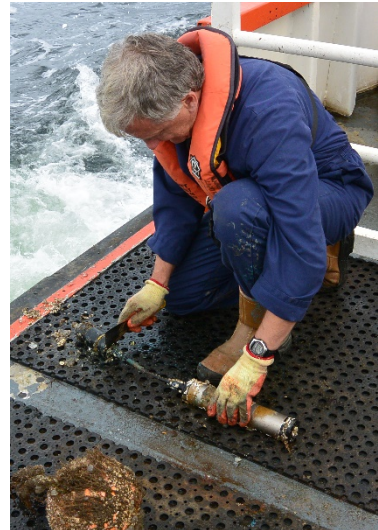# Construction Marine Mammal Monitoring Programme Fieldwork Report 2020

Graham, I.M., Cheney, B.J., Hewitt, R.C., Barton, T.R. and Thompson, P.M.

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Executive Summary

The aim of this report is to provide an overview of the fieldwork that has been conducted during 2020.

In March 2020 restrictions and guidelines were put in place by the UK and Scottish governments due to the COVID-19 pandemic. It was identified that the core fieldwork planned was essential to maintain the research monitoring required under the planning consent conditions for the Moray East Offshore Windfarm as a critical national infrastructure project. We risk assessed all fieldwork, adding to our protocols and procedures. Approval to carry out this work, where it was deemed safe, and under strict procedures and current guidelines, was given by both the University of Aberdeen and Moray East.

We completed a further year's individual-based monitoring of harbour seals at our Loch Fleet study site and conducted counts at other Moray Firth haulout sites. Individual based photo-identification studies of bottlenose dolphins were also conducted through most of the summer, and PAM studies were carried out to monitor dolphin occurrence in key inshore areas within the inner and southern Moray Firth. Most of the inshore long term and south coast CPODs were successfully recovered. Four inshore long term CPODs remain deployed over the winter.

PAM studies also continued within the Moray East construction site and in reference areas. Most offshore CPODs and all SoundTraps were successfully recovered. Twelve CPODs and two long term noise recorders (SoundTraps) remain deployed at the construction site and reference areas over the winter. Data from these recordings will underpin the monitoring of harbour porpoise occurrence during construction and will be used to investigate variation in noise levels during the different phases of construction.

Background

Moray Offshore Windfarm (East) Limited (referred to hereafter as Moray East) has been granted a number of Marine Licences and consents under Section 36 of the Electricity Act 1989 from the Scottish Ministers, permitting the installation and operation of the Wind Farm (WF) and the Offshore Transmission Infrastructure (OfTI). As a condition of these consents, Moray East is required to participate in a regional programme of marine mammal monitoring in the Moray Firth. Following earlier pre-construction studies, a Construction Marine Mammal Monitoring Programme (cMMMP) has been developed and agreed through the Marine Mammal subgroup of the Moray Firth Renewables Advisory Group (MFRAG-MM).

The University of Aberdeen and its sub-contractors have been contracted by Moray East to deliver the Construction Marine Mammal Monitoring Plan (cMMMP). The monitoring activities to be undertaken under the cMMMP are set out below, under four work packages. These build upon the programme of work that was detailed in Thompson (2016) and agreed by MFRAG. The initial phase of work was carried out during construction at the Beatrice Offshore Windfarm, which is adjacent to the Moray East site and completed construction prior to the commencement of construction at Moray East. Results from these studies have been used to update the proposed programme for Moray East. Background to each of the work packages and approaches to sampling and data analysis are as detailed in Thompson (2016, 2018).

This report provides an overview of fieldwork conducted during 2020.

Programme structure

This construction Marine Mammal Monitoring Programme consists of four work packages. The first covers the requirements for harbour seal monitoring, the second for bottlenose dolphin monitoring, the third for harbour porpoise monitoring, and the fourth for providing the underpinning noise measurements and modelling.

Work Package 1: Harbour Seal Monitoring

1.1 Individual based studies of reproduction and survival
- Land based photo-identification of individual seals to determine birth rates, pupping dates and sex specific survival.
- Studies to be undertaken at Loch Fleet National Nature Reserve (NNR).
- Sampling May to August 2019, 2020 and 2021.

