63° (both at approximately 06:00 on the clock-face). Bearings to detected clicks for the first train changed from ± 44-92° (relative to the hydrophone array) over a 15s period and bearings for the second train changed from ± 25 to 32° over a 10s period. Both trains were detected at 06:29. Click amplitude ranged from 124-158dB (average of 138dB). Concave whistles, downsweep, and concave whistles were detected throughout the acoustic event. Overall whistle frequency ranged from 8-15kHz, with an average amplitude of 98dB (minimum amplitude 83, maximum amplitude 115). Bearings to whistles were primarily between ± 40-50°, with a few around ± 105-110° at 06:23. Dolphins were last detected at 06:33. The acoustic detection was not correlated with a visual sighting on the IR cameras. The dolphins were likely outside the cameras' panning range (limited due to obstruction of the stern by the bridge wings) with the localization indicating the dolphins were astern of the vessel). The shallow penetration sub-bottom profiler (chirper), multi-beam echosounder, and USBL were active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display, whereas whistle bearings were determined from the clip generator. All bearings are provided as \pm some value to account for left/right ambiguity.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
521	<p>Faint dolphin whistles were aurally and visually (on the mid-frequency spectrogram) detected at 06:57 UTC. Downsweep, upsweep, and near constant frequency whistles were detected throughout the 13 minute event (last detected at 07:10). Bearings to whistles, which were generated by selecting whistles from the spectrogram using the clip generator and evaluating the bearing lines plotted on the map, were concentrated $\pm 42-48^\circ$. Overall whistle frequency ranged from 7.6-13.5kHz, with an average received amplitude of 97dB (minimum amplitude 91dB, maximum amplitude 104dB). A localization was not achieved. The acoustic detection was not correlated with a visual sighting on the IR cameras. The shallow penetration sub-bottom profiler (chirper), multi-beam echosounder, and USBL were active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display and are provided as \pm some value to account for left/right ambiguity.</p>
522	<p>Five brief (3-10s length) high frequency click trains were detected between 08:40-08:43 UTC on the HF click bearing time display. These click trains were detected in bearing ranges $\pm 70-90^\circ$, $\pm 100-120^\circ$, and \pm only small changes in bearing of $<20^\circ$ from start to end of each train. One train was localized to within 500m, however not quick enough to provide an accurate estimate, or obtain the exact distance or margin. Observed HF click amplitudes (relative amplitude only, not corrected by a calibration factor) were in the range of 128-161dB. Observed HF click frequencies were in the range of 20-110kHz, with peaks around 80kHz. The localized click train, combined with some clicks with energy up to 100+kHz led the operator to believe the dolphins were within the 500m EZ. The detection was not correlated with a visual sighting on the thermal camera watch at the time, and no mitigation was required. Multibeam echosounder, Sub-bottom profiler, and USBL were the active sound sources during the detection (Sparker not deployed), requiring an exclusion zone. All bearings are listed as $\pm xyz^\circ$ to indicate left/right ambiguity.</p>
523	<p>A short detection event consisting of high frequency dolphin clicks at 09:05 UTC, followed by faint, audible whistles (not visible on the spectrogram at 09:10. Clicks were observed in short bouts around $\pm 18-20^\circ$ hydrophone array, with no clear click trains visible. Click frequency ranged from 15-50kHz and contained a single peak around 35kHz. Amplitudes to detected clicks ranged from 136-138dB (135 average). A localization was not possible due to the lack of sufficient data from the two short periods of acoustic activity. The acoustic detection was not correlated with a visual sighting on the IR cameras. The shallow penetration sub-bottom profiler (chirper), multi-beam echosounder, and USBL were active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity.</p>
524	<p>Dolphin whistles from $\pm 15^\circ$ and $\pm 78^\circ$ (relative to the hydrophone array) bearing were detected at 09:43 UTC. Whistles continued throughout the 11 minute acoustic detection, with concave and downsweep whistles detected. One downsweep whistle had a leading edge with a steep slope and a long, trailing tail. Harmonics were observed for a few of the whistles. High frequency dolphin clicks (18-82kHz with single peak 30-40kHz) were first detected at 09:44 from bearings between $\pm 19-21^\circ$. Clear click trains with bearing changes were not observed until the end of the detection event at 09:54 when two click trains were observed. Individual click trains were tracked, with their bearings plotted on the map display to produce localizations via target motion analysis (TMA least squares algorithm). The first tracked click train produced a localization of 9 (perpendicular error $\pm 3.5m$, parallel error 3m) from a bearing of $\pm 168^\circ$ relative to the hydrophone array. The second tracked click train failed to produce a localization, possibly due to a shallow change in bearing. Amplitudes ranged between 93-118dB for whistles (107dB average) and between 133-158dB for clicks (143dB average). The acoustic detection was not correlated with a visual sighting on the IR cameras. The shallow penetration sub-bottom profiler (chirper), multi-beam echosounder, and USBL were active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display, whereas whistle bearings were determined from the clip generator. All bearings are provided as \pm some value to account for left/right ambiguity.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
055	<p>heading toward the bow from approximately 5m off the port side of the vessel at 06:44. The PSO checked the starboard side of the vessel in between sightings and observed two dolphin surfacing, exposing the 5m off the starboard bow at 06:47 (heading toward the bow). It is presumed that the dolphin were bow riding due to their movements on both sides of the vessel's bow. The dolphin were not observed again. The sighting was not correlated with an IR camera sighting (cameras panning further out and angle would have needed to be steeper to view dolphins at the close range). The vessel was running weather patterns with the multi-beam echosounder active at the time of the sighting (EZ 200m). Mitigation was not required as the dolphin were in the zone for less than 10 minutes and voluntarily approached the vessel.</p>
056	<p>A single falcate dolphin dorsal fin was observed, through the night vision monocular, breaking the sea surface heading toward the bow approximately 10m off the port side of the Discovery at 10:04 UTC. Two dolphins surfaced, one of which broke the surface exposing its flanks (showing a gradient of light to dark similar to the hourglass pattern of common dolphins) 5m off the starboard bow at 10:08 (the PSO moved between starboard sides). The dolphins were not observed again. The night vision sighting was not correlated with an IR camera sighting (cameras panning further out and angle would have needed to be steeper to view the close range). The vessel was running weather patterns with the multi-beam echosounder active at the time of the sighting (EZ 200m). Mitigation was not required as the dolphin were in the zone for less than 10 minutes and voluntarily approached the vessel.</p>
525	<p>Two downsweep dolphin whistles (19.7-11.6kHz) were aurally and visually detected from bearings of $\pm 28^\circ$ and $\pm 33^\circ$ relative to the hydrophone array at 22:06 UTC. Received whistle amplitudes ranged from 84-105.2dB. Bearings to whistles were estimated using the clip generator and amplitudes were measured during playback in Raven. Localization was not possible due to an insufficient number of bearings and the short duration (a few seconds) of the detection event. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. The acoustic detection was not correlated with a visual sighting on the Discovery. The shallow penetration sub-bottom profiler (chirper), multi-beam echosounder, and USBL were active at the time of the acoustic detection (EZ 500m) and no mitigation was required. All bearings are provided as \pm some value to account for left/right ambiguity.</p>
526	<p>Intermittent dolphin clicks (18-100kHz with a single peak around 36kHz) with no clear click trains were detected on the high frequency click detector from bearings between $\pm 76-82^\circ$ relative to the hydrophone array at 22:29UTC. The click amplitudes, which were measured from the high frequency click detector bearing/time display, ranged from 128-134dB (average 130dB). Upsweep and convex whistles, ranging in frequency from 18.8kHz were aurally and visually detected at 22:36. A few whistles were aurally detected but not observed on the mid-frequency spectrogram. Whistle amplitudes, which were measured during playback in Raven, ranged from 86.4-105.2dB (average 96dB). Bearings to whistles were not obtained. Click bearings were obtained from the high frequency click detector bearing/time display. Localization was not possible due to an insufficient number of bearings; however, it is suspected that the dolphins were within the exclusion zone based on the presence of click energy in excess of 80kHz. The acoustic detection was not correlated with a visual sighting on the Discovery. The shallow penetration sub-bottom profiler (chirper), multi-beam echosounder, and USBL were active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. All bearings are provided as \pm some value to account for left/right ambiguity.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
527	<p>single peaks between 30-35kHz or 65-70kHz) were detected after a short break in whistle activity at 03:05. Individual clicks were tracked over a bearing change from $\pm 47^\circ$ to $\pm 80^\circ$ and localized using target motion (TMA least squares algorithm) to $25\text{m} \pm 6.6\text{m}$ (perpendicular error $\pm 6.6\text{m}$, parallel error $\pm 1.5\text{m}$) at a bearing of $\pm 17^\circ$ (distance and bearing relative to the hydrophone array). Upsweep, downsweep, near constant whistles ranging in frequency from 9-13kHz were intermittently detected throughout the detection event and only whistles were detected between 03:06 and 03:30. Bearings to selected whistles were primarily $\pm 70^\circ$, however a few whistles were observed around $\pm 20^\circ$ and $\pm 90-100^\circ$. Click activity increased again at 03:31 with four additional click trains tracked and dolphins localized between 03:31 and the end of event at 03:45. Localizations obtained were as follows: $7.6\text{m} \pm 4.6\text{m}$ (perpendicular error $\pm 4.6\text{m}$, parallel error $\pm 7.3\text{m}$) at a bearing of $\pm 122.7^\circ$ at 03:31, $24.9\text{m} \pm 4.2\text{m}$ (perpendicular error $\pm 4.2\text{m}$, parallel error bearing of $\pm 64.2^\circ$ at 03:37, $41.5\text{m} \pm 29.9\text{m}$ (perpendicular error $\pm 29.9\text{m}$, parallel error $\pm 36.4\text{m}$) at a bearing of $\pm 128^\circ$ also at 03:37, and $56.6\text{m} \pm 127.2\text{m}$ (perpendicular error $\pm 127.2\text{m}$, parallel error $\pm 67.5\text{m}$) at $\pm 30^\circ$ at 03:44. Most of the localizations contained high error levels in one or both directions (perpendicular and/or parallel), both with errors 50% or more than the estimated range. The high errors were likely tracking only a few (less than 20) clicks from trains of short durations and of small bearing changes. However, even the most conservative range estimates from the localizations place the dolphins within the 50 zone. Whistle amplitudes measured during playback in Raven ranged from 89-107dB (average 99dB). Click amplitudes ranged from 129-160dB (average 146dB) and were obtained from the amplitude/time display frequency click detector. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Whistle bearings were determined by selection of the tones using the clip generator evaluation of the resulting bearing line overlay on the map display, while click bearings were obtained from the high frequency bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras (the dolphins were likely outside the cameras' panning range (limited due to obstruction of the stern by the bridge wings) with the localization indicating the dolphins were astern of the vessel). The shallow penetration sub-bottom profiler (chirper), multi-beam echosounder, and USBL were active at the start of the acoustic detection. The sparker was 03:27, 29 minutes after the start of the detection. Mitigation was not required.</p>
528	<p>A short detection event consisting of a high frequency dolphin click train at 06:24 UTC, followed by a single 1.3s upsweep dolphin whistle (10.4-18.2kHz) at 06:25. Clicks were observed in a 12s click train that bearing change from $\pm 25^\circ$ to $\pm 97^\circ$ relative to the hydrophone array. Individual clicks from the click train were tracked, with their bearings plotted on the map display to produce a localization using target motion (least squares algorithm) of $7\text{m} \pm 0.8\text{m}$ (perpendicular error $\pm 0.8\text{m}$, parallel error 0.4m) from a bearing of $\pm 65^\circ$ relative to the hydrophone array. Click frequency ranged from 20-100kHz and contained a single peak at 36kHz. Amplitudes to detected clicks ranged from 129-140dB (135 average). A whistle amplitude of 102dB was measured during playback in Raven. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. A bearing to the detected whistle was not obtained. Click bearings were obtained from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras (the dolphins were likely outside the cameras' panning range (limited due to obstruction of the bridge wings) with the localization indicating the dolphins were astern of the vessel). The two sub-bottom profilers (chirper and sparker), multi-beam echosounder, and USBL were active at the time of the acoustic detection. Mitigation was not required.</p>
529	<p>Multiple brief (approximately 3-10s length) high frequency click trains were detected between 08:03-08:05 UTC on the HF click bearing time display. These click trains were detected in bearing ranges $\pm 20-40^\circ$, $\pm 55-65^\circ$, with only small changes in bearing of $< 20^\circ$ from start to end of each train. Several buzzes were also visible on the HF spectrogram display. Operator was unable to localize due to the short length of click trains and overall detection. Observed HF click amplitudes (relative amplitude only, not corrected by a calibration factor) were in the range of 135-160dB. Observed HF click frequencies were in the range of 20-138kHz, around 20-40, 80-100, and 120kHz. Due to observed clicks in excess of 100kHz, the dolphins were believed to be within the exclusion zone at some point during the detection. The detection was not correlated with a visual sighting by PSO on thermal camera watch at the time, and no mitigation was required. Multibeam echosounder, Sub-bottom profiler, Sparker, and USBL were the active sound sources during the detection, recording the exclusion zone. All bearings are listed as $\pm xyz^\circ$ to indicate left/right ambiguity.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
530	<p>Dolphin whistles (7-21kHz) were aurally and visually detected at 09:20 UTC. Whistles were intermittent for the first 3 minutes of the detection event, but became more regular from 09:23 to 09:25. Clicks (20-120 kHz peak around 85kHz) were also detected during the bout of increased acoustic activity. Whistles became intermittent again after 09:25 and were last detected at 09:26. Upsweep, downsweep, and concave whistle were observed. Whistle amplitudes measured during playback in Raven ranged from 81-112dB, with an average of 99dB. Up to the first harmonic was visible for a few of the higher intensity whistles. Bearings to whistles with the clip generator were concentrated near $\pm 50^\circ$ relative to the hydrophone array at the start of the detection and were observed around $\pm 85-90^\circ$ near the end of the detection. Clicks were initially detected at $\pm 30-38^\circ$, where they remained for a 10s period before gradually increasing (over 15s) to a final bearing of $\pm 109^\circ$. Individual clicks from the click train were tracked, with their bearings plotted on the map display localization using target motion analysis (TMA least squares algorithm) of $8.8m \pm 1.5m$ (perpendicular error $\pm 1.5m$, parallel error 0.9m) from a bearing of $\pm 120^\circ$ relative to the hydrophone array (at 09:24). Click localization obtained from the high frequency click detector bearing/time display. Click amplitudes recorded from the high frequency click detector amplitude/time display ranged from 128-143dB (average of 137dB). Amplitudes are relative received amplitudes that have not been corrected by a calibration factor. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with sighting on the IR cameras (the dolphins were likely outside the cameras' panning range (limited due to obstruction of the stern by the bridge wings) with the localization indicating the dolphins were astern of the shallow penetration sub-bottom profiler (chirper), multi-beam echosounder, and USBL were active at the start of the acoustic detection. The sparker was activated at 09:23, 3 minutes after the start of the detection was not required.</p>
531	<p>Dolphin whistles (7-20.7kHz) were aurally detected and visually observed on the mid-frequency spectrogram display at 00:05 UTC. Whistles were intermittent for the first 20 minutes of the detection, with whistle short periods of activity (<20s) between short (<2 minutes) breaks in whistle activity, but became more regular after 00:25. Upsweep, downsweep, constant frequency, concave, chirp, and sinusoidal whistle types were observed. Some concave whistles contained sharper inflections that gave them a squared look. Bearings to whistles selected with the clip generator ranged between $\pm 10^\circ$ and $\pm 88^\circ$ (relative to the array) throughout the 51 minute detection event. Whistle amplitudes measured during playback in Raven ranged from 92-111dB, with an average of 100dB. Up to the first harmonic was visible for a few of the whistles. Whistles became quite faint at 00:41 and were no longer observed on the mid-frequency spectrogram. Aural detection of the faint whistles continued though to the end of the acoustic event at 00:56. Dolphin clicks (15-140kHz with single peaks at 25-30kHz, 32-36kHz, or 65-70kHz) were first detected at 00:13, with a buzz detected at 00:30. Most click trains were observed in short bouts of click activity concentrated at bearings between $\pm 20-40^\circ$ (relative to the hydrophone array), however some clicks were observed between $\pm 70-102^\circ$. Click bearings were obtained from the high frequency click detector bearing/time display. Individual clicks from four click trains were tracked, with their bearings plotted on the map display to produce localizations via target motion analysis (TMA with least-squares algorithm). Localizations obtained were $182.3m \pm 36.2m$ (perpendicular error $\pm 36.2m$, parallel error not available) at a bearing of $\pm 90^\circ$ at 00:13, $10.2m \pm 14.6m$ (perpendicular error $\pm 14.6m$, parallel error $\pm 23m$) at a bearing of $\pm 69^\circ$ at 00:15, $89.5m \pm 22.2m$ (perpendicular error $\pm 22.2m$, parallel error $\pm 2.9m$) at a bearing of $\pm 3^\circ$ at 00:16, and $20.7m \pm 99.4m$ (perpendicular error $\pm 99.4m$, parallel error $\pm 177m$) at a bearing of $\pm 119^\circ$ at 00:26. Two of the localizations contained error levels in one or both directions (perpendicular and/or parallel), with errors 50% or more than the estimated range. The high errors were likely the result of tracking only a few (less than 10) clicks from train durations and of small bearing changes. However, even the most conservative range estimates from the localizations place the dolphins within the 500m exclusion zone. Click amplitudes recorded from the high frequency click detector amplitude/time display ranged from 121-151dB (average of 136dB). Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras. The two sub-bottom profilers (chirper and sparker), multi-beam echosounder, and USBL were active at the start of the acoustic detection. Mitigation was not required.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
532	<p>A short detection event consisting of two slightly upsweep dolphin whistles (14.4-14.6kHz) were aurally and visually detected on the mid-frequency spectrogram at 01:45 UTC. Whistle amplitudes were measured during playback in Raven ranged from 80-90dB, with an average of 85dB. Bearings to whistles selected with the clip generator were concentrated near $\pm 93^\circ$ relative to the hydrophone array at the start and end of the detection (due to the short duration of the detection). The acoustic detection was not correlated with a visual sighting on the IR cameras. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. All bearings are provided as \pm some value to account for left/right ambiguity. The shallow penetration sub-bottom profiler (chirper), multi-beam echosounder, and USBL were active at the start of the acoustic detection. The sparker was activated at 01:46, about 1 minute after the start of the detection. Mitigation was not required.</p>
533	<p>A series of downsweep dolphin whistles were aurally and visually detected on the mid-frequency spectrogram at 02:34 UTC. Initial bearings to detected whistles were variable, ranging from ± 36-52° relative to the hydrophone array. Whistle amplitudes measured during playback in Raven ranged from 136-148dB (average 142dB). Whistles were last detected at 02:41 UTC, however, final bearings were not obtained. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Whistle bearings at the start of the detection were determined by selection of the tones (7 whistles were selected for analysis) using the bearing line overlay on the map display. All bearings are provided as \pm some value to account for left/right ambiguity. The shallow penetration sub-bottom profiler (chirper), sparker, multi-beam echosounder, and USBL were active at the start of the acoustic detection. Mitigation was not required.</p>
534	<p>Multiple high frequency dolphin click trains composed of clicks containing energy between 15-80kHz and with a single peak 20-36kHz were observed on the high frequency click detector between 03:08 and 03:10 UTC. Click amplitudes ranged from 121 to 158dB, with an average of 143dB. Most click trains were short and exhibited small changes in bearings of 10-20°, while one train's bearings changed 121°. Bearings to this click train changed from ± 20-40° over approximately 35s before they began to rapidly increase over 5s to a final bearing of $\pm 141^\circ$. Individual clicks from this train were manually tracked and bearing lines plotted to produce a localization (via target motion analysis with the least squares algorithm) of 10.9m \pm 0.6m (perpendicular error \pm 0.6m, parallel error \pm 0.3m) from a bearing of $\pm 110^\circ$ (at 03:10). Clicks from three additional trains were tracked following localizations: 7.3m \pm 1.4m (perpendicular error \pm 1.4m, parallel error \pm 1.2m) at a bearing of $\pm 60^\circ$ at 03:08, 7.2m \pm 3.5m (perpendicular error \pm 3.5m, parallel error \pm 1.8m) at a bearing of $\pm 147^\circ$ at 03:09, and 4.6m \pm 4.6m (perpendicular error \pm 4.6m, parallel error \pm 2.5m) at a bearing of $\pm 145^\circ$ also at 03:09. Click amplitudes and bearings were obtained from the high frequency click detector amplitude/time and bearing/time display. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required.</p>
535	<p>High frequency dolphin clicks with two distinct frequency ranges, 60-120kHz with a single peak 88-90kHz and 15-50kHz with a single peak 25-36kHz, were observed on the high frequency click detector between 04:43 and 04:44 UTC. In addition to difference in frequency, the waveforms from the first click type contained more oscillations than the second type. The higher frequency clicks were detected first, from bearings between ± 30-37° relative to the hydrophone array, with the second frequency type detected 20s later and from bearings between ± 30-37°. Additional clicks of the second type (15-50kHz) were detected in short bouts (most with changes) throughout the acoustic event from bearings between ± 40-65° and ± 41-103° from a single train at 04:43. Individual clicks from the train at 04:43 were manually tracked and bearing lines plotted, but a localization was not produced. The terminal buzz from an echolocation click train was observed at the end of the acoustic event at 04:44. Click amplitudes recorded from the high frequency click detector amplitude/time display ranged from 116-151dB (average of 140dB) for both click types. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m). Mitigation was not required for the dolphin detection.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
536	<p>A short detection event consisting of high frequency dolphin clicks between 05:07 to 05:09 UTC, ending with a 1s high amplitude (123dB) concave dolphin whistle (5.7-19kHz). A terminal buzz was detected at echolocation click train at 05:07. Up to the 5th harmonic was observed for the whistle. Clicks were first observed in bouts of short click trains around $\pm 28^\circ$ to $\pm 40^\circ$ relative to the hydrophone array. Two longer bearing changes were observed at the end of the detection. The first train exhibited a bearing change from $\pm 110^\circ$ to $\pm 137^\circ$ over 10s, while the second train changed from $\pm 124^\circ$ to $\pm 141^\circ$. Individual clicks from were tracked, with their bearings plotted on the map display to produce a localization using target motion analysis (TMA with least squares algorithm). The localizations were as follows: 7.3m \pm 1.5m (perpendicular error 2.4m) from a bearing of $\pm 125^\circ$, 2.4m \pm 1.5m (perpendicular error \pm 1.5m, parallel error 2m) from a bearing of $\pm 59^\circ$, 11.2m \pm 2m (perpendicular error \pm 2m, parallel error 1.1m) from a bearing of $\pm 151^\circ$, 1.4m \pm 1.4m (perpendicular error \pm 1.4m, parallel error 1.1m) from a bearing of $\pm 142^\circ$. Click frequency ranged from 15-100kHz and contained a single peak between 32-36kHz or 70-75kHz. Amplitudes to detected c from 124-156dB (139dB average) and were estimated from the high frequency click detector amplitude/time display. Whistle amplitude was measured during playback in Raven. Amplitudes provided are relative amplitudes that have not been corrected by a calibration factor. A bearing to the detected whistle was not obtained. Click bearings were obtained from the high frequency click detector bearing/time display. All provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras (the dolphins were likely outside the cameras' panning range (in obstruction of the stern by the bridge wings) with the localizations indicating the dolphins were astern of the vessel). The shallow penetration sub-bottom profiler (chirper), multi-beam echosounder, and USBL were used at the time of the acoustic detection (EZ 500m). Mitigation was not required.</p>
537	<p>High frequency dolphin clicks (15-120kHz with single peaks of 25-30kHz or 80-90kHz) were detected on the click detector between 05:25 and 05:35 UTC. Click activity was highest at the start and end of the acoustic detection with clear click trains and bearing changes observed. Bearings to detected clicks were concentrated near $\pm 20^\circ$ relative to the hydrophone array at the start of the detection. A click train with a slight gradual bearing change from ± 70-90° (over 25s) was observed at 05:26. Individual clicks from this train were manually tracked and localized using target motion analysis (TMA with least squares algorithm) to 34.4m \pm 28.7m (perpendicular error \pm 28.7m, parallel error 3.2m) from a bearing of $\pm 7.3^\circ$. Intermittent clicks from variable bearings were observed for 7 minutes, after which time another click train with a bearing change from ± 18-51° over 12s was observed. The second train was localized to 3.6m \pm 1.1m (perpendicular error \pm 1.1m, parallel error 1m) from a bearing of $\pm 129^\circ$. The first localization contained high error in the perpendicular direction, possibly the result of the first bearing (10) being selected over the relatively long duration of the click train. However, even with the most conservative range estimate (63.1m), the dolphins were localized within the 500m exclusion zone. Click amplitudes from the high frequency click detector amplitude/time display ranged from 127-158dB with an average of 142dB. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m). Mitigation was not required.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
538	<p>Faint dolphin whistles (7.3-14.4kHz) were aurally and visually (on the mid-frequency spectrogram) detected at 06:07UTC. Upsweep, constant frequency, concave, and chirp whistle types were observed intermittently to the end of the detection at 06:21. Many convex whistles contained squared edges, instead of smooth, at the inflection points. Whistle amplitudes were estimated during playback in Raven and ranged from (average 97dB). Bearings to whistles were not acquired. High frequency clicks, which were first detected at 06:08, were the dominant vocalization type recorded. The dolphin clicks (15-100kHz with single peak 30kHz) were detected primarily in short click trains (<5s) from relatively consistent bearings between ± 20-30° relative to the hydrophone array (at 06:08), ± 37-40° (at 06:16), and ± 50-75° (from 06:18 to the end of the detection at 06:21). Few click trains exhibited bearing changes of more than $\pm 10^\circ$. Clicks from seven trains were manually tracked in the high frequency bearing/time display, with their bearings plotted to produce localization motion analysis (TMA with least squares algorithm). Three of the seven localizations were thrown out due to extremely high error values (one with perpendicular error of 1km). Localizations for the remaining four are as follows: 11.4m ± 20.6m (perpendicular error ± 20.6m and parallel error ± 41.9m) from a bearing of $\pm 65^\circ$ relative to the hydrophone array at 06:08, 9.7m ± 2.4m (perpendicular error ± 2.4m, parallel error 4.8m) from a bearing of $\pm 114^\circ$ at 06:10, 35.6m ± 11.1m (perpendicular error ± 11.1m, parallel error 4.8m) from a bearing of $\pm 149^\circ$ at 06:20, and 35.9m ± 2.8m (perpendicular error ± 2.8m, parallel error 0.98m) from a bearing of $\pm 149^\circ$ at 06:20. Received click amplitudes estimated from the amplitude/time display ranged from 117-160dB (average 148dB). Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras. The survey team was in the process of recovering the geophysical equipment due to weather at the time of the acoustic detection. The chirper, multi-beam echosounder, and USBL remained active throughout the recovery (EZ 500m). Mitigation was not required.</p>
539	<p>Faint dolphin whistles (8.8-17.9kHz) were aurally and visually detected over a 11 minute period from 06:43 to 06:54 UTC. Chirp, downsweep, constant frequency, and sinusoidal whistle types 0.2-1.3s in duration were observed. Whistle amplitudes were measured during playback in Raven and ranged from 84-108dB (average of 97dB). Bearings to observed whistles were not acquired. Short bouts of clicks were detected between $\pm 120^\circ$ relative to the hydrophone array at 06:50. These clicks did not form clear click trains, however, and were therefore not tracked to produce a localization. Clicks contained energy between 15-100kHz and single peak of 25-32kHz. Click amplitudes were not acquired. Weather conditions were deteriorating at the time of the acoustic detection. The swells were building, which generated noise on the hydrophone array and an unstable deployment (cable appeared to be moving up and down with the swell). The weather conditions may have impeded the detection of click trains or made clicks from trains appear disjointed due to the noise. The acoustic detection was not correlated with a visual sighting on the IR cameras. The shallow penetration sub-bottom profiler (chirper), multi-beam echosounder, and USBL were active at the time of the detection (EZ 500m). The survey team was in the process of recovering equipment due to inclement weather. Mitigation was not required for the acoustic detection. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. All bearings are provided as \pm some value to account for left/right ambiguity.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
540	<p>detection, with some gaps up to 60s. Multiple click trains were observed at variable bearings, ranging between ± 20-160 (left/right ambiguity). Some of these trains were at near constant bearing or had minimal bearing changes $< 20^\circ$, while others displayed rapid changes up to 135°. At times multiple click trains were simultaneously detected, indicating the presence of multiple individuals. Click train duration ranged from approximately 10-30s (some of the longer ones had slight gaps, but appeared to be from the same individual). Frequency range of observed HF dolphin clicks was variable from 11-160kHz, with variable peak frequencies ranging 20-40kHz. The lower frequency portion of observed dolphin clicks were consistently visible on the MF spectrogram display, as well as during playback of low frequency (LF) recordings (using Raven software). Occasional buzz was audible and visible on the MF spectrogram, as well as during playback of LF recordings (using Raven software). Amplitudes of observed HF dolphin clicks were in the range of 128-162dB. Exact distance estimates were unsuccessful: either yielded a large margin of error, or operator was not fast enough to obtain the distance info in a timely manner (was particularly difficult as operator was in communication with survey vessel during operations/recovery for weather, during the detection). However, some attempts to localize HF clicks yielded results within the exclusion zone (EZ) that were visible on the map display, even at the farthest edge of the EZ. Based on these localizations (although not exact), as well as peak click frequencies above 80kHz, it is suspected that the dolphins were within the EZ at some point during the detection. Whistles were also detected (visually and aurally) on the MF spectrogram display. From 07:22-07:29, intermittent faint (SNR 1) whistles were detected. Whistle activity increased from 07:32-07:35, with more frequent and slightly louder (SNR 2) whistles detected. Upsweep, downsweep, and convex whistles 0.3-1.5s in duration were detected, from 6.9-19.1kHz, with occasional 2nd level harmonics observed. Whistle amplitude, measured through playback in Raven, was approximately 140-150dB. No mitigation was requested.</p>
057	<p>sight of them beneath the boat. One dolphin was sighted on the starboard side bow, swimming the same direction of the vessel, porpoising. The approach was determined by the PSO to be voluntary; no mitigation was requested.</p>
058	<p>At 12:00 (UTC) about 10 dolphins were sighted approximately 100m from the bow of the vessel swimming toward the vessel at the surface. A number of dolphins were sighted breaking the surface as they traveled toward the vessel riding through the crest of a wave. Once closer to the vessel they traveled slightly from portside under the bow to starboard side of the vessel. At 12:56 (UTC) three dolphins were sighted bow riding on the portside. By 13:00 (UTC) just one was seen bow riding along the starboard side. At 13:01, two dolphins were sighted bow riding the starboard side. At 13:04 (UTC) two dolphins were sighted once again swimming under. A few minutes passed before one dolphin was sighted on the starboard side bow at 13:08. The final sighting of a single dolphin along the portside bow was at 13:11. Approach was determined by the PSO to be voluntary; no mitigation was requested.</p>
059	<p>At 13:53 (UTC) 2-4 Common dolphins were sighted off the starboard bow, swimming just beneath the surface of the water (animal heading 12:00 using clockface). PSO quickly lost sight of them after they swam away from the bow. The dolphins may have been bowriding, but PSO was unable to determine due to length of sighting and current weather conditions/sea state. Only the MBES was active at the time of the sighting (EZ=200m) being used as a depth sounder for navigation. No mitigation was necessary due to voluntary approach behavior and length of sighting.</p>
060	<p>Common dolphins were observed porpoising as they travelled along the starboard side of the vessel at mid-ship at 02:00. The dolphins were observed breaking the surface at distances between 2 and 10m off the starboard side. The dolphins were travelling in the same direction as the vessel and were last observed along the same trajectory toward the bow at 02:05. The PAM operators spotted the dolphin while positioning the starboard arm in preparation for PAM deployment. The unaided night sighting was not correlated with a camera sighting nor where the dolphin detected acoustically once PAM was deployed (16 minutes had, however, elapsed since the last sighting when PAM began). The survey crew was preparing to deploy the geophysical equipment when the dolphins were observed. The multi-beam echosounder was active (EZ 200m), however no mitigation was required since the dolphin were observed within the zone for less than 10 minutes and their approach was deemed voluntary.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
541	<p>High frequency dolphin clicks containing energy between 15-100kHz and with a single peak at 25-32kHz or 50-55kHz were observed on the high frequency click detector at 04:41 UTC. Bearings to the detected clicks remained between ± 23-25° relative to the hydrophone array on first detection, with no clear click trains visible. Two click trains, one with a gradual change in bearings and a second with a rapid change in bearings, were identified in the bearing/time display at 04:42. The first click train had an initial bearing of $\pm 36^\circ$ that gradually increased to a final bearing of $\pm 56^\circ$ over a 15s period, while bearings for the second click train changed from $\pm 70^\circ$ over less than 5s. Individual clicks from the two click trains were tracked, with their bearings plotted on the map display to produce localizations via target motion analysis (TMA with least squares algorithm). The first tracked click train produced a localization of $29.3\text{m} \pm 3.2\text{m}$ (perpendicular error $\pm 3.2\text{m}$, parallel error 2.4m) from a bearing of $\pm 52^\circ$ relative to the hydrophone array. The dolphin from the second tracked click train produced a localization of $14.2\text{m} \pm 6.1\text{m}$ (perpendicular error $\pm 6.1\text{m}$, parallel error 2.6m) from a bearing of $\pm 149^\circ$. A 4 minute break in acoustic activity was observed between the last detection of clicks at 04:42 and the first detection of whistles at 04:46. Upsweep dolphin whistles (8.4-13kHz, 1s duration) were regularly detected for 3 minutes before whistle activity became less frequent and fainter. No other whistle types were observed. Bearings to whistles were not determined during the acoustic event. Click bearings were measured from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m). Mitigation was not required.</p>
542	<p>Dolphin clicks containing energy between 15-115kHz and with a single peak at 27-32kHz or 50-55kHz were observed on the high frequency click detector at 05:40 UTC. Initial bearings to the detected clicks ranged from $\pm 67^\circ$ to $\pm 58^\circ$ (relative to the hydrophone array) over 20s. Manual click tracking and analysis of bearing changes over time (target motion analysis using least squares algorithm – TMA) produced a localization of $36.9\text{m} \pm 36.9\text{m}$ (perpendicular error $\pm 36.9\text{m}$, parallel error $\pm 14.8\text{m}$) from a bearing of $\pm 22^\circ$ relative to the hydrophone array. Click activity continued through to the end of the detection event at 05:49, with one additional click train tracked and localized ($9.3\text{m} \pm 2\text{m}$ (perpendicular error $\pm 2\text{m}$, parallel error $\pm 3.7\text{m}$) from a bearing of $\pm 69^\circ$) as the detection came to completion. Bearings for the final click train at 05:49 rapidly changed from $\pm 20^\circ$ to $\pm 55^\circ$. In addition to frequent clicks, dolphin whistles were detected for a brief period at 05:42. Chirp, constant frequency, and downsweep whistles 0.2-0.5s in duration and ranging in frequency from 9.3-15kHz were detected. Whistle amplitudes, which were estimated during playback in Raven, ranged from 102-113dB (average of 107dB). Click amplitudes ranged from 121-146dB with an average of 132dB. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Bearings to detected whistles were not determined during the acoustic event. Click bearings were measured from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m). Mitigation was not required.</p>
543	<p>A short detection event consisting of high frequency dolphin clicks and dolphin whistles between 06:03 to 06:07 UTC. Five short click trains were observed during the 3 minute detection event, including three that produced localizations. Clicks were primarily observed in bouts of short click trains less than 15s in duration, however one longer train was observed over 32s during which time the bearings changed from $\pm 29^\circ$ to $\pm 176^\circ$. Despite manual tracking of individual clicks contained within the longer train, a localization was not produced. However, localizations for three other click trains were determined using manual tracking and target motion analysis (TMA with least squares algorithm). The localizations were as follows: $24.3\text{m} \pm 3.5\text{m}$ (perpendicular error $\pm 3.5\text{m}$, parallel error $\pm 1.8\text{m}$) from a bearing of $\pm 29^\circ$ relative to the hydrophone array at 06:03; $24.3\text{m} \pm 6.3\text{m}$ (perpendicular error $\pm 6.3\text{m}$, parallel error $\pm 3.4\text{m}$) from a bearing of $\pm 161^\circ$ at 06:04; and $23.1\text{m} \pm 9.1\text{m}$ (perpendicular error $\pm 9.1\text{m}$, parallel error $\pm 1.9\text{m}$) from a bearing of $\pm 176^\circ$ also at 06:04. Terminal buzzes were observed at the end of echolocation click trains at 06:04 and 06:05 (twice). Overall bearings to detected clicks ranged from $\pm 58^\circ$ to $\pm 127^\circ$, with a progression of increasing bearings over the course of the detection (hydrophone moving away from the source). Constant frequency 12kHz dolphin whistles were detected at 06:04 and 06:07. Whistles were short (0.3-0.6s in duration) and had received amplitudes between 100-102dB. Click amplitudes ranged from 14-120kHz and contained a single peak around 36kHz or between 70-75kHz. Amplitudes to detected clicks ranged from 122-156dB (138dB average) and were estimated from the high frequency click detector bearing/time display. Whistle amplitude was measured during playback in Raven. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Bearings to the detected whistles were not obtained. Click bearings were obtained from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m). Mitigation was not required.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
544	<p>Multiple high frequency dolphin click trains composed of clicks containing energy between 15-100kHz and with a single peak 25-35kHz were observed on the high frequency click detector between 06:47 and 07:18. Click amplitudes ranged from 119 to 162dB, with an average of 136dB. Most click trains were observed between $\pm 40-70^\circ$ relative to the hydrophone array, however a few click trains were observed around $\pm 14-25^\circ$ extended down to $\pm 104^\circ$. Bearing changes were quite rapid for nearly all click trains observed, with changes from as little as 6° over 5s to as large as 77° over 30s. Dolphin whistles were also detected throughout the acoustic event (last detected at 06:55). Whistle activity was more intense during the first five minutes of the detection event. Concave, convex, downsweep, upsweep, and sinusoidal whistles ranging in frequency from 15-18.8kHz were observed primarily at bearings between $\pm 10-12^\circ$. Received whistle amplitudes, which were measured during playback in Raven, ranged from 88-117dB (104dB average). Click amplitudes and bearings were obtained from the high frequency click detector amplitude/time and bearing/time displays. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. All bearings are \pm some value to account for left/right ambiguity. The GPS received its last fix more than 20 minutes before the detection event began, with the vessel's position updated approximately 15 minutes after the detection event was complete. Lack of GPS data prevented a precise localization, however bearings from tracked clicks continued to be displayed on the map over their observed time series. Clear cross bearings were observed at 07:00, zoomed in on, appeared to place the dolphins well within the 500m exclusion zone. The detection event began at 06:47 UTC during Rebecca Snyder's acoustic monitoring shift and was complete at the start of Horwell's monitoring shift at 07:00. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (10:00). No mitigation was required.</p>
545	<p>High frequency, sinusoidal with sharp peaks/valleys, and combination), in the range of 6-18.8kHz, with occasional 2nd level harmonics present. Relative amplitudes (not corrected by calibration factor), determined through playback in Raven, were in the range 82-98dB, and SNR was primarily 1 (max 2). Bearings were not obtained for whistle activity. Three brief sections of high frequency (HF) click activity were observed, at 07:30, 07:56. Peak activity was at 07:32 (time of CPA), with 3 click trains (two of approx. 2-4s duration, and one of approx. 20s duration) detected at bearings $\pm 40-50^\circ$ and $\pm 105-115^\circ$, with only small bearing changes ($< 1^\circ$). One click train (07:32) was localized (plotted on map using target motion analysis) inside the exclusion zone [113m \pm 95m (95.2m perpendicular error, 20.2m parallel error)] at bearing $\pm 168.1^\circ$. Additional scattered clicks were detected at 07:43 (bearing $\pm 24-26^\circ$) and 07:56 (bearing $\pm 26-30^\circ$), but with no noticeable click trains present. Frequencies of observed HF dolphin clicks were in the range of 20-130kHz with peaks around 100kHz. Relative amplitudes (not corrected by calibration factor) of observed HF dolphin clicks were in the range of 125-160dB. Localization combined with observed HF click frequency led operator to believe dolphins were within the exclusion zone (500m). All HRG survey equipment < 200kHz was active for the duration of the detection: Multibeam echosounder, USBL, sub-bottom profiler, and sparker. This detection was not correlated with a visual sighting, and no mitigation was required. All times indicated are in UTC format. All bearing are described as "\pm" to indicate left/right ambiguity.</p>
546	<p>High frequency (HF) dolphin clicks were briefly detected on the HF click detector at 08:53 UTC, with the detection lasting less than 1 minute. One ~ 10s click train (used for localization) was observed at bearing $\pm 168.1^\circ$ with some scattered clicks at bearing $\pm 20-40^\circ$. The one click train was localized and plotted on the map using target motion analysis, and yielded an estimate (most conservative) of 70m \pm 37m at a bearing of $\pm 168.1^\circ$. Observed click amplitudes were in the range of 125-160dB, and frequencies in the range of 20-120kHz (peaks 30-40kHz, and 80-90kHz). Localization combined with observed HF click frequency led operator to believe dolphins were within the exclusion zone (500m). All HRG survey equipment < 200kHz was active for the duration of the detection: Multibeam echosounder, USBL, sub-bottom profiler, and sparker. This detection was not correlated with a visual sighting, and no mitigation was required. Bearings are given as \pm to indicate left/right ambiguity.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
547	<p>A short detection event consisting of high frequency dolphin clicks from 09:53 to 09:56 UTC. Click trains were observed in short bouts, with two distinct trains detected between $\pm 91-94^\circ$ and $\pm 22-98^\circ$ at 09:54 respectively. Individual clicks from the two click trains were tracked, with their bearings plotted on the map display to produce localizations via target motion analysis (TMA with least squares algorithm). The first train produced a localization of $70\text{m} \pm 123.5\text{m}$ (perpendicular error $\pm 123.5\text{m}$, parallel error $\pm 4.9\text{m}$) from a bearing of $\pm 178^\circ$ relative to the hydrophone array. The dolphin from the second tracked click train was $15.8\text{m} \pm 11.8\text{m}$ (perpendicular error $\pm 11.8\text{m}$, parallel error $\pm 4\text{m}$) from a bearing of $\pm 156^\circ$. The first localization contained a high degree of error in the perpendicular direction. The high error was likely the result of a few (less than 10) clicks from a train of short duration ($<5\text{s}$) and over a small bearing change (3°). However, even the most conservative range estimate, 193.5m, places the dolphins within the exclusion zone. The frequency ranged from 15-120kHz and contained a single peak around between 28-36kHz or 80-85kHz. Amplitudes to detected clicks ranged from 126-153dB (139 average). The acoustic detection was not confirmed by visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided are relative received and have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for left/right error.</p>
061	<p>At 11:37 (UTC), one bushy blow was sighted just off the portside bow at a distance of approximately 2420m (2 reticles). Over the next hour and a quarter, blows were sighted every one to three minutes, with some between blows being upwards of 15 minutes. The general direction of travel of the whale was from the just left of the portside bow, across the bow to the starboard side and then parallel in the opposite direction. The closest point of approach was just off the starboard side bridge at about 400m at 12:04 (UTC). The animal did not appear to be moving very quickly as there was not much distance covered between blows time between blows. A number of blows could be seen in the same relative area that did not require great adjustments to one's gaze in order to track the animals movement. There were 22 blows sighted between sighting at 11:37 (UTC) and the last at 12:53 (UTC). The last blow sighted at 12:53 (UTC) was accompanied by a small splash. This last blow was off the starboard stern, at about 5 o'clock at approximately 12' vessel. No other distinguishing characteristics other than a low bushy blow were able to be identified. Vessel was on weather standby for the duration of the sighting. The only active sound source at the time was the multibeam echocounder, being used for navigational purposes only, therefore the exclusion zone was 200m. No mitigation was necessary (animal did not enter the EZ).</p>
062	<p>At 14:15 UTC, one large blow was sighted on the port side, mid ship at approximately 600m (1 reticle). Blows were sighted every 1-3 minutes between 14:15 and 15:02, averaging about 2 minutes between blows. At the closest point of approach, at 14:19 UTC, the whale's dorsal surface could be observed as it appeared to roll and dive and the dorsal fin could be seen. Due to the large blows, position of the dorsal fin, and absence of any dorsal bumps, the whale was presumed to be a fin whale. The whale appeared to be traveling slowly due to the short distances between blows--first parallel to the vessel in the opposite direction away from the mid-ship and then away from the stern. The whale was last observed off the stern of the vessel at ~2424m (1 reticle) at 15:02 and appeared to be traveling away from the vessel toward the horizon. Mitigation was requested due to the animal being outside the exclusion zone (200m) for the duration of the sighting. The Discovery was on weather delay for the duration of the sighting. The only active source was the echosounder, being used for navigational purposes only.</p>
063	<p>sighted at 18:22. A total of 8-11 blows were observed. The animal did not appear to be moving quickly or travelling in any particular direction, although it's general direction of travel was away from the starboard and slightly towards the stern (animal heading NNE). The closest point of approach was at 18:18, marked by a blow at about 600m - 700m from the starboard side. At 18:20 after a blow, the dorsal body surface and dorsal fin (profile view) was viewed through binoculars, confirming the species ID. No mitigation was requested due to the animal being outside the exclusion zone (200m) during the entire duration of the sighting. Mitigation was requested due to the animal being outside the exclusion zone (200m) for the duration of the sighting. The Discovery was on weather delay, and only the MBES was active for navigational purposes (no other source activity).</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
548	<p>A slightly downswept dolphin whistle (11.1-9.9kHz) was aurally and visually (on the mid-frequency spectrogram) detected from a bearing of $\pm 11^\circ$ relative to the hydrophone array at 03:13 UTC. High frequency clicks were observed on the high frequency click detector bearing/time display 3 minutes after the whistle detection (03:16). Clicks were observed in three short click trains, each 5s or less in duration, over a 3 minute period. The last detected at 03:19. Bearing changes for all three trains were gradual (changes of 2-9° observed). The first train was detected between $\pm 25-27^\circ$, while the remaining two trains were observed between $\pm 80-83^\circ$ respectively. Individual clicks from the three click trains were tracked, with their bearings plotted on the map display to produce localizations via target motion analysis (TMA with least squares algorithm). The first tracked click train produced a localization of 3.8m ± 0.9m (perpendicular error ± 0.9m, parallel error ± 2.5m) from a bearing of $\pm 65^\circ$ relative to the hydrophone array (at 03:16). The dolphins from remaining two trains were localized to 12.5m ± 30m (perpendicular error ± 30m, parallel error ± 57.9m) from a bearing of $\pm 116^\circ$ (at 03:17) and 9.7m ± 2.1m (perpendicular error ± 2.1m, parallel error ± 2.1m) from a bearing of $\pm 116^\circ$. The second localization contained a high degree of error in both the perpendicular and parallel directions. The high error may have been the result of poor click selection during tracking with a few false clicks added to the train. However, even the most conservative range estimate, 70.4m, places the dolphins within the exclusion zone. Click frequency ranged from 15-55kHz and contained a single peak around between 20-25kHz. Amplitudes to detected clicks ranged from 121-150dB (134dB average). A few constant frequency whistles (11kHz) were detected at the end of the detection event at 03:25. Whistle amplitude, which was estimated during playback in Raven, ranged from 101-106dB with an average of 104dB. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display, while whistle bearings were obtained from the clip generator. All bearings are provided as \pm some value to account for left/right ambiguity.</p>
549	<p>A brief detection of a single 0.5s upsweep dolphin whistle (10.7-12.5kHz) from a bearing of $\pm 8.7^\circ$ at 10:59 UTC. Whistle amplitude, which was measured during playback in Raven, was 106dB. No other dolphin whistles were detected. Localization was not possible due to the lack of sufficient bearing data and the brevity of the acoustic event. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Amplitude provided is the relative received amplitude and has not been corrected by a calibration factor. Whistle bearing was obtained by selecting the whistle using clip generator and evaluating the bearing overlay on the map. All bearings are provided as \pm some value to account for left/right ambiguity.</p>
550	<p>A single high frequency dolphin click train composed of clicks containing energy between 20-120kHz and with a single peak between 20-25kHz or 70-75kHz was observed on the high frequency click detector at 12:14. Bearings to detected clicks within the click train ranged from $\pm 95-106^\circ$ relative to the hydrophone array. Click amplitudes ranged from 124 to 141dB, with an average of 137dB. Individual clicks from this train were tracked and localized using target motion analysis (TMA with least squares algorithm) to 414.8m ± 157.7m (perpendicular error ± 157.7m, parallel error 15.9m) from a bearing of $\pm 176^\circ$. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m). Mitigation was not required. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity.</p>
064	<p>At 12:14, a very tall blow was sighted off of the starboard side approximately 4840m from the vessel at about 2 o'clock. The next blow wasn't sighted until 12:16 at which point the individual was more perpendicular to the vessel at about 3 o'clock; maintaining the same distance. Between 12:17 and 12:18 there were a series of 4 blows, and by 12:19 it was determined that there were two whales, as SM sighted two blows at the same time. The whales were last sighted at 12:27, still at an approximate distance of 4840m and off the starboard side of the Fugro Discovery at 3 o'clock. It should be noted that these two whales were in relative proximity to a vessel at the time of the sighting. No mitigation was requested as the animals remained outside of the exclusion zone (500m) for the duration of the sighting. Survey operations were underway during the time of the sighting. USBL, Chirp, Sparker all active. All times indicated are UTC.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
065	<p>At 12:27 UTC, a tall blow was sighted off the starboard side bow, approximately 1210m from the vessel at about 1 o'clock. The animal appeared to remain in the same general location for the duration of the sighting. Approximately 14 blows were sighted, one every 1 to 3 minutes. The closest point of approach was when the individual was last sighted at 13:06, at a distance of 812m (TH) off the starboard bow at 1 o'clock. The animal was requested as the animal remained outside of the exclusion zone (500m) for the duration of the sighting. Survey operations were underway during the time of the sighting with MBES, USBL, Chirp, Sparker.</p>
066	<p>At 12:43 UTC, a relatively tall and slender blow was sighted off the starboard side, approximately 2420m from the vessel, at about 2 o'clock. About 15 blows were sighted until 13:05, at intervals of 30 seconds between blows. Distance to the animal from the vessel remained at approximately 2420m for the duration of the sighting. The general direction of travel was parallel to the Discovery in the opposite direction (i.e., the animal could have remained somewhat stationary, as the Discovery maintained its heading at 3.5kts) with the first blow being sighted at 2 o'clock and the last being slightly more aft at about 4 or 5 o'clock. No request was requested as the animals remained outside of the exclusion zone (500m) for the duration of the sighting. Survey operations were underway during the time of the sighting with MBES, USBL, Chirp, Sparker.</p>
067	<p>At 14:31, two tall elliptical shaped blows were sighted off the starboard side of the Discovery, at a distance of approximately 1624m (1.5 reticles, TH), bearing 2:30. From 14:40-14:43 three similar shaped/sized blows were sighted again off the starboard side, at a distance of approximately 2436m (1 reticle, TH), and bearing 03:00. One additional blow (same shape/size) was sighted at 14:51 off the starboard side, at a distance of approximately 2436m (1 reticle, TH), and bearing 04:00. It is hypothesized the animal dove in between series of blows. No other identifying characteristics could be seen during the sighting. The blows were the characteristic size and shape associated with a Fin whale. All times indicated are UTC, and all bearings indicated are in reference to clockface. All survey equipment operating below 200kHz was in use for the duration of the sighting (multibeam echosounder, USBL, sub-bottom profiler, sparker). No mitigation was required, as the whale did not enter the 500m exclusion zone.</p>
068	<p>At 14:43, a tall elliptical blow was sighted off the starboard bow of the Discovery [bearing 1:00, approximate distance 2420m (1 reticle SB)] by on effort PSO (SB). Two more blows were sighted (14:44-14:45), and the animal presumably dove. Four additional blows (same shape/size) were sighted from 14:54-14:56 off the starboard side, at bearing 03:00, and a distance of approximately 1624m (1.5 reticles TH). One final blow (same shape/size) was sighted at 15:01 off the starboard side, at bearing 03:30, and an approximate distance of 1924m (1.25 reticles TH). The animal was not seen again. No other identifying characteristics could be seen during the sighting. The blows were the characteristic size and shape associated with a Fin whale. All times indicated are UTC, and all bearings indicated are in reference to clockface. All survey equipment operating below 200kHz was in use for the duration of the sighting (multibeam echosounder, USBL, sub-bottom profiler, sparker). No mitigation was required, as the whale did not enter the 500m exclusion zone.</p>
069	<p>At 14:44 UTC, a single tall elliptical shaped blow was sighted off the starboard side of the Discovery [bearing 02:00, distance 609m (4 reticles TH)], before the animal rolled its body and dove. The whale was not seen again. Another sighting was in progress at the time (sighting # 068), so it is possible this individual was seen during that sighting if it travelled a considerable distance away from the vessel after diving, but this could not be confirmed. All survey equipment operating below 200kHz was in use for the duration of the sighting (multibeam echosounder, USBL, sub-bottom profiler, sparker). No mitigation was required, as the whale did not enter the 500m exclusion zone.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
551	<p>Dolphin whistles (10.1-15.4kHz) were intermittently detected over an 8 minute period from 03:49 to 03:57 UTC. Upsweep, downsweep, constant frequency, and chirp whistle types, 0.4-0.6s in duration were observed. Whistles were faint, with received amplitudes between 88-106dB (98dB average) and a few were only aurally detected. Bearings to observed whistles were variable and ranged from $\pm 10-72^\circ$ relative to the hydrophone. Although bearing lines for a few selected whistles were plotted on the map, a localization was not obtained for the event. The bearing lines from the clip generator overlay did not produce a clear point of cross bearing from which to estimate range. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m). Mitigation was not required. Amplitudes provided, which were measured during playback in Raven, are relative received amplitudes that have not been corrected by a calibration factor. Whistle bearings were determined by selection of the tones using the clip generator and evaluation of the resulting bearing line overlay on the map display. All bearings are provided as \pm some value to account for left/right ambiguity.</p>
070	<p>At 15:20 UTC a broad bushy blow was sighted off the starboard side of the Discovery (bearing 2:00 using clockface) at an approximate distance of 609m (4 reticles TH). The blow was followed by a dive. The animal rolled its back, and displayed its fluke during the dive, confirming the species id. PSO was unable to see the dorsal fin, as the whale was heading directly away from the vessel/view of PSO, but the full profile view of the stock was clearly visible. The whale was not seen again, and the sighting lasted less than 10 seconds. The Discovery was beginning a turn to port (away from the animal) for the next survey line at the time of the survey equipment operating below 200kHz was in use for the duration of the sighting (multibeam echosounder, USBL, sub-bottom profiler, sparker). No mitigation was required, as the whale did not enter the 500m exclusion zone.</p>
071	<p>From 18:46-18:48, three tall elliptical shaped blows were sighted off the port side of the Discovery (bearing 08:30), at an approximate distance of 1624m (1.5 reticles, TH). The whale presumably dove as it was 1 minute after the third blow. From 18:55-18:57, four additional blows (same approximate size/shape) were sighted off the starboard side (bearing 08:00), at an approximate distance of 2436m (1 reticle, TH). After the blow, the whale was viewed diving through binoculars. PSO was able to see the animal roll its back before the dive, and a falcate dorsal fin characteristic of a Fin whale. The whale was not seen again after this sighting. All bearings indicated are UTC, and all bearings indicated are in reference to clockface. All survey equipment operating below 200kHz was in use for the duration of the sighting (multibeam echosounder, USBL, sub-bottom profiler, sparker). No mitigation was required, as the whale did not enter the 500m exclusion zone.</p>
552	<p>A series of near constant frequency dolphin whistles, some with a slightly downsweep or shallow concave structure, was aurally and visually (on the mid-frequency spectrogram) detected over a 2 minute period from 21:17 UTC. Whistle frequency was primarily around 12kHz, however some whistles extended down to as low as 11kHz. Bearings to observed whistles were concentrated between $\pm 30-40^\circ$ relative to the hydrophone. Whistle amplitudes ranged from 97-102dB, with an average received amplitude of 100dB. The last few whistles were quite faint and were not visible on the spectrogram display. Although bearing lines for a few selected whistles were plotted on the map, a localization was not obtained for the event. The bearing lines from the clip generator overlay did not produce a clear point of cross bearing from which to estimate range. To estimate range, bearings were also selected to produce a good range estimate. Amplitudes were measured during playback in Raven and are provided as relative received amplitudes that have not been corrected by a calibration factor. Whistle bearings were determined by selection of the tones using the clip generator and evaluation of the resulting bearing line overlay on the map display. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting by the PSOs. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m). Mitigation was not required.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
553	<p>Dolphin upsweep, downsweep, and concave whistles (10.9-17.7kHz) were detected over a 6 minute period from 22:48 to 22:54 UTC. Whistles were intermittent at the start and end of the detection event, with a few observed after breaks in activity of 20-30s, but were consistently detected between 22:51 and 22:53. Bearings to observed whistles were concentrated between $\pm 31-38^\circ$ relative to the hydrophone array, however a few selected whistles were observed from bearings around $\pm 75-78^\circ$ and $\pm 11^\circ$. Whistle amplitudes ranged from 88-102dB, with an average received amplitude of 97dB. Although bearing lines were plotted on the map, localization was not obtained for the event as a clear point of cross bearings was not observed. Amplitudes were measured during playback in Raven and are provided as relative received amplitudes that have not been corrected by a calibration factor. Whistle bearings were determined by selection of the tones using the clip generator and evaluation of the resulting bearing line overlay on the map display. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m). Mitigation was not required.</p>
554	<p>Upsweep and constant frequency dolphin whistles were intermittently detected, both aurally and visually on the mid-frequency spectrogram from 04:50 to 05:09 UTC. Whistle frequency was primarily between 10-14kHz, however some whistles were observed down to 9.3kHz and up to 14.3kHz. Bearings to observed whistles were concentrated between $\pm 31-38^\circ$ relative to the hydrophone array, however a few selected whistles were observed from bearings around $\pm 64^\circ$ near the end of the detection event at 05:06. Whistle amplitudes ranged from 95-103dB, with an average received amplitude of 99dB. A single high frequency dolphin click train containing energy between 18-140kHz and with a single peak between 85-95kHz was observed on the high frequency click detector at 05:09. Bearings to detected clicks within the click train ranged from $\pm 57-111^\circ$ relative to the hydrophone array. Click amplitudes ranged from 131 to 158dB, with an average of 143dB. Individual clicks from this train were manually tracked and localized using target motion analysis (TMA with leapfrog algorithm) to 39.4m ± 2.4m (perpendicular error ± 2.4m, parallel error 0.7m) from a bearing of $\pm 32^\circ$. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was deployed and active at the time of the acoustic detection (EZ 500m) and no mitigation was required. Whistle amplitudes were measured during playback in Raven and click amplitudes were obtained from the amplitude/time bearing display in Pamguard. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display, and whistle bearings were obtained from the clip generator. All bearings are provided as \pm some value to account for left/right ambiguity.</p>
072	<p>At 19:28 UTC a seal was sighted off of the portside perpendicular to the bridge at about 10 o'clock. The seal surfaced with its head visible just briefly before rolling under the surface. The sighting was too brief to distinguish identification characteristics for speciation. The only equipment active at the time of the sighting was the MBES. PSO (TH) requested that the MBES be turned off and it survey obliged. Other equipment was active but not active at the time of the sighting. Vessel was heading towards a survey line, however it was unclear if the shutdown caused a delay of operations.</p>
073	<p>From 20:28-20:30 UTC, three broad bushy blows of variable height were sighted off the port side of the Discovery, at an approximate distance of 4872m (0.5 reticle, TH). The third blow was followed by a dive, and the whale displayed its fluke. The whale was not seen again. Dive and fluking were observed through binoculars, but the whale was too far to be able to see any detail of the edges of the fluke. No other identifying characteristics were observed. Only the multibeam echosounder was active during the sighting. No mitigation was required, as the whale was well outside of the 200m exclusion zone.</p>
555	<p>Faint dolphin whistles were intermittently detected, both aurally and visually on the mid-frequency spectrogram from 23:48 to 00:00 UTC. Upsweep, downsweep, and constant frequency whistle types ranging in frequency from 10-18.4kHz were observed. Whistle amplitudes, which were measured during playback in Raven, ranged from 91-98dB, with an average received amplitude of 94dB. Bearings to observed whistles were not obtained. The acoustic detection was not correlated with a visual sighting on the IR cameras. The multi-beam echosounder was active at the time of the detection (EZ 200m) and survey was in the process of recovering the streamer and sparker. Mitigation was not required. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
556	<p>High frequency dolphin clicks containing energy between 15-100kHz and with a single peak 35-40kHz were observed on the high frequency click detector from 03:17 to 03:18 UTC. Clicks were difficult to identify on the detector's bearing/time display due to an abundance of noise/false clicks, however some clicks were observed at bearings between $\pm 27\text{-}30^\circ$ relative to the hydrophone array. Bearings to these clicks were determined on the position of the tracked clicks marker in the margin of the bearing/time display from clicks that were manually selected and tracked from the amplitude/time display. Once the clicks were identified in the amplitude/time display, additional clicks within the train were manually tracked and localized using target motion analysis (TMA with least squares algorithm) to $13.6\text{m} \pm 2.8\text{m}$ (perpendicular error $\pm 2.8\text{m}$, parallel error 5.6m) from the vessel at $\pm 117^\circ$. Individual click amplitudes, which were determined from the high frequency click detector amplitude/time display ranged from 131-139dB with an average of 135dB. Amplitudes provided are relative amplitudes that have not been corrected by a calibration factor. The acoustic detection was not correlated with a visual sighting on the IR cameras (the dolphins were likely outside the cameras' panning range (obstruction by the bridge wings) with the localization indicating the dolphins were astern of the vessel). The sparker (medium penetration sub-bottom profiler) and multi-beam echosounder were active at the time of the acoustic detection (EZ 500m). Mitigation was not required. All bearings are provided as \pm some value to account for left/right ambiguity.</p>
557	<p>Intermittent high frequency dolphin clicks (15-100kHz with a single peak 35-40kHz) were observed from bearings between $\pm 35\text{-}25^\circ$ relative to the hydrophone array over a one minute period from 04:33 to 04:34 UTC. Received click amplitudes ranged from 129-139dB and averaged 133dB. Although several dolphin clicks were tracked, a localization was not obtained. The GPS received its last fix one minute before the dolphins were detected and the vessel's position was not updated until approximately two minutes after the detection was complete. The lack of GPS data, as well as difficulty in locating a clear point of cross bearings from the map (for manual localization), hindered localization. The acoustic detection was not correlated with a visual sighting on the IR cameras. The multi-beam echosounder and shallow penetration sub-bottom profiler were active at the time of the detection (EZ 500m). Mitigation was not required. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. All bearings are provided as \pm some value to account for left/right ambiguity.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
558	<p>observed until 05:00, just after a peak in acoustic activity at 04:59. In addition to upsweep and downsweep whistles, chirp, sinusoidal, convex, concave, and constant frequency whistle types were also observed 10 minutes of the acoustic detection. Chirp-like whistles were the shortest duration whistle type detected, while sinusoidal whistles were the longest duration (0.05s and 1.5-2s respectively). Overall whistle frequency from 6.2-20.9kHz, however most whistles were observed at frequencies between 12-16kHz. Whistle amplitudes were measured during playback in Raven and ranged from 93-117dB (average 103dB). The highest amplitudes were observed during the peak in acoustic activity at 04:59. The first harmonic was visible for a few of the more intense whistles during this period. Whistles were last detected at 05:00. High frequency whistles which were first detected at 04:51, were the dominant vocalization type recorded. The dolphin clicks (12-120kHz with a single peak between 32-36kHz) were observed in bouts of click activity at 04:51, 04:57, 04:59. As with whistles, click activity peaked between 04:59 and 05:00. Up to seven simultaneous click trains at different bearings (indicating a minimum of seven individuals) were observed during this one minute per acoustic activity. Click trains were detected from relatively consistent bearings between $\pm 30^\circ$ and $\pm 60^\circ$ for most of the acoustic detection, with the majority of trains observed undergoing small bearing changes over 20s periods. However, shorter trains (2-4s) underwent large bearing changes of 22-132° during the peak period of acoustic activity between 04:59 and 05:00. Clicks from these trains were manually tracked on frequency bearing/time display and localized using target motion analysis (TMA with least squares algorithm) to produce range estimates of: 11.6m ± 3.8m (perpendicular error ± 3.8m and parallel error ± 5.2m) from a bearing of $\pm 56^\circ$, 9m ± 1.3m (perpendicular error ± 1.3m and parallel error ± 0.6m) from a bearing of $\pm 134^\circ$, 4.2m ± 0.5m (perpendicular error ± 0.5m - parallel error and bearing not recorded), 2.7m ± 0.3m (perpendicular error and bearing not recorded), and 3.6m ± 0.1m (perpendicular error ± 0.1m and parallel error ± 0.1m) from a bearing of $\pm 106^\circ$. It should be noted that all localizations from 04:59-05:00 were obtained from less than 15 clicks from each train that were selected over short periods of less than 5s. However, the rapid change in bearings observed for these tracked trains supports a close pass of the dolphins by the array. Dolphin clicks were manually tracked and localized for the three additional bouts of click activity at 04:51, 04:57, and 05:03. Range estimates for these trains were as follows: 85.4m ± 451.3m (perpendicular error ± 451.3m and parallel error ± 589m) from a bearing of $\pm 53^\circ$, 12.8m ± 1.2m (perpendicular error ± 1.2m and parallel error ± 1.4m) from a bearing of $\pm 118^\circ$, and 6.5m ± 0.9m (perpendicular error ± 0.9m - parallel error not recorded) at 04:51; 30.4m ± 11.6m (perpendicular error ± 11.6m and parallel error ± 22.5m) from a bearing of $\pm 63^\circ$ and 260.9m ± 151.2m (perpendicular error ± 151.2m - parallel error and bearing not recorded), 14.5m ± 7.8m (perpendicular error ± 7.8m and parallel error ± 6.6m) from a bearing of $\pm 133^\circ$ at 05:03. Some of the localizations contained high error levels in one or both directions (perpendicular and/or parallel errors 50% or more than the estimated range. The high errors were likely the result of tracking only a few (less than 10) clicks from trains of short durations and of small bearing changes. However, even the most conservative range estimates from the localizations place the dolphins within the exclusion zone except for the first localization at 04:51 (536m). The lower frequency component (<24kHz) of the clicks were often visible on frequency spectrogram display during the detection event. Terminal buzzes were detected at the end of echolocation click trains at 04:59 and 05:03. The relative received click amplitudes were estimated from detector amplitude/time display and ranged from 116 to 163dB (average 146dB). Clicks were last detected at 05:04. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor.</p> <p>Whistle bearings were determined by selection of the tones using the clip generator and evaluation of the resulting bearing line overlay on the map display, while click bearings were obtained from the high frequency bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras (the dolphins were likely in the cameras' panning range with the localization indicating the dolphins were astern of the vessel). The medium penetration sub-bottom profiler (sparker) and the multi-beam echosounder were active at the time of the detection (EZ 200m). Mitigation was</p>
559	<p>A brief detection of dolphin whistles (8-15.1kHz) from 05:51 to 05:52 UTC. Convex, concave, constant frequency, and sinusoidal whistle types, each 0.4-0.5s in duration, were observed during the one minute detection. Bearings to whistles selected with the clip generator were concentrated near ± 10-14° relative to the hydrophone array for the duration of the detection. Whistle amplitudes, which were measured during playback in Raven, ranged from 101-105dB (103dB average). Amplitudes provided are the relative received amplitudes and have not been corrected by a calibration factor. Localization was not possible due to the lack of bearing data and the brevity of the acoustic event. Whistle bearing was obtained by selecting the whistle using clip generator and evaluating the bearing overlay on the map. All bearings are provided as \pm some value to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras. The multi-beam echosounder was active at the time of the detection (EZ 200m). Mitigation was</p>

