Marine Mammal Observer Report
Barryroe Site Survey

3rd to 17th September 2019

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Exploration licence: SEL 1/11

Client:	Providence Resources Plc
Contractor/Vessel:	Gardline / Kommandor
Licence no:	SEL 1/11
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1. Executive Summary

Project Overview:

A site survey was undertaken by Gardline on-board the RV Kommandor for the client, Providence Resources P.l.c., in the Barryroe site SEL 1/11 situated in the North Celtic Sea Basin off the south coast of Ireland. The RV Kommandor departed Waterford, Ireland, on the 3rd of September and commenced operations on the 4th of September. Operations were completed on the 13th of September and the RV Kommandor arrived at Lowestoft, UK, on the 17th of September 2019.

Several acoustic sources were used during this project and included, a single-beam echo sounder (SBES), multi-beam echo sounder (MBES), side scan sonar (SSS), ultra-short base line (USBL) and pinger. During periods of bad weather the SBES, MBES, SSS and USBL were switched off, while the pinger remained switched on.

In total, there were thirty five sightings of marine mammals during this project including three which were recorded as incidental sightings. These incidental sightings were recorded by the crew and were not observed by the MMO who was off effort during these times. There was one sighting detected during a pre-work watch which consisted of common dolphins. This sighting resulted in a delay of thirty four minutes to the commencement of operations. After this mitigation measure took place, operations commenced immediately and remained efficient throughout out the project. There were no further mitigations actions required at any stage.

The survey operations were fully compliant with the Department of Arts, Heritage and the Gaeltacht (DAHG)'s, '*Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters*' (2014).

Date and Location of Survey

The survey site was located in the North Celtic Sea Basin, approximately 43km off the south coast of Ireland (see Figure 1). Operations commenced on the 4th of September and continued until the 13th of September 2019. The approximate working depth of the survey area was 100 – 105m.