1.2 Trends in Abundance
- Land based photo-identification studies to record summer abundance of harbour seals (during the pupping season and moult).
- Studies to be undertaken at harbour seal haul-out sites along the northern Moray Firth coast.
- Up to four counts to be undertaken at Loch Fleet and Sputie Burn in the pupping season (15th June – 15th July) and up to four counts at all five sites during the moult (1st – 31st August) during 2019, 2020 and 2021.
- Monthly counts to be made at Loch Fleet and Sputie Burn during winter months (September to May) during 2019, 2020 and 2021.

Work Package 2: Bottlenose Dolphin Monitoring

2.1 Individual based studies of reproduction and survival
- Boat based photo-identification studies to determine birth rates and to estimate sex-specific survival.
- Study area to focus on the Moray Firth SAC.
- Up to 20 surveys to be undertaken during May to September in 2019, 2020 and 2021.

2.2 Trends in Abundance
- Use of boat-based photo identification data (from WP2.1) to provide annual estimates of bottlenose dolphin abundance and population trends in the Moray Firth.

2.3 Baseline occurrence of dolphins in favoured areas and responses to piling
- Deployment of passive acoustic monitoring equipment (CPODs) at previously used locations in the Moray Firth.

- Four long-term locations (year-round) and four summer only locations.
- Deployments to take place during 2019, 2020 and 2021.
- Six additional summer only deployments to be made in 2019.

Work Package 3: Harbour Porpoise Monitoring

3.1 Broad-scale changes in the occurrence of harbour porpoises during different phases of wind farm construction

- Deployment of a broad-scale array of CPODs to monitor seasonal and annual variation in the occurrence of harbour porpoises during different phases of construction.
- Eight locations to be used, four on the Moray East site and four in a reference area.
- Deployments to be made at 4- to 6-month intervals to provide year-round coverage.

3.2 Fine-scale responses of harbour porpoises to construction vessels, ADD and piling

- Deployment of a medium-scale array of CPODs and fine-scale arrays of 4-channel sound recorders to study responses of porpoises to different noise sources during foundation installation.
- CPOD array to provide a gradient of distances from piling. Arrays of sound recorders to be focused around individual foundation locations. The final design to be based around the Moray East installation contractor scheduling and pilot studies with SoundTraps aimed at determining detection rates.
- Up to 25 CPODs to be deployed 2-4 weeks prior to the start of piling, for a period of up to 5 months.
- Up to eight 4-channel sound recorders to be deployed for periods of 1-3 weeks around selected turbine sites. Timing of deployments to be determined based on pilot studies and the timing of Phased Piling Mitigation.

Work Package 4: Noise Measurement and Modelling

4.1 Temporal variation in noise levels during different phases of wind farm construction

- Long-term deployment of calibrated noise recorders in parallel with CPOD deployments under WP 3.1. Repeat deployments to be made at two locations to cover a range of piling hammer energies and different phases of construction.
- Short-term deployments of calibrated noise recorders in parallel with deployments of CPODs and sound recorders under WP 3.2.
- Analysis of data with detailed construction records and available AIS data to characterise variation in construction noise in relation to different sound sources.

4.2 Spatial variation in received levels of piling noise and ADD noise

- Use the parabolic equation models developed by CEFAS, and optimised in earlier phases of the cMMMP, to provide predictions of received levels of different types of construction noise (piling, ADD and vessel) at key locations of interest.

- Use recordings made within WP 4.1 to validate model predictions.

- Assess the effect of conversion factor on the accuracy of predicted noise levels from piling, and derive empirical conversion factor, with associated levels of confidence, from the field measurements.

Harbour Seal Monitoring Work Packages

Objectives

This work package will be used to assess changes in the abundance of harbour seals and estimate variation in vital rates.