Project Detection Number	<p>Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)</p>
	<p>A pod of common dolphins (species identification from visual observation) was acoustically detected from 09:25 to 10:12 UTC. Dolphin whistles and clicks were detected simultaneously at the start of the detection. Dolphin whistles detected through to the end of the detection and the last detection of high frequency clicks at 09:57. Whistle activity was intermittent for the first 14 minutes and last 12 minutes of the acoustic event. Periodic faint whistles aurally detected (not visible on the mid-frequency spectrogram) near the end of the event. Acoustic activity (both whistles and clicks) increased significantly between 09:39-09:48. Multiple whistles, indicating the presence of more than one vocalizing individual, were observed during this period of increased whistle activity. Although the intensity of whistle activity decreased (fewer overlapping whistles) after 09:48, whistles continued to be regularly detected until 10:00 when they became intermittent. Upsweep, downsweep, sinusoidal, concave, convex, chirp, and constant frequency whistle types ranging in frequency from 2.3 to 23.8 kHz were observed. A series of concave whistles had a sharp inflection point at the peak of the whistle contour which gave the whistles a triangular shape was observed from 09:41-09:43. The triangular shape whistle was the only type detected for about 30s at 09:42. Chirp and constant frequency whistles were the shortest duration tonal signals and sinusoidal whistles were the longest (0.4s and 1.3s respectively). Relative amplitudes, which were measured during playback of recordings in Raven, ranged from 86-114dB (average amplitude of 100dB). The first harmonic was observed for several of the higher amplitude whistles. Bearings were obtained for a small number of whistles at the beginning of the detection using both the clip generator and the whistle and moan detector. The whistle and moan detector generated bearings to detected whistles of ± 109-110° relative to the hydrophone array. Whistles selected using the clip generator were observed at bearings between ± 8-13°. Localization of whistles was not attempted due to the operator collecting an insufficient amount of bearings from the clip generator and due to the lack of a clear cross bearing from whistle and moan detector generated bearings. High frequency common dolphin clicks (12-120kHz containing a single 30-36kHz or 75-85kHz) were detected on the high frequency click detector from 09:25 to 09:57. The lower frequency components (<24kHz) of several clicks were also observed on the mid-frequency spectrogram as click trains, as well as intermittent clicks that did not clearly form click trains were observed during the common dolphin acoustic detection event. Four simultaneous click trains were observed at different bearing points during the dolphin detection event, indicating at least four dolphins were present and vocalizing. Most click trains exhibited small gradual changes in bearing of 2-10°, however a few trains underwent more rapid changes with one train observed making a 51° change in bearings over a 5s period. An echolocation terminal buzz was observed for one train at 09:53. Bearings to detected clicks were variable throughout the event, possibly indicating a dispersed group of dolphins that made passes of the hydrophones in waves or a single cohesive group of dolphins that were undergoing numerous direction changes such as those of foraging activities or when milling. The latter is the more likely scenario as bearings often changed from ahead to behind the hydrophone array to the opposite behind to ahead direction over short periods of time. Bearings for some click trains oscillated between a narrow range in bearings over the course of the click train. The vessel was heading straight when these oscillating trains were observed, which lends some support to the hypothesis that the rapid and repeated changes in bearings were likely related to a behavioral event such as foraging or milling. Individual clicks from 15 click trains were manually tracked, with 13 resulting in range estimates derived using target motion analysis (TMA with least squares algorithm). Range estimates to individual dolphins ranged from $456\text{m} \pm 136.7\text{m}$ at the start of the detection to a low of $7.1\text{m} \pm 1\text{m}$ at 09:46. The localizations derived by tracking and TMA of dolphin clicks were as follows (in chronological order): $456\text{m} \pm 136.7\text{m}$ (perpendicular error $\pm 136.7\text{m}$, parallel error 13.5m) from a bearing of $\pm 159^\circ$ at 09:25, $39.2\text{m} \pm 10.3\text{m}$ (perpendicular error $\pm 10.3\text{m}$, parallel error 4m) from a bearing of $\pm 18^\circ$ at 09:27, $12.1\text{m} \pm 0.7\text{m}$ (perpendicular error $\pm 0.7\text{m}$, parallel error 0.3m) from a bearing of $\pm 22^\circ$ at 09:35, $35.8\text{m} \pm 19.3\text{m}$ (perpendicular error $\pm 19.3\text{m}$, parallel error 1.1m) from a bearing of $\pm 125^\circ$ at 09:43, $69.5\text{m} \pm 36.8\text{m}$ (perpendicular error $\pm 36.8\text{m}$, parallel error 2.5m) from a bearing of $\pm 175^\circ$ at 09:45, $55.8\text{m} \pm 26.8\text{m}$ at 09:46, $7.1\text{m} \pm 1\text{m}$ (perpendicular error $\pm 1\text{m}$, parallel error 0.4m) from a bearing of $\pm 17^\circ$ also at 09:46, $36.4\text{m} \pm 45.5\text{m}$ (perpendicular error $\pm 45.5\text{m}$, parallel error 20m) from a bearing of $\pm 25^\circ$ at 09:47, $40.4\text{m} \pm 10.3\text{m}$ (perpendicular error $\pm 10.3\text{m}$, parallel error 7.2m) from a bearing of $\pm 37^\circ$ at 09:48, $116.7\text{m} \pm 36.9\text{m}$ (perpendicular error $\pm 36.9\text{m}$, parallel error 3.6m) from a bearing of $\pm 175^\circ$ at 09:52, $116.7\text{m} \pm 40.4\text{m}$ at 09:53, $92.8\text{m} \pm 76.9\text{m}$ (perpendicular error $\pm 76.9\text{m}$, parallel error 27.9m) from a bearing of $\pm 157^\circ$ at 09:54, and $126.7\text{m} \pm 199.1\text{m}$ (perpendicular error $\pm 199.1\text{m}$, parallel error 85.4m) from a bearing of $\pm 157^\circ$ at 09:55. Range estimates provided here are the best fit estimates (lowest chi-square values) to the model. Some localizations contain high levels of error in one or both directions (perpendicular and/or parallel), some with errors 50% or more than the estimated range. The high errors may have been the result of tracking or misassignment of clicks (more than 10) clicks from trains of short durations and of small bearing changes or from accidentally assigning clicks from different trains/individuals to the same train. Localizing dolphins using TMA is also not ideal if dolphin movements violate the assumption that the target is stationary while the vessel moves, which introduces error as well. The common dolphin acoustic detection was correlated with a visual sighting (#074) using the IR camera (dolphins were outside the panning range of the IR cameras). The IR camera operator was notified of the dolphin acoustic detection and their general location astern of the vessel. Due to the position of the IR camera the operator switched to night vision and first spotted the dolphins approximately 200m off the port side of the vessel (around mid-ship at 04:00 on the clock face) at 09:47. The visual PSO observed possible foraging. The dolphins were last seen visually 50m off the port stern at 09:56. The range estimates generated through visual observations are in line with some of the estimates obtained from PAM. Note that range estimates from TMA are relative to the hydrophone and not to the vessel. If the offset from the stern of the vessel to the rear pair of hydrophones used for high frequency detection (approximately 64m) is taken into account, the range estimates are approximately 64m greater than those reported here.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
074	<p>search the aft perimeter of the vessel, using night vision monocular, at approximately 09:42. At 09:47, a pod of 10-15 Common dolphins was sighted off the starboard stern at a visually estimated distance of 200m. The pod porpoised directly towards the vessel at a rapid pace, approached within 10m of the hull, and swam towards the bow. Once near the vessel, the dolphins remained just beneath the water surface for the remainder of the sighting event. The pod was seen swimming towards the bow, but PSO was unable to determine if bow riding occurred, as the bow of the vessel was obstructed from view. From 09:48-09:50, a pod of dolphins was sighted within 10m of the hull, swimming alongside (both port and starboard) and riding in the vessel's wake. Between 09:50-09:56, the pod of dolphins was sighted primarily off the port stern, at an approximate distance ranging 10-50m from the vessel, at an approximate bearing of 08:00. Dolphins were seen rapidly darting back and forth with their dorsal fins and body at times visible above the surface, displaying feeding behavior while swimming along with the vessel. A large number of birds was also seen in the same area displaying feeding behavior. Some dolphins occasionally broke away from the pod, swimming back and forth along the port hull. At 09:56, the pod was last seen moving slightly away from the port side of the vessel at an approximate distance of 50m from the hull, bearing 08:00. The hourglass pattern characteristic of the Common dolphin was visible with the night vision unit, while the dolphins were swimming alongside the hull just under the water surface. No sighting on thermal cameras occurred. PSO determined the dolphins approach was clearly visible (they approached the vessel in a direct line at a rapid pace, and swam with the vessel for the duration of the sighting), therefore no mitigation was required. Multibeam echosounder was active for the duration of the sighting.</p>
075	<p>From 14:50-14:53, a series of four broad bushy shaped blows of varying height (height gradually reduced from 1st to 4th blow) were observed off the starboard bow (bearing 1:00) at an approximate distance of 1624m (1.5 reticle, TH). From 14:55-15:00, 6 additional broad bushy blows of variable height were observed, at the same approximate bearing (1:00) and an approximate distance of 1624m (1.5 reticle TH). After the 6th blow, PSO viewed the dorsal surface of the whale through binoculars, noting a small dorsal fin and highly arched back. It was difficult to tell the shape of the dorsal at this distance, but it did not appear to be falcate. At 15:00, additional blows were sighted, at bearing 1:30 and approximate distance of 1624m (1.5 reticle TH). These blows were again broad and bushy shaped. The whale appeared to be headed in a general southward direction. At 15:05, a single broad, bushy blow was observed approximately 200m (1 reticle, TH) off the starboard side of the Discovery, at bearing 08:00. The blow was followed by a dive at 15:06 (same approximate distance and bearing), in which the whale highly arched its back prior to the dive, and displayed its fluke during the dive. Dive was observed through binoculars, and PSO was able to see a small dorsal fin (did not appear falcate to tell at this distance) and broad black fluke (unable to see detail of trailing edge of fluke due to distance) and tail stock. The whale was not seen again. All HRG survey equipment operating <200kHz was active for the duration of the sighting (Multibeam echosounder, USBL, Sparker, Sub-bottom profiler). No mitigation was required, as the whale did not enter the 500m exclusion zone. All times indicated are UTC, and all bearings are relative to clockface.</p>
076	<p>A single, tall, column-like blow was observed at 17:59 off the port side of the vessel at 1 reticle (~2424m). Based on blow shape, animal was presumed to be a fin whale but no other identifying characteristics or behaviors could be observed. At the time of the sighting, the sparker, multibeam, sidescan sonar and gradiometer were all active. The whale never entered the 500m exclusion zone and mitigation was not required.</p>
077	<p>A single broad, bushy blow was observed approximately 200m (1 reticle, TH) off the starboard side of the Discovery, at bearing 08:00. The blow was followed by a dive at 15:06 (same approximate distance and bearing), in which the whale highly arched its back prior to the dive, and displayed its fluke during the dive. Dive was observed through binoculars, and PSO was able to see a small dorsal fin (did not appear falcate to tell at this distance) and broad black fluke (unable to see detail of trailing edge of fluke due to distance) and tail stock. The whale was not seen again. All HRG survey equipment operating <200kHz was active for the duration of the sighting (Multibeam echosounder, USBL, Sparker, Sub-bottom profiler). No mitigation was required, as the whale did not enter the 500m exclusion zone. All times indicated are UTC, and all bearings are relative to clockface.</p>
078	<p>From 21:00-21:02 UTC, two broad bushy blows were observed off the port side of the Discovery, at an approximate distance of 1218m (2 reticle, TH), and bearing 09:30 (using clockface). These blows were followed by a dive at 21:02 UTC in which the whale highly arched its back, and then displayed its fluke and tail stock. PSO observed the dive through binoculars, and a small dorsal fin could be seen, along with a broad black fluke and white patches. The whale was not seen again. All HRG survey equipment operating <200kHz was active for the duration of the sighting (Multibeam echosounder, USBL, Sparker, Sub-bottom profiler). No mitigation was required, as the whale did not enter the 500m exclusion zone.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
561	Two dolphin whistles and two short high frequency click trains were detected from 03:07 to 03:19 UTC. A downsweep whistle (14.8-9.5kHz) and a constant frequency whistle (11.5kHz) were detected at the start event, with the two click trains detected at 03:12 and 03:19. The received amplitudes for the two whistles were 93.3dB and 105.5dB respectively for the downsweep and constant frequency whistle (100dB average) were not obtained for either whistle. The two click trains were composed of clicks containing energy between 20-120kHz and with a single peak between 24-26kHz or 78-80kHz. Click amplitudes ranged from 13 to 143dB. The first click train exhibited a gradual change in bearings from $\pm 67-69^\circ$. The second train also underwent a gradual change in bearings from $\pm 68-77^\circ$. Individual click trains were tracked and localized using target motion analysis (TMA with least squares algorithm) to $2.8m \pm 19.4m$ (perpendicular error $\pm 19.4m$, parallel error 8.1m) from a bearing of $\pm 26^\circ$ relative to the hydrophone and $18m \pm 11.8m$ (perpendicular error $\pm 11.8m$, parallel error 3.2m) from a bearing of $\pm 20^\circ$. The high level of error associated with each localization was likely the result of the selection of only a few clicks (<10 durations ($\leq 3s$)). Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Whistle amplitudes were measured during playback in Raven, while click amplitudes were determined from the high frequency click detector amplitude/time display. Click bearings were obtained from the high frequency bearing/time display. All bearings are provided as \pm some value to account for ambiguity. All geophysical equipment was active at the start of the detection, however the medium penetration sub-bottom profiler (sparker) was shut off at 03:08 as the survey team prepared to recover all equipment.
079	At which point the PSO were able to identify the animal as a humpback whale. The animal was moving from the portside across the front of the bow. When seen by secondary observer (EF), an approx. 2m medium blow was detected. Shortly thereafter, a very small dorsal fin was seen, hump-like instead of falcate, on a dark gray body. Individual was sighted at this time at a bearing of 330 degrees from the bow and was in the bow at an approx. distance of 600m. Animal was not seen again, and at time of last sighting had not entered the mitigation zone. All HRG survey equipment operating below 200kHz was active for the duration of the sighting (Sparker, Sub-bottom profiler, USBL, Multibeam echosounder). Mitigation was not required, as the whale did not enter the exclusion zone (500m).
080	(using clockface). The whale was not seen again. No other identifying characteristics were observed, and species could not be determined. Certainty of family Balaenopteridae listed as Moderate, as it could have been Balaenidae (NARW), or Physeteridae (Sperm Whale), based on observed information. All HRG survey equipment operating below 200kHz was active for the duration of the sighting (Sparker, Sub-bottom profiler, USBL, Multibeam echosounder). Mitigation was not required, as the whale did not enter the exclusion zone (500m).
081	From 15:50-16:00 UTC, a series of 6 tall elliptical shaped blows were sighted off the starboard side of the Discovery, at an initial distance of ~2436m (1 reticle, TH), and final distance of ~1624m (1.5 reticle, TH). The blows remained constant at 3:00 (using clockface) for the duration of the sighting. Blows were characteristic of a Fin whale, but no other identifying characteristics were observed. All HRG survey equipment operating below 200kHz was active for the duration of the sighting (Sparker, Sub-bottom profiler, USBL, Multibeam echosounder). Mitigation was not required, as the whale did not enter the exclusion zone (500m).
082	The animal was not seen again. No other identifying characteristics were observed, and PSO was unable to determine direction of travel or pace of the animal due to the brevity of the event. Blows appeared to be characteristic of a Fin whale. The Sparker, USBL, and Multibeam echosounder were active for the duration of the sighting, and the vessel was preparing to recover the equipment for transit. Although equipment was active, the vessel was not on a survey line/ in production. Mitigation was not required, as the whale did not enter the exclusion zone (500m).
562	A brief detection of two downsweep dolphin whistles (12.8-8.8kHz and 19.6-10.8kHz, 0.5s and 0.8s in duration respectively) at 03:50. Each downsweep whistle contained two inflection points. Whistle amplitudes were measured during playback in Raven, ranged from 96-105dB (101dB average). Bearings were not obtained for either whistle. Localization was not possible due to the lack of sufficient bearing data and the brevity of the acoustic event. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical equipment was inactive on deck and the vessel was running weather patterns at the time of the detection (50m strike avoidance zone). Mitigation was not required. The amplitude provided is the relative received amplitude that has not been corrected by a calibration factor.