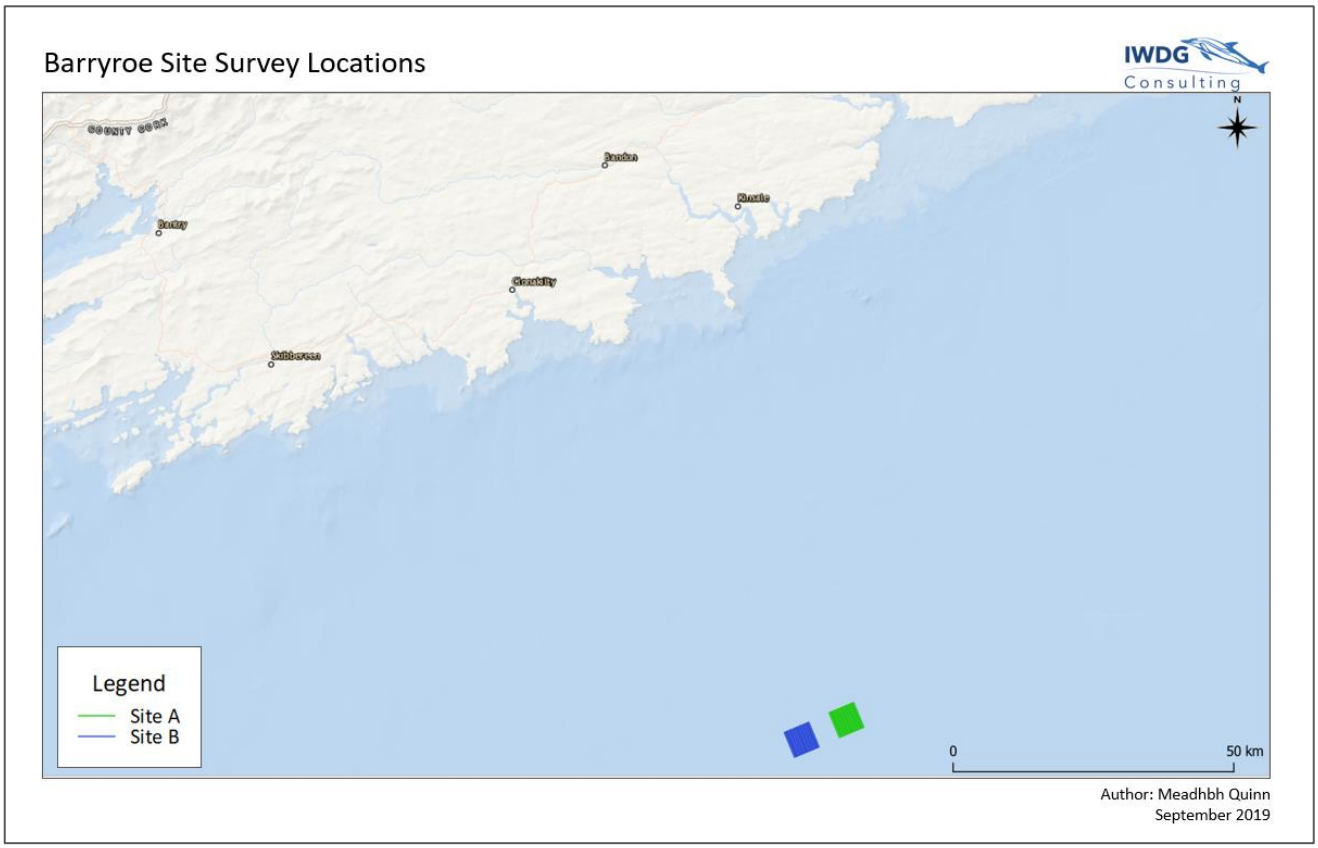

Figure 1: Site survey location

2. Methods:

Vessel Involved in the Survey

The RV Kommandor (Table 1, Figure 2) was the sole vessel involved in operations for this survey.

Table 1: Vessel details

Vessel	Kommandor
Call sign	MCJ02
Built	1986
Length	68.51m
Breadth	11.71m
Draft	5.2m
GRT	1573t
Accommodation	42

Figure 2: RV Kommandor

Specifications and Acoustic Characteristics of all Sound-Producing Equipment

The systems employed for this survey were as follows; sub-bottom profiler (SBP), side scan sonar (SSS), multibeam echo-sounder (MBES), single beam echo-sounder (SBES) and ultra-short baseline positioning system (USBL). The SBP and USBL were hull mounted whereas all other towed equipment was towed 200-300m astern of the vessels at varying depths. See Table 2 below.

Table 2: Acoustic equipment specifications

Equipment	Peak Frequency	Maximum Source level
Kongsberg EM710 Multibeam Echosounder (MBES)	65 – 100 kHz	224.9 dB re 1µPa @ 1m
Kongsberg EA400 Combi Singlebeam Echosounder (SBES)	38 – 200 kHz	224.9 dB re 1µPa @ 1m
Kongsberg HIPAP 500 Ultra Short Baseline (USBL)	23 – 29 kHz	206.3 dB re 1µPa @ 1m
Sub Bottom Profiler (Pinger)	3.5 kHz	223.5 dB re 1µPa @ 1m
Edgetech 4200 F-S Side Scan Sonar (SSS)	120 – 200 kHz	210.0 dB re 1µPa @ 1m

Soft Start Methodology

Several pieces of survey equipment could be soft started sequentially or interchanged during the survey, requiring one pre-watch prior to the start of initial acoustic output. A soft start procedure was not possible for the following survey equipment; MBES, USBL and SSS. However, due to the working water depth (100 – 105m) all were running on the lowest power setting and added sequentially after the initial soft start. Soft start methodologies for the SBP and SBES equipment are detailed below in Table 3 and Table 4 respectively.

Table 3: Soft start methodology for SBP

Step	Time (mins)	Full Power (%)	Power Increment Increase (dBm)
1	0	20	60
2	5	40	63
3	10	60	65
4	15	80	66
5	20	100	67

Table 4: Soft Start methodology for SBES

Step	Time (mins)	Full Power (%)	Power Increment Increase (W)
1	5	25	100
2	10	50	200
3	15	75	300
4	20	100	400

Latitudes, Longitudes for Survey Area

Survey effort for shallow geophysical acquisition and environmental baseline survey was concentrated within two 3.8km grids, coordinates of which can be found below in Table 5.