Fieldwork conducted in 2020

- As a response to the ongoing COVID-19 pandemic some surveys and counts were cancelled or reduced in frequency (Table 1).
- Annual breeding season photo-identification surveys were made at Loch Fleet on 15 days between 28th May and 14th July.
- Photo-identification pictures were also taken at Sputie Burn on four days alongside breeding season haul-out counts.
- Four haul-out counts were made in August during the moult at the five harbour seal haul-out sites closest to Moray East (Table 1; Figure 1).
- Monthly haul-out counts were made at Loch Fleet and Sputie Burn outside the breeding season and moult, COVID-19 guidelines permitting (Table 1). Additional photo-identification pictures were taken during these trips where conditions allowed.
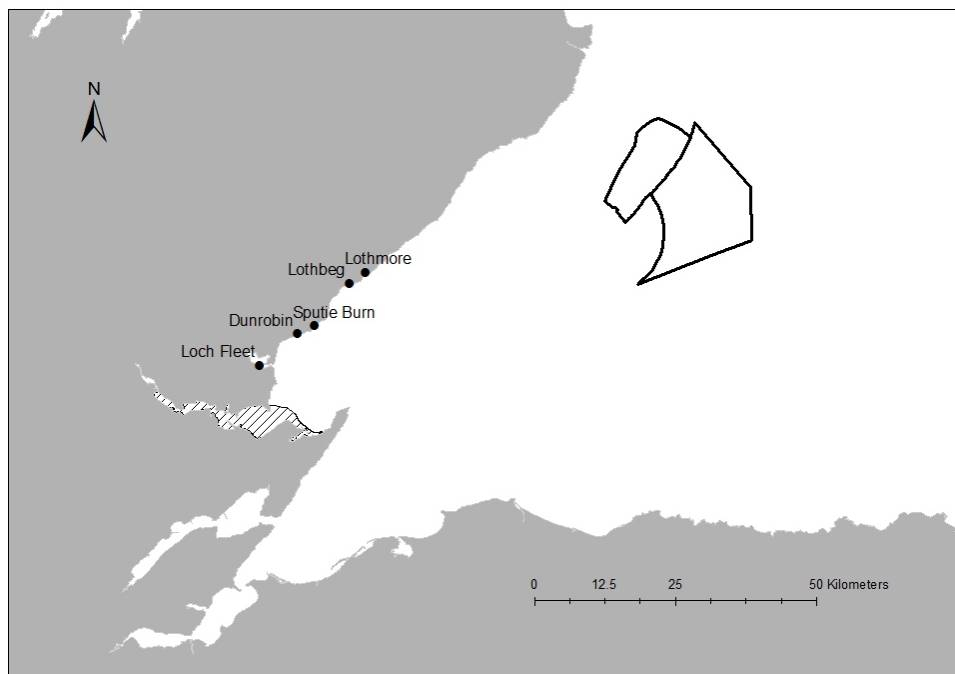
Figure 1. Map of the Moray Firth showing the position of the BOWL and Moray East windfarm sites and the five closest harbour seal haul-out sites. The Dornoch Firth and Morrich More SAC is hatched.

Table 1. Number of counts made at each of the five focal haul-out sites from January to December 2020.

	Lothmore	Lothbeg	Sputie Burn	Dunrobin	Loch Fleet
January	0	0	1	0	1
February	0	0	1	0	1
March	0	0	1	0	1
April	0	0	0	0	0
May	0	0	0	0	2
June	0	0	2	0	10
July	0	0	2	0	4
Aug	4	4	4	4	4
Sept	0	0	1	0	1
Oct	0	0	1	0	1
Nov	0	0	1	0	1
Dec	0	0	1	0	1

- Annex 4 has a summary of the harbour seal surveys carried out in 2019.

Bottlenose Dolphin Monitoring Work Package

Objectives

This work package will be used to collect data to provide annual estimates of bottlenose dolphin abundance and variability in vital rates. In addition, passive acoustic monitoring (PAM) devices will be deployed in coastal sites to collect data on variation in dolphin occurrence and responses to piling.

Fieldwork conducted in 2020

- No photo-identification surveys were conducted in May due to the ongoing COVID-19 pandemic.
- Photo-identification surveys were conducted on 20 days during June to September, and dolphins were successfully encountered and photographed on all surveys (Table 2; Figure 2).

Table 2. 2020 photo-identification survey details, by month, for the Moray Firth.