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
563	<p>Several short high frequency dolphin click trains composed of clicks containing energy between 12-110kHz and with a single peak at 20-32kHz or 60-65kHz were detected from 06:34 to 06:43 UTC. The first click train was observed undergoing a gradual change in bearing from ± 103-95° relative to the hydrophone array. All other click trains observed were concentrated between bearings ± 24-32°. Individual clicks from three click trains were tracked, with their bearings plotted on the map display to produce localizations via target motion analysis (TMA with least squares algorithm). The first tracked click train produced a localization of $15.6\text{m} \pm 5.9\text{m}$ (perpendicular error $\pm 5.9\text{m}$, parallel error 9.4m) from a bearing of $\pm 63^\circ$ at 06:37. The remaining two click trains produced localizations of: $14\text{m} \pm 11.6\text{m}$ (perpendicular error $\pm 11.6\text{m}$, parallel error $\pm 19.5\text{m}$) from a bearing of $\pm 24^\circ$ at 06:38 and $13.9\text{m} \pm 4.7\text{m}$ (perpendicular error $\pm 4.7\text{m}$, parallel error $\pm 8.7\text{m}$) from a bearing of $\pm 61^\circ$ at 06:42. Most localizations contained high error levels in one or both directions (perpendicular and/or parallel), some were more than the estimated range. The high errors were likely the result of tracking only a few (less than 10) clicks from trains of short durations and of small bearing changes. However, even the most conservative estimates from the localizations place the dolphins within the exclusion zone. Click amplitudes ranged from 119-141dB with an average received amplitude of 128dB. In addition to high frequency clicks, two dolphin whistles were observed at the start of the acoustic event at 06:35. The two whistles, which were approximately 0.5s in duration each, ranged in frequency from 12.4-9.1kHz and 12.4-8.6kHz. Both whistles had a high signal to noise ratio, with relative received amplitudes of 114dB and 110dB respectively (average received amplitude of 112dB). The first harmonic was observed for both whistles. Bearings to the two whistles were not obtained. The dolphins were last detected at 06:43. The acoustic detection was not correlated with a visual sighting on the IR cameras (the dolphins were likely outside the cameras' panning range (limited due to the stern by the bridge wings) with the localizations indicating the dolphins were astern of the vessel). The multibeam echosounder was active during the entire detection event and the shallow penetration echosounder was active 3 minutes after the start of the detection (200m EZ 06:34-06:37, 500m EZ 06:37-06:43). The survey team was preparing to deploy the towed survey equipment at the time of the acoustic detection. Mitigation was not required. Whistle amplitudes were measured during playback in Raven, while click amplitudes were measured from the high frequency amplitude/time display. Amplitudes provided are relative amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for bearing error.</p>
083	<p>At 16:11, a blow was sighted off the portside bow at approximately 12100m (1 reticle SB) from the vessel, and bearing 11 o'clock. At 16:12 another blow was sighted. At 16:13 there were a series of blows, after which dorsal bodies and fins of three individual whales were visible. The height of the blows, and the small falcate dark dorsal fin being positioned at two thirds back on the body lead both PSOs to identify the whales as humpbacks. The whales weren't seen again until 16:20 at which time there was another series of approximately 7 to 10 blows. The back and dorsal fin of one individual was also sighted at this time. By 16:30 the position of the whales was still at 12100m from the vessel, and bearing of 12 o'clock (bow of the vessel). There were a few more blows by 16:31, and another surfacing in which the whale exposed its dorsal body/fin. The animals were not sighted thereafter. The multi-beam, chirp, and USBL were active for the duration of the sighting event. It is unknown if the sparker was active at the time of sighting, as survey was in the process of troubleshooting. No mitigation was requested as the animals remained outside of the exclusion zone (500m) for the entirety of the sighting. All times indicated are UTC.</p>
084	<p>At 15:13 UTC, a blow about 2m in height from an unidentified whale was observed off the bow of the vessel at an approximate distance of 1212m (2 reticles) and a bearing of 12:00 (using clock face). Another blow of similar height to the first was seen again at 15:18 at an approximate distance of 1212m (2 reticles) and a bearing of 2:00 (using clock face). Although the whale's direction of travel was not able to be determined at the time of the sighting due to just a single blow being sighted, the whale appeared to be traveling in a perpendicular direction to the vessel's course of travel, towards the starboard side based on the position of the second blow and visual observations again after 15:18. The sparker (possibly deactivated if vessel was on line change turn), chirp, USBL, and multibeam echosounder were active for the duration of the sighting. Although equipment was active, mitigation was not required, as the whale did not enter the exclusion zone (500m).</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
085	<p>At 19:56 UTC, a pod of dolphins (8-12 estimated individuals) was sighted approximately 50m off the bow of the Discovery, at bearing 12:00 (slightly to starboard side). The dolphins porpoised directly toward the bow, and dove under the surface approximately 10m from the starboard bow (bearing 1:00). The group was then sighted on the port side of the vessel, and bow riding was observed, within 5m of the bow. The dolphins were observed bow riding (both port and starboard), porpoising and leaping, circling near the bow, swimming alongside the vessel (between bow and approximately 20m aft of bow of, both port and starboard), crossing back and forth in front of the bow, for the duration of the sighting. A few juveniles were sighted within the group. The sighting event ended with approximately 4-6 dolphins sighted within 10m of the port bow at 20:05 UTC. They dove under the surface and were not seen again. No HRG survey equipment was active during the sighting event (exclusion zone 50m for strike avoidance). No strike avoidance measures were required; dolphins approach was determined to be voluntary based on observed behavior.</p>
086	<p>At 14:57 UTC, a pod of dolphins (6-10 estimated individuals) was observed approximately 100m off the bow of the Discovery, at bearing 12:00 (slightly to starboard side). The group porpoised directly towards the bow of the vessel, and dove under the surface out of view. Approximately one minute later, several dolphins were sighted swimming along the port side of the vessel (bearing 09:00) within 10-20m of the hull, between mid bow and starboard bow. The dolphins continued swimming and porpoising (occasional full leaps out of water were observed) along the side of the vessel, at times bow riding within 5m of the hull for the remainder of the sighting. The dolphins were last observed at 15:00 UTC. Vessel was in transit to the survey site for the duration of the sighting, and no HRG equipment was active. The exclusion zone was 50m for strike avoidance protocol. No avoidance measures were taken due to the determined voluntary approach behavior of the dolphins.</p>
087	<p>At 15:16 UTC, a pod of dolphins was observed approximately 100m off the port bow of the Discovery, at bearing 11:00, heading across the bow port to starboard (animal heading SSW). For the remainder of the sighting, the dolphins were observed primarily bow riding (within 5m of the hull) and swimming near the bow (mostly within 20m of the hull) on both port and starboard sides, at times porpoising and leaping completely out of the water. The dolphins were last observed at 15:24 at a distance of approximately 30 meters, swimming away from the bow of the vessel at bearing 02:00. Vessel was in transit to the survey site for the duration of the sighting. HRG equipment was active. The exclusion zone was 50m for strike avoidance protocol. No avoidance measures were taken due to the determined voluntary approach behavior of the dolphins. Potential startup of the HRG was delayed due to this sighting, however, there was no estimated loss of production as survey was not ready to begin until more than 60 minutes after last sighting within 500m. Photos taken by PSO</p>
088	<p>presumably dove at 19:10. From 19:16-19:18, four additional broad, bushy blows were observed, at bearing 2:00 and an approximate distance of 1624m (1.5 reticle, TH) from the vessel. After the fourth blow, the whale's head and fin was seen through binoculars, and the whale's back was highly arched. The whale presumably dove at 19:18, and was not seen again. During the second series of blows, the whale appeared to be moving at a slow pace, heading west. The Discovery was deploying the gradiometer and side scan sonar during the sighting (sparker and streamer already deployed, but sparker not active). MBES, USBL, and sub-bottom profile were active during the sighting. No mitigation was required, as the whale did not enter the 500m exclusion zone. All times indicated are UTC, and all bearings are in reference to clockface.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
564	<p>A brief detection event, consisting of two upsweep dolphin whistles and short high frequency click trains from 23:39-23:41 UTC. The two dolphin whistles were detected at the start of the event at 23:39. The first whistle had a much steeper slope to the upsweep than the second, with the first whistle sweeping from 8.3-10.3kHz over 0.2s and the second sweeping from 11-12kHz over 0.8s. The second whistle began just as the first whistle amplitude, which was measured during playback in Raven, was 108dB. Bearings to the detected whistles were not obtained. High frequency clicks (15-110kHz with single peak around 75-85kHz) were at the start of the detection, however clear click trains were not observed until 23:41 when two short click trains (each <5s) were detected between bearings of $\pm 24-34^\circ$ relative to the hydrophone array. Individual click trains were manually tracked, with their bearings plotted on the map display to produce localizations via target motion analysis (TMA with least squares algorithm). The first tracked click train produced a localization of $6.5\text{m} \pm 1.6\text{m}$ (perpendicular error $\pm 1.6\text{m}$, parallel error 2.8m) from a bearing of $\pm 116^\circ$, while the second train was localized to $5.1\text{m} \pm 3.1\text{m}$ (perpendicular error $\pm 3.1\text{m}$, parallel error 4.8m) from a bearing of $\pm 116^\circ$. Click amplitudes measured from the amplitude/time display ranged from 117-138dB and averaged 130dB. No additional dolphin vocalizations were detected after the two click trains at 23:41. The acoustic detection was correlated with a visual sighting on the IR cameras (the dolphins were likely outside the cameras' panning range (limited due to obstruction of the stern by the bridge wings) with the localizations indicating the dolphins were to the east of the vessel). The vessel was running a single channel survey line with all sources deployed and active at the time of the detection (500m EZ). Mitigation was not required. Amplitudes provided are relative amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for ambiguity.</p>
565	<p>Faint dolphin whistles were aurally and visually (in the mid-frequency spectrogram display) detected at 04:00 UTC. Upsweep, downsweep, concave, convex, and constant frequency whistle types were observed during the first 5 minutes of the detection event. A few whistles were manually selected using the clip generator to produce bearings relative to the hydrophone array of $\pm 30-40^\circ$ at the start of the detection and 04:10. The observed whistles were 1s or less in duration and ranged in frequency from 8-19kHz. Most whistles had received amplitudes around 98dB, however amplitudes up to 103dB and as low as 94dB were observed. A few whistles. A bout of high frequency dolphin click activity was observed at the end of the detection event from 04:14-04:15. The dolphin clicks were quite dense during this period, which made identification of click trains difficult in real time (offline review using Panguard Viewer Mode revealed 5 simultaneous click trains). The dense nature of the clicks may be indicative of a cohesive group of dolphins. Bearings to the click trains began around $\pm 36^\circ$ and decreased to about $\pm 28^\circ$ before undergoing a rapid change of bearings to $\pm 139^\circ$ (click train duration of 12s). Individual clicks from the dense bout of clicks were manually tracked in the bearing/time display to plot tracked click bearings which were then used to produce a localization (via target motion analysis or TMA) of $4\text{m} \pm 0.3\text{m}$ (perpendicular error $\pm 0.3\text{m}$ and parallel error $\pm 0.2\text{m}$) from a bearing of $\pm 139^\circ$ relative to the hydrophone array (corresponded to the 06:00 position on the clock face relative to the vessel's bow). Click frequency ranged from 15-100kHz and contained a single peak around 28-36kHz. The low frequency components (<24kHz) of the clicks were visible in the mid-frequency spectrogram. Received click amplitudes ranged from 121-142dB, with an average of 135dB. Dolphin clicks were last detected at 04:15. Whistles were measured during playback in Raven, while click amplitudes were derived from the amplitude/time display for the high frequency click detector. Amplitudes provided are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity. The dolphin detection was not correlated with a visual sighting on the IR cameras. The vessel was undergoing a line change with all geophysical sources active at the time of the detection. Mitigation was not required for</p>
089	<p>At 12:31 UTC a large splash was sighted at a distance of 2420m (1 reticle, SB) slightly starboard of the bow. The splash was about the size of a small boat - about 10m wide and 3m tall and bush shaped. The subsequent splashes at 12:32, 12:33, 12:34, and 12:35; all of which were in the same location and at the same distance. There did not appear to be any clear direction of travel. No distinguishing characteristics were identified but PSO are confident that it was a large whale. All HRG equipment was active during the time of the sighting. No mitigation was required as the animal remained outside of the exclusion zone for the sighting (500 m). Photo was taken by PSO EF.</p>
090	<p>At 20:44 a blow was sighted off of the portside of the vessel at approximately 605m (4 reticles, SB). Two more blows were sighted at 20:46 and 20:48 in almost the same location, at the same distance. The blow was medium in size but not particularly tall or bushy, and dissipated in the air rather quickly. No other characteristics were able to be identified. No clear direction or speed of travel was able to be determined. All HF equipment was active during the time of the sighting. No mitigation was required as the animal remained outside of the exclusion zone for the entirety of the sighting (500 m). All times indicated are UTC.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
566	<p>High frequency (HF) dolphin clicks were briefly detected on the HF click amplitude display at 07:02, for approximately 5s. No localization or bearing was obtained for this part of the detection, as it was difficult to see the clicks on the HF time bearing display due to the brevity of the observed clicks, and abundance of other noise detected. It is unknown if a click train was present at this time. At 07:11, approximately 10s of additional clicks, including one observed short click train, were detected, at bearing $\pm 55-60^\circ$. The lone observed click train was localized and plotted on the map using target motion analysis, and yielded an estimate (most likely) of 20m ± 40m from the sound source, relative to the hydrophone array. Note that only ~ 5 clicks were used to obtain this localization, due to the brevity of the event. Observed click amplitudes were in the range of 120-140dB (avg 130dB), and frequencies in the range of 20-100kHz (single peaks 25-30kHz, and 80-90kHz). Localization combined with observed HF click frequency led operator to believe the dolphins were within the exclusion zone (100m). A series of faint (SNR1) whistles was also detected at 07:11. Bearings were not obtained for whistles. Observed whistle contours consisted of upsweep, downsweep, and constant frequency. Whistles were in the range of 0.6s duration, and 6.2-16.8kHz. Whistle amplitudes ranged 92-104dB (avg 98dB), and were obtained through recording analysis with Raven software. All HRG survey equipment <200kHz was active for the duration of the detection: Multibeam echosounder, USBL, sub-bottom profiler, and sparker. This detection was not correlated with a visual sighting, and no mitigation was required. Bearings are given as \pm to indicate left/right ambiguity. All amplitudes indicated are relative, and have not been corrected by a calibration factor.</p>
091	<p>At 17:50 a large splash was observed by SB off the starboard bow, at approximately 4840m (0.5 reticles, SB), and bearing of 02:00. At 17:58 a tail slap was observed at approximately 4848m (0.5 reticles, MK). At 18:03:00 a large, dark, V-shaped fluke was observed. Based on the fluke shape and tail slapping behavior, the animal was determined to be a humpback whale. Two more tail slaps were observed by MK at 18:04:00 and 18:05:00. The whale was not seen again. All HRG equipment was active during the time of the sighting. No mitigation was required as the animal remained outside of the exclusion zone (500m) for the entirety of the sighting. Bearings are indicated as UTC, and all bearings in reference to clockface.</p>
092	<p>From 18:14-18:15, two blows were observed off the port bow of the Discovery, at an approximate distance of 4872m (0.5 reticle TH), and bearing 11:00. The first blow was barely visible with the naked eye, but then confirmed with binoculars. From 18:17-18:19, three additional blows were sighted at the same distance and bearing. After the second blow, a large splash was observed. The whale appeared to be moving in a northerly direction. The whale was not seen again after 18:19. All the blows were broad and bushy of variable height, and were characteristic of a Humpback whale, but no other identifying characteristics were observed. The Discovery was on weather standby for weather during the sighting, and only the multibeam echosounder was active (for navigation purposes). The whale did not enter the 200m EZ, so no mitigation was required. All times indicated are in reference to clockface.</p>
567	<p>The detection was brief, consisting of four dolphin whistles (both audible and visible on the mid-frequency spectrogram display) over a 20s period at 07:01 UTC, in the bearing range of $\pm 5-18^\circ$ (\pm indicates ambiguity). Observed whistle contours consisted of upsweep, concave ending in upsweep, concave ending in near constant frequency, and upsweep ending in constant frequency. Second level harmonics were visible on the mid-frequency spectrogram display for all detected whistles, up to 24+kHz. Whistles were in the range of 0.4-1.2s duration, and 8.0-13.7kHz. Whistle amplitudes ranged 89-108dB (avg 98dB), and were obtained through recording analysis with Raven software. The Discovery was on weather standby during the detection, with the multibeam echosounder as the only active source. All other HRG equipment was powered off/ not deployed. This detection was not correlated with a visual sighting, and no mitigation was required. All amplitudes indicated are relative, and have not been corrected by a calibration factor.</p>
568	<p>Dolphin whistles, both audible and visible on the mid-frequency spectrogram, were first detected at 08:07 UTC. Approximately 14 individual whistles were detected over a two minute period, in two bearing ranges of $\pm 51-57^\circ$ (obtained by plotting on map using clip generator). The primary observed contour was a similar repeating convex whistle (upper peak reaching a maximum of 22.8kHz) leading into a downsweep (trailing edge). One basic downsweep whistle was also observed. Second level harmonics were visible on the mid-frequency spectrogram display for the majority of detected whistles, often exceeding 24kHz. Whistles were in the range of 0.3-1.4s duration, and 7.8-22.8kHz. Amplitudes ranged 83-110dB (avg 97dB), and were obtained through recording analysis with Raven software. The Discovery was on weather standby during the detection, with the sub-bottom profiler, and multibeam echosounder as the only active sources. All other HRG equipment was powered off/ not deployed. This detection was not correlated with a visual sighting, and no mitigation was required. Bearings given as \pm° to indicate left/right ambiguity. All amplitudes indicated are relative, and have not been corrected by a calibration factor.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
093	<p>At 16:50 UTC, a large splash was sighted off the portside bridge along the horizon by SB at approximately 12100m (1 reticle, SB) from the vessel, and bearing 10:00. Between 16:51 and 16:54 four more splashes by both PSOs. At 16:55, MK sighted two blows simultaneously indicating that two animals were present. Two more splashes were observed at 16:55. At 16:56 a distinct flipper slap was clearly observed which enabled us to positively identify the animals. The flipper was long, thin, and white with a black edge that was uneven. All HRG equipment was active during the time of the sighting. No mitigation was required as the animal remained outside of the exclusion zone (500m) for the entirety of the sighting.</p>
094	<p>At 16:58 UTC, a seal was sighted off the portside bridge at an approximate distance of 242m (10 reticle, SB) and bearing 9:00. The seal was first sighted by the ship's Master and 2nd Officer. The seal's head was above water and birds appeared to be harassing it. All HRG equipment was active during the sighting. Since the animal was within the exclusion zone (500 m), MK called for a shutdown of equipment at 17:03. Sparker, sub-bottom profiler were shut down immediately, and MBES approximately 2 minutes later. With no further sightings of the individual or any other protected species, ramp-up began at 17:18 (15 min re-clearance period). Ramp-up was complete by 17:33. Estimated loss of production is 30 minutes - 15 minutes due to shutdown and 15 minutes for ramp-up period.</p>
095	<p>From 19:20-19:22 UTC, three blows were observed off the starboard side of the Discovery, at an approximate distance of 1624m (1.5 reticle, TH) and bearing 02:00. The blows were characteristic of a Fin whale (estimated height), elliptical shaped, and almost perpendicular to the water surface. The whale was not seen again, and most likely dove after the last observed blow. No other identifying characteristics were observed. We were unable to determine the direction of travel or speed of the animal. All HRG equipment below 200kHz (Sparker, MBES, Sub-bottom profiler, USBL) was active for the duration of the sighting. No mitigation was required as the whale did not enter the exclusion zone (500m).</p>
096	<p>At 21:08 UTC, a large, bushy-shaped blow was observed off the bow (bearing of 12:00, clockface) at an approximate distance of 4848m (.5 reticle, MK). At 22:18 UTC 2 blows were observed at the same time, at an approximate lateral distance at an approximate distance of 4848m (.5 reticle, MK) at a bearing of 11:00 (clockface), indicating that there were 2 whales present. Another single blow was observed at 21:19 in the same area as the previous blow and 5 more blows were observed between 21:28 UTC and 21:33 UTC at an approximate distance of 4848m (.5 reticle, MK) and a bearing of 11:00 (clockface). A single blow at 21:33 UTC was observed by MK. At 21:37 UTC, TH observed 6-8 blows at a distance of 4872m (0.5 reticles) at a bearing of 04:00 (clockface), however, the vessel had turned to port and the whales were still in the same general area as noted time and vessel heading was 81 degrees. The whales were last observed (5-6 additional blows) by TH at an approximate distance of 4872m (0.5 reticles) at a bearing of 07:00 (vessel heading was 86 degrees). Mitigation was required as the animal remained outside of the exclusion zone for the duration of the sighting (500 m).</p>
569	<p>A single upsweep dolphin whistle (10.4-20kHz) was detected at 00:42 UTC. The whistle was selected using the clip generator to produce a bearing of $\pm 6^\circ$ relative to the hydrophone array. A high frequency dolphin whistle was observed approximately 2 minutes after the whistle. The short click train, which was composed of broadband clicks (15-90kHz with a single peak 20-25kHz) underwent a 30° change in bearing ($\pm 45-75^\circ$) over the duration of the sighting. Individual clicks from the click train were manually tracked, with their bearings plotted to produce a localization (via target motion analysis or TMA) of $14.3\text{m} \pm 1.6\text{m}$ (perpendicular error $\pm 1.6\text{m}$ and parallel error $\pm 1.6\text{m}$). The highest measured amplitude for the whistle was 109dB, whereas click amplitudes ranged from 122-137dB (130dB average). The dolphins were last detected at 00:45. Whistle amplitude was 109dB during playback in Raven and click amplitudes were derived from the amplitude/time display for the high frequency click detector. Amplitudes provided are relative received amplitudes that have not been corrected for a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time display. All bearings are provided as \pm some value to account for left/right ambiguity. The dolphin acoustic detection was correlated with a visual sighting on the IR cameras. The vessel was conducting a single channel survey line with all geophysical sources active at the time of the detection. Mitigation was not required for the detection. The GPS lost satellite connection at the end of the detection event (shown in screen capture).</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
570	<p>Dolphin whistles were detected, both aurally and visually on the mid-frequency spectrogram display, over a 3 minute period beginning at 06:16 UTC. Upsweep, downsweep, concave, and sinusoidal whistle type in duration and ranging in frequency from 8.7-20kHz were observed during the acoustic event. The majority of the detected whistles were of a relatively high amplitude, with an average received amplitude of 10 (range 97-110dB). The first harmonic was visible for several of the more intense dolphin whistles. Despite the relatively high received amplitudes, a few whistles were partially masked as the vessel underwent a overlapping whistles were observed during the bout of acoustic activity, indicating at least two dolphins were present and vocalizing. Whistles selected using the clip generator produced bearings between $\pm 8-48^\circ$ hydrophone array at the start of the detection and a bearing of $\pm 16^\circ$ at the end of the detection event at 06:19. Although bearings from several whistles were plotted on the map display, a clear point of cross bearing was not observed and therefore a localization was not achieved for dolphins producing whistles. A short bout of click activity was detected at 06:17 at bearings between $\pm 45-65^\circ$, however these clicks did not form clear bearings were therefore not tracked to produce a localization. Click frequency ranged between 15-80kHz with single peaks observed between 25-36kHz. Received click amplitudes were not recorded. Whistle amplitude measured during playback in Raven and are relative received amplitudes that have not been corrected by a calibration factor. Click bearings were obtained from the high frequency click detector bearing/time bearings are provided as \pm some value to account for left/right ambiguity. The dolphin acoustic detection was not correlated with a visual sighting on the IR cameras. The vessel was undergoing a line change geophysical sources active at the time of the detection. Mitigation was not required for the dolphin acoustic detection.</p>
097	<p>From 14:12-14:14, six blows were observed off the starboard stern of the Discovery, at an approximate distance of 3248m (0.75 reticle, 1H), and bearing 05:00. Two blows were observed simultaneously in different directions indicating the presence of at least two whales. From 14:19-14:20, four additional blows were observed, again off the starboard stern, at an approximate distance of 4872m (0.5 reticle, TH), and bearing 05:00. The surface of one of the whales could be seen after one of the blows during an apparent dive, but the distance was too great to view any additional identification characteristics, such as a dorsal fin. All but two blows were observed through binoculars, and they were all characteristic of a Fin whale: tall (estimated height to 5+m) and elliptical shaped, and nearly perpendicular to the water surface. The whales were not seen again. Direction of travel and speed was estimated by the difference in distance observed between 14:14-14:19, which was estimated to be more than twice the distance the Discovery had traveled in that time (vessel speed on the same heading for the duration of the sighting, at approximately 3.5 kt). All HRG equipment was active for the duration of the sighting. No mitigation was required, as the whales remained outside the 500m exclusion zone. All times indicated are UTC, and all bearings are in reference to clockface.</p>
098	<p>At 12:46 UTC, a very large splash was sighted straight off the bow by SB at an approximate distance of 5500m, estimated to be 20m - 30m wide and at least 5m tall. At 12:48 and 12:49 two smaller splashes were observed (5m - 8m wide and 3m tall), approximately 5 degrees off the bow (est. 175 degrees absolute bearing). Four blows were seen sequentially at 12:50. At 12:53 one animal breached, exposing its head, underbelly, and tail, which were long and approximately one third the length of its body. The body appeared out of water in a convex, inverted U shape before crashing into the water to create another large splash. A smaller splash was followed at 12:55; blows were broad and bushy. There was a series of at least 8 blows between 12:55 and 12:57, most occurring as 2 blows appearing in short sequence and close proximity. Twice, two blows were observed simultaneously, indicating the presence of at least two individuals. The next blow was seen at 13:01, and at 13:02 simultaneous blows were observed again. The vessel began turning to follow the next line, and a second blow was seen between 13:11 and 13:12 while turning. A single blow was visible at 13:17 and lastly at 13:18 (130 degrees absolute bearing after the turn of the vessel). The whales stayed in the same location throughout the detection and did not appear to be moving in any direction. The sparker had been turned off before (and during) the detection, but all other HRG equipment was active for the duration of the sighting. No mitigation was required, as the whales remained outside the 500m exclusion zone. The horizon appeared blurry due to the haze of the rising sun, and a true horizon could not be determined with reticles, so sighting distance was estimated by naked eye.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
099	<p>From 18:47-18:52 UTC, a series of seven blows were observed off the starboard side of the Discovery, at an approximate distance of 4872m (0.5 reticle, TH), and bearing 2:00 (using clockface). All blows were s and characteristic of a Humpback whale: broad and bushy of relatively low height (est <3m height). Two blows occurred within a few seconds, indicating the possible presence of two whales. No other identifying were observed, so the suspected species is of low confidence level. The whale(s) remained at the same approximate distance and bearing for the duration of the sighting, so direction of travel and pace were determined. No behavior type could be determined based on observed blows. The vessel was on weather standby, with the multibeam echosounder, USBL, and sub-bottom profiler active for the duration of the mitigation was required, as the whale(s) remained outside the exclusion zone of 500m.</p>
571	<p>each 0.5-1s in duration and ranging in frequency from 8.4-17.7kHz were intermittently observed during the acoustic event. The majority of the detected whistles were of a relatively high amplitude, with an average amplitude of 103dB recorded (range 100-110dB). The first harmonic was visible for a few of the more intense dolphin whistles. Two whistles selected using the clip generator produced bearings of $\pm 9.6^\circ$ relative to the hydrophone array at the start of the detection and $\pm 11.7^\circ$ at 00:08. A localization was not achieved due to an insufficient number of bearings. Whistle amplitudes were measured during playback in Raven and received amplitudes that have not been corrected by a calibration factor. All bearings are provided as \pm some value to account for left/right ambiguity. The dolphin acoustic detection was not correlated with a view from the IR cameras. The survey team was making the transition between single and multi-channel seismic at the time of the detection. The shallow penetration sub-bottom profiler (chirp), multibeam echo sounder, and active throughout the dolphin detection. Mitigation was not required.</p>
100	<p>At 07:46 UTC, two blows were seen on the thermal cameras approximately 30-40 seconds apart off the starboard vessel. The blows were seen at an estimated 190 degrees (absolute bearing) at an approximate distance of 1500m (estimated using RADES). The blows appeared moderate in height, approximately 3m. No identifying body features could be seen, but the height of the blow and time lapse between blows suggest a medium-sized whale (Humpback) over a smaller whale (Minke) or larger whales (Fin, Sei). The vessel started into a turn, and the individual was not seen again. No mitigation was required, as the individual was seen outside the exclusion zone. Multibeam echosounder, USBL, and sub-bottom profiler were active for the duration of the sighting event. Sparker was turned off for line change turn.</p>
101	<p>At 08:26, one dolphin was seen porpoising at an approximate distance of 200m from the starboard side of the vessel midship, heading parallel to the vessel towards the bow. A few seconds later a dolphin was seen slightly to the right of the first individual while a second dolphin simultaneously jumped at an approximate distance of 400m from the vessel. A few seconds later a dolphin was seen porpoising slightly further right at an approximate distance from the vessel and oriented more toward the vessel. Shortly after, two dolphins porpoised simultaneously headed toward the vessel, followed by a third individual forward (closer to the vessel) of where the pair was. Total detection time was only one minute. The dolphins moved at a rapid pace, and appeared to be traveling toward the ship in a northeast direction. Each porpoising event was closer to the ship until they were seen on the thermal cameras at an estimated distance of 100m. EF went outside with night vision but was unable to see the dolphins in any direction. Upon returning to thermal cameras, dolphins were not sighted through the view of the cameras nor when the cameras were pointed toward the bow to determine if individuals were bow riding. The sighting was determined to be a voluntary approach, as during the time on the thermal cameras the individuals did not appear to change direction away from the ship, and as such no mitigation was required despite coming within the 500m exclusion zone. No concurrent acoustic detections were made (some initial contact noise was being picked up by PAM operator during the line change turn). Photo stills were taken from video recording.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
102	<p>At 17:04, a blow was sighted off of the starboard bow at an approximate distance of 1613m (1.5 reticles, SB) and bearing 1 o'clock. Another blow was sighted at 17:05 at an approximate distance of 1210m (2 r followed by a dive that confirmed the identification of the animal as a humpback whale, due to its highly arched back and knuckles located just after the dorsal fin. At this same time, 17:05, the vessel began to r port. As the vessel continued to turn to port and onto another line in the opposite direction, the location of the whales shifted to 4 o'clock at an approximate distance of 4840m (0.5 reticle, SB). At 17:09 two blow simultaneously, one was notably larger - taller and more boad than the other, though the overall shape of the two was the same. Two consecutive blows were observed at 17:14. At 17:18 another set of simult was sighted, again with one blow being notably larger than the other, but with the same general shape: broad and bushy. A final blow was sighted at 17:22. Neither direction of travel or behavior type could be based on observed blows. No mitigation was required, as the whale(s) remained outside the exclusion zone of 500m. All survey equipment was active for the duration of the sighting, although the sparker ma turned off during the turn. All times indicated are UTC.</p>
103	<p>From 17:47-17:58 UTC, a series of fifteen blows were observed off the port side of the vessel, at an approximate distance of 4848m (0.5 reticle, MK), and bearing 10:00 (using clockface). The first two blows that at 17:47 appeared to be tall, and column-shaped, however, subsequent blows appeared to be broad and bushy of relatively low height (est <3m height). Several of the blows occurred within a few seconds of each other. At 17:52, two blows were observed concurrently. At 17:53 and 17:56, three blows were observed concurrently indicating the possible presence of three whales. No other identifying characteristics were observed, and varying blow shapes observed and the fact that the shaped could have appeared distorted due to sighting distance (>4.5km), species was not determined. The whale(s) remained at the same approximate distance for the duration of the sighting, so direction of travel and pace were unable to be determined. No behavior type could be determined based on observed blows. The vessel was actively surveying, with the sparker streamer, multibeam echosounder, USBL, and sub-bottom profiler active for the duration of the sighting. No mitigation was required, as the whale(s) remained outside the exclusion zone of 500m. Photos were taken.</p>
104	<p>From 18:19-18:20, three broad bushy blows were observed off the port side of the Discovery, at an approximate distance of 4872m (0.5 reticle, TH), and bearing 09:00. The third blow was followed by a dive, in which the whale highly arched its back and displayed its fluke. From 18:22-18:27, a series of eight blows were observed at the same approximate distance, and bearing 10:00. Some of these blows were taller, and ranged from low height/broad and bushy, to moderate height/plume shaped. Three blows were observed in rapid succession, indicating the presence of at least three whales. One obvious dive was observed, in which the whale highly arched its back and displayed a broad black fluke. At 18:29, one moderately tall plume shaped blow was observed at bearing 09:00, at the same approximate distance of 4872m (0.5 reticle, TH). At 18:37, two additional blows (one tall, plume shaped) were observed again at bearing 09:00, and 4872m (0.5 reticle, TH). From 18:44-18:47, four bushy blows of variable height were observed further away than the previous blows (est. 6000m), bearing 08:00. Two distinct dives were observed, in which the whales arched their backs and displayed broad black flukes. From 18:50-18:52, four final blows (moderate height, broad and bushy to plume shaped) were observed at approximately 6000m, bearing 08:00. The Discovery was on a multi-channel survey line, with all HRG equipment operating below 200kHz (Multibeam echosounder, sub-bottom profiler, USBL, sparker) active for the duration of the sighting. Mitigation was not required since the whales never approached/entered the 500m exclusion zone. All times indicated are UTC, and all bearings are in reference to clockface.</p>
105	<p>From 19:10-19:12 UTC, three broad/bushy to plume shaped blows of moderate height were observed off the port side of the Discovery, at an approximate distance of 4872m (0.5 reticle, TH), and bearing 09:00 (clockface). One dive was observed, in which the whale highly arched its back, and displayed a broad black fluke. The whale(s) were not seen again. The Discovery was on a multi-channel survey line with all HF equipment operating below 200kHz (sparker, sub-bottom profiler, USBL, multibeam echosounder) active for the duration of the sighting. No mitigation was required, as the whale(s) did not enter/approach the 500m exclusion zone.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
106	<p>At 22:46, a large, plume-like blow was observed on thermal camera #13 (port side). A few seconds later, two whales were observed surfacing simultaneously at an approximate distance of 1200m (estimated using the port side of the vessel at a bearing of 10:00 (clockface, using pan and tilt screen). About 20 seconds later, one of the whales could be seen surfacing again in the same position and neither of the whales were seen again. The blows appeared moderate in height, approximately 3m. During the first and second surfacing, triangular-shaped dorsal fins could be seen. Based on the shape of the dorsal fins and the size and shape of the blows, the whales were determined to be humpback whales. No mitigation was required, as the whales were seen outside the 500m exclusion zone. The sparker, multibeam echosounder, USBL, and sub-bottom profiler were active for the duration of the sighting event. Video recording and still image were taken by MK.</p>
107	<p>At 00:33 UTC, two white objects were sighted with thermal cameras at the edge of the Port side screen, estimated to be at a distance of 900m. This was seen again at 00:36, as a series of blows and following video. The white objects appeared after a blow and slightly forward; it is suspected that these objects were some part of the dorsal of a whale, but due to the distance and video quality no identifying features could be determined. At the start of the video from 00:36, three separate blows in a row can be seen in the time span of only a couple seconds, indicating at least three individuals. Throughout the video there were at least fourteen blows occurring almost simultaneously as a pair. The blows appeared similar in size. The whales disappeared at 00:37, at an estimated distance of 1700m (estimated using RADES). All HRG equipment was active for the duration of sighting, but no mitigation was required as the whales were outside the 500m exclusion zone.</p>
108	<p>At 01:51, one dolphin was detected on the Port thermal camera, the upper-half of the body breaking the surface of the water at an estimated distance of 100m. The falcate dorsal fin and beak were clearly visible. At an estimated distance of 125m from vessel, was seen a few seconds later breaking the surface of the water as well, with two other dolphins breaking the surface almost in unison an additional 25m away. All individuals were parallel to the vessel in the direction of the bow. Attempts were made to follow with the thermal camera, but the dolphins were lost on screen. EF then went outside with the night vision and could not see the individuals. Despite being outside the 500m exclusion zone, the sighting lasted less than ten minutes; no mitigation was required. All HRG survey equipment was active for the duration of the sighting.</p>
109	<p>At 02:16, at approximately 600m from the vessel, white splashes were detected with the thermal camera off the port side. A pod of 10-20 dolphins was porpoising, in three separate sections. A group of at least 10 dolphins was seen porpoising in a parallel direction opposite the vessel (toward the stern), in between 530 and 700m (estimated using RADES). At 02:18, a group of 5-7 individuals was closer to the vessel, at approximately 300m, with the first group remaining at the farther distance. At this time, a few dolphins could be seen making splashes that appeared more like lunges toward an unseen object rather than porpoising intended. Additionally, another group of at least 4 came within 50m of the vessel at 02:19, again in a parallel direction opposite the vessel. The thermal cameras lost track of the closest group due to their proximity to the vessel. Over thermal cameras while EF went outside with night vision, but was unable to see the pod once outside. The dolphins were last seen at 02:21, until detected again at 02:26 as two individuals at 900m away from the vessel again on the port side. At the initial sighting (02:18), the vessel was entering a turn, and was coming out of the turn at 02:26. It is suspected that while the video seemed to show the dolphins moving in a determined direction that due to the turn of the vessel and the sightings always occurring on the port side, that the pod most likely stayed within a certain area and that it was the boat that moved around the dolphins. The pod, was seen again at 02:28, the time of the last sighting, at a final distance of 800m from the vessel. The porpoising events at this time had greatly diminished, with only one dolphin seen jumping at a time with at least a six second interval between events, growing as a longer time lapse until they were not seen again (02:28). While the dolphins entered the 500m exclusion zone, they were determined to be outside the zone at the end of a 10 minute period, and continued to stay outside the zone until the end of the detection. As such, no mitigation was required. Multibeam echosounder, sub-bottom profiler, and USBL were active for the duration of the sighting. Video recording was turned off for line change).</p>
572	<p>A brief acoustic detection of dolphin whistles (10.2-18.3kHz) from 04:19 to 04:20 UTC. Three downsweep whistles, each 0.3-0.4s in duration, were observed during the one minute acoustic detection. A single whistle was selected with the clip generator to generate a bearing of $\pm 9.1^\circ$ relative to the hydrophone array (\pm to account for left/right ambiguity). Whistle amplitudes, which were measured during playback in Raven, range from 109dB (106dB average). Amplitudes provided are the relative received amplitudes and have not been corrected by a calibration factor. Localization was not possible due to the lack of sufficient bearing data and the acoustic event. The acoustic detection was not correlated with a visual sighting on the IR cameras. The vessel was undergoing a line change between multi-channel survey lines, with the chirper, multibeam echosounder, and USBL active at the time of the detection (EZ 500m). Mitigation was not required.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
573	<p>Low frequency dolphin clicks were detected in short bouts of activity, each 0.5 to 100 in duration, from 09:17 to 09:23 UTC. Aural detection was the primary method of real-time observation, with only a few clicks the low frequency click detector bearing (from ± 80-100° relative to the hydrophone array) and amplitude displays. A few clicks were also visible in real-time on the mid-frequency spectrogram. More distinct clicks were observed offline during playback and analysis of recordings in Raven. The dolphin clicks were not observed in the high frequency click detector. Click waveforms observed in the low frequency click detector showed a strong signal on channel 0 (hydrophone 1 of 4) with a weak signal on channel 1 (hydrophone 2 of 4). The discrepancy in signal strength may have contributed to the low number of clicks detected by the low frequency click detector, as the minimum number of channels required to trigger a detection was set to two and a weak signal on the second channel may have resulted in the rejection of true clicks. The clicks were also pre-observed in the spectrogram panel for channel 0 (hydrophone 1) when compared to channel 1 (hydrophone 2). Bouts of click activity were detected for 15s at 09:17, for 0.5s and 1s (twice) at 09:20, for 6s at 9:21 and 09:23. Click energy was concentrated at frequencies below 7kHz, with a broad click spectrum of 3-20kHz (single peak around 5-6kHz). The inter-click interval was consistently between 0.09 and 0.1s. Relative amplitudes measured from the low frequency click detector amplitude/time display ranged from 141-143dB (average 142dB). (Amplitudes provided are the relative received amplitudes and have not been corrected for calibration factor.) Individual clicks observed in the bearing/time display were manually tracked and localized using target motion analysis (TMA with least squares algorithm) to 36.3m \pm 7.4m (perpendicular error \pm 2.7m) from a bearing of $\pm 100^\circ$ at 09:18. Additional localizations were not obtained over the course of the detection due to the sparse number of clicks available for tracking in the low frequency click detector. Acoustic detection was not correlated with a visual sighting on the IR cameras. The survey team had just completed the deployment of the single channel streamer and was commencing survey operations when the clicks were detected. The chirper, multibeam echosounder, and USBL were active at the time of the detection (EZ 500m). Mitigation was not required.</p>
574	<p>A single downsweep dolphin whistle (14.3-9.2kHz with a received amplitude of 108dB) was detected, both aurally and visually on the mid-frequency spectrogram display at 04:45 UTC, with high frequency dolphin clicks (100kHz with single peak between 26-38kHz) observed shortly after. Clicks were initially identified using the amplitude/time display. The manual selection of clicks from the amplitude display allowed the operator to determine the bearing from which the click originated and ultimately locate the dolphin clicks in the bearing/time display. However, concentrated areas of noise from the vessel and geophysical survey equipment at ± 20-33° (bearings identified from clicks selected from the amplitude display) on the bearing/time display made identification of click trains difficult which impeded manual tracking and localization. As a result, a localization was not obtained. Click amplitudes, which were estimated from the amplitude/time display ranged from 130-140dB. Dolphin clicks were last detected at 04:48. Whistle and click amplitudes provided are the relative received amplitudes and have not been corrected by a calibration factor. Bearings are relative to the hydrophone array and are provided as \pm values to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras. The survey team was troubleshooting the multichannel streamer at the time of the detection. The chirper, multibeam echosounder, and USBL were active at the time of detection (EZ 500m). Mitigation was not required for the dolphin acoustic detection.</p>
575	<p>The detection was brief, consisting of a single upsweep dolphin whistle at 07:04 UTC, that was both audible and visible on the mid-frequency spectrogram display. The whistle was approximately 1.4s in duration, with a frequency range of 7.5-12.3kHz, and SNR of 2-3. Amplitude ranged from 98dB on the ends, to a maximum 108dB in the middle of the whistle (Relative amplitude determined through playback in Raven, not corrected for calibration factor). No bearing was obtained, and localization was not possible for a single whistle. The Discovery was heading for a multi-channel survey line at the time of the detection, with the sub-bottom profiler and MBES active. The detection was not correlated with a visual sighting by PSO on thermal camera watch, and no mitigation was required.</p>
110	<p>At 07:59, a solitary blow was seen on the starboard side thermal camera, midship. The blow was vertical and singular (not v-shaped), moderate in size and somewhat bushy. Video was taken, but only recorded the blow when it was dissipating into the wind. Direction of travel was not able to be determined, as the body was not seen on camera and the wind took the blow. Distance was estimated using RADES at 570m. The blow was within the 500m exclusion zone. No mitigation was requested at time of sighting, and whale was not sighted again. All HRG equipment was on at the time of the sighting.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
111	<p>A moderate-sized broad blow was spotted by off-effort observer BS at 13:44 UTC, approx. 15 degrees off the bow. Reticle distance was estimated by EF as 1200m at the initial sighting. A second blow was seen by SB at 13:45. A third blow was seen by all observers at 13:46, followed by a dark gray, arched back with a low profile "hump-like" dorsal fin. Afterwards, the whale raised its peduncle and displayed dark, broad fluke entering a deep dive. At the time of the sighting, the individual appeared to be crossing before the bow heading Southwest, but was not seen again after the dive. No mitigation was required as the whale was out of the 500m exclusion zone throughout visual detection.</p>
112	<p>From 14:03-14:07, a series of seven blows were observed off the port stern (bearing 07:00) of the Discovery at an approximate distance of 1218m (2 reticles, TH). At least two whales were present, indicated by simultaneous blows in different locations. The dorsal body of the whales could be seen, but not well enough to see the dorsal fin. At 14:13, a single blow was observed, at an approximate distance of 1624m (1.5 reticles, TH) and bearing 07:00. From 14:20-14:23, a series of five blows were observed at an approximate distance of 3000-4000m (two whales appeared to be separated by a significant distance), bearing 07:00. Again, simultaneous blows were observed in different locations. The whales were not seen after 14:23. All blows were broad and bushy and low-moderate in height (estimated 2-4m). Their direction of travel remained consistent throughout the entire sighting event. All HRG equipment was active until approximately 14:10, when the sparker was turned off for line change. Multibeam echosounder, USBL, and sub-bottom profiler were active for the duration of the sighting. No mitigation was required, as the whales remained outside the exclusion zone for the entire sighting event. All times indicated are UTC, and all bearings are in reference to clockface.</p>
113	<p>From 14:44-14:47, a series of four blows was observed approximately 6000m (<0.5 reticle, TH) off the port bow of the Discovery, at bearing 11:00. Two nearly simultaneous blows were observed, one appearing to be slightly ahead of the other, indicating there may have been some distance between the whales. Four minutes later (14:51-14:53) after possible dive(s), three additional blows were sighted directly off the bow of the Discovery, at an approximate distance of 6000m (0.5 reticle, TH), bearing 12:00. All observed blows were characteristic of a humpback whale: broad and bushy shaped, and relatively low height (estimated 2-4m tall). No other identifying characteristics were observed. It is possible these were the same whales as the previous sighting (#112) that ended at 14:23 with the whales off the stern of the vessel. Following end of sighting #112, the Discovery turned at 14:26, and was heading in the opposite direction for this sighting. All HRG equipment operating below 200kHz (sparker, sub-bottom profiler, MBES, USBL) was active for the duration of the sighting. No mitigation was required, as the whales did not enter the 500m exclusion zone. All times indicated are UTC, and all bearings are in reference to clockface.</p>
114	<p>Beginning at 15:17, repeated broad bushy blows were observed approximately 2436m (1 reticle, TH) off the port side of the Discovery, bearing 10:00. The whales were moving parallel and opposite the vessels slightly toward the vessel. At 15:24, two whales were observed rolling on their sides and lunging across the surface in unison, approximately 1624m (1.5 reticle, TH) off the port side, bearing 09:00. Long white flippers, and white patches on their ventral bodies could be seen. This was the CPA for the sighting event. At 15:32, at least three whales were visible at the same time, approximately 2436m (1 reticle, TH) off the port side, bearing 08:00. At 15:37, the whales were approximately 4872m (0.5 reticle, TH) off the port stern, bearing 07:00. The whales were last sighted milling at 15:40, approximately 5000m (visually estimated, <0.5 reticle, TH) off the port stern, bearing 07:00. The whales appeared to be milling and feeding, with surface splashes visible along with blows. Various types of surface activity were observed throughout the sighting event: Fluking (flukes observed), rolling lunges, pectoral flipper slaps, splashing. Simultaneous lunges/rolls were observed on multiple occasions. Repeated large splashes were created by the whales rapid movement at the surface. Observed behaviors indicated the whales were likely feeding. Blows were consistently observed throughout the event, with a total estimated 60-70 blows. Up to three simultaneous blows were observed on several occasions. Blows were variable in shape and height: broad and bushy, to plume shaped, and approximately 2-4m estimated height. All HRG equipment operating below 200kHz (sparker, sub-bottom profiler, MBES, USBL) was active for the duration of the sighting. No mitigation was required, as the whales did not enter the 500m exclusion zone. All times indicated are UTC, and all bearings are in reference to clockface.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
115	<p>From 18:43-18:46, a series of seven blows was observed approximately 7293m (0.33 reticle, TH) off the starboard stern of the Discovery, bearing 05:00. After the last blow, a broad black fluke was observed slap creating a large splash. The whales most likely dove by 18:46. From 18:54-18:57, another series of nine blows was observed off the starboard stern (bearing 05:00), at an approximate distance of 9744m (0.25 reticle, TH). This series of blows was accompanied by two full breaches, and one dive/fluke up of a broad black fluke. Breaching whales had large black robust bodies, but no specific characteristics could be determined at this time. Blows for the sighting event were variable in shape and height: broad and bushy to plume shaped, and relatively low to moderate in height. Nearly simultaneous blows and breaches indicated the presence of whales. Direction of travel could not be determined for the start of the sighting, but the whales appeared to have moved further away in between the two rounds of blows/ surface activity. All HRG equipment operating below 200kHz (sparker, sub-bottom profiler, MBES, USBL) was active for the duration of the sighting. No mitigation was required, as the whales did not enter the 500m exclusion zone. All times indicated are UTC, and all bearings are in reference to clockface.</p>
116	<p>From 19:44-19:45 UTC, a series of four blows were observed off the starboard side of the Discovery, at an approximate distance of 2436m (1 reticle, TH), and bearing 02:00 (using clockface). Two simultaneous blows were observed, indicating the presence of at least two whales. Blows were of moderate height and plume shaped (not quite bushy, not elliptical). No other identifying characteristics were observed, and the whales were out of sight again. Due to the brevity of the event, no direction of travel or pace of the animals could be determined. No distinct behaviors were observed, although the whales may have dove out of sight. The Discovery was on the channel survey line, with all HRG equipment operating below 200kHz (sparker, sub-bottom profiler, MBES, USBL) active for the duration of the sighting. No mitigation was required, as the whales did not enter the 500m exclusion zone.</p>
117	<p>At 20:11, two broad plume shaped blows were observed approximately 3248m (0.75 reticle, TH) off the starboard side of the Discovery, bearing 03:00. From 20:16-20:19 a series of six blows were observed (three plume shaped) approximately 4280m (0.5 reticle, TH) off the starboard side at bearing 03:00. Two near simultaneous blows were observed (occurred twice), indicating the presence of at least two whales. Two lunge-feeding (possible feeding behavior) were observed, in which the whales turned sideways exposing white patches on the ventral side of its head, long white pectoral flippers, and created large splashes. The vessel began a turn to port at 20:20 (to port), which made determining the whales speed and direction of travel difficult. A few more blows were sighted by MK approximately 4848m (0.5 reticle, MK) off the port stern (bearing 07:00) during the turn (heading 350°), at 20:30. All blows were broad, slightly variable in shape (bushy to plume), and height (relatively low to moderate). All HRG equipment operating below 200kHz was active for the duration of the sighting except the sparker which was turned off at 20:18 for the turn (multi-channel survey in progress). The whales did not enter the 500m exclusion, and no mitigation was required. All times indicated are UTC, and all bearings are in reference to clockface.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
576	<p>A series of near-constant frequency (9.2 and 12.8kHz) dolphin whistles was detected, both aurally and visually on the mid-frequency spectrogram at 23:21 UTC. Initial bearings to whistles selected using the clip generator were concentrated between $\pm 9-22^\circ$ relative to the hydrophone array, however one whistle was detected from a bearing of $\pm 61^\circ$. Upsweep, downsweep, and chirp whistle types, each 0.2-1.5s in duration and frequency from 7.8-15.4kHz were also observed during the acoustic event. The majority of the detected whistles were of a relatively high amplitude, with an average received amplitude of 107dB recorded (range 101-109dB) (Whistle amplitude was measured during playback in Raven). Up to the second harmonic was visible for a few of the more intense dolphin whistles. Dolphin whistles were last detected at 23:26. Two short frequency dolphin click trains were observed at consistent bearings between $\pm 80-82^\circ$ and $\pm 112-113^\circ$ at 23:23 and 23:24 respectively. Individual clicks from the two trains were manually tracked and localized using target motion analysis (TMA with least squares algorithm) to 222 and 234m, however the initial range estimates contained extremely high error values (± 926 and ± 8478m perpendicular error and ± 147 and ± 3510m parallel error respectively) and should be considered with caution. Intermittent clicks were observed until a bout of increased click activity at 23:26, when four simultaneous click trains at different but similar bearings (indicative of four individuals) were detected. The four click trains originated from bearings between $\pm 28-38^\circ$ and underwent rapid bearing changes over 5s periods with final bearings of $\pm 42^\circ$, $\pm 72^\circ$, $\pm 107^\circ$, and $\pm 158^\circ$. Click trains were manually tracked to produced range estimates relative to the hydrophone array of: 11.4m ± 1.1m (perpendicular error ± 1.1m and parallel error ± 0.59m) from a bearing of $\pm 55^\circ$, 9.1m ± 2.7m (perpendicular error ± 2.7m and parallel error ± 2.9m) from a bearing of $\pm 119^\circ$, 5.8m ± 0.2m (perpendicular error ± 0.18m and parallel error ± 0.09m) from a bearing of $\pm 61^\circ$, and 3.7m ± 0.18m (perpendicular error ± 0.18m and parallel error ± 0.18m) from a bearing of $\pm 58^\circ$. All localizations were obtained from a selection of less than 15 clicks from each train that were selected over short periods of 5s or less. However, the rapid change in bearings observed for the tracked trains supports a close pass of the dolphins by the hydrophone array. Terminal buzzes were detected at the end of two of the four echolocation click trains at 23:26. The high frequency dolphin clicks corresponded between 12-120kHz, with a single peak between 25-36kHz (most frequently observed during detection) or between 75-85kHz. Click amplitudes, which were estimated from the amplitude/time display ranged from 134-146dB (average 147dB). Clicks were last detected at 23:27. Whistle and click amplitudes provided are the relative received amplitudes and have not been corrected by a calibration factor. Bearings are relative to the hydrophone array and are provided as \pm values to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras. The dolphins were likely outside the cameras' panning area indicating the dolphins were astern of the vessel. All geophysical survey equipment was active at the time of the acoustic detection, with the vessel running a multichannel survey line (EZ 500m). Mitigation was not required for the dolphin acoustic detection.</p>
577	<p>Dolphin whistles and high frequency clicks were detected over a 4 minute period from 00:33 to 00:37 UTC. Constant frequency, upsweep, and concave whistle types, each 0.5-1s in duration and ranging in frequency from 13-17.7kHz were observed over the course of the detection event. Concave whistles were the dominant whistle type observed. A sharp inflection point was observed for several concave whistles at the upsweep to downsweep transition, which gave the whistles an inverted 'v' appearance. Bearings to whistles selected using the clip generator were concentrated between $\pm 4-8^\circ$ relative to the hydrophone array. Whistle amplitudes, measured during playback in Raven, ranged from 101-109dB with an average received amplitude of 107dB. Short bouts of click activity 5s or less in duration were observed throughout the acoustic event at bearings between $\pm 34-50^\circ$. Click frequency spectrums ranged between 13-120kHz with individual clicks having a single peak between 25-30kHz or 75-80kHz. Received click amplitudes ranged from 134-146dB (139dB average). The dolphin acoustic detection was not correlated with a visual sighting on the IR cameras. The vessel was conducting a multichannel survey line on the Revolution Win area with all geophysical equipment deployed and active at the time of the acoustic detection (500m EZ). Mitigation was not required for the detection. Click bearings and amplitudes were recorded from the click detector displays. Whistle and click amplitudes provided are the relative received amplitudes and have not been corrected by a calibration factor. Bearings are relative to the hydrophone array and are provided as \pm values to account for left/right ambiguity.</p>
578	<p>A brief acoustic detection of high frequency dolphin clicks (15-100kHz with a single peak between 30-50kHz) from 09:58:52 to 09:58:56 UTC. The clicks were observed in a single click train whose bearings graduated from $\pm 58^\circ$ relative to the hydrophone array to $\pm 69^\circ$ over a 18s period. Individual clicks from this train were manually tracked to produce a localization using target motion analysis (TMA with least squares algorithm) to 13.8m (perpendicular error ± 13.8m and parallel error ± 5.6m) at $\pm 30^\circ$. Received click amplitudes ranged from 123-149dB with an average of 137dB. Dolphin click bearings and amplitudes were derived from the corresponding high frequency click detector displays. Whistle and click amplitudes provided are the relative received amplitudes and have not been corrected by a calibration factor. Bearings are relative to the hydrophone array and are provided as \pm values to account for left/right ambiguity. The acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical survey equipment was deployed and active at the time of the dolphin detection (500m EZ). Mitigation was not required for the detection.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
118	<p>At 12:18 UTC, a blow was sighted off the starboard bow at an approximate distance of 4840m (0.5 reticle, SB) and bearing of 1 o'clock. The animals were next observed at 12:26, at which point two simultaneous blows were observed, followed by two more blows; confirming the presence of two whales, though it is possible there was a third. There were three consecutive blows at 12:28, at which time the approximate distance from the animals was 2420m (1 reticle, SB). Two more blows were observed at 12:29 and a round, full, and bushy blow was sighted at 12:30. Blows were sighted at 12:31 and lastly at 12:32. All blows were broad and low-moderate in height (estimated 2-4m). No clear direction of travel, other identifying characteristics, or behaviors could be determined. The vessel was actively surveying, with the sparker, multi-channel streamer echosounder, USBL, and sub-bottom profiler active for the duration of the sighting. No mitigation was required, as the whale(s) remained outside the exclusion zone of 500m. Photo by SB</p>
119	<p>At 12:42 UTC, a short round blow (estimated 2m high) was sighted off the starboard side bridge at approximately 691m (3.5 reticle, SB) and bearing of 3 o'clock. At 12:44 animal was observed at the surface at a distance of 1613m (1.5 reticle, SB). The animal stayed at the surface for about a minute with its dorsal clearly out of the water. The dorsal was small with a raised hump in front. Knuckles behind the dorsal were visible when the animal did a shallow dive, exposing the area just behind the dorsal. Only a small bit of the area behind the dorsal was exposed as the animal did not display the high arched back that is characteristic of a humpback whale. A blow was sighted at 12:47. At 12:48 the dorsal back and fin were again visible, followed by a small blow. One minute later at 12:49 the animal surfaced again, exposing its dorsal back and fin. Two blows followed. The direction of travel of this individual was parallel and in the opposite direction of the vessel. The individual was last sighted heading from 3 o'clock to 4 o'clock at a final approximate distance of 1613 (1.5 reticle, SB). At 15:10, a large whale was observed breaching on the starboard side of the Discovery, at an approximate distance of 2450m (1 reticle, TH), bearing 02:00. This was not seen directly, as TH was turning his head to look at the animal, and it was seen in peripheral vision with the naked eye. Immediately after, two whales were seen (simultaneously) partially coming out of the water, moving rapidly across the surface in a lunging motion, exposing their undersides (appeared to be some white color visible on underside of heads, but difficult to see much detail due to splashes). Between 15:10-15:18, a variety of surface activities were observed with multiple occurrences of the following: partial breaches, rapid surface lunging motions, entire heads coming straight out of the water (possible skim feeding). One tail slap was observed. Much of the surface activity consisted of large/broad splashes, that often obstructed view of the whales body parts. Dorsal fins were not able to be seen due to splashing, distance, and sea state. One apparent dive occurred, in which the whale highly arched its back. Approximately 15-18 blows were observed during this time, in between other surface activities. All blows were similarly shaped and characteristic of humpback whales: broad and bushy, of relatively low height, with a maximum of 3m. The whales heads (seen several times coming straight out of the water in profile view) appeared too tapered and pointed to be that of a NARW, so it is highly likely these were humpback whales. At times, two whales were seen breaking the surface simultaneously. Bearing of the whales shifted from 2:00 to 4:00 during the sighting, as the vessel was turning to port during the sighting for a line change. Initially appeared to be travelling in the same direction as the Discovery, but final direction was unable to be determined due to the turning of the vessel. The whales were at an approximate distance of 3248m (0.75 reticle, TH) and last sighted by a blow at 15:10. The Discovery was conducting single-channel survey, with all HRG equipment operating <200kHz active for the duration of the sighting. Mitigation was not required, as the whales remained outside the exclusion zone of 500m. All times indicated are UTC, and all bearings are in reference to clockface. Photo taken by MK.</p>
121	<p>At 21:23, a black dorsal fin was briefly sighted approximately 300m (visually estimated) off the port side of the Discovery, bearing 10:00. Species could not be determined at this time, as the animal was barely seen. A confirmed Humpback whale was sighted approximately 271m (9 reticles, TH) off the port side, bearing 09:00. The whale broke the surface twice, exposing part of its head, back, and dorsal fin. The whale slightly surfaced after the second surfacing. It was travelling at a rapid pace in the opposite direction of the vessel heading. Once the species was confirmed (21:25), PSO requested shutdown of all HRG survey equipment on the Discovery (Sparker, Sub-bottom profiler, MBES, USBL). Shutdown confirmed at 21:27. The whale was not seen again after 21:25. 30 minute exclusion zone clearance was required following the shutdown. PSO got back to begin ramp up procedure at 21:57, after confirming no additional sighting or acoustic detection had occurred since shutdown. Estimated loss of production was 45 minutes (30 min shutdown + 15 min ramp up). All times indicated are UTC, and bearings are in reference to clockface.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
122	<p>A splash was first detected off the port side of the vessel at 00:13 by EF. Multiple splashes were seen thereafter. Splashes were low-profile and directional, pushing the water forward. Each splash was pointed direction. At times the splashes originated in the same place, at other times they were an estimated 25-50m away from one another. SB and TH maintained thermal camera watch while EF went outside with night vision. Thermal cameras show the first few splashes to be at an approx. 350m from the vessel (estimated visually due to the reduced visibility on RADES from inclement weather), with closer splashes at an approx. distance.</p> <p>00:17. At least two individuals can be seen in closer proximity of the vessel at this point, as well as clearly defined dorsal fins. The directional changes of the splashes suggested that the dolphins were feeding. This was confirmed when EF went outside with the night vision. EF saw only one dolphin with the night vision, of an approx. size of 1.5m, indicating the presence of at least one juvenile. The juvenile was seen towards the stern, in a torpedo shape near the surface of the water at 00:24, making rapid direction changes while chasing a fish/squid in the surrounding light from the vessel. This continued for one minute, with the juvenile remaining near the surface, and only displaying the top of head and dorsal fin when surfacing. It then swam parallel alongside the port towards the bow, porpoising once and prominently displaying the dark saddleback and hourglass pattern of a common dolphin that was clearly visible with the night vision. At this point, the individual was closest to the side of the vessel, and estimated 1m from the port side. It swam close to the side until an estimated 10:00, and veered right (towards the vessel) and down. EF went to the starboard side but was unable to locate the juvenile, or any other individual of the pod. Upon returning to thermal cameras, the dolphins were again visible until 00:32, as a series of three small splashes at an estimated distance of 350m from the port side at bearing 9:00/10:00 (using clockface). While inside the exclusion zone of 500m, the sighting was determined to be a voluntary approach (due to the dolphin using the vessel light to feed) and no mitigation was required. All HRG equipment was active at the time of sighting. Thermal camera detection correlates with simultaneous detection 579. All times indicated are UTC.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
579	<p>click trains were observed from bearings around $\pm 75^\circ$ and between ± 25-30° relative to the hydrophone array. These click trains were short (5s or less in duration) and exhibited little to no change in bearings. A click trains were regularly detected from bearings between ± 25-30° for the first 5 minutes of the acoustic event. Click activity increased between 00:25 and 00:28, during which time multiple click trains were undergoing gradual bearing changes of 45-75° over 15-25s periods. The click trains exhibiting large but gradual bearing changes were observed in bouts, with 5 simultaneous click trains observed at 00:26: additional 5 simultaneous click trains observed 16s later at 00:26:35. Clicks continued to be detected from bearings of ± 25-30° during, between, and after (until 00:29) the two bouts, with concentrated clicks at bearings between ± 130-160° after the first bout and through to the end of the acoustic detection at 00:35. Nearly all clicks detected from 00:29 through to the end of the acoustic detection at 00:35 were at bearings between ± 100-160°. Bearing changes consistently indicated the dolphins were moving from a location ahead of the hydrophone array to behind. Only a few short click trains were observed to have been indicating movement in the opposite direction. Individual clicks from two click trains were manually tracked and localized using target motion analysis (TMA with least squares algorithm) at the start of the detection, however the GPS received its last fix 3 minutes after the detection event began, with the vessel's position updated approximately 5 minutes after the detection was complete. The first range estimate was derived from the clicks and was therefore discarded. The second tracked train produced a localization of 232.4m \pm 31.6m (perpendicular error \pm 31.6m and parallel error \pm 20m) from a bearing of $\pm 63^\circ$ relative to the hydrophone array (corresponding to either the 2 or 10 o'clock positions on a clock face) at 00:21. Lack of GPS data prevented additional localizations, however bearings from tracked clicks continued to be displayed on the map throughout the observed time series. Clear cross bearings were observed and when zoomed in on, appeared to place the dolphins well within the 500m exclusion zone. The high frequency common dolphin clicks contain between 12-110kHz, with a single peak between 25-38kHz or between 75-85kHz. Click amplitudes ranged from 120-161dB (average 143dB). The low frequency portion (<24kHz) of the clicks was visible on the spectrogram display. A faint down sweep dolphin whistle (18-14.3kHz with a received amplitude of 96dB) was observed at 00:26 (identified during offline analysis of the detection files). The common dolphin acoustic activity was correlated with a visual sighting (#122) using the IR cameras and night vision device (00:13-00:32). The camera operator identified the species through observation with night vision. The visual PSO observation is often associated with foraging (rapid direction changes and water agitation at surface) during their visual sighting. Range estimates derived from visual observations indicate the dolphins were 100-200m off the port side of the vessel (between 10 and 11 o'clock on the clock face) at 00:17. The localization obtained through TMA indicated the dolphin(s) producing the tracked click train was at a similar distance to those observed by visual observation and at the 10 o'clock (or 2 o'clock to account for left/right ambiguity) position. However, the two range estimates were made 4 minutes apart and cannot be directly compared. A dolphin was, however, observed along the port side of the vessel for 1 minute from 00:23, therefore it is reasonable that individual dolphins observed 200m from the hydrophone array would cover that distance in 2 minutes. Dolphin click amplitudes were derived from the corresponding high frequency click detector displays. Whistle and click amplitudes provided are the relative received amplitudes and have not been corrected by a calibration factor. All bearings are relative to the hydrophone array and are provided as \pm values to account for left/right ambiguity. All geophysical survey equipment was deployed and active at the time of the dolphin detection (500m EZ). The observer determined the dolphin's approach to be voluntary, therefore mitigation was not required.</p>
123	<p>400m). At first, the splashes looked directional, with one side of the splash bigger than the other, as if lunging toward something. Additionally, some splashes appeared to be pointed toward the bow, and others toward the stern, exhibiting possible feeding behavior. Once video recording was started, 3-4 small splashes can be seen in a row, ending in a fairly large splash. The large splash was greater in area and height than the smaller splashes, appearing slightly smaller in the base than the top, and with a somewhat flattened top. In between the small and large splashes, an additional small splash can be seen further in the distance, indicating at least three dolphins. Due to poor weather conditions, video quality was marginal, as was night vision. Animals were suspected to be delphinid due to similarities in splash pattern/behavior from the previous dolphin detection of 122, and was estimated visually based on similar distances from detection 122 as well. All HRG equipment was active at the time of the sighting, but no mitigation was required as the sighting lasted less than 10 minutes within the 500m exclusion zone.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
580	<p>A brief acoustic detection of high frequency dolphin clicks (12-15 kHz with a single peak between 20-30 kHz, 10-15 kHz, or 10-30 kHz) from 09:07 to 09:09 UTC. The dolphin clicks were observed in distinct click trains at bearings ranging from ± 28-145°. Most trains underwent small bearing changes of 10° or less over 3-8s periods, however the first click train observed exhibited a 32° bearing change (over 12s). Clicks from this train were observed at bearings between ± 28-31° for 9s before undergoing a rapid change to $\pm 60^\circ$ over 3s. Individual clicks from this train were manually tracked to produce a localization using target motion analysis (TMA with localization algorithm) of $6.5\text{m} \pm 3.5\text{m}$ (perpendicular error $\pm 3.5\text{m}$, parallel error $\pm 3\text{m}$) from a bearing of $\pm 60^\circ$. Clicks from five additional trains were tracked to produce the following localizations: $60.4\text{m} \pm 31.1\text{m}$ (perpendicular error $\pm 31.1\text{m}$, parallel error $\pm 27.5\text{m}$) from a bearing of $\pm 47^\circ$ at 09:07, $38.2\text{m} \pm 18.3\text{m}$ (perpendicular error $\pm 18.3\text{m}$, parallel error $\pm 7.4\text{m}$) from a bearing of $\pm 150^\circ$ at 09:08, $6.4\text{m} \pm 0.5\text{m}$ (perpendicular error $\pm 0.5\text{m}$, parallel error $\pm 0.2\text{m}$) from a bearing of $\pm 22^\circ$ at 09:08, $6.1\text{m} \pm 2.7\text{m}$ (perpendicular error $\pm 2.7\text{m}$, parallel error $\pm 1\text{m}$) from a bearing of $\pm 176^\circ$ at 09:08, and $21\text{m} \pm 4.7\text{m}$ (perpendicular error $\pm 4.7\text{m}$, parallel error $\pm 7.9\text{m}$) from a bearing of $\pm 176^\circ$ at 09:09. Changes in bearings over the course of the detection indicated the dolphins were passing from ahead of to behind the hydrophone array. The low frequency components ($<24\text{kHz}$) of the clicks were visible in the frequency spectrogram. Received click amplitudes ranged from 126-158dB with an average of 140dB. Dolphin click bearings and amplitudes were derived from the corresponding high frequency click detection. Amplitudes provided are the relative received amplitudes and have not been corrected by a calibration factor. Bearings are relative to the hydrophone array and are provided as \pm values to account for left/right acoustic detection was not correlated with a visual sighting on the IR cameras. All geophysical survey equipment was deployed and active at the time of the dolphin detection (500m EZ). Mitigation was not requested/required as animals were outside the 500m exclusion zone. All bearings indicated are in reference to clockface.</p>
124	<p>A small pod of dolphins was detected off the starboard bow at bearing 1:00 (approx 15° starboard of the bow) at 12:13UTC. Sea conditions were near flat calm, and dolphins were barely breaking the surface. Approx. 6-7 individuals were estimated in the group. Animals were surfacing so that only the tops of their heads and dorsal fins could be seen. Due to the overcast sky and distance of the pod, the dolphins appeared gray and no distinctive markings could be discerned. Once sighted, the boat entered a turn to start a new survey line, and the pod position moved from bearing 01:00 to 03:00, although the actual pod did not travel in that location. Individuals in the group were shallowly surfacing in a tight cluster, and would surface with heads oriented in different positions from one another; the pod did not appear to travel in any one direction. On a mid-turn, the pod was not seen again after 12:16 UTC. Attempts at photographs were made, but unsuccessful. Distance was estimated visually, as the true horizon line was obscured (could not use reticle). While all HRG equipment was active, no mitigation was required as animals were outside the exclusion zone. All bearings indicated are in reference to clockface.</p>
125	<p>While deploying the PAM hydrophone cable, observer SC spotted a dolphin porpoising next to the vessel on the starboard side at approx. 06:30 UTC, swimming in a parallel direction to the boat. Observers EF also spotted a delphinid porpoise again, showing the prominent hourglass pattern on its side. Thermal camera did not detect any dolphins, and individual(s) were not seen after 06:32. Sighting was determined to be a voluntary surface. The dolphin was very close to the vessel and appeared to be porpoising in the wake created by the side of the vessel and did not move further away between sighting events. Mitigation was not requested/required as animals were outside the 500m exclusion zone. All bearings indicated are in reference to clockface. beam echo sounder was the only HRG equipment active at the time of sighting.</p>
581	<p>At 07:43 UTC, two small peaks were observed on the HF click detector, above ambient vessel noise. They peaked at an amplitude of 124dB. Frequency was not obtained, but waveform and Wigner plot displayed were indicative of delphinid species. GPS was not receiving data, so tracking/localization was not possible and vessel location was obtained to the nearest hour from visual watch. Mitigation was not requested as animals were outside the 500m exclusion zone. All bearings indicated are in reference to clockface. vocalizations lasted less than one minute. The multi-beam echo sounder was the only HRG equipment active at the time of sighting.</p>
126	<p>Two bushy blows detected ~1km at 4:00 position off starboard; shape of blow suggested that the animal was a humpback whale. No further blows or animals detected. While all HRG equipment was active, no mitigation was required as animals were outside the 500m exclusion zone. All bearings indicated are in reference to clockface.</p>