Table 5: Survey coordinates

Survey Coordinates	Latitude	Longitude
Site A	51.20174342	-8.377567185
	51.17676396	-8.361108593
	51.18713387	-8.321486631
	51.21206469	-8.337899526
Site B	51.1818794	-8.449314285
	51.15696394	-8.432851775
	51.16730419	-8.39323481
	51.19227922	-8.409707482

Observation Platform and Monitoring Methodology

Two dedicated, experienced, trained and JNCC certified MMOs were on-board the RV Kommandor throughout the duration of the project. The role of the MMOs was to visually conduct 30 minute pre-work watches prior to the commencement of any operations. The pre-work watches were carried out on the bridge deck at a height of 7.8m above sea level. The MMOs used several cues to locate and identify marine mammals including splashes, dorsal fins, blows, aggregations of seabirds, footprints on water surface (left behind after a cetacean has surfaced) and floating rafts of vegetation. The MMO's role also included to advise a delay in the commencement of the operations should any marine mammals be detected within the 500m mitigation zone around the sound source during the pre-work watch.

Observations were undertaken with the naked eye or using binoculars. Ranges to sightings were determined using a range finder stick (Heinemann, 1981) or reticular binoculars. Where possible in the event of sightings, photos were taken with a DSLR camera (Canon EOS 100D and Nikon D3500) with a 75-300mm lens to aid the identification of the species seen. The identification book *Whales, Dolphins, and Seals: A Field Guide to the Marine Mammals of the World* by Shirihai & Jarrett (2006) was also on hand to aid with identification if needed. Effort and sightings data were recorded on the standard DAHG's JIP22 recording forms.

3. Results

Survey Operations

The Kommandor departed Waterford on September 3rd and steamed approximately 43km to the survey area. Operations commenced on September 4th at 06:52 UTC with a soft start and continued until September 13th until 23:37 UTC.

Visual Monitoring Effort

Visual monitoring was conducted from the 05th to the 13th of September during suitable weather conditions. No monitoring effort was recorded during periods of bad weather (sea state 6 and above). MMO effort continued after the initial pre-watch, even though operations were continuous, in order to assess marine mammal distribution and behaviour towards the operations; and in the case of a break down or stop to operations.

77 hours and 24 minutes of visual monitoring effort was conducted over the course of the survey. The majority of visual monitoring was performed while the sound source was active and accounted for 76 hours and 10 minutes. Visual monitoring while the source was inactive accounted for 1 hour and 14 minutes (Table 6).

Table 6: Visual monitoring effort

Visual Monitoring Effort	Duration (hh:mm)	Overall Visual Monitoring Effort (%)
Total Monitoring while Acoustic Source Active	76:10	98
Total Monitoring while Acoustic Source Inactive	01:14	2
Total Monitoring Effort	77:24	100

Weather Conditions

Several environmental conditions were recorded while the MMO was on effort. Beaufort wind force, wind direction, Beaufort Sea state, swell height, visibility and sun glare were recorded during monitoring effort. The combination of these conditions have a differing effect on either the ability to spot marine mammals or may impair the MMO's ability to conclusively identify those animals which are sighted. Beaufort Sea state, swell and visibility are represented in figures 3-5 below.

Throughout the majority of the project, the Beaufort wind force and Beaufort sea state were 4, the swell height was low (< 2m), and the visibility was good (> 5km). Visual pre-work searches were conducted in WMO sea state 4 or less (~Beaufort Sea state 4 or less), which is considered more favourable for cetacean observation.

It should be noted that the weather conditions do not include any information for any periods where the MMO was not on watch e.g. periods of darkness or down-time due to bad weather.

Beaufort Sea State

Throughout the project the Beaufort Sea state was between force 2 and force 5 during observations. Beaufort Sea state force 4 dominated accounting for 34 hours and 19 minutes (44%) during observations, followed by force 3 which accounted for 20 hours and 59 minutes (27%) and force 5 accounted for 16 hours and 35 minutes (22%). See Figure 3.