	Number of surveys	Survey duration (hours)	Number of encounters	Time on encounters (hours)	% of survey time with dolphins
May	0				
June	4	23.88	15	7.05	30%
July	7	37.03	33	16.05	43%
August	5	32.98	15	8.45	26%
September	4	26.12	11	7.72	30%
TOTAL	**20**	**120.02**	**74**	**39.27**	**33%**

- Annex 5 has a summary of the photo-identification surveys carried out in 2019.
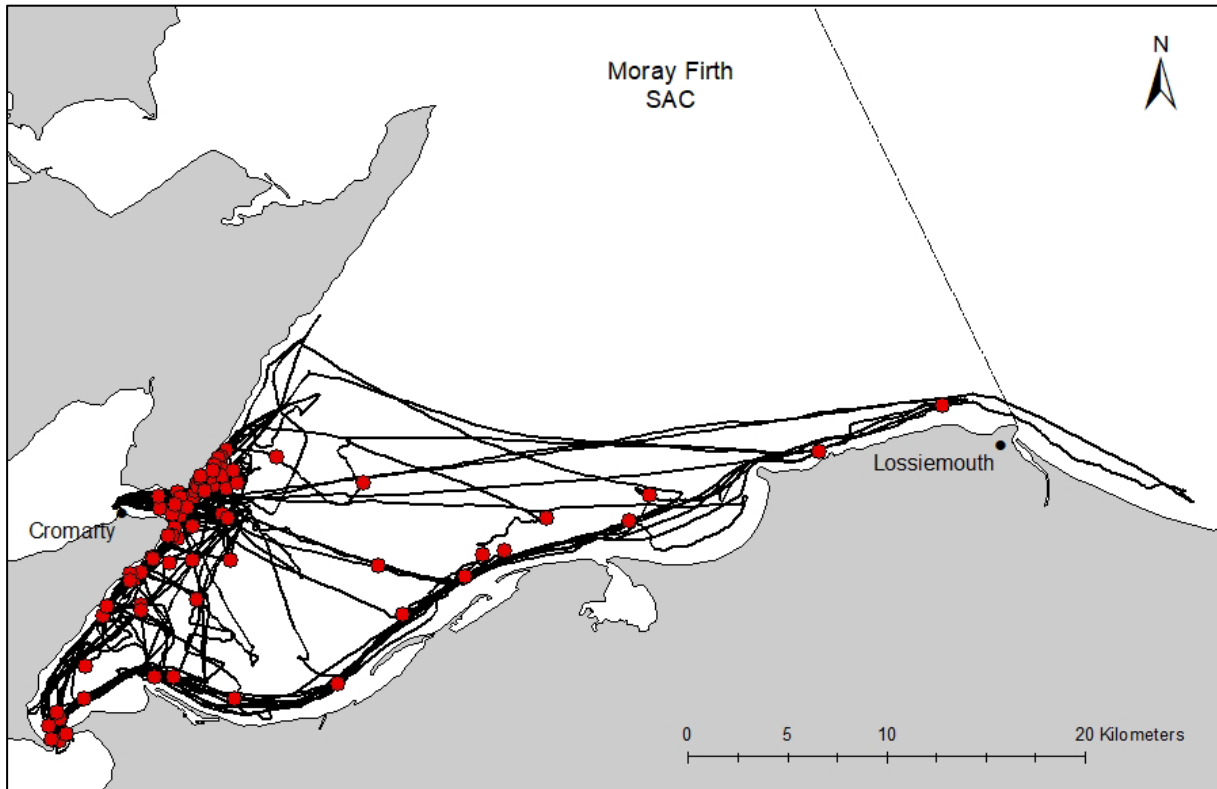
Figure 2. Map showing the areas covered by photo-identification surveys (black lines) and the location of all encounters with groups of bottlenose dolphins (red dots) in 2020.