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any changes in behavior)
127	<p>First blow seen at 19:50 at 11:00 position port side. One animal briefly rolled partially out of water at same time another was spouting nearby. Boat went into a 90-degree turn from W to E shortly after sighting; went again until 20:00, when boat now heading E. At least two were seen thrashing and spouting ~1.5km from stern on starboard (5:00 position). Boat now heading away from whales, and last spout seen at 20:10. bushy and presumably made by Humpbacks; ~15 spouts seen. Animals rolled briefly out of water a few times, but too distant and too low in water to get field marks. All HRG equipment was active, but no mitigation required as animals were outside the 500m exclusion zone. All bearings indicated are in reference to clockface.</p>
582	<p>Whistles first detected on LF spectrogram by observer SC at 06:57 to 06:59 UTC. After a brief period of silence, a faint whistle was detected on the spectrogram at 07:09, barely audible above the vessel and HF noise at a signal strength of 1. It was 1 second in duration, at a frequency range of 11-12.9kHz and 63dB amplitude. From 07:10-07:15, five more whistles were discerned (signal strength 1-2) as upsweeps and ranging from 9-14kHz and 0.5-1s in duration. At 07:12 one click train was tracked, lasting less than 1 minute. Selected clicks estimated the dolphin at an approx. 59m from the hydrophone array, within a 200m edge from the vessel. The vessel entered a turn and whistles were not detected again until 07:24, as an upsweep of 10-13kHz visible on the spectrogram but not audible, and a stronger upsweep ending in a concave 07:25 of 9-17.9kHz and 64dB with a 2nd harmonic observed at a range of 18.2-23kHz. Simultaneously, amplitude peaks were seen on the HF click detector amplitude display, reaching a peak amplitude of 160dB. Additional whistles were detected afterward, from 07:29-07:32, as two faint upsweeps followed by two continuous frequency whistles. Analysis through Raven Lite 2.0 revealed that there were many more fainter time of last detection (07:32) than were visible on the spectrogram, with at least two whistles appearing at the same time as an upsweep and downsweep, suggesting the presence of 2 or more delphinids. There were whistles in a 2.4s period, ranging from 7.9-17kHz and an average amplitude of 65dB, of which only one whistle was audible. All HRG equipment was active at the time of detection; no concurrent visual sighting; mitigation was not requested/required.</p>
583	<p>One click train was detected at 07:57 UTC. Tracked clicks showed the dolphin(s) at an estimated 43m from the hydrophone and within 200m from the vessel. The amplitude display showed three small peaks, with the highest amplitude being 153dB. The detection lasted less than a minute; no concurrent visual sighting was made; all HRG equipment was active but mitigation was not required.</p>
128	<p>Detected a distant flock of gannets over a school of fish well off starboard; watched a minute or two, and when closer saw dolphin(s) roll out of the water 4 times over ~3 mins., breaching once, moving in parallel direction of vessel. Gannets and dolphins lost in sun glare as they continued to move in opposite direction of vessel. Chirper active, but due to distance from exclusion zone, no mitigation required.</p>
129	<p>remained at the same location feeding while the boat passed it. A 15-minute shutdown for active HRG equipment (multibeam, USBL, sub-bottom profiler) was requested and complied with at 17:48. At the end of shutdown the seal was outside of the 500m exclusion zone and last seen at the surface at 550m. With no further sightings of the individual or any other protected species within the 500m exclusion zone, ramp-down was complete by 18:03 (15 min re-clearance required for pinniped within the EZ). Ramp-up was complete by 18:13 (MBES powered on at 18:03, USBL powered on 18:08, and sub-bottom profiler powered on at 18:13). Estimate production is 25 minutes - 15 minutes due to shutdown and 10 minutes for ramp-up period. Photo taken by SM.</p>