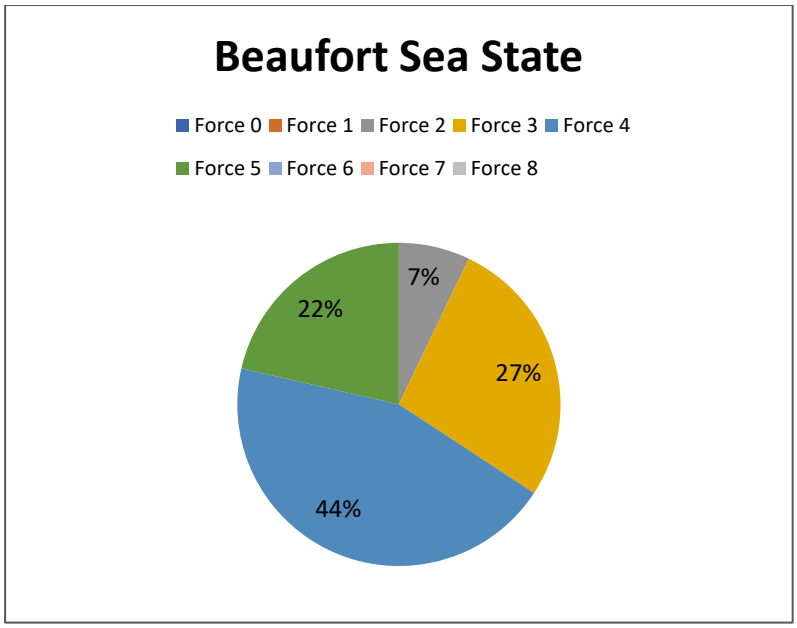

Figure 3: Beaufort Sea state recorded during marine mammal monitoring

Swell

Low swells (<2m) accounted for the majority of observation time totalling 60 hours and 01 minutes (78%). Medium swells (2-4 m) accounted for 17 hours and 23 minutes of observation time (22%). See Figure 4.

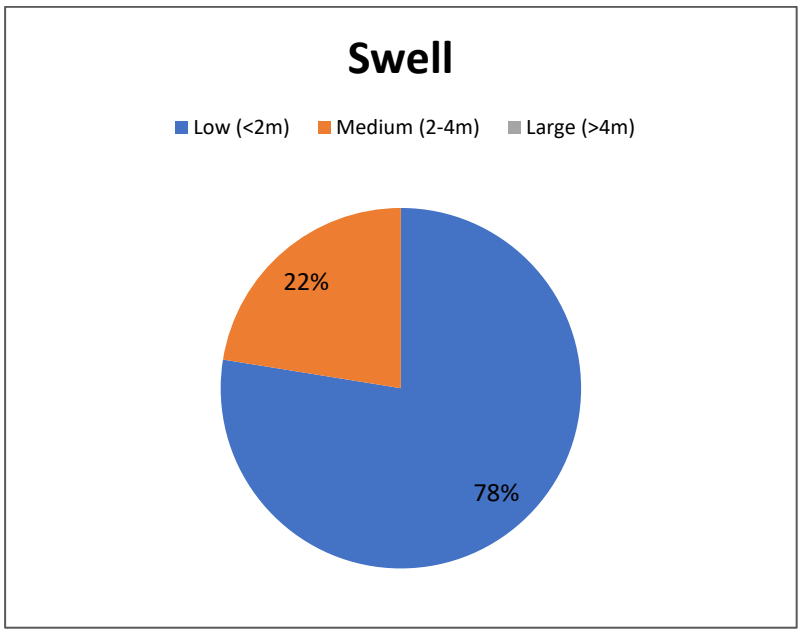

Figure 4: Swell height recorded during marine mammal monitoring

Visibility

During this project, the visibility was predominantly good (> 5 km). There was a total of 77 hours and 07 minutes of good visibility (99.5%), and 00 hours and 17 minutes of moderate (1-5 km) visibility (0.5%). See Figure 5.