- CPODs were maintained at the four long-term study sites (Sutors (#1); Chanonry (#2); Lossiemouth (#3); Spey Bay (#4); Figure 3) throughout the year, although one CPOD at Chanonry was not recovered (Annex 2).
- CPODs were deployed at the additional four south coast monitoring sites (Figure 3) in May, with three recovered in October and one (location #67) washed up onshore at Whitehills, on or before 20th July 2020. Data were recovered from three of these CPODs (Annex 2). The CPOD from location #67 is still to be collected and downloaded.
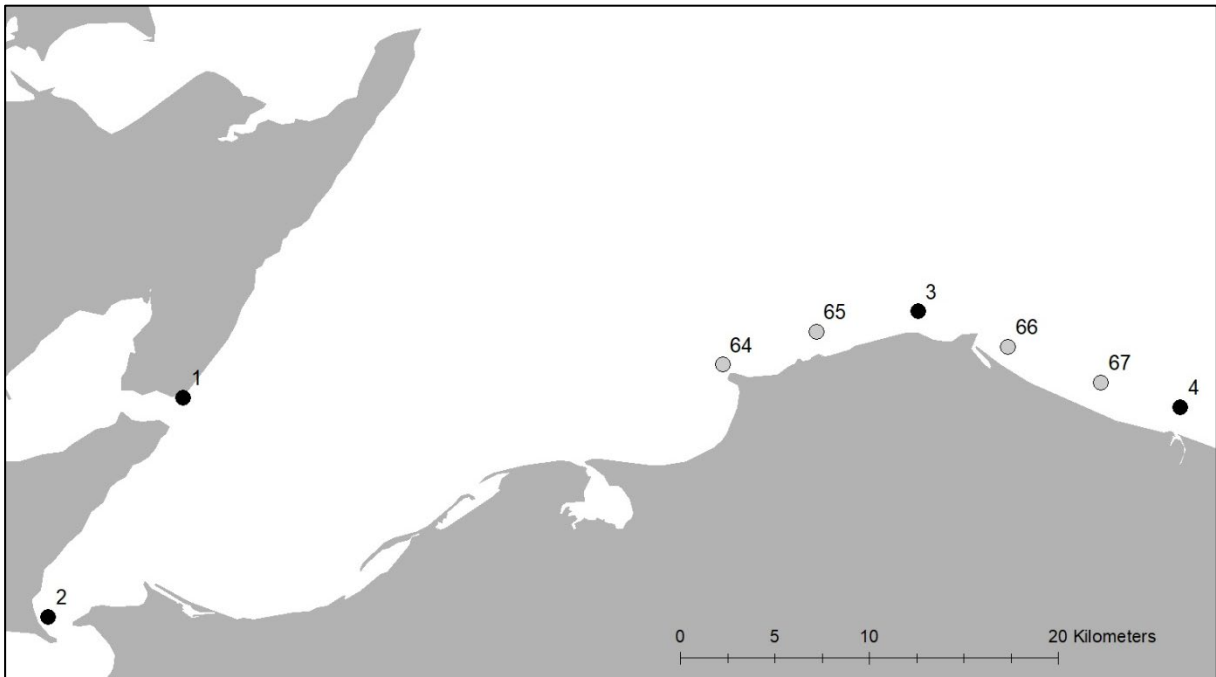
Figure 3. Location of coastal CPOD deployments in 2020 (see Annex 2) with the long-term coastal array (black) and south coast array (grey).
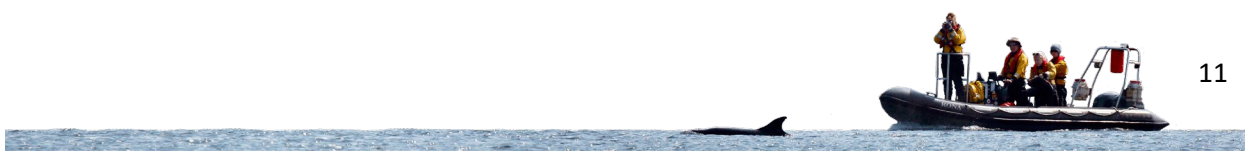
Harbour Porpoise Monitoring Work Package

Objectives

This work package will be used to assess variation in harbour porpoise occurrence during different phases of windfarm construction and fine-scale responses to construction vessels, ADD mitigation and piling.