Attachment 3

MV Discovery –Revolution Wind Farm Detection Summary

[illegible]

Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any observed changes in behavior)
001	<p>Splashes could be seen on the horizon approx 2300m off in the distance at a bearing of 1:00 from the bow of the vessel. When the animals came into focus they could be seen traveling quickly at the surface and occasionally jumping out of the water. First the animals appeared to be swimming parallel/towards the boat (with the closest point of approach being at a bearing of 3:00 and a distance of 760m) before continuing on and away from the vessel (mid ship) in a diagonal direction. The group was large but due to distance, a confident ID down to species level and age could not confidently be determined. In addition to the dolphins, several birds were also seen in the distance so it is possible that the animals were moving on from feeding. Only the multibeam was operating at the time and the animals never came close to entering the mitigation zone before moving on so no measures were taken.</p>
002	<p>At 21:08, during transit to Revolution work area, pod of 4-8 dolphins detected a visually-estimated distance of 1.5km from port side, travelling parallel and opposite to boat direction. The dolphins rolled out of the water several times; due to distance, a positive identification could not be made, but they were presumably Delphinus delphis. Due to distance of dolphins from boat, no mitigation necessary.</p>
003	<p>At 00:55, two delphinids were spotted off the bow with the thermal camera at an approximate distance of 320m. Dorsal fins could be seen cutting through the surface of the water as the animals made low-profile porpoising movements across the bow to the port side. Once lost on the Starboard camera, EF panned the Port camera towards the bow and detected the individuals approx. 30 degrees off the port side bow (11:00). At this time, they were an estimated 100m from the side of the vessel, and appeared to be traveling parallel to, if not slightly towards, the vessel in the opposite direction. At this time they were lost on thermal cameras, and EF went outside with the night vision goggles but was unable to detect the individuals. Last time of detection was 00:57 on the thermal cameras, and distance was estimated using the RADES camera program. Total detection was less than ten minutes, and mitigation was not required/requested. All HRG equipment for single-channel survey was active at the time of the detection.</p>
004	<p>At 04:59, small splashes of at least three dolphins were seen off the Port side cameras at an estimated distance of 1700m and -30 degrees off the bow; dolphins were moving at a speed slightly faster than the vessel. As the vessel continued to approach the dolphins while entering a turn, their estimated distance became closer (1070 to 800 to 600m), and they left the Port camera to be detected on the Starboard camera at an estimated distance of 540m (CPA) at 05:04. EF went out to detect on NVD but could not locate the dolphins. Dolphins reappeared on the Port side screen at 05:20 at an initial estimated distance of 1300m. At this time, at least four individuals could be seen at varying distances of 1200-1600m. The pod, while porpoising and creating splashes, appeared to be almost stationary; it is unclear whether they were milling in the same spot and/or feeding, or moving toward the bow at a similar or slower pace of the vessel. This continued until 05:35, closing their approach from 1600m to 650m. At this point, EF went outside with NVD again but was unable to detect the pod. Once inside the vessel, the pod was detected again off the Port side camera at 05:43 at an estimated distance of 700m. The pod appeared to be moving away from the vessel midship, and was last seen at 05:47 at a distance of 1100m. During this time the splashes became minimal and lower in profile until they were no longer detected on the thermal cameras. All HRG equipment for single-channel surveying was active at the time of the detection, but the pod was never detected inside the 500m exclusion zone and mitigation was not required or requested. All distances were estimated using RADES.</p>

APPENDIX D. *MV MEGAN MILLER* –REVOLUTION WIND FARM GEOPHYSICAL SURVEY PROTECTED SPECIES OBSERVER REPORT



Revolution Wind Farm Lease OCS-0486
Megan Miller Geophysical Survey 2018
Protected Species Observer Combined 90-Day and Final Report

Prepared by: A.I.S. Inc.

Prepared for: Deepwater Wind New England, LLC
and CSA Ocean Sciences Inc.

Submittal Date: January 08, 2019

This report is being submitted to satisfy the following lease stipulations:

BOEM Lease OCS-A 0486; Section 4.4 Reporting Requirements

4.4.3 Report of Activities and Observations

The Lessee must provide the Lessor and NMFS within 90 calendar days following the commencement of HRG survey activities that includes a summary of survey activities, and an estimate of the number of listed marine mammals and sea turtles observed and/or Taken during these survey activities.

4.4.4 Report Information

Data on all protected species observations must be recorded based on standard marine mammal observer collection data by the PSO. This information must include: dates, times, and locations of survey operations; time of observation, location, and weather; details of marine mammal sightings (e.g., species, number, behavior); and the details of any observed Taking (e.g., behavioral disturbances or injury/mortality).

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1 INTRODUCTION

Deepwater Wind South Fork, LLC (Deepwater Wind), an affiliate of lease holder Deepwater Wind New England, LLC is proposing to develop the Revolution Wind Farm (Rev) project, an offshore wind energy project within the Bureau of Ocean Energy Management (BOEM) Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf, OCS-A 0486 (Lease), interconnecting with the Connecticut and Rhode Island.

This report documents the complete results of the protected species detections from the 2018 geophysical surveys conducted by Fugro aboard the MV Megan Miller for Deepwater Wind. A summary of the data collected and, the number of animals detections are included in this report. Protected Species Observer (PSO) methodology and monitoring protocols are discussed, however, a detailed description is provided in the Alternative Monitoring Plan (AMP). An assessment of effectiveness of PSO monitoring and future recommendations is provided in the final section of the report.

2 SUMMARY OF GEOPHYSICAL SURVEY ACTIVITIES

Deepwater Wind completed site characterization surveys in the lease area consisting of geophysical sampling surveys from October 11th through December 14th, 2018. Both visual and Passive Acoustic Monitoring (PAM) observers were aboard the vessel during survey activities in accordance with the Construction and Operations Plan (COP).

3 PROTECTED SPECIES OBSERVATION METHODS

In order to comply with the lease protected species monitoring requirements issued by BOEM, Deepwater Wind contracted A.I.S. Inc. (AIS) to provide PSO and PAM operators to monitor for marine mammals and sea turtles during geophysical survey operations. These monitoring activities were completed in accordance with the BOEM approved Rev COP Survey Plan and AMP.

Protected species monitoring occurred at all times during this geophysical survey, in anticipation of geophysical operational activities, as well as during the transit to and from survey sites to avoid any potential protected species ship strikes. Visual monitoring occurred for a total of 358.1 hours, and acoustic monitoring during 17.6 hours.

3.1 PROTECTED SPECIES OBSERVER TRAINING AND COMPLIANCE

All PSO and PAM operators who monitored during this survey attended the Permit and Environmental Compliance (PECP) Training compiled and presented by Deepwater Wind. Additionally, all PSO and PAM operators received project specific training that covered the following topics:

- Permits and plans relevant to the project
- Environmental compliance requirements
- Health and safety requirements
- PSO/PAM operator requirements and scheduling
- Protected species mitigation methods

- Communication
- Authorized takes
- Data form
- PSO and PAM equipment, use, and maintenance
 - 7 X 50 Waterproof binoculars with reticles
 - Rangefinders
 - Gen 3 Night vision monoculars
 - High Definition/Thermal imaging cameras
 - PAM equipment
- Protected species identification review

All PSO and PAM operators who participated in the survey were approved by BOEM, per lease stipulation 4.3.4. All PSO and PAM staff were required to comply with Fugro operating standards, possess fit for sea duty medical clearance and offshore safety training.

Detailed PSO methodology and monitoring protocols are provided in the AMP. An assessment of effectiveness of PSO monitoring and future recommendations is provided in the final section of the report.

3.2 PROTECTED SPECIES OBSERVATION DATA

PSO and PAM entries and mitigation summaries were recorded on data sheets, which were provided to CSA and Deepwater Wind on a daily basis via email. Attached are summaries of the detections from PSO/PAM data for the MV Megan Miller in relation to specific survey activities (Attachment 1).

Summary details provided include:

- Dates, times
- Species encountered
- Initial detection method
- Location
- Group Size (Minimum, Maximum, Best)
- Description of the observed behaviors (in both the presence and absence of activities)
- A summary of event details
- Description of survey activities at the time of sighting/detection
- Approximate closest point of approach (CPA)
- Mitigation Measures Taken

4 GEOPHYSICAL SURVEY DATA SUMMARY

4.1 Geophysical Survey – Sighting/Detection Data

There were a total of 14 visual sighting events, and one acoustic detection made during the geophysical survey. The acoustic detection was not paired with a visual sighting. Table 1 provides the total number (best estimate) of individuals by species visually sighted and acoustically detected. A summary of the details associated with these sightings can be found in Attachment 1.

93% of the sightings/detections occurred during daylight, between the hours of 6:00 AM (sunrise) and 6:00PM (sunset), and the other 7% occurred during nighttime hours.

Table 1 Species and Number if Individuals Sighted or Detected during Geophysical Survey

Species	Number of Individuals Sighted/Detected
Dolphin, Short-Beaked Common	46
Dolphin/porpoise, Unidentified	9
Whale, Fin	1
Whale, Unidentified	1
Seal, Grey	1
Seal, Harbor	3
Seal, Unidentified	2

4.2 Geophysical Survey – Mitigation Activities

Mitigation activities were initiated when marine mammals or sea turtles were sighted within the 500 meter exclusion zone while geophysical equipment was engaged or while the vessel was in transit. Of the sightings/detections outlined in Section 4.1, six of the encounters resulted in mitigation activities. Table 2 summarizes the number of mitigation events per species as well as the amount of time delays created by the events. There were a total of three hours and four minutes of mitigation.

Table 2 Summary of Mitigation Events during Geotechnical Survey

Species	Number of Mitigation Events	Total Mitigation Time (hh:mm)
Seal, Harbor	2	1:18
Dolphin, Unidentified	1	1:46

4.3 Geophysical Survey – Dead or Injured Marine Mammal or Sea Turtles

There were no dead or injured marine mammals or sea turtles reported during this survey.

5 CHALLENGES/RECOMMENDATIONS

There were no performance issues with the PAM equipment during the survey. Overall, the PSO team, and passive acoustic array provided effective means for the team to efficiently monitor the exclusion zone for encroaching animals, with enough time to make appropriate mitigation decisions. The PSO/PAM team only encountered a few challenges during this survey; however these challenges did not result in any major delays in operations.

The single PAM detection was delphinid in nature, but species could not be identified via visual confirmation from PSO on deck using night vision.

Attachment 1

MV Megan Miller Detection Summary

A.I.S. Inc. Protected Species Observer – Megan Miller Combined 90-Day and Final Report

Project Detection Number	Date			Primary Detection Method (how was animal first detected)	Time at first encounter (EDT)	Time at end of encounter (EDT)	Total Encounter Time		Time of closest approach to source whether active or inactive (EDT)	Ship Position - latitude	Ship Position - longitude	Family	Genus	Species	Description of Animal(s)
	YYYY	MM	DD				HH	MM							
1	2018	10	11	Visual	14:58	14:59	0	1	14:59	41 21.551	71 20.639	Delphinidae	Delphinus	delphis	Light slender bodies bodies of approximately 2m of length.
2	2018	10	13	Visual	8:08	8:09	0	1	8:09	41 22.676	71 22.014	Delphinidae	Delphinus	delphis	Narrow rostrum, medium sized falcate dorsal fin. Characteristic light grey, black and yellow hourglass pattern mid-body.
3	2018	10	13	Visual	8:33	8:50	0	17	8:33	41 19.73	71 20.168	Delphinidae	Delphinus	delphis	Narrow rostrum, medium sized falcate dorsal fin. Characteristic light grey, black and yellow hourglass pattern mid-body.
4	2018	10	26	Visual	9:07	9:15	0	8	9:15	41 22.933	71 23.467	Delphinidae	Delphinus	delphis	Medium-sized dolphins; about 2 meters in length. Bi-colored hourglass pattern composed of yellow and dark grey. Falcated dorsal fin with a thin rostrum.
5	2018	10	26	Visual	9:44	11:46	2	2	11:00	41 22.787	71 21.777	Delphinidae	Delphinus	delphis	Medium-sized dolphins; about 2 meters in length. Bi-colored hourglass pattern composed of yellow and dark grey. Falcated dorsal fin with a thin rostrum.
6	2018	10	31	Visual	8:50	9:10	0	20	8:50	41 23.482	71 19.872	Balaenoptera	Balaenoptera	physalus	Long, sleek, dark body. Falcated, small, blunt dorsal fin located two-thirds back on body.
7	2018	11	8	Visual	7:17	7:18	0	1	7:17	41 22.978	71 20.956	Balaenoptera	n/a	n/a	Dark dorso and nostrils, tall and difusse blow
8	2018	11	8	Visual	12:17	12:29	0	12	12:20	41 23.91	71 20.853	Phocidae	Phoca	vitulina	Mottled coat with a puppy-like face. V-shaped nostrils observed.
9	2018	11	15	Acoustic	5:32	7:46	2	14	n/a	41 24.618	71 21.221	Delphinidae	Delphinus	n/a	n/a
10	2018	11	15	Visual	6:59	7:00	0	1	14:30	41 23.471	71 21.944	Phocidae	n/a	n/a	Mottled dark grey coat and dog-like face.
11	2018	11	30	Visual	12:37	12:39	0	1	12:39	41 18.377	71 13.944	Delphinidae	Delphinus	n/a	Dark dorso with falcate dorsal fins
12	2018	12	3	Visual	8:53	8:54	0	1	8:35	41 34.23	71 21.46	Phocidae	Phoca	vitulina	Brown, grey coat coloration. Relatively small nostrils.
13	2018	12	5	Visual	10:11	10:12	0	1	10:12	41 13.119	71 13.844	Phocidae	Halichoerus	grypus	Dark Brown/grey coloration with irregular light splotching patterns. Distinctive horse-like head with straight snout. Large in girth and length approx 6ft
14	2018	12	6	Visual	8:07	8:08	0	1	8:08	41 18.506	71 14.682	Phocidae	n/a	n/a	Seal like body shape
15	2018	12	14	Visual	7:16	7:17	0	1	7:17	41 27.038	71 24.724	Phocidae	Phoca	vitulina	Brown, grey coat coloration.