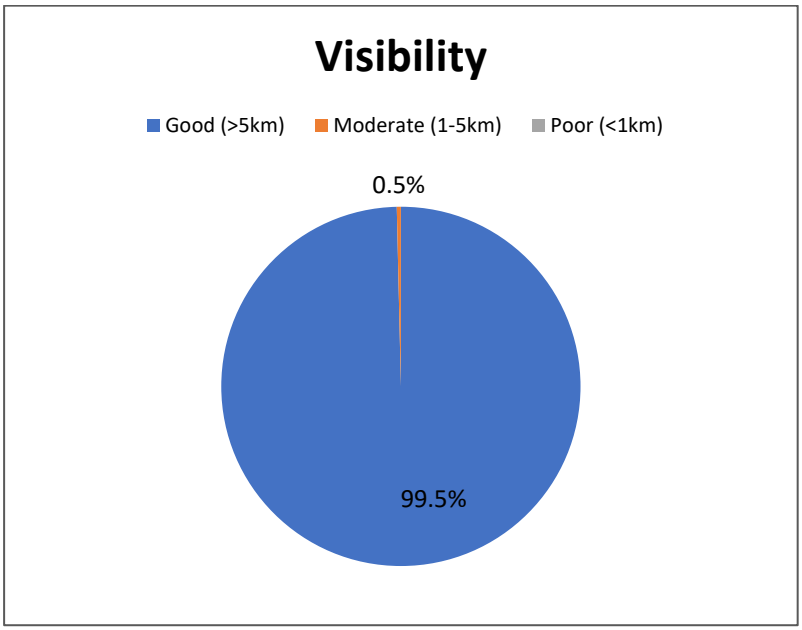

Figure 5: Visibility recorded during marine mammal monitoring

Marine Mammal Sightings

A total of 35 marine mammal sightings were recorded during MMO observations during this survey, accounting for a total of 184 individuals. Of these 35 sightings, 34 were sighted when equipment was at full power and 1 when equipment was not active. According to NPWS Guidelines (2014), if an animal enters the mitigation zone during operations a shut-down requirement is not necessary, as operations are said to be continuous once started.

Common dolphins (*Delphinus delphis*) were the most numerous and frequent species encountered, accounting for 84% of the total sightings.

Table 7: Sightings table

Species	Latin Name	No. of Sightings	No. Of Individuals	Range of Group Size
Common dolphin	*Delphinus delphis*	27	160	1 - 30
Dolphin sp		6	22	1 - 6
Unidentified large baleen whale		1	1	1
Unidentified large whale		1	1	1
	Total	32	184	

A list of species encountered can be seen above in Table 7 and sightings distribution is visually represented below in Figure 6.