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Project Detection Number	Bearing to animal (using clock face with bow = 12:00)			Range to animal (metres)			Total number			Best Number of adults (visual sightings only)	Best Number of juveniles (visual sightings only)	Best Number of calves (visual sightings only)	Behaviour (visual sightings only)		Did animals bowride?		Source activity	Vessel Activity	Time animals entered the exclusion zone (if relevant) (UTC)		Time animals left the exclusion zone (if relevant) (UTC)		CPA to <u>active</u> source (even if shutdown or powerdown occurred)	CPA to inactive source
																Source Less than 200kHz?				HH	MM	HH	MM	meters
	First	Last	CPA	First	Last	CPA	Max	Min	Best				Primary	Secondary		Y/N								
1	12	11	11	35	40	35	25	18	20	20	0	0	Surface travel	Surface travel	NO	N	On Deck	Transit	n/a	n/a	n/a	n/a	n/a	60
2	12	11	11	30	5	5	6	4	5	5	0	0	Surface travel	Surface travel	NO	N	On Deck	Transit	n/a	n/a	n/a	n/a	n/a	10
3	12	12	12	1	1	1	6	4	5	5	0	0	Surface travel	Surface travel	NO	N	On Deck	Transit	n/a	n/a	n/a	n/a	n/a	25
4	9	4	1	500	30	10	20	15	10	8	0	0	Surface travel	Diving	YES	Y	Full Power	Equipment testing	9	7	9	15	1	N/A
5	9	6	1	20	1	1	10	6	6	6	1	1	Surface travel	Bow Riding	YES	Y	Full Power	Equipment testing	9	44	11	46	1	1
6	9	7	9	200	500	200	1	1	1	1	0	0	Surface Active	Diving	NO	N	Silent in Water	Drifting	8	50	9	0	n/a	200
7	2	3	2	1500	1500	1500	1	1	1	1	0	0	Traveling	Traveling	NO	N	On Deck	Drifting	n/a	n/a	n/a	n/a	n/a	1500
8	1	5	4	200	650	150	1	1	1	1	0	0	Resting	Feeding	NO	Y	Full Power	Surveying	12	17	12	26	150	n/a
9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5	n/a	n/a	n/a	n/a	n/a	NO	N	On Deck	Prewatch	n/a	n/a	n/a	n/a	n/a	n/a
10	13:30	14:30	10	25	10	10	1	1	1	1	0	0	Diving	Swim	NO	N	On Deck	Prewatch	6	59	7	0	n/a	n/a
11	13:00	14:30	14:30	1000	986	986	8	2	4	2	0	0	Porpoising	Surface Active	NO	N	Full Power	Surveying	n/a	n/a	n/a	n/a	986	n/a
12	15:00	15:15	15:15	300	300	300	1	1	1	1	0	0	Surface travel	Surface travel	NO	N	On Deck	Transit	0	53	n/a	n/a	n/a	n/a
13	11:00	12:00	12:00	350	300	300	1	1	1	1	0	0	Resting	Diving	NO	Y	Full Power	Surveying	10	12	10	12	300	n/a
14	11:00	11:00	11:00	30	30	30	1	1	1	1	0	0	Spyhop	Diving	NO	N	On Deck	Transit	8	7	8	8	30	n/a
15	10:00	10:00	10:00	30	30	30	1	1	1	1	0	0	Spyhop	Looking	NO	N	Silent in Water	Deploying Equipment	7	16	7	17	30	n/a

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Project Detection Number	MITIGATION MEASURES											PAM DETECTIONS					
	What action requested?	Was action implemented	What source(s) were involved in the action was taken (list all that apply)	Bearing to animal at time of action (clockface with bow = 1200)	Range to animal at time of action	Duration of power-down and/or shut-down	Duration of start up delay (hh:mm)	Time of equipment restart		Estimated Loss of Production		Call Type	Amplitude (dB)		Bearings obtained?	Distance estimated?	Was visual confirmation made?
	Codes	Y / N						HH	MM	HH	MM		Max	AVE			
1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
8	Shutdown	Y	Multi-beam, USBL, Boomer, Sub-bottom Profiler	1	200	0:19	0:12	12	48	0	31	n/a	n/a	n/a	n/a	n/a	n/a
9	Delay	Y	n/a	n/a	n/a	n/a	1:46	n/a	n/a	1	46	Whistle and click trains	110	160	NO	Inside EZ	NO
10	Delay	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
13	Vessel Maneuver	Y	USBL, Sub-bottom profiler, and Boomer	12:00	300	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
15	Delay	Y	n/a	10:00	30	n/a	0:47	n/a	n/a	0	47	n/a	n/a	n/a	n/a	n/a	n/a

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Project Detection Number	Detailed narrative of detection event and behaviors. (e.g., number of blows, number of surfaces, number of dive, type of feeding: as explicit and detailed as possible; note any observed changes in behavior)
1	At 14:58 Local time, a pod of approximately 20 possible common dolphins, was detected at a bearing of 12:00 (clockwise). The dolphins were crossing ahead the vessel showing fast travel and jumping behavior. The pod was last seen at 14:59 local time, when they dove and were not seen again. At the time of the detection the source was onboard, as the vessel was transiting to port. No mitigation action was required.
2	At 8:08 local time, a pod of approximately 5 (best estimate) common dolphin were observed actively travelling towards the bow at a distance of 30 m at 1/12 O'clock off the bow. At the time of the initial sighting, the vessels heading was 158 degrees. At 8:09, the dolphin turned towards the bow, showing vessel attraction, to approximately 5 m, at 12 O'clock off the bow. The dolphin then swam under the vessel and were not seen again. One photo taken from observation point inside wheelhouse.
3	At 08:33 Local time, a pod of 5 common dolphins, was detected at a bearing of 12:00 (clockwise). The dolphins were bowriding for 17 minutes. The pod was last seen at 08:50 local time, when they dove and were not seen again. At the time of the detection the source was onboard, as the vessel was transiting. No mitigation action was required.
4	At 9:07 local time, a pod of 15-20 Common dolphins were visually observed about 500m away on the portside of the vessel. The pod was seen traveling fast towards the vessel bowriding, porpoising, breaching and following our trajectory, this event lasted about 8 minutes. The last time of detection was observed at 9:15 local time on the starboard side of the vessel with an animal diving out of sight. At the time of the detection, all gear was deployed and powered on. Dolphins were observed in the exclusion zone engaging the vessel; no mitigation action was required.
5	At 9:44 local time, a pod of 10 Common dolphins were observed at 9'clock. Two individual dolphins were seen fast-traveling towards the bow of the vessel and then dove out of sight. Six dolphins continued to bow-ride and follow the vessel's trajectory for two hours. A mom/calf pair was seen following alongside of the vessel for a few minutes then dove out sight. Dolphin copulation was observed in front of the vessel several times. At 11:46 local time, dolphins were seen travelling away from the exclusion zone and diving out of sight. At the time of the detection, no actions were taken for 10 minutes while dolphins were observed in the exclusion zone. After ten minutes, dolphins were observed still engaging the vessel bowriding and swimming alongside the port and starboard side. No further action was taken, and no mitigation action was necessary.
6	At 8:50 local time, a tall blow was observed on the portside of the vessel at 200m. The animal dove in a wheel-like motion with the falcated, small dorsal fin exposed. The whale was seen again at 9:03 surfacing the water for a few seconds at 8'clock then dove again. At 9:08 the whale was observed surface- traveling slowly towards the 6'o clock direction then proceeded to dive out of sight at 9:10 at a distance of 500m. At the time of the detection, equipment was deployed but the source was off, therefore no mitigation action was required. The animal was not seen again after 30 minutes of clearing the 500 m exclusion zone. Operations were cleared at 9:40 local time.
7	At 07:17 Local time, an unidentified large whale was detected at a bearing of 02:00 (clockwise) at an approximate distance of 1500 m. The vessel's bearing was 204 degrees (absolute). The whale was traveling in parallel and opposite direction of the vessel, at a relative slow pace. Two medium/tall blows were observed in an interval of 20 seconds and dissipated in the wind. A NW wind speed was 12.9 mph at the time of detection. At 7:18, the whale was lost from sight and was not seen again. No dorsal fin or fluke was observed during the detection. Numerous whitecaps and 1.5m seas were present during the detection. At the time of the detection the source was silent as we were still in the 60 minute EZ clearance period. No mitigation action was required.
8	At 12:17 a Harbor seal was observed at 1'clock at the surface on the starboard side of the vessel in the exclusion zone. A mitigation action call was requested at 12:17 to shutdown operations. The animal was observed resting at the surface for a few seconds then dove out of sight. At 12:19 the animal was sighted at 4'clock feeding on a fish about 150m from the stern of the vessel. Seal seen eating four separate times between 12:19 and 12:24; each sighting the seal was moving clockwise around the vessel and further away from the vessel. Last sighted at 12:26 outside of the EZ swimming on the surface away from the Megan Miller. During the shut down the vessel made an SVP test at 12:25. Mitigations was requested early, when the error was discovered clearance for operations were immediately given.
9	At 05:32 Local time, faint dolphin whistles were visually detected on the low frequency spectrogram and aurally on the headphones. The whistles increased in intensity and number as the time passed showing upsweeps, downsweeps and sinusoidal shapes (Figure 3). From 05:32 until the end of the detection, numerous whistles were observed. At 6:19 local time, click trains were detected on the PAMguard high frequency Click detector, at a bearing of 90 degrees relative to the hydrophones. The clicks had waveforms and wigner plots characteristic of delphinids (Figure 4). The clicks were observed between 80 and 100 degrees; several click trains veered between different bearings, indicating that the dolphins were constantly changing direction. The clicks ranged in frequency from 50 to 120 KHz and the whistles from 6 to 24 KHz. Overlapping whistles and stacked click trains indicated that there were at least five dolphins. The intensity of the vocalizations indicated that the dolphins were inside the 500 meter EZ. The detection ended when the last whistle was detected at 07:46 local time. The detection happened during the pre-search for clearance; therefore, a delay of one hour and 46 minutes was implemented, as a mitigation action.
10	At time of detection, 1 PSO was on Day PAM watch, and 1 PSO on deck on day visual watch because of continued dolphin detections. At 06:59, a small seal was observed at 13:30 slowly swimming towards the vessel's stern, and dove shortly after initial sighting 10 seconds later 14:30 off the vessel's starboard side, (approximately 10 meters away from vessel). The diving behavior did not appear rushed. Because of the short duration of sighting, no species confirmation was made. Vessel crew and bridge were notified of the sighting and that the prewatch for ramp up would be extended 60-minutes due to the sighting in the exclusion zone.
11	At 12:37 Local time, a pod of unidentified dolphins were detected at a bearing of 01:00 (clockwise) at an approximate distance of 1000 m (distance estimated using reticled binoculars. Distance was slightly less than 1 reticle at first sighting, so additional distance was estimated). The vessel's bearing was 188 degrees (absolute). The dolphins were traveling in parallel and opposite direction of the vessel, at a relative fast pace chasing a fishing boat. A NW wind speed was 7 mph at the time of detection. At 12:39, the pod was lost from sight and was not seen again at the 14:00 position at approximately 986 m (distance estimated using reticled binoculars. At the time of the detection the source was active on a survey line. As the dolphins were sighted outside the exclusion zone, no mitigation action was required.
12	A seal was visually detected at 08:35 local time at 15:00 degrees relative to the bow of the vessel. The animal appeared to breach the surface to breath and then dove and submerged. The seal was swimming parallel to the vessel in the opposite direction at a distance of approximately 300 meters. Based on the brown coloration of the coat and the small size of the nostrils the species identification was determined to be a harbor seal.
13	A seal was visually detected at 10:11 local time at approx 11:00 relative to the bow of the vessel. At first the animal very much resembled a large fat log as it was sunning itself at the surface. At this time the vessel was running weatherpatterns around the start of the survey line while waiting for the weather to calm down for more optimal conditions for data collection. Gear was turned on but not logging. The animal was first sighted at about 350 meters off the bow of the vessel and once the vessel reached about 300 meters from the animal it dove. Evasive action was taken by the vessel to avoid striking or coming too close to the animal. Because the Boomer, USBL and Sub-bottom profiler were on at the time, the seal was inside the 500 m exclusion zone. However, after evasive action was taken and course altered, the seal was not spotted again within the exclusion zone after 10 minutes. Therefore, no shutdown was necessary based on the 10-minute exception for dolphins and pinnipeds per the lease stipulation.
14	At 08:07 Local time, an unidentified seal was detected at a bearing of 11:00 (clockwise) at an approximate distance of 30 m. The vessel's heading was 307.2 degrees (absolute). The seal was floating and spyhopping. At 08:08, the seal dove and was not seen again. At the time of the detection the source was on board as the vessel was transiting to Quonset port. No course alteration was necessary because the seal was not in danger of a vessel strike, therefore no mitigation action was required.
15	At 07:16 Local time, a harbor seal was detected at a bearing of 10:00 (clockwise) at an approximate distance of 30 m. The vessel's heading was degrees 355.5 (absolute). The seal was spyhopping. At 07:17, the seal dove and was not seen again. At the time of the detection the source was being deployed, therefore a delay mitigation of 0:47 minutes was required.

APPENDIX E. *MV SEACOR SUPPORTER* – SOUTH FORK WIND FARM GEOTECHNICAL SURVEY PROTECTED SPECIES OBSERVER REPORT



South Fork Wind Farm Lease OCS-0486

GZA Geotechnical Survey 2018

Protected Species Observer Combined 90-Day and Final Report

Prepared by: A.I.S. Inc.

Prepared for: Deepwater Wind New England, LLC
and CSA Ocean Sciences Inc.

Submittal Date: October 14, 2018

This report is being submitted to satisfy the following lease stipulations:

BOEM Lease OCS-A 0486; Section 4.4 Reporting Requirements

4.4.3 Report of Activities and Observations

The Lessee must provide the Lessor and NMFS within 90 calendar days following the commencement of HRG survey activities that includes a summary of survey activities, and an estimate of the number of listed marine mammals and sea turtles observed and/or Taken during these survey activities.

4.4.4 Report Information

Data on all protected species observations must be recorded based on standard marine mammal observer collection data by the PSO. This information must include: dates, times, and locations of survey operations; time of observation, location, and weather; details of marine mammal sightings (e.g., species, number, behavior); and the details of any observed Taking (e.g., behavioral disturbances or injury/mortality).

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1 INTRODUCTION

Deepwater Wind South Fork, LLC (Deepwater Wind), an affiliate of lease holder Deepwater Wind New England, LLC is proposing to develop the South Fork Wind Farm (SFWF) project, an offshore wind energy project within the Bureau of Ocean Energy Management (BOEM) Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf, OCS-A 0486 (Lease), interconnecting with the Long Island Power Authority transmission system on Long Island, New York.

This report documents the complete results from the 2018 geotechnical surveys conducted by GZA aboard the MV Seacor Supporter for Deepwater Wind. A summary of the data collected and, the number of sightings and acoustic detections are included in this report. PSO methodology and monitoring protocols are discussed, however detailed description is provided in the Alternative Monitoring Plan (AMP) (Attachment 1). An assessment of effectiveness of PSO monitoring and future recommendations is provided in the final section of the report.

2 SUMMARY OF GEOTECHNICAL SURVEY ACTIVITIES

Deepwater Wind completed site characterization surveys in the lease area consisting of geotechnical sampling surveys between August 5th, 2018 and September 6th, 2018. Both Protected Species Observers (PSO) and Passive Acoustic Monitoring (PAM) operators were aboard the vessel during survey activities in accordance with the COP Survey Plan.

3 PROTECTED SPECIES OBSERVATION METHODS

In order to comply with the lease protected species monitoring requirements issued by BOEM, Deepwater Wind contracted A.I.S. Inc. (AIS) to provide PSO and PAM operators to monitor for marine mammals and sea turtles during geotechnical survey operations. These monitoring activities were completed in accordance with the BOEM approved SFWF COP Survey Plan and AMP.

Protected species monitoring occurred at all times during this geo-tech survey, in anticipation of geotechnical operational activities, as well as during the transit to and from survey sites to avoid any potential protected species ship strikes. Visual monitoring occurred for a total of 776 hours, and acoustic monitoring during 356 hours.

3.1 PROTECTED SPECIES OBSERVER TRAINING AND COMPLIANCE

All PSO and PAM operators who monitored during this survey attended the Permit and Environmental Compliance (PECP) Training compiled and presented by Deepwater Wind and CSA. Additionally, all PSO and PAM operators received project specific training that covered the following topics:

- Permits and plans relevant to the project
- Environmental compliance requirements
- Health and safety requirements
- PSO/PAM operator requirements and scheduling

- Protected species mitigation methods
- Communication
- Authorized takes
- Data form
- PSO and PAM equipment, use, and maintenance
 - 7 X 50 Waterproof binoculars with reticles
 - Rangefinders
 - Gen 3 Night vision monoculars
 - High Definition/Thermal imaging cameras
 - PAM equipment
- Protected species identification review

All PSO and PAM operators who participated in the survey were approved by BOEM, per lease stipulation 4.3.4. All PSO and PAM staff were required to comply with GZA operating standards, possess fit for sea duty medical clearance, billy pugh training and offshore safety training.

Detailed PSO methodology and monitoring protocols are provided in the AMP. An assessment of effectiveness of PSO monitoring and future recommendations is provided in the final section of the report.

3.2 PROTECTED SPECIES OBSERVATION DATA

PSO and PAM entries and mitigation summaries were recorded on data sheets, which were provided to CSA and Deepwater Wind on a daily basis via email. Attached are summaries of the detections from PSO/PAM data for the MV Seacor Supporter in relation to specific survey activities (Attachment 2). Summary details provided include:

- Dates, times
- Species encountered
- Initial detection method
- Group Size
- Description of the observed behaviors (in both the presence and absence of activities)
- A summary of event details
- Description of survey activities at the time of sighting/detection
- Estimated number of individuals within Mitigation Zone during survey activities
- Approximate closest point of approach
- Mitigation Measures Taken

4 GEOTECHNICAL SURVEY DATA SUMMARY

4.1 Geotechnical Survey – Sighting/Detection Data

There were a total of 68 visual sighting events, 14 thermal imaging/infrared sighting events and 69 acoustic detections made during the geotechnical survey. Four of the visual sighting events were paired with acoustic detections (3%), and nine thermal imaging/infrared sightings were paired with acoustic detections (6%). Table 1 provides the total number (best estimate) of individuals by species visually

sighted and/or acoustically detected (all double entries were discounted). A summary of the details associated with these sightings can be found in Attachment 2.

47% of the sightings/detections occurred during daylight, between the hours of 6:00 AM (sunrise) and 7:00PM (sunset), and the other 53% occurred during nighttime hours.

Table 1 Species and Number if Individuals Sighted or Detected during Geotechnical Survey

Species	Number of Individuals Sighted/Detected
Dolphin, Short-Beaked Common	354
Unidentified dolphin/porpoise	92
Whale, North Atlantic Right	3
Whale, Fin	3
Whale, Minke	49
Whale, Humpback	2
Unidentified whale	11
Sea Turtle, Loggerhead	2

4.2 Geotechnical Survey – Mitigation Activities

Mitigation activities were initiated when marine mammals or sea turtles were sighted within the 200 meter exclusion zone while geotechnical equipment was engaged. Of the sightings/detections outlined in Section 4.1, 15 of the encounters resulted in mitigation activities. Table 2 summarizes the number of mitigation events per species as well as the amount of time delays created by the events. There were a total of 17 hours and 12 minutes of mitigation, approximately 1.13 hours of delay per event.

Table 2 Summary of Mitigation Events during Geotechnical Survey

Species	Number of Mitigation Events	Total Mitigation Time (hh:mm)
Unidentified dolphin/porpoise	1	1:42
Whale, North Atlantic Right	1	0:52
Whale, Minke	12	13:38
Sea Turtle, Loggerhead	1	1:00

4.3 Geotechnical Survey – Dead or Injured Marine Mammal or Sea Turtles

A single Loggerhead Sea Turtle was found to be entangled in some type of cordage, possibly fishing line or ribbon. The cord was not in anyway associated with the activities unfolding on the MV Seacor Supporter. The animal was seen off the starboard side of the stationary vessel with rope like debris around its neck and trailing behind it. The animal was alive and swimming, it did appear to be sluggish and encumbered by the debris. The animal dove out of sight and was not brought aboard the vessel and was reported to BOEM.

5 CHALLENGES/RECOMMENDATIONS

There were no performance issues with either the HD/Thermal Imaging cameras or PAM equipment during the survey. Overall, the PSO team, thermal camera system and passive acoustic array provided

effective means for the team to efficiently monitor the exclusion zone for encroaching animals, with enough time to make appropriate mitigation decisions. The PSO/PAM team only encountered a few challenges during this survey; however these challenges did not result in any major delays in operations.

One challenge was that, the stationary nature of the work vessel required the passive acoustic monitoring equipment be statically deployed off the side of the vessel, in a vertical orientation, while the vessel was raised in working position. The vertical orientation of the equipment limited the localizing capabilities of the hydrophones, resulting in many 'not able to determine' (NAD) detections. This resulted in the PAM operators relying on frequency content and/or signal to noise ratio (SNR) to estimate the animal(s) distance from the sounds source.

There was a single incident when the PAM hydrophone array cable became wrapped around one of the vessels legs during deployment. This did not interfere with the detection capabilities nor did it damage the equipment, however it delayed retrieval of the PAM hydrophone array at the end of the PAM shift. This was likely the result of a combination currents and deployment proximity to the leg. The deployment location was altered and no future incidents occurred.

The majority of the PAM detections were delphinid in nature, but species could only be identified via visual confirmation from PSO on deck using night vision (this only occurred twice throughout the survey).

Similarly, while the Seiche thermal imaging cameras greatly improve the PSO team detection ability at night (by increasing their field of view and distance of detections in comparison to handheld night vision), however identifying some species was, at times, problematic. The majority of the animals detected via thermal imaging were delphinids, and species was not possible to identify based on the vague silhouettes provided by the thermal imaging equipment. The animals also never approached the vessel close enough to allow for a visual confirmation via night vision.

Lastly, the PSO team initially had some communication issues with the geotechnical crew which seemed to be the result of misinformation with regards to exactly what equipment would trigger PSO mitigation. This was rectified with the introduction of a Client generated document providing clarification with regards to what equipment needed to be shut down and what equipment could continue to run in the event of a PSO call for mitigation.

Attachment 1

Alternative Monitoring Plan

Alternative Monitoring Plan to Support 2018 Geotechnical Survey for
the South Fork Wind Farm

03 July 2018

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1. Purpose of this Document

Deepwater Wind New England, LLC (DWW) has developed this Alternative Monitoring Plan (Plan) to satisfy the following stipulations of commercial lease OCS-A 0486 (Lease):

- **Addendum C, Stipulation 4.3.2: Visibility.** The Lessee must not conduct G&G surveys in support of plan (i.e. SAP and / or COP) submittal at any time when lighting or weather conditions (e.g. darkness, rain, fog, sea state) prevents visual monitoring of the HRG survey exclusion zone (see 4.3.6) or the geotechnical sampling exclusion zone (see 4.3.7) except as allowed under 4.3.3.
- **Addendum C, Stipulation 4.3.3: Modification of Visibility Requirement.** If the Lessee intends to conduct G&G survey operations in support of plan submittal at night or when visual observation is otherwise impaired, it must submit to the Lessor an alternative monitoring plan detailing the alternative monitoring methodology (e.g. active or passive acoustic monitoring technologies). The Lessor may, after consultation with NMFS, decide to allow the Lessee to conduct G&G surveys in support of plan submittal at night or when visual observation is otherwise impaired using the proposed alternative monitoring methodology.

Beginning in July 2018, Deepwater Wind will be conducting geophysical and geotechnical surveys within the Lease Area for the South Fork Wind Farm (SFWF) see **Figure 1**. Deepwater Wind respectfully submits this Plan and request BOEM approval for geophysical and geotechnical survey to occur 24 hours per day, 7 days per week.

Protected species monitoring and mitigation requirements will be presented at project training sessions and will be included in the Project Environmental Compliance Plan (PECP). It is understood that no single monitoring method is capable of providing unequivocal detection of marine species under practical conditions; this is especially true during night time monitoring. To compensate for the detection challenges during night time operations, multiple methods and technologies will be employed through the AMP including Passive Acoustic Monitoring (PAM), thermal imaging, and night vision technology. Any single technology will have limitation, therefore, these methods *in toto* provide comprehensive monitoring comparable to visual monitoring during daylight conditions. This Plan describes the additional mitigation measures that will be used at night or when visual observation is otherwise impaired.

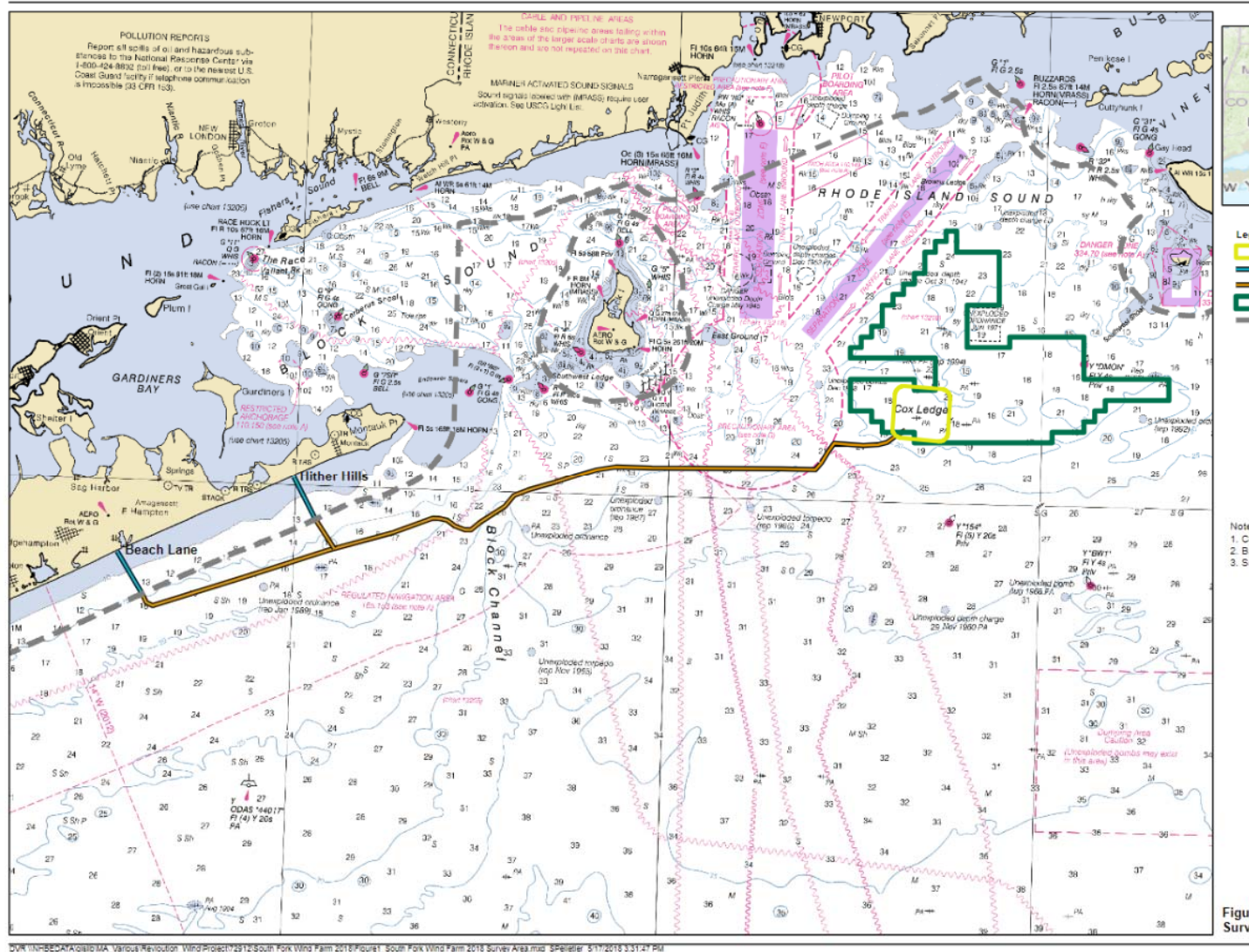


Figure 1 SFWF project area

All Protected Species Observers (PSO) must receive written approval by the National Marine Fisheries Service (NMFS) before they can serve as a PSO on this project. Resumes will be provided to BOEM and NMFS at least 45 days prior to the start of the project. Additionally, all PSO and PAM operators will receive project specific training prior to the start of the geophysical and geotechnical surveys.

PSO observations must be conducted in accordance with the following:

- The watch schedule for PSO will follow the guidelines in the National Standards for a Protected Species Observer and Data Management Program which states that no PSO will be allowed more than 4 consecutive hours on watch as a visual observer and a break

time of no less than 2 hours must be allowed before a PSO begins another visual monitoring watch rotation. This will reduce eye fatigue. No PSO will be assigned a combined watch schedule of more than 12 hours in a 24 hour period.

- A Lead PSO will be designated during every shift. The Lead PSO will be responsible for:
 - Communication with the PAM operators, the Protected Species Observer Manager, and the vessel survey team. The Lead PSO will communicate with the vessel and survey equipment operators in the event that mitigation measures need to be implemented.
 - Monitoring the NMFS North Atlantic right whale reporting systems for the presence of right whales during the geophysical and geotechnical surveys. This includes checking the Early Warning System, Sighting Advisory System, and the Mandatory Ship Reporting System.

An example of a shift rotation schedule for the PSO and PAM operators is shown in **Table 1**. This table incorporates the requirement that PSO must not be on watch for more than 4 consecutive hours, with at least a 2 hour break after a 4 hour watch. Two PSO will be on watch during daylight hours. During night time operations, one PSO and one PAM operator will monitor for any visual or acoustic signs of protected species. It is assumed that the work will take place in July through August when the sunrise is around 5:00 and sunset is around 20:15. This schedule calls for a team of five PSO and PAM operators to be utilized during the course of the survey. At least three of the team members will be cross trained as PAM operators and PSOs.

Table 1 Example of 24 Hour PSO/PAM Schedule

Hours	Observer 1	Observer 2	Observer 3	Observer 4	Observer 5
1200-1300			VISUAL		VISUAL
1300-1400			VISUAL		VISUAL
1400-1500	VISUAL			VISUAL	
1500-1600	VISUAL			VISUAL	
1600-1700	VISUAL			VISUAL	
1700-1800		VISUAL		VISUAL	
1800-1900		VISUAL	VISUAL		
1900-2000	PAM	VISUAL	VISUAL		
2000-2100	PAM		VISUAL		
2100-2200	PAM		VISUAL		
2200-2300	PAM				VISUAL
2300-0000		PAM			VISUAL
0000-0100		PAM			VISUAL
0100-0200	PAM				VISUAL
0200-0300	PAM			VISUAL	

0300-0400		PAM		VISUAL	
0400-0500		PAM		VISUAL	VISUAL
0500-0600	VISUAL				VISUAL
0600-0700			VISUAL		VISUAL
0700-0800		VISUAL	VISUAL		
0800-0900		VISUAL	VISUAL		
0900-1000			VISUAL	VISUAL	
1000-1100				VISUAL	VISUAL
1100-1200				VISUAL	VISUAL

- Grayed out time blocks indicates expected nighttime monitoring hours

In **Table 1**, observers 1 and 2 (cross -trained PSO/PAM operators) would serve as PAM operators during night time operations. One of the remaining 3 observers would also be cross-trained and able to serve as PAM operator during period of low visibility during daytime operations.

To ensure that the most efficient protected species monitoring plan is executed, immediate and effective communication will be required between the PSO team and PAM operator when they are working in low visibility conditions. When a protected species is visually detected by the PSO team, the Lead PSO will communicate with the PAM operator so that the PAM operator can potentially pair the sighting with any acoustic detection.

The PSO duties will include:

- Visually monitoring the exclusion zone 360° around the survey vessel operations, 24/7 for the presence of marine mammals and all other protected species during survey operations, as required. They will document all protected species sightings and environmental conditions on approved data forms and report all incidents to proper personnel.
- Informing captain, or designated personnel, if a protected species is heading towards or enters the exclusion zone around the vessel so as to minimize or reduce the chance of injuring a protected species.
- Summarizing daily monitoring effort and submitting data forms to the appropriate staff or database.

For every protected species observation the following information will be recorded on the approved PSO data logs:

- Date and location of survey vessel
- Time of observation
- Environmental conditions (e.g. tidal stage, sea state, weather, water temperature)

- Species identification characteristics
- Numbers and age classification (if known) of individuals observed
- Frequency of observation
- Location of protected species (i.e. distance from the sound source)
- Sound source status (i.e. soft start/ramp-up, active, post survey, etc.)
- Reaction of the animal(s) to relevant sound source (if any) and observed behavior, including bearing and direction of travel
- Details of any observed Taking (e.g. behavioral disturbances or injury/mortality)
- Action taken (i.e., ramp-down, shut-down)

1.1. Visual Monitoring (Day Light Hours)

Visual monitoring will be conducted on a 24 hour basis. During daylight hours, two PSO will be on watch at all times using the following guidelines:

- PSO must be stationed on the highest available vantage point on the vessel.
- Two PSO will actively observe during daylight hours; each PSO will observe on opposite sides of the survey vessel, in 180° sweeps to ensure 360° observation. The Lead PSO will work with the PSO team and vessel crew to determine the best position for the PSO to have an unobstructed view of the entire exclusion zone.
- PSO will estimate distances to protected species visually, using reticle binoculars, or using range finder sticks during daylight hours.
- When possible, protected species sightings will be documented via digital camera with video capabilities.

1.2. Visual Monitoring (During Night Hours and Times of Limited Visibility)

During periods of darkness or limited visibility (e.g. fog, heavy rain, poor lighting conditions), infra-red (IR) thermal imaging cameras will be used to supplement PAM operations. Two camera systems, each providing 180 degrees of coverage, will be positioned near the center of the vessel at an elevated location in an area with minimal obstruction to ensure the maximum amount of 360-degree coverage of the area surrounding the vessel including the exclusion zone. **Figure 2** shows a rendering of a typical 2-camera installation on the bridge wings of the vessel. Our deployment will vary slightly with both camera system mounted higher and at or near the center of the vessel. Manufacturer specification indicate that for every 5 m of separation between cameras there is roughly 20 meters of gap in field of view before overlap, which, when added to the vessel length becomes a very small portion of water immediately adjacent to the vessel. Our planned installation has the cameras less than 3 m apart on the highest point of the vessel, thereby achieving maximum coverage of the surrounding water rather than having 2 cameras positioned lower on the vessel.

Previous use of 3-camera systems (Jeff Martin, pers comm, 2018) indicates that one of the drawbacks of multiple cameras is the viewing fatigue for the multiple monitors. Therefore, this configuration should assist the camera operator by eliminating one full viewing screen and, with two cameras essentially side by side at the highest point, it provides the viewer with comparative views from both port and starboard cameras. One on-duty PSO will monitor images in real-time received from the thermal imaging cameras on display screens. An iPad will also be available for monitoring of the camera displays over a wireless connection, allowing the operator to work from the deck with supplemental NVDs if needed.

The manufacturer's automated pan speeds range from roughly 5 to 60 seconds per change in degree. The installation and environmental conditions will affect how fast a user can pan a sector effectively without losing resolution in the image. Based on discussions with the manufacturer and past equipment use, we expect a full sector (180 degrees) scan every 50-70 seconds. Monitors will adjust pan rates to achieve the fastest sector scan while maintaining image resolution.

The system's monitoring station has built-in stabilization software and software that enables the user to overlay the boundaries of the mitigation/exclusion zone on the image being viewed. For the most effective monitoring, the cameras will be set to autonomously pan the viewing area; however, the operator has the ability to stop and manipulate the cameras manually.