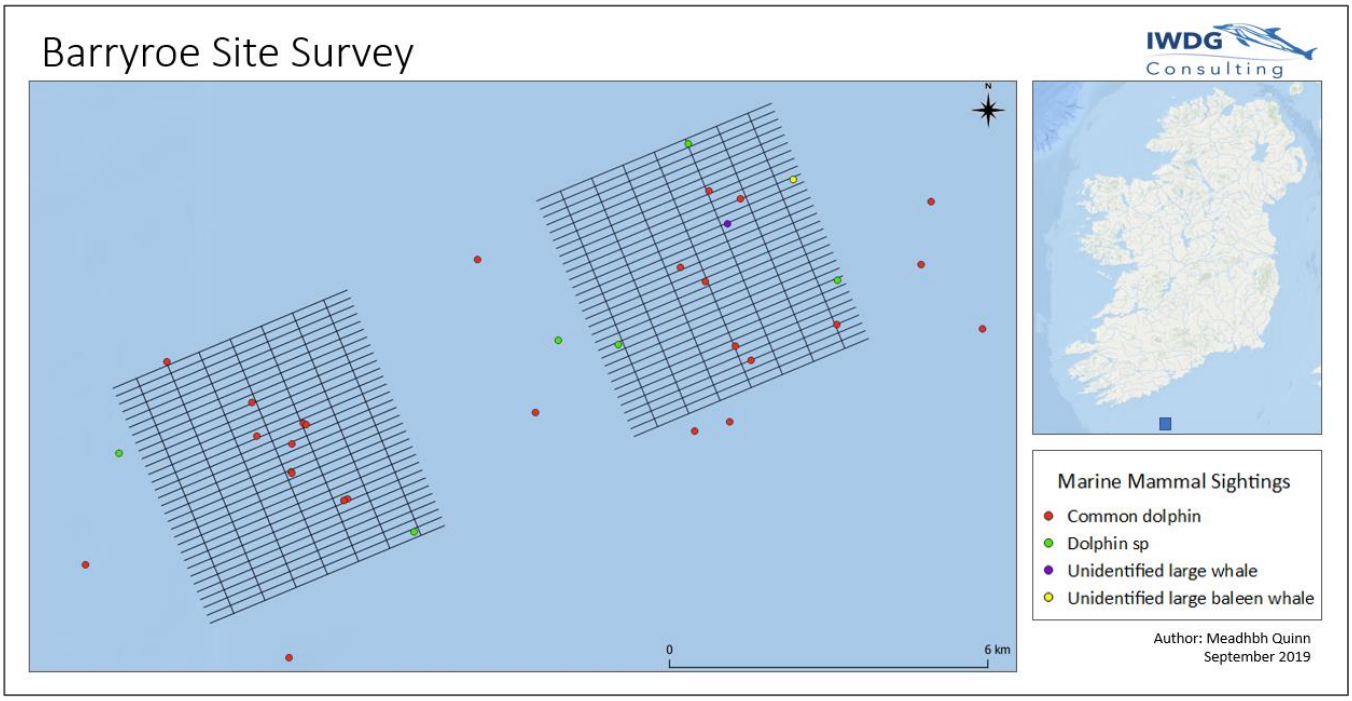

Figure 6: Marine mammal sightings distribution

Sighting numbers 6 and 15 can be seen in Figure 7 below.

Figure 7: Sighting No. 6 - Common dolphin (left); Sighting No. 15 - Unidentified large baleen whale (right) showing only blow

Marine Mammal Delays and Mitigation Measures

Survey operations were delayed on one occasion due to the presence of marine mammals within the MZ. On the 4th of September at 06:08 UTC, a group of common dolphins were detected by the MMO's within the MZ during a pre-watch. When 30 minutes had elapsed from the last sighting of the animals, permission was given to the survey crew for the soft start to commence.

4. Discussion:

Operational Efficacy of Mitigation Measures

While operations ran smoothly throughout this survey the MMOs have some recommendations for future projects.

Currently passive acoustic monitoring (PAM) is not recognised as an independent mitigation measure in the DAHG's guidelines. The addition of a PAM system on-board, whereby marine mammals could be detected acoustically, along with simultaneous visual observations, is recommended as it should increase the detection rate of marine mammals. Weather can affect the ability to detect marine animals visually in a number of ways, with increasing sea state, wind force and decreasing visibility reducing the detection probability of marine animals (Forney, 2000) particularly those with inconspicuous surfacing behaviour such as the harbour porpoise (Palka, 1996). PAM has the potential to detect vocalising marine mammals that may not been seen by an observer who is conducting a visual watch. It is therefore recommended that any future review of the DAHG's mitigation guidelines should examine the use of PAM as an additional independent mitigation tool during daylight hours.

It is also recommended that the use of the survey's sound source should be revised in the guidelines. During this survey there were several periods of down time due to weather. During these times the pinger remained constantly switched on to monitor data. Guidelines with further details and clarification on sound source use, particularly during periods of bad weather, could greatly reduce the amount of noise introduced to the marine environment for future surveys.

Finally, the MMOs recommend clarity in the guidelines on sea state conditions for effective visual monitoring. The guidelines currently state that a WMO sea state 4 (~ Beaufort Force 4) or less is required for effective monitoring. However, as a WMO sea state 4 and a Beaufort Force 4 differ from each other, this guideline could lead to potential issues on-board future surveys.

5. References

DAHG (Department of Arts, Heritage and the Gaeltacht) (2014). Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters.

Forney, K.A. 2000. Environmental models of cetacean abundance: reducing uncertainty in population trends. *Conservation Biology*, 14: 1271-1286.

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