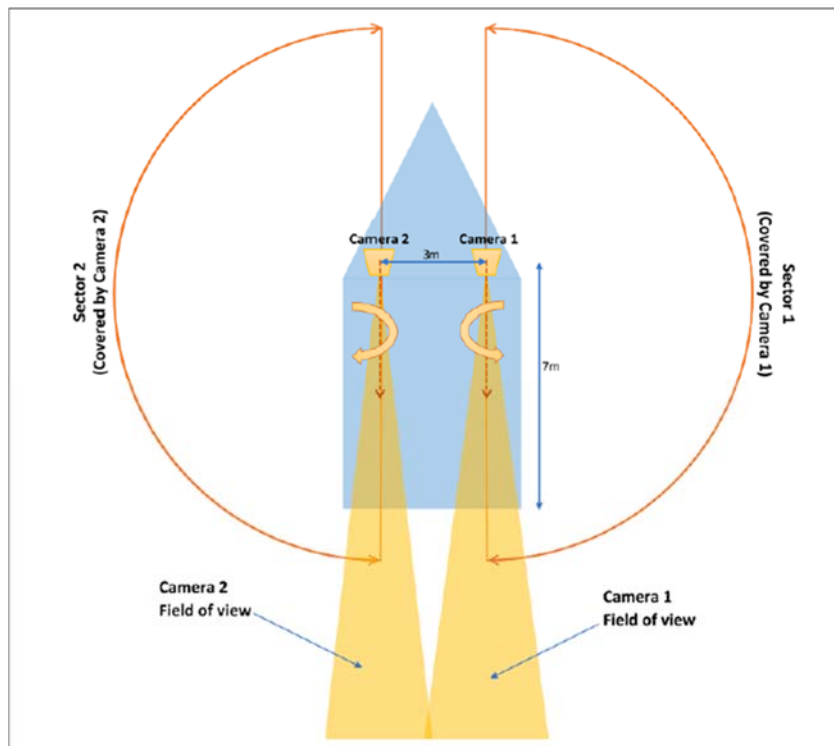


Figure 2 Schematic of thermal camera viewing sectors with side-mounted installation

In addition to utilizing the thermal imaging cameras and software, the PSO will also be issued a Gen 3 or higher Night Vision Device (NVD) to be used as a supplement or as a full backup in the event that the thermal imaging cameras do not perform satisfactorily. If the thermal imaging cameras malfunction a second PSO will be summoned to assist in visual observations to ensure maximum coverage with the night vision monocular. The effective viewing range (ability to both detect and discern) for cetaceans using the NVD is expected to be from 100 – 500 m depending on the environmental conditions and animal size and behavior. Accurate distance determination is not consistently possible with NVD; and because of the variability in effective viewing range, a protected species detected with the NVD will be assumed to be in the exclusion zone. Visual Monitoring Equipment

PSO will be supplied the following equipment, and will be trained in the proper use and care of the equipment:

- Personal Protective Equipment including steel toed shoes, hard hat, USCG approved PFD, polarized safety glasses, hearing protection, and rain gear
- Waterproof marine binoculars with reticles
- Rangefinder
- Handheld GPS
- High resolution digital camera with video capabilities
- Gen 3 night vision monoculars. The specifications for the Gen 3 AGM-HS Hand Select Night Vision Monocular is as follows:
 - Image Tube Type: Gen 3 A Grade Autogated/Pinnacle Manual Gain Hand Select
 - FOV @1000 yards: 40*/218ft
 - Magnification: 1x
 - Resolution: 64 to 72 lp/mm
 - Range of Focus: “10” to infinity
 - IR Illuminator: Built In
 - Environmental Rating: Waterproof to 66’
 - Diopter Adjustment: +2 to -6
 - Detection Range: 1148 ft
 - Recognition Range: 984 ft
- Laptop computer
- Waterproof notebook and pencils
- Field identification guides

In addition, the following equipment will be included with the thermal imaging system. Each pan and tilt module makes up a wholly separable Remote High-definition (HD) Visual Monitoring (RHVM) system (**Figure 3**) consisting the following:

- Pan and tilt head with two cameras (one HD visual camera and one IR camera)
- Cat7 link to display system
- Display system consisting of one screen per RHMV system
- Computer system and software control panel
- Data storage



Figure 3. High definition and thermal imaging camera

The images are stabilized in software using horizon detection and an inertial measurement unit. Graphics are drawn on the images to demarcate the mitigation zone on the sea surface (**Figure 4**). In addition, a mouse pointer system enables distance determination to any point on the image.

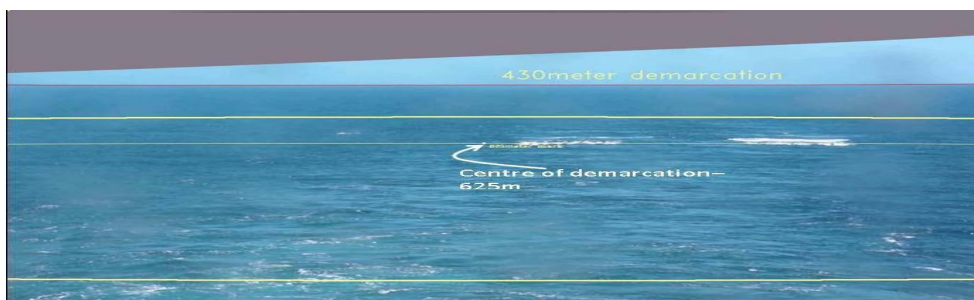


Figure 4. Horizon detection and demarcation around seismic source

The system uses one screen per RHVM system to display images from both thermal and visual cameras (**Figures 5 and 6**). Depending on individual preference, a user can choose to view only thermal or visual images at a time to get higher resolution. As the cameras will be operating at night only, the thermal images will be monitored.



Figure 5 High definition and thermal images



Figure 6. High definition and thermal images of a whale blow at approximately 3500 m.

2. Passive Acoustic Monitoring

The PAM operators will begin monitoring 30 minutes before sunset and continually monitor until 30 minutes after sunrise. No nighttime operations will take place without both visual and PAM operations being fully operational. If visibility is reduced during daylight hours (i.e. fog, poor weather, or rough seas) the Lead PSO will direct the PAM operators to conduct passive

acoustic monitoring in order to allow geophysical and geotechnical survey operations to continue until visibility has improved enough for the PSO to monitor the exclusion zone effectively.

The PAM operators will monitor both the sound received by the hydrophones as well as the visual output in the form of spectrographs and click detectors. The PAM system will be operated using PAMGuard software. The PAM system, hardware (hydrophones, pre-amp, etc.) and software will be calibrated prior to dispatch. The PAM operators will make any necessary changes (deployment and/or software adjustments) throughout the survey to ensure optimal system performance within the frequency bandwidths of interest for the particular survey activity, species, and environment where the survey is occurring. At least once daily, the PAM operator will provide a noise performance graph from at least 1 minute of sound recording with generalized representative species' (e.g. North Atlantic right whale, harbor porpoise, and common dolphin) vocal ranges overlaid to confirm equipment detection efficacy.

If the PAM operator determines that an acoustic detection of a non-delphinoid cetacean has been made, the PAM operator will notify the Lead PSO, who will verify visually using NVD or thermal cameras, the distance of the animal and in turn notify the survey vessel representative immediately and request mitigation measures be taken if the detection is made within the exclusion zone. There will be no shutdowns for delphinoid cetaceans; however, the PAM operator will notify the Lead PSO of any detection either inside or outside the exclusion zone. Because protected species can start or stop vocalizing at any time, both the PSO and PAM operators will have to communicate effectively so that they can monitor any protected species sighted acoustically or visually. In the event that vocalizations consistent with North Atlantic right whales are detected by the PAM operators but are not possible to be localized and visual confirmation cannot be made by the PSO, the Lead PSO will call for a shut down or delay of operations.

If accurate acoustic localization cannot be obtained for species other than North Atlantic right whales, shutdowns will default to visual observers.

For every acoustic detection of protected species by the PAM operators the following information will be recorded:

- Whether the detection was linked with a visual sighting
- Time when animal is first detected and time last detected
- Types and nature of sounds heard (i.e. clicks, whistles, creaks, burst pulses, continuous, sporadic, etc.)
- Strength of detected signals
- Bearing of the animal to the vessel (if determinable)
- Species or taxonomic group (if determinable)

Upon any sightings or detections of protected species by the PSO or the PAM operator, the Lead PSO will be responsible for communicating the need for a shut down or reduction of power depending on the equipment being used by the survey vessel. Communication between the PSO team and survey crew will occur via the VHF radio or directly person to person.

2.1.Passive Acoustic Monitoring Equipment

A designated area will be required onboard the vessel for the PAM equipment including computer, monitor, and electronic data capture and processing unit to be stationed. The PAM operators will maintain a daily record of protected species detections, as well as a record of how the PAM equipment functioned, if any malfunctions occurred and the times at which they occurred.

PAM array deployment during geotechnical operations will depend on operational constraints. Two possible methods include: horizontal deployment from the leeward side of the vessel, incorporating a drogue at the tail end of the array to generate the drag needed to horizontally deploy the array or vertical deployment with the hydrophones positioned in the water column. If vertically deployed, direction-finding and localization will not be possible. The PAM array will be deployed such that the distance of the hydrophones behind the vessel is able to accommodate the portion of the exclusion zone ahead of the vessel.

The PAM equipment will include the following items:

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

During the survey, a hydrophone array will be deployed from the vessel. The array includes four hydrophones arranged in pairs of identical specification with appropriate physical separation to provide direction-finding (bearings) to marine mammals and localization using Target Motion Analysis (TMA) (**Figure 7**). The front pair (H1 and H2, 8m separation) consists of two “Low Frequency” hydrophones with a response of 10Hz to 24kHz and the rear pair (H5 and H6, 0.25m separation) consists of two “Broadband” hydrophones with a response of 2kHz to 200kHz. The “Low Frequency” hydrophones are configured to detect very low frequency vocalizations while the “Broadband” hydrophones are configured to detect mid-high vocalizations respectively. The

four hydrophone arrays provide the capability to detect the full range of marine mammal vocalizations anticipated to be encountered during the survey.

Simulation exercises were carried out using the PAMGuard software to verify that the within-pair separation provides consistently accurate bearings to a range of marine mammal vocalizations. Test signals used in these exercises simulated right whale up-calls, broadband sperm whale clicks, delphinid whistles, and narrow band high frequency harbor porpoise clicks. Anecdotal reports from surveys utilizing Seiche PAM systems with simultaneous visual and acoustic monitoring indicate that the acoustic range estimates have been sufficiently accurate for decision-making on whether vocal animals are within or beyond a 500m mitigation zone.

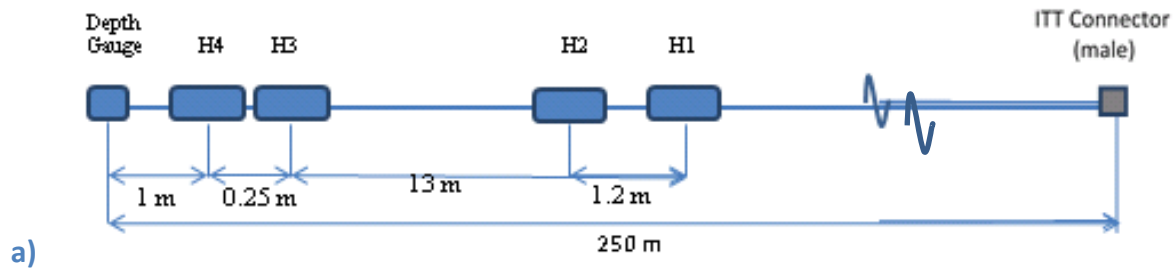


Figure 7. Schematic of four-hydrophone array.

Frequency response curves provide a standard for demonstrating hydrophone sensitivity over a range of frequencies. A flat response between the frequencies of interest is desirable, indicating consistent sensitivity across the band of interest. The frequency response curves provided in **Figure 8** were generated from 10Hz to 24kHz, 200Hz to 200kHz, and 2kHz to 200kHz hydrophone elements (including pre-amps) of a Seiche six hydrophone towed array and are representative of the response curves for the arrays that will be deployed for the survey. The frequency response curves for each element within the arrays (main system and spare) used on the survey will be generated as part of the calibration process prior to their dispatch. Figure 8 shows overlap in sound detection between the low and mid frequency hydrophones as well as between the mid and high frequency hydrophones. Essentially, the more numerous the hydrophones, the higher the likelihood of detection and localization of marine mammals, but the basic, four hydrophone array covers the necessary spectrum of vocalizations. Due to the static nature of the vessel being used on the survey, the hydrophone array will not be towed and will therefore not be able to determine a bearing for any vocalizations.

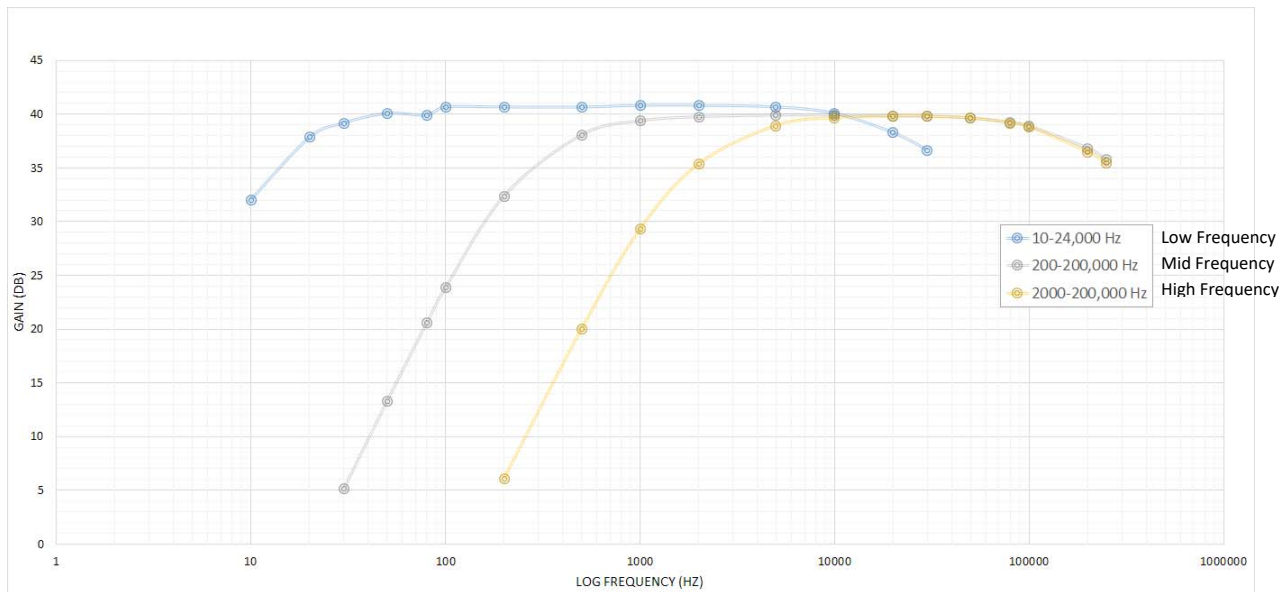


Figure 8. Frequency response curves for three representative hydrophones.

3. Distance Calibration

Prior to the start of the survey, each PSO will calibrate their reticle binoculars (using individual height of eye off water) for each observation location and provide a spreadsheet indicating the reticle and corresponding distance. Calibration exercises will be conducted regularly by the PSO during the course of the survey. Whenever objects of adequate size are visible (e.g. other vessels, navigation buoys, land masses, other fixed structures) the ship's radar and rangefinders will be used to measure "true" distances which will be compared to distances obtained using reticle binoculars and range-finding sticks. Measurements will be obtained during different weather and lighting conditions during mobilization and periodically throughout the course of survey effort.

The thermal imaging cameras that will be primarily used during observations conducted during periods of limited visibility and nighttime, are able to triangulate distance using the Real-time Automated Distances Estimation at Sea (RADES) software included with the camera system. An overlay of the exclusion zone will be included in the visual output of the cameras on the display screen and also on the included iPads to allow the PSO to make confident assessments in whether a protected species is approaching or has entered the exclusion zone. Additionally, there is a mouse pointer system included in the software that allows distance determination to any point on the image. The accuracy of distance measurements made using the RADES software will be validated at the time of installation using objects of known distances. Additionally, the spatial coverage of each camera system will be validated on installation to ensure the margins of each 120-degree span align to provide a complete 360-degree coverage area.

The night vision devices proposed to be used during the survey do not have a function that determines distance. Additionally, reticule binoculars, range finders, and range-finding sticks cannot be used as a calibration tool during periods of limited visibility and during night time observation hours. In order to test the effectiveness of the night vision devices at night, the distance of stationary objects at a known distance will be checked against the vessels radar whenever possible.

4. Reporting

A comparative assessment of protected species detection using PAM and visual monitoring efforts will be completed at the conclusion of the geophysical and geotechnical surveys. This report will include a summary of the equipment used for detections, the methods in which protected species were detected/sighted, and recommendations for future use. The assessment and final report will be submitted to BOEM within 30 days of the survey being completed.

Attachment 2

MV Seacor Supporter Detection Summary

Date	Species (one line per PSO Sighting/PAM Detection)	Initial Detection	Check if Initial	Group Size	Time First Sighted/ Detected	Vessel Activity at Time of Sighting/ Detection	No. Indiv.	No. Indiv. Sea Turtles Observed	No. Indiv NARW Observed in 200-m EZ*	Approx.	Observed Behavior during Sighting	Mitigation Measures Taken
		Method (Visual; unaided eye, reticle binoculars)	Detection Method was PAM				Marine Mammal Observed 200-m EZ*			Closest Observed Distance (m)		
8/7/2018	Dolphin spp.	PAM	x	10	0:41	deploying equipment		10	0	0	NAD unknown	None
8/8/2018	Whale, North Atlantic Rig	PAM	x	1	1:39	drilling in progress		0	0	1	NAD unknown	Shutdown
8/8/2018	Dolphin spp.	PAM	x	8	3:46	drilling in progress		8	0	0	NAD unknown	None
8/8/2018	Dolphin spp.	PAM	x	4	5:19	drilling in progress		0	0	0	NAD unknown	None
8/8/2018	Dolphin, Short-beaked Cc	binocular		16	7:25	drilling in progress		0	0	0	388 porpoising, br	None
8/8/2018	Dolphin spp.	PAM	x	10	12:38	drilling in progress		0	0	0	NAD unknown	None
8/8/2018	Dolphin, Short-beaked Cc	binocular		30	13:03	drilling in progress		0	0	0	364 porpoising, br	None
8/8/2018	Dolphin, Short-beaked Cc	binocular		10	13:54	drilling in progress		0	0	0	234 porpoising, br	None
8/8/2018	Dolphin, Short-beaked Cc	binocular		15	14:49	drilling in progress	15	0	0	0	100 porpoising, br	None
8/10/2018	Dolphin spp.	PAM	x	5	3:12	drilling in progress		0	0	0	NAD unknown	None
8/10/2018	Dolphin spp.	PAM	x	5	20:49	shut down - operational		0	0	0	NAD unknown	None
8/11/2018	Whale, North Atlantic Rig	PAM	x	1	1:31	shut down - operational		0	0	0	NAD unknown	None
8/11/2018	Dolphin spp.	binocular		1	12:53	shut down - operational		0	0	0	387 porpoising	None
8/11/2018	Dolphin spp.	PAM	x	1	22:54	setting up equipment		0	0	0	NAD unknown	None
8/12/2018	Dolphin spp.	PAM	x	5	0:04	setting up equipment		0	0	0	NAD unknown	None
8/12/2018	Dolphin spp.	PAM	x	5	1:09	setting up equipment		0	0	0	NAD unknown	None
8/12/2018	Dolphin spp.	PAM	x	1	2:25	setting up equipment		0	0	0	NAD unknown	None
8/12/2018	Dolphin spp.	PAM	x	5	3:52	setting up equipment		0	0	0	NAD unknown	None
8/12/2018	Whale spp.	binocular		1	6:13	setting up equipment		0	0	0	358 unknown	None
8/12/2018	Dolphin spp.	PAM	x	10	12:24	setting up equipment		0	0	0	NAD unknown	None
8/12/2018	Dolphin spp.	binocular		2	12:30	setting up equipment		0	0	0	339 unknown	None
8/12/2018	Dolphin spp.	PAM	x	5	16:07	setting up equipment		0	0	0	NAD unknown	None
8/13/2018	Dolphin spp.	PAM	x	1	0:43	drilling in progress		0	0	0	NAD unknown	None
8/13/2018	Dolphin spp.	PAM	x	1	1:20	drilling in progress		0	0	0	NAD unknown	None
8/13/2018	Dolphin spp.	PAM	x	5	1:41	drilling in progress		0	0	0	NAD unknown	None
8/13/2018	Dolphin, Short-beaked Cc	PAM	x	6	5:40	drilling in progress	6	0	0	0	10 unknown	None
8/13/2018	Dolphin, Short-beaked Cc	PAM	x	4	5:46	drilling in progress	4	0	0	0	10 traveling	None
8/14/2018	Dolphin spp.	PAM	x	8	5:08	drilling in progress		0	0	0	NAD unknown	None
8/14/2018	Whale spp.	naked eye		1	15:52	shut down - operational		0	0	0	700 blow only	None
8/14/2018	Whale, Fin	binocular		1	16:17	shut down - operational		0	0	0	3259 blows only	None
8/15/2018	Dolphin spp.	PAM	x	5	2:34	drilling in progress	5	0	0	0	NAD unknown	None
8/15/2018	Dolphin spp.	PAM	x	1	3:09	drilling in progress		0	0	0	NAD unknown	None
8/15/2018	Dolphin spp.	PAM	x	5	23:14	downhole geophysical logging	5	0	0	0	NAD unknown	None
8/16/2018	Dolphin spp.	PAM	x	5	1:47	downhole geophysical logging		0	0	0	NAD unknown	None
8/16/2018	Dolphin spp.	PAM	x	10	5:53	downhole geophysical logging		0	0	0	NAD unknown	None
8/16/2018	Whale, Minke	naked eye		1	8:17	shut down - operational	1	0	0	0	0 Milling, dive	None
8/16/2018	Whale, Minke	naked eye		1	9:33	shut down - operational	1	0	0	0	10 Milling, dive	None
8/17/2018	Whale, Minke	naked eye		1	6:07	setting up equipment	1	0	0	0	5 travelling, dive	Delay
8/18/2018	Whale, Minke	naked eye		1	10:16	drilling in progress	1	0	0	0	5 Milling	Shutdown
8/18/2018	Whale spp.	naked eye		1	16:27	drilling in progress		0	0	0	1088 Travelling	None
8/19/2018	Whale, Minke	naked eye		1	6:21	shut down - operational	1	0	0	0	5 slow swimmin	Delay
8/19/2018	Sea Turtle, Loggerhead	naked eye		1	14:16	shut down - operational	1	0	0	0	10 Surface, swim	Delay
8/19/2018	Dolphin spp.	PAM	x	5	21:21	downhole geophysical logging		0	0	0	NAD unknown	None
8/21/2018	Dolphin spp.	PAM	x	5	2:21	drilling in progress		0	0	0	NAD unknown	None
8/21/2018	Whale, Humpback	binocular		1	12:58	drilling in progress		0	0	0	3972 tail slapping, c	None
8/22/2018	Dolphin spp.	PAM	x	1	4:15	downhole geophysical logging		0	0	0	NAD unknown	None
8/22/2018	Whale, Humpback	binocular		1	13:46	drilling in progress		0	0	0	1405 four breaches,	None
8/22/2018	Whale, Minke	naked eye		1	15:42	downhole geophysical logging	1	0	0	0	40 travelling	None
8/22/2018	Whale, Minke	binocular		1	17:12	downhole geophysical logging		0	0	0	2534 breach	None
8/22/2018	Dolphin spp.	PAM	x	5	22:05	downhole geophysical logging	5	0	0	0	NAD unknown	None

8/23/2018 Dolphin spp.	PAM	x	1	4:22 downhole geophysical logging	0	0	0	NAD unknown	None
8/23/2018 Dolphin spp.	binocular		1	6:45 downhole geophysical logging	0	0	0	235 milling	None
8/23/2018 Whale, Minke	binocular		1	9:39 retrieving equipment	0	0	0	235 Directional tra	None
8/23/2018 Whale, Minke	naked eye		1	13:12 other	1	0	0	100 Directional tra	None
8/23/2018 Whale, Minke	binocular		1	16:22 other	0	0	0	820 slow transit, m	None
8/23/2018 Whale, Minke	naked eye		1	18:18 other	1	0	0	150 Directional tra	None
8/23/2018 Whale, Minke	thermal camera		1	21:58 other	0	0	0	250 Directional tra	None
8/24/2018 Whale, North Atlantic Rig	PAM	x	1	1:24 other	0	0	0	NAD unknown	None
8/24/2018 Whale, Minke	naked eye		1	9:04 other	1	0	0	70 transit, surfaci	None
8/24/2018 Whale, Minke	naked eye		1	19:26 pre-loading	1	0	0	15 milling, transit,	None
8/25/2018 Dolphin spp.	PAM	x	5	1:58 other	0	0	0	NAD unknown	None
8/25/2018 Whale, Minke	binocular		1	6:58 other	1	0	0	199 surfacing	None
8/25/2018 Dolphin, Short-beaked Cc	PAM	x	15	18:02 deploying equipment	0	0	0	NAD unknown	None
8/25/2018 Dolphin, Short-beaked Cc	binocular		6	18:10 deploying equipment	6	0	0	180 travel, porpois	None
8/25/2018 Whale, Minke	naked eye		1	19:21 other	1	0	0	100 milling, slow tr	None
8/25/2018 Dolphin spp.	PAM	x	5	19:47 other	0	0	0	NAD unknown	None
8/25/2018 Whale, Minke	thermal camera		1	19:57 other	0	0	0	600 Directional tra	None
8/25/2018 Dolphin spp.	PAM	x	5	20:30 other	0	0	0	NAD unknown	None
8/25/2018 Dolphin spp.	PAM	x	5	21:04 other	0	0	0	NAD unknown	Delay
8/25/2018 Dolphin spp.	thermal camera		5	22:49 deploying equipment	0	0	0	1660 travel	None
8/26/2018 Dolphin spp.	PAM	x	5	0:10 drilling in progress	0	0	0	NAD unknown	None
8/26/2018 Dolphin spp.	PAM	x	5	1:53 drilling in progress	0	0	0	NAD unknown	None
8/26/2018 Whale, Minke	naked eye		1	10:39 other	1	0	0	170 unknown	Shutdown
8/26/2018 Whale, Fin	binocular		1	17:48 drilling in progress	0	0	0	2603 Transiting	None
8/27/2018 Whale, Minke	naked eye		1	6:40 shut down - operational	1	0	0	50 milling	Delay
8/27/2018 Whale, Minke	naked eye		1	7:43 shut down - operational	1	0	0	15 milling	Delay
8/27/2018 Whale, Minke	naked eye		1	15:39 shut down - operational	1	0	0	35 travel	Delay
8/27/2018 Dolphin spp.	PAM	x	10	21:15 drilling in progress	0	0	0	NAD unknown	None
8/27/2018 Dolphin spp.	thermal camera		8	21:29 drilling in progress	8	0	0	20 travel, foraging	None
8/27/2018 Whale spp.	thermal camera		1	23:43 drilling in progress	0	0	0	1085 travel	None
8/28/2018 Whale, Minke	binocular		2	6:04 downhole geophysical logging	2	0	0	100 travel, blow	None
8/28/2018 Whale, Minke	naked eye		2	9:50 downhole geophysical logging	2	0	0	5 milling	None
8/28/2018 Whale, Minke	naked eye		2	10:41 downhole geophysical logging	2	0	0	1 milling	None
8/28/2018 Whale, Minke	naked eye		2	14:07 downhole geophysical logging	2	0	0	200 breaching, tra	None
8/29/2018 Whale, Minke	naked eye		1	6:59 downhole geophysical logging	1	0	0	25 milling	None
8/29/2018 Whale, Fin	naked eye		1	10:46 other	1	0	0	150 Traveling, blo	None
8/29/2018 Whale, Minke	naked eye		1	11:11 other	1	0	0	30 milling	None
8/29/2018 Whale spp.	binocular		1	11:33 other	0	0	0	918 blow	None
8/29/2018 Whale, Minke	naked eye		1	12:30 other	1	0	0	45 travel	None
8/29/2018 Whale, Minke	naked eye		1	14:30 downhole geophysical logging	1	0	0	75 transit	None
8/29/2018 Whale spp.	naked eye		1	16:12 other	0	0	0	1000 unknown	None
8/29/2018 Whale spp.	HD camera		1	16:49 downhole geophysical logging	0	0	0	300 travel	None
8/30/2018 Dolphin spp.	PAM	x	5	0:12 retrieving equipment	0	0	0	NAD unknown	None
8/30/2018 Dolphin spp.	PAM	x	5	0:28 retrieving equipment	0	0	0	NAD unknown	None
8/30/2018 Whale spp.	binocular		1	7:35 other	0	0	0	748 unknown	None
8/30/2018 Whale, Minke	binocular		1	16:25 shut down - operational	0	0	0	231 milling	None
8/30/2018 Whale, Minke	binocular		1	16:49 shut down - operational	1	0	0	150 milling	None
8/30/2018 Whale spp.	naked eye		1	17:45 shut down - operational	0	0	0	1000 breach, travel	None
8/30/2018 Whale, Minke	naked eye		1	17:58 shut down - operational	1	0	0	100 travel	None
8/30/2018 Dolphin spp.	PAM	x	5	21:16 pre-loading	0	0	0	NAD unknown	None
8/30/2018 Dolphin spp.	PAM	x	5	21:48 pre-loading	0	0	0	NAD unknown	None
8/31/2018 Dolphin spp.	PAM	x	5	3:00 pre-loading	0	0	0	NAD unknown	None
8/31/2018 Whale, Minke	naked eye		1	11:24 shut down - operational	1	0	0	25 milling, travel	Delay
8/31/2018 Whale, Minke	binocular		1	13:52 drilling in progress	0	0	0	564 travel	None
8/31/2018 Whale, Minke	naked eye		1	15:16 drilling in progress	1	0	0	35 travel	Shutdown
8/31/2018 Whale, Minke	binocular		1	16:31 drilling in progress	0	0	0	563 travel	None
8/31/2018 Whale, Minke	binocular		1	17:32 drilling in progress	0	0	0	2905 breach, surfac	None

8/31/2018 Dolphin spp.	PAM	x	1	23:48 drilling in progress	0	0	0	NAD unknown	None
9/1/2018 Dolphin spp.	PAM	x	5	1:56 drilling in progress	0	0	0	NAD unknown	None
9/1/2018 Dolphin spp.	PAM	x	5	3:01 drilling in progress	0	0	0	NAD unknown	None
9/1/2018 Dolphin spp.	PAM	x	1	4:42 drilling in progress	0	0	0	NAD unknown	None
9/1/2018 Whale, Minke	naked eye		1	13:12 drilling in progress	1	0	0	17 milling, surfaci	Shutdown
9/1/2018 Whale spp.	binocular		1	16:50 drilling in progress	0	0	0	2542 blow	None
9/1/2018 Whale, Minke	naked eye		1	19:18 drilling in progress	1	0	0	20 milling, surfaci	Shutdown
9/1/2018 Dolphin spp.	PAM	x	12	22:33 drilling in progress	0	0	0	NAD unknown	None
9/1/2018 Dolphin spp.	thermal camera		12	23:29 drilling in progress	12	0	0	20 foraging, porp	None
9/2/2018 Dolphin spp.	PAM	x	3	0:32 drilling in progress	0	0	0	NAD unknown	None
9/2/2018 Dolphin spp.	PAM	x	8	4:06 drilling in progress	0	0	0	NAD unknown	None
9/2/2018 Dolphin spp.	thermal camera		8	5:24 drilling in progress	0	0	0	403 porpoising, tra	None
9/2/2018 Whale, Minke	binocular		2	9:46 drilling in progress	0	0	0	342 travel, surfaci	None
9/2/2018 Whale, Minke	naked eye		1	12:40 downhole geophysical logging	1	0	0	25 Travel, surfaci	None
9/2/2018 Whale, Minke	binocular		1	15:19 downhole geophysical logging	0	0	0	215 surfacing, dive	None
9/2/2018 Dolphin spp.	PAM	x	3	21:05 shut down - operational	0	0	0	NAD unknown	None
9/2/2018 Dolphin spp.	thermal camera		2	21:41 shut down - operational	0	0	0	280 travel, porpois	None
9/3/2018 Dolphin spp.	PAM	x	3	1:11 shut down - operational	0	0	0	NAD unknown	None
9/3/2018 Dolphin spp.	PAM	x	3	1:45 shut down - operational	0	0	0	NAD unknown	None
9/3/2018 Sea Turtle, Loggerhead	naked eye		1	10:23 downhole geophysical logging	0	1	0	20 surfacing, dive	None
9/3/2018 Dolphin spp.	PAM	x	5	19:08 downhole geophysical logging	0	0	0	NAD unknown	None
9/3/2018 Dolphin spp.	PAM	x	10	20:57 downhole geophysical logging	0	0	0	NAD unknown	None
9/3/2018 Dolphin spp.	thermal camera		5	22:44 downhole geophysical logging	5	0	0	NAD Porpoising	None
9/4/2018 Dolphin spp.	PAM	x	3	3:32 shut down - operational	0	0	0	NAD unknown	None
9/4/2018 Whale, Minke	naked eye		1	6:34 downhole geophysical logging	1	0	0	5 possible feedin	None
9/4/2018 Dolphin spp.	PAM	x	3	19:01 pre-loading	0	0	0	NAD unknown	None
9/5/2018 Dolphin spp.	PAM	x	3	2:20 pre-loading	0	0	0	NAD unknown	None
9/5/2018 Dolphin spp.	PAM	x	20	2:46 pre-loading	0	0	0	NAD unknown	None
9/5/2018 Dolphin spp.	thermal camera		15	5:54 deploying equipment	0	0	0	300 porpoising	None
9/5/2018 Dolphin spp.	binocular		23	5:52 deploying equipment	0	0	0	277 travelling, milli	None
9/5/2018 Dolphin spp.	binocular		14	11:27 drilling in progress	0	0	0	277 travelling, milli	None
9/5/2018 Whale spp.	binocular		1	13:51 drilling in progress	0	0	0	273 travel, surfaci	None
9/5/2018 Whale, Minke	naked eye		1	15:29 drilling in progress	1	0	0	45 milling, surfaci	Shutdown
9/5/2018 Dolphin spp.	PAM	x	3	17:24 drilling in progress	0	0	0	NAD unknown	None
9/5/2018 Dolphin spp.	PAM	x	5	19:04 drilling in progress	0	0	0	NAD unknown	None
9/5/2018 Dolphin spp.	PAM	x	10	23:25 downhole geophysical logging	0	0	0	NAD unknown	None
9/6/2018 Dolphin spp.	thermal camera		2	0:09 downhole geophysical logging	0	0	0	600 breaching	None
9/6/2018 Dolphin spp.	thermal camera		8	3:10 downhole geophysical logging	8	0	0	178 porpoising	None
9/6/2018 Dolphin spp.	PAM	x	20	5:53 downhole geophysical logging	0	0	0	NAD unknown	None

APPENDIX F. *MV WESTERLY* – REVOLUTION WIND FARM GEOPHYSICAL AND GEOTECHNICAL SURVEY PROTECTED SPECIES OBSERVER REPORT



Protected Species Observer Combined 90-Day and Final Report

Revolution Wind

BOEM Lease OCS-A 0486

MV Conti and MV Westerly

Prepared by: A.I.S. Inc.

Prepared for: Deepwater Wind New England, LLC
and CSA Ocean Sciences Inc.

Submittal Date: March 20, 2019

Revised: 22 May 2019

Revolution Wind - Protected Species Observer
Combined 90-Day and Final Report

This report is being submitted to satisfy the following lease stipulations:

BOEM Lease OCS-A 0486; Section 4.4 Reporting Requirements

(4.4.3) Report of Activities and Observations

The Lessee must provide the Lessor and NMFS within 90 calendar days following the commencement of HRG survey activities that includes a summary of survey activities, and an estimate of the number of listed marine mammals and sea turtles observed and/or Taken during these survey activities.

(4.4.4) Report Information

Data on all protected species observations must be recorded based on standard marine mammal observer collection data by the PSO. This information must include: dates, times, and locations of survey operations; time of observation, location, and weather; details of marine mammal sightings (e.g., species, number, behavior); and the details of any observed Taking (e.g., behavioral disturbances or injury/mortality).

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1 INTRODUCTION

Deepwater Wind South Fork, LLC (Deepwater Wind), an affiliate of lease holder Deepwater Wind New England, LLC is proposing to develop the Revolution Wind Farm (REV) project, an offshore wind energy project within the Bureau of Ocean Energy Management (BOEM) Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0486). Located approximately 15 miles south of the Rhode Island coast, REV will ultimately provide the state with 400-MW of renewable energy generated by up to 50 offshore wind turbines.

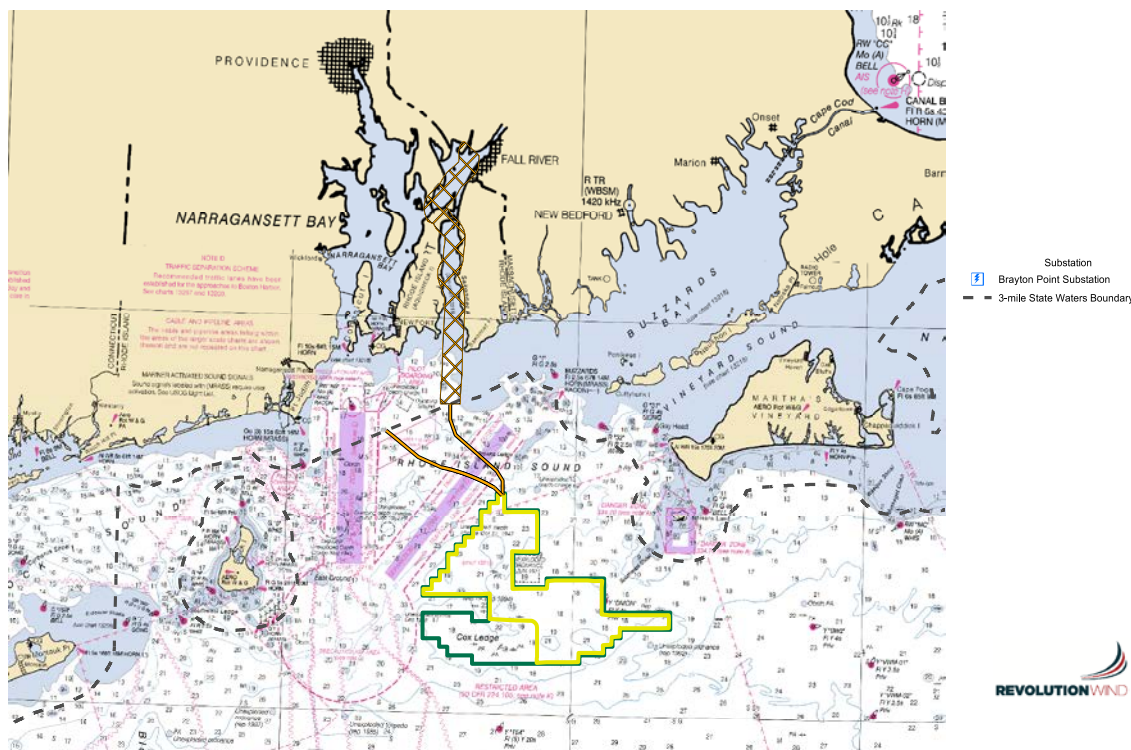


Figure 1 Lease Area (OCS-A 0486) and associated export cable routes

This report documents the complete results from the 2019 geotechnical survey, conducted from January 18th through March 3rd, aboard the MV Conti and the 2019 geophysical surveys, conducted from January 13th through February 25th, aboard the MV Westerly by Fugro for Deepwater Wind. A summary of the survey operations, observer effort, visual and acoustic detections of protected species and mitigation actions are included in this report. There were no observed incidents with protected species throughout the survey timeframe. Protected Species Observer (PSO) methodology and monitoring protocols are summarized and a detailed description may be referenced in the Alternative Monitoring Plan (AMP). An assessment of the effectiveness of alternative monitoring methods and future recommendations is provided in the final section of this report.

2 SUMMARY OF GEOTECHNICAL AND GEOPHYSICAL SURVEY ACTIVITIES

Geophysical and geotechnical surveys were conducted on the REV Lease area and export cable route by Fugro for Deepwater Wind from January 13th through March 3rd, 2019. Two vessels were utilized to complete these surveys: the MV Conti and the MV Westerly.

Offshore site characterization surveys in the REV lease area consisting of geotechnical operations aboard the MV Conti occurred January 18th through 25th, January 28th through February 14th, February 16th through 21st and February 24th through March 3rd, 2019. Due to the 24-hour operations schedule, both PSOs and Passive Acoustic Monitoring (PAM) Operators were aboard the vessel during all survey activities in accordance with the Construction and Operations Plan (COP). The equipment associated with the geotechnical survey for which mitigation measures were implemented (ie. operating frequency <200kHz) were the dynamic positioning (DP) thrusters used by the vessel for maintaining station.

All geotechnical operations on board the MV Conti were conducted according to the mitigation protocols. Records of operations data for each type of equipment utilized during the survey were kept in accordance with the reporting requirements.

Inshore site characterization surveys in the REV lease area consisting of geophysical operations aboard the MV Westerly occurred January 13th through February 25th, 2019. Since operations aboard the MV Westerly were restricted to daylight hours, night vision devices and PAM were not required and only visual PSOs were monitoring during survey activities in accordance with the COP.

Table 1. Geophysical equipment used aboard the MV Westerly, with operating frequencies of concern

Equipment Type	Operating Frequency (kHz)
Multibeam	500
USBL	22-33
Sidescan	400/600
Sub-Bottom Profiler	0.5-15
Streamer	3-300
Boomer	3-300

All geophysical operations on board the MV Westerly were conducted according to the mitigation protocols. Records of operations data for each type of equipment utilized during the surveys were kept in accordance with the reporting requirements.

3 PROTECTED SPECIES OBSERVATION METHODS

To fulfill the protected species monitoring requirements of the BOEM-issued lease, Deepwater Wind contracted A.I.S. Inc. (AIS) to provide PSOs and PAM Operators to monitor for marine mammals and sea turtles during geotechnical and geophysical survey operations. These monitoring activities were completed in accordance with the NOAA Fisheries IHA, the BOEM Lease OCS-A 0486, and the BOEM-approved REV COP and AMP.

3.1 Protected Species Observer Training and Compliance

All PSOs and PAM Operators, who participated in the survey, were approved by NMFS/BOEM, per the applicable lease stipulation. All PSO and PAM Operator staff were required to comply with Fugro operating standards, possess fit-for-sea duty medical clearance and offshore safety training.

All PSOs and PAM Operators, who monitored during this survey, attended the Permit and Project Environmental Compliance Plan (PECP) training compiled and presented by Deepwater Wind and CSA. Additionally, all PSOs and PAM Operators received project specific training that covered the following topics:

- Permits and plans relevant to the project
- Environmental compliance requirements
- Health and safety requirements
- PSO/PAM Operator requirements and scheduling
- Protected species mitigation methods
- Communication
- Authorized takes
- Data forms
- Use and maintenance of PSO and PAM equipment:
- Protected species identification review

3.2 Monitoring Methods and Equipment

Protected species monitoring methods included visual observations, as well as alternative monitoring for observations during nighttime hours and periods of reduced visibility. Alternative monitoring methods consisted of night vision devices (night vision monoculars and a thermal camera system), and acoustic observations utilizing PAM equipment.

The following visual PSO equipment was utilized during surveys on both vessels:

- 7 X 50 waterproof binoculars with reticles;
- rangefinders.

The following PSO and PAM alternative monitoring equipment was used for surveys on the MV Conti:

- Gen 3 night vision monoculars;
- high definition thermal imaging cameras;
- PAM equipment.

There were two PSOs and three PAM Operators aboard the MV Conti, and three PSOs aboard the MV Westerly to fulfill protected species monitoring and mitigation requirements. All PSOs and PAM Operators worked in shifts to ensure that each individual did not exceed four consecutive hours of watch and received a two-hour break for every four hours of watch. Best efforts were made to ensure that no individual worked more than 12 hours in a 24-hour period.

During daylight hours, PSOs scanned the strike avoidance and exclusion zones for protected species with the naked eye and with reticle binoculars. Visual observations took place from a high vantage point allowing

for a 360-degree view of the exclusion zone. PSOs estimated distance utilizing both reticle binoculars and rangefinders. During nighttime hours and periods of reduced visibility the PSOs scanned the strike avoidance and exclusion zones for protected species with night vision monoculars and a thermal camera system. PSOs remained on watch 24-hrs per day aboard the MV Conti and during daylight hours aboard the MV Westerly to implement strike avoidance measures during vessel transits and to enact mitigation protocols for protected species during geophysical and geotechnical operations. In addition, PAM Operators aboard the MV Conti acoustically monitored the exclusion zone for protected species during nighttime/reduced visibility geotechnical operations.

The PAM system consisted of an array of hydrophones with two broadband hydrophones (sampling mid-range frequencies of 2 to 200 kHz) and two low-frequency hydrophones (sampling range frequencies of 75 Hz to 30 kHz). The PAM operators monitored acoustic signals in real-time both aurally (using headphones) and visually (via sound analysis software).

PSOs and PAM Operators recorded data on standard observation forms including details on survey operations, observer effort and protected species sightings and incidents. PSOs regularly checked the whale alert app and the Right Whale Sighting Advisory System (RWSAS) for recent north Atlantic right whale sightings and established DMAs in the survey area. For each shift, a designated Lead PSO was responsible for communicating the presence of protected species and for communicating and enforcing the appropriate mitigation actions. PAM operators communicated nighttime detections to the lead PSO on duty to ensure the implementation of the appropriate mitigation measure.

Detailed PSO methodology and monitoring protocols are provided in the AMP. An assessment of effectiveness of alternative monitoring methods and future recommendations is provided in the final section of the report.

3.3 Mitigation Requirements

Mitigation activities vary per species and survey activity. According to the IHA, mitigation for DP thrusters was not necessary due to a determination by NMFS that the sound produced was not likely to result in harassment of marine mammals in the project area. The DP thrusters referenced in the IHA fall in the range of 0.1 to 10kHz, which can potentially result in Level B harassment of certain protected species.

According to section 4.1.1 of the lease, any vessel in transit is required to implement strike avoidance measures for marine mammals and sea turtles. Vessel operators are required to stop, alter course or slow the vessel to avoid striking marine mammals and sea turtles. These measures require maintaining a minimum separation distance of 500m from north Atlantic right whales, 100m from other non-delphinoid cetaceans and 50m from delphinoid cetaceans, seals and sea turtles. The vessel must slow speed and shift to neutral for any non-delphinoid cetacean within 100m. In addition, vessel operators must comply with 10-knot speed restrictions in any DMA, and vessels greater than or equal to 65ft in length must operate at speeds of 10-knots or less from November 1st through July 31st. In regard to delphinoid cetaceans, the vessel must avoid excessive speed or abrupt changes in direction until the animals have moved beyond 50m and/or abeam of the underway vessel. The vessel should reduce speed to 10 knots or less when pods (including mother/calf pairs) or large assemblages of delphinoid cetaceans are observed.

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According to section 4.3.6 of the lease, the implementation of mitigation measures is required for geophysical surveys with one or more acoustic sound sources operating below 200kHz. During geophysical operations, the following exclusion zones were stipulated in the IHA issued 13 June 2018: 500m for north Atlantic right whales, 200m for all non-delphinoid cetaceans; 50m for sea turtles, and 25m for all delphinoid cetaceans and pinnipeds. The 500-m right whale exclusion zone was applied and a 200-m exclusion zone for all marine mammals and sea turtles was applied. A 60-minute pre-survey of the exclusion zone and surrounding area is required prior to the start of operations. Delays to the start of operations should occur for any marine mammal or sea turtle within the exclusion zone. Shut downs should occur for any marine mammal or sea turtle within the exclusion zone(s). General dolphin conditions were specified to address the inability of the geophysical equipment to power down. The following general dolphin conditions were applied for this survey:

- If dolphins are observed in the exclusion zone while the source is operating, no action is taken for 10 minutes while the dolphins are observed.
- If dolphins leave the exclusion zone after 10 minutes, no further action is taken.
- If dolphins are voluntarily entering the exclusion zone on a trajectory toward the vessel, bowriding, or otherwise engaging the equipment and vessel, no further action is taken.
- If the vessel encroaches on dolphins (involuntarily) putting them within the exclusion zone, and the dolphins do not leave the exclusion zone after 10 minutes, then a shutdown should occur.

Voluntary Dolphin Behavior consists of:

- swimming toward the vessel at a trajectory that would intersect the vessel's path;
- milling, playing, group interactions within the exclusion zone;
- bowriding.

Conditions where encroachment on the exclusion zone is more likely involuntary include:

- vessel movement resulting in interaction with a group that appears to be resting (resting is typically slow group movement at or near the surface with limited interactions between dolphins, no direction or speed changes, no porpoising or aerial behaviors, no bow riding and slow/splashless breaths);
- bottom feeding, cooperative feeding, school / bait ball feeding;
- adult-calf pairs where calves may be inhibited from maneuvering out of the exclusion zone.

A 60-minute clearance period and a full ramp up of equipment (if possible) is necessary after any shut down of operations for protected species or pauses in operations (not concerning protected species) greater than 20 minutes. According to section 4.3.6.5 of the lease, when technically feasible, a ramp-up should begin with the power of the smallest acoustic equipment at the lowest power output once the animal that triggered the shutdown is no longer in the Exclusion Zone. The ramp-up can begin after 15 minutes for harbor porpoises, 30 minutes for non-delphinoid cetaceans and 60 minutes for sea turtles. The power output should be gradually increased and other acoustic sources added in a way such that the source level would increase in steps not exceeding 6dB per 5-minute period. For pauses (not concerning protected species) less than 20 minutes, the equipment may be restarted at operational level as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of protected species.

According to section 4.3.7 of the lease, the implementation of mitigation measures is required for geotechnical surveys. During geotechnical operations, the following exclusion zones apply: 500m from North Atlantic Right Whales and 200m from all non-delphinoid cetaceans; 50m for sea turtles, and 25m for

all delphinoid cetaceans and pinnipeds. A 60-minute pre-survey of the exclusion zone and surrounding area is required prior to the start of operations. Any delays to the start of operations or shutdowns should occur for any marine mammal or sea turtle within the exclusion zone. A 60-minute clearance period is necessary after any shut down of operations for protected species or pauses in operations (not concerning protected species) greater than 20 minutes. For pauses (not concerning protected species) less than 20 minutes, the equipment may be restarted at operational level as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of protected species.

According to section 4.4, any injury or mortality of a protected species should be reported to both BOEM and NMFS within 24 hours. In addition, any incidents with protected species, not resulting in injury or mortality should be reported to BOEM and NMFS within 48 hours. Furthermore, sightings of north Atlantic right whales should be reported to NMFS and a follow-up report should be provided to BOEM. A more detailed description of the mitigation measures applied to this survey can be found in the COP and AMP.

3.4 Protected Species Observation Data

PSO and PAM entries and mitigation summaries were recorded on data sheets, which were provided to CSA and Deepwater Wind on a daily basis via email. Observer effort, record of operations and sighting data were all recorded in standardized forms.

According to lease stipulation 4.4.4, data collected by PSOs based on standard MMO collection data included:

- dates, times, locations of survey operations;
- time of observation, location and weather;
- details marine mammal sightings (species, #, behavior);
- details of any observed taking (behavioral disturbances or injury/mortality).

Attached are summaries of the detections from PSO/PAM data for the MV Conti and MV Westerly in relation to specific survey activities in the REV Lease Area. There were no confirmed sightings of north Atlantic right whales throughout the survey period. Summary details provided include:

- Dates and times of each detection
- Species encountered
- Initial detection method
- Group Size
- Description of the observed behaviors (in both the presence and absence of activities)
- A summary of event details
- Description of survey activities at the time of sighting/detection
- Estimated number of individuals within Mitigation Zone during survey activities
- Approximate Closest Point of Approach
- Mitigation Measures Taken

4 GEOTECHNICAL SURVEY PSO DATA SUMMARY

4.1 Observer Effort

Protected species monitoring occurred at all times during geotechnical survey operations, in anticipation of geotechnical operational activities, as well as during the transit to and from survey sites to avoid any potential ship strikes. Total hours of visual and acoustic monitoring during the geotechnical survey periods per vessel are summarized in Table 2.

Table 2. Total hours visual and acoustic monitoring during the geotechnical survey period aboard MV Conti

Survey Vessel/Survey Type	Visual Monitoring (hh:mm)	Acoustic Monitoring (hh:mm)
Conti/Geotechnical	513:18	270:00

On one occasions the visibility was poor enough to interfere with clearing the 500m exclusion zone. Fog reduced the visual monitoring team's visibility to 200m on 2/5/19 for a total of 37 minutes. Otherwise, visibility remained at 500m or more.

4.2 Geotechnical Survey Operations

The DP thrusters referenced in the IHA fall in the range of 0.1 to 10kHz, which can potentially result in Level B harassment of certain protected species. Figure 2 summarizes the total hours that the dynamic positioning (DP) thrusters were active.

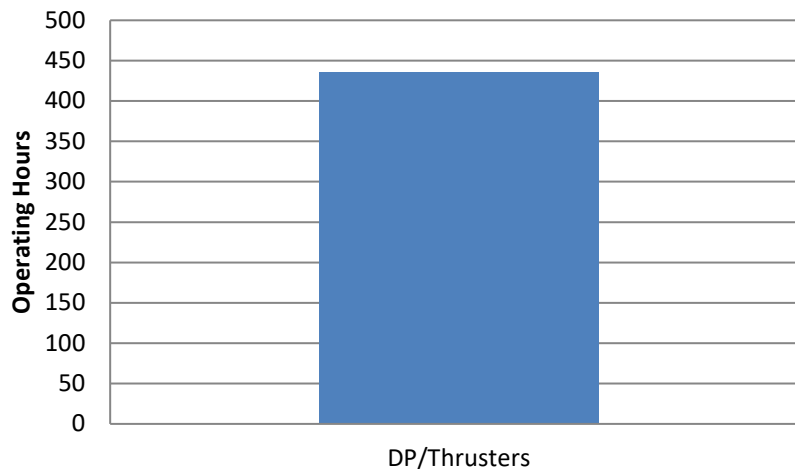


Figure 2. Total operating hours of the mitigating source aboard MV Conti

4.3 Sighting/Detection Data

There were a total of ten visual sighting events, one of which was captured using the thermal imaging cameras, and two acoustic detections occurring during the geotechnical surveys aboard the MV Conti. The location of these sightings/detections is depicted in Figure 3. None of the acoustic detection events were paired with visual sightings. Table 3 provides the total number of protected species sightings/detections and

the best estimate of individuals, by species. A summary of the details associated with these sightings can be found in Attachment 1.



Figure 3 Locations of animal detections aboard the MV Conti by species

Ninety-two percent of the sightings/detections occurred during daylight, between the hours of 6:00 AM EST (sunrise) and 5:00 PM EST (sunset), and the other six percent occurred during nighttime hours.

Table 3 Species and Number of Individuals Sighted or Acoustically Detected during REV Geotechnical

Common Name	Species	Number of Sightings/Detections	Number of Individuals Sighted/Detected
Dolphin, Short-Beaked Common	<i>Delphinus delphis</i>	1	8
Unidentified dolphin	Delphinidae	2	5
Seal, Grey	<i>Halichoerus grypus</i>	1	1
Seal, Harbor	<i>Phoca vitulina</i>	7	7
Unidentified whale	Balaenopteridae	1	1

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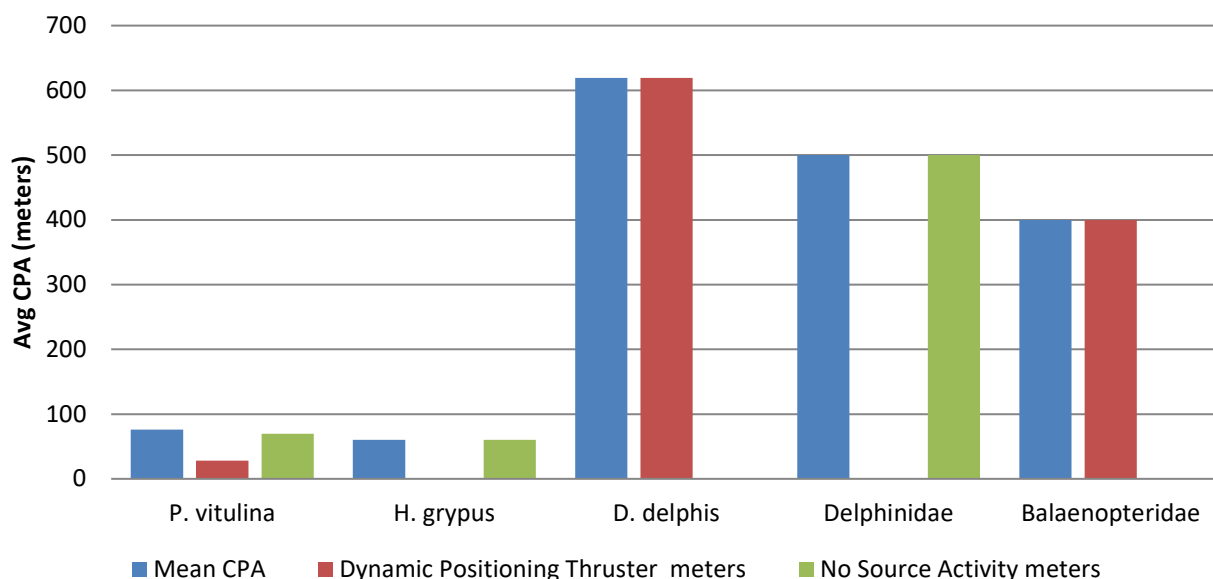


Figure 4 Summary for closest point of approach (CPA) of species detected during MV Conti geotechnical survey

4.4 Mitigation Activities

Mitigation activities were initiated when marine mammals or sea turtles were sighted within their respective exclusion zone while geotechnical equipment was engaged or while the vessel was in transit (outlined in Section 3.3). Of the sightings/detections outlined in Section 4.3, mitigation was only implemented for a harbor seal in the harbor, for which the vessel slowed its pace in accordance with vessel strike avoidance measures as it transited to the work site. No other mitigations were required. There was a total of 1 minute of operational delays due to mitigation.

Table 4 Summary of Mitigation Events during REV Geotechnical Survey aboard MV Conti

Common Name	Species	Number of Mitigation Events	Total Mitigation Time (hh:mm)
Seal, Harbor	<i>Phoca vitulina</i>	1	00:01

4.5 Dead or Injured Marine Mammals or Sea Turtles

There were no dead or injured marine mammals or sea turtles recorded during the REV geotechnical surveys aboard the MV Conti.

5 GEOPHYSICAL SURVEY PSO DATA SUMMARY

5.1 Observer Effort

Protected species monitoring occurred at all times during geophysical survey operations, in anticipation of geophysical operational activities, as well as during the transit to and from survey sites to avoid any potential ship strikes. Total hours of visual and acoustic monitoring during the geophysical survey period are summarized in Table 5

Table 5 Total Hours Visual and Acoustic Monitoring during Geophysical Survey Period aboard MV Westerly

Survey Vessel/Survey Type	Visual Monitoring (hh:mm)	Acoustic Monitoring (hh:mm)
Westerly/Geophysical	250:48	0

Though there were a couple foggy days in the forecast, the fog was never thick enough to inhibit visual monitoring.

5.2 Geophysical Survey Operations

The operating frequency ranges of the geophysical survey equipment used aboard the MV Westerly are summarized in Table 1 and total operating times for each piece of equipment are described Figure 5.

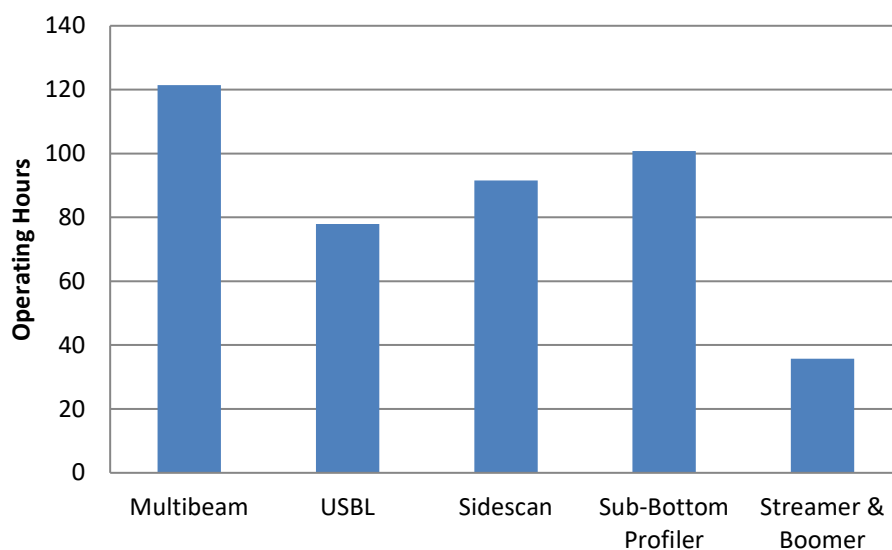


Figure 5 Total operating hours of the geophysical equipment aboard the MV Westerly

5.3 Sighting/Detection Data

There were a total of nine visual sighting events during the geophysical survey. Due to the MV Westerly only conducting daytime operations, PAM was not required for this survey and no acoustic detections were recorded. Table 6 provides the total number (best estimate) of individuals by species. A summary of the details associated with these sightings can be found in Attachment 2.

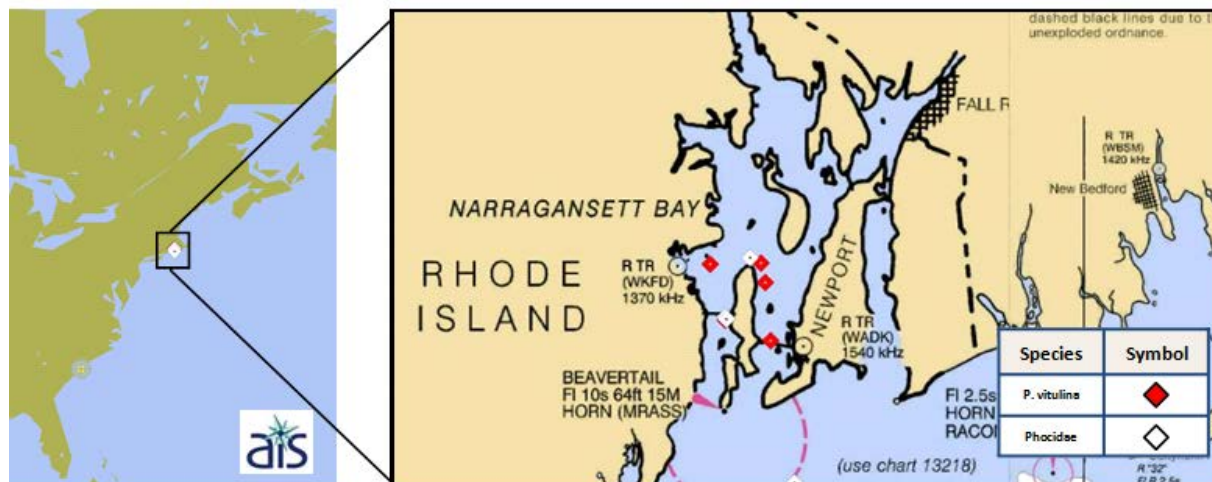


Figure 6 Locations of animal detections aboard the MV Westerly by species

Table 6 Species and Number of Individuals Sighted during REV Geophysical Survey aboard MV Westerly

Common Name	Species	Number of Sightings	Number of Individuals Sighted
Seal, Harbor	<i>Phoca vitulina</i>	5	5
Unidentified seal	Phocidae	4	4

5.4 Mitigation Activities

Mitigation activities were initiated when marine mammals or sea turtles were sighted within their respective exclusion zone while geophysical equipment was engaged or while the vessel was in transit (outlined in Section 3.2). Of the sightings outlined in Section 5.3, three of the encounters resulted in mitigation in the form of pre-watch delays. Table 7 summarizes the number of mitigation events per species as well as the amount of time associated with the mitigation delays. There was a total of 57 minutes of operational delays associated with mitigation.

Table 7 Summary of Mitigation Events during REV Geophysical Survey aboard MV Westerly

Common Name	Species	Number of Mitigation Events	Total Mitigation Time (hh:mm)
Seal, Harbor	<i>Phoca vitulina</i>	1	00:35
Unidentified seal	Phocidae	2	00:22

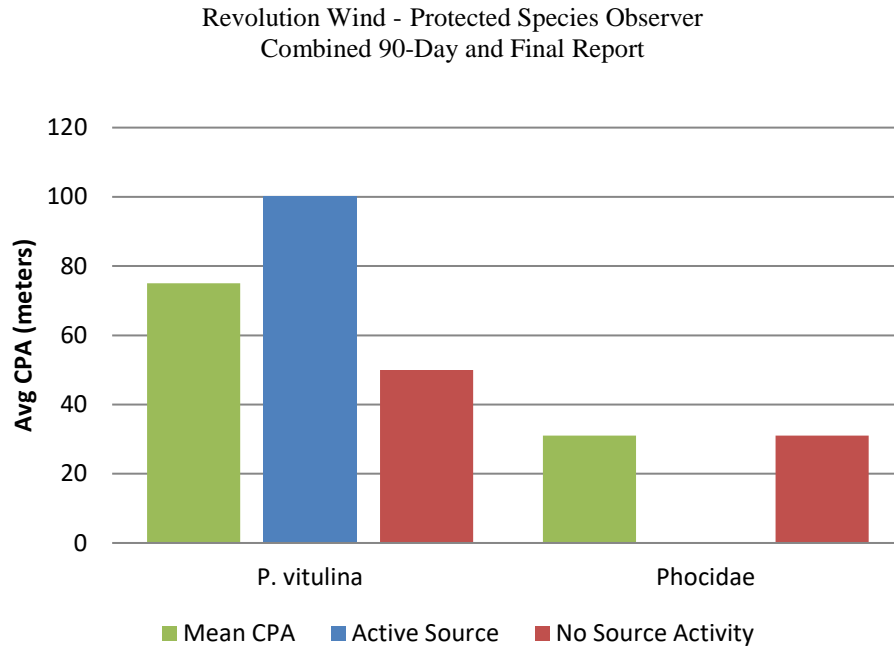


Figure 7 Summary for closest point of approach (CPA) of species detected during MV Westerly geophysical survey

5.5 Dead or Injured Marine Mammals or Sea Turtles

There were no dead or injured marine mammals or sea turtles recorded during the REV geophysical surveys aboard the MV Westerly.

6 ALTERNATIVE MONITORING EFFECTIVENESS/RECOMMENDATIONS

Overall, the night vision monoculars, thermal camera system, and PAM system provided effective means for the team to efficiently monitor the exclusion zones for encroaching animals during nighttime hours and periods of reduced visibility, with enough time to make appropriate mitigation decisions on the MV Conti. The MV Westerly was restricted to daylight operations, and therefore, did not implement alternative monitoring methods for periods of reduced visibility.

Table 8 Total Protected Species Detections according to Monitoring Method

PAM Detections	Night Vision Monocular Detections	Thermal Camera Detections	Visual Detections during Daylight
2	0	1	16

No protected species were observed using the night vision monoculars. The lack of detections utilizing the night vision monoculars may have been due to the limited range of visibility. The thermal camera system had one protected species detection and the PAM system had two protected species detections. The results show that the PAM system had a higher detection rate than the thermal camera system, suggesting that PAM is a more effective tool for detecting protected species during reduced visibility. The higher detection rate of protected species utilizing the PAM system may be due to limited surface activity and increased vocalizations of the animals during the periods of reduced visibility.

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Altogether, 15.8 percent of the protected species detections occurred utilizing both the night vision devices and PAM equipment, compared to a daylight visual detection percentage of 84.2. Therefore, the combined use of night vision devices and PAM equipment was effective in monitoring and mitigating for protected species during periods of reduced visibility but not more reliable than visual observations during daylight hours.

Night vision devices were utilized during nighttime hours for strike avoidance of protected species and to supplement acoustic monitoring during survey operations. Night vision devices were aimed away from vessel flood lights to prevent damage and maintain effectiveness of the equipment. Vessel flood lights reduced the effectiveness of the night vision devices at close range; however, safety of the crew working on deck took precedence. Based on the number of detections utilizing the night vision devices, it is recommended that efforts to minimize lighting be implemented when utilizing night vision devices. It is also recommended that distance estimation features be more reliable with hand-held night vision devices.

The PAM detections aboard the MV Conti were delphinid in nature, but the team was unable to identify the animals to species as there was no opportunity to confirm the species visually. The PAM technology does not currently allow for species identification without the utilization of post-processing software; therefore, any acoustic detections of dolphins were categorized as 'Unidentified Dolphin.' The higher occurrence of delphinid detections was expected based on the estimated delphinid populations in the survey area (IHA, 2018). The lack of low-frequency cetacean detections may be due to vessel noise or ambient noise level in the survey area. Based on depths in the survey area and vessel equipment, the PAM hydrophones are unable to be deployed deep enough or far enough behind the vessel to avoid interference. It is recommended that measures be taken to allow for the optimum positioning of the hydrophone array in order to obtain the most accurate acoustic detection data. However, the PAM system allowed for the most accurate distance estimates based on the time of arrival of the signal received at each hydrophone.

Attachment 1

MV Conti – Revolution Wind Farm Geotechnical Survey Detection Summary

Attachment 2

MV Westerly – Revolution Wind Farm Geophysical Survey Detection Summary