Fieldwork conducted in 2020

- Annex 1 has a summary of the PAM devices deployed during piling at all 103 foundation locations in 2019 and 2020.
- All 12 CPODs deployed offshore at the end of 2019 were recovered in Spring 2020, and data were successfully downloaded (Annex 2).
- There were two deployments of CPODs in 2020 in a broad-scale array at the 12 long-term offshore locations (Figure 4; Annex 2).
- The first deployment of CPODs in April 2020 were recovered in October 2020 and January 2021 (due to weather constraints). Data were successfully downloaded from the 10 recovered CPODs, but 2 CPODs were not found and are missing (Annex 2).
- The second deployment of 12 CPODs in 2020/21 remain deployed and will be recovered and redeployed in Spring 2021 (Annex 2).
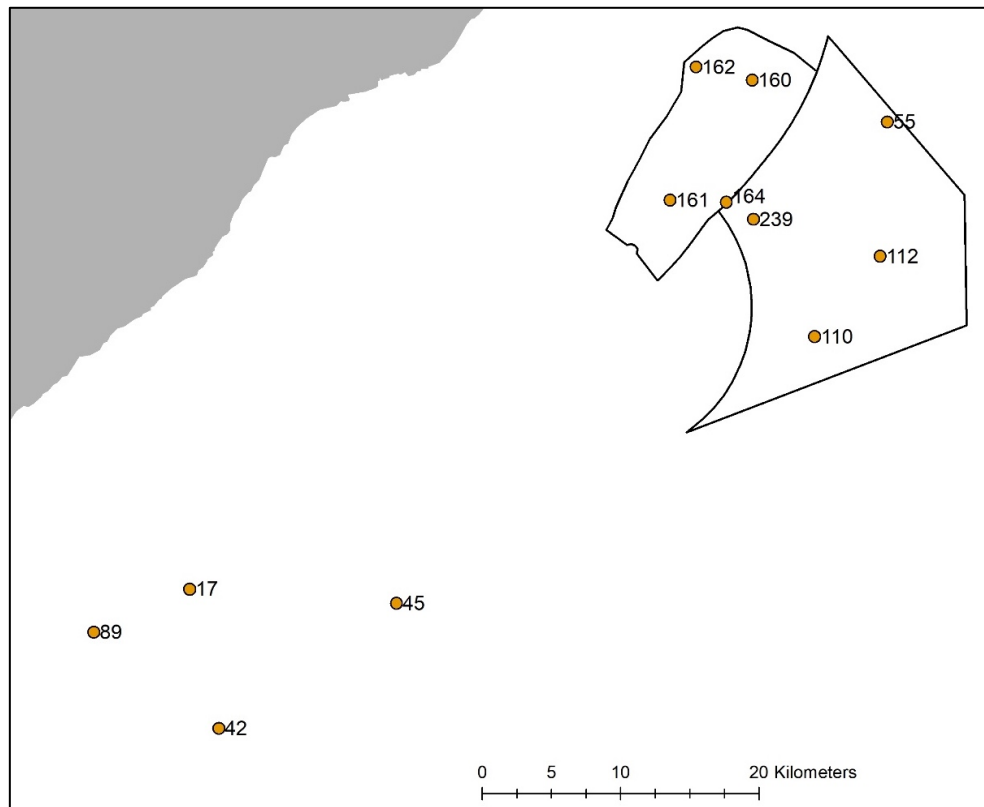
Figure 4. Location of long term offshore CPOD deployments in 2020 (see Annex 2).

Noise Measurement and Modelling Work Package

Objectives

This work package will be used to assess spatial and temporal variation in noise levels during different phases of windfarm construction, due to different types of construction activity, including piling, ADD mitigation and vessels.

Fieldwork conducted in 2020

- Annex 1 has a summary of the PAM devices deployed during piling at all 103 foundation locations in 2019 and 2020.
- Two SoundTraps deployed at the end of 2019 were recovered in Spring 2020, and data were successfully downloaded (Annex 3).
- There were two deployments of SoundTraps in 2020 at 2 long-term offshore locations (Figure 5; Annex 3).
- The first deployment of 2 SoundTraps was in April 2020. One SoundTrap was successfully recovered and redeployed in October 2020. Due to weather constraints the second SoundTrap was recovered and redeployed in January 2021. Data were successfully downloaded from both (Annex 3).
- The second deployment of 2 SoundTraps in 2020/21 remain deployed and will be recovered and redeployed in Spring 2021 (Annex 3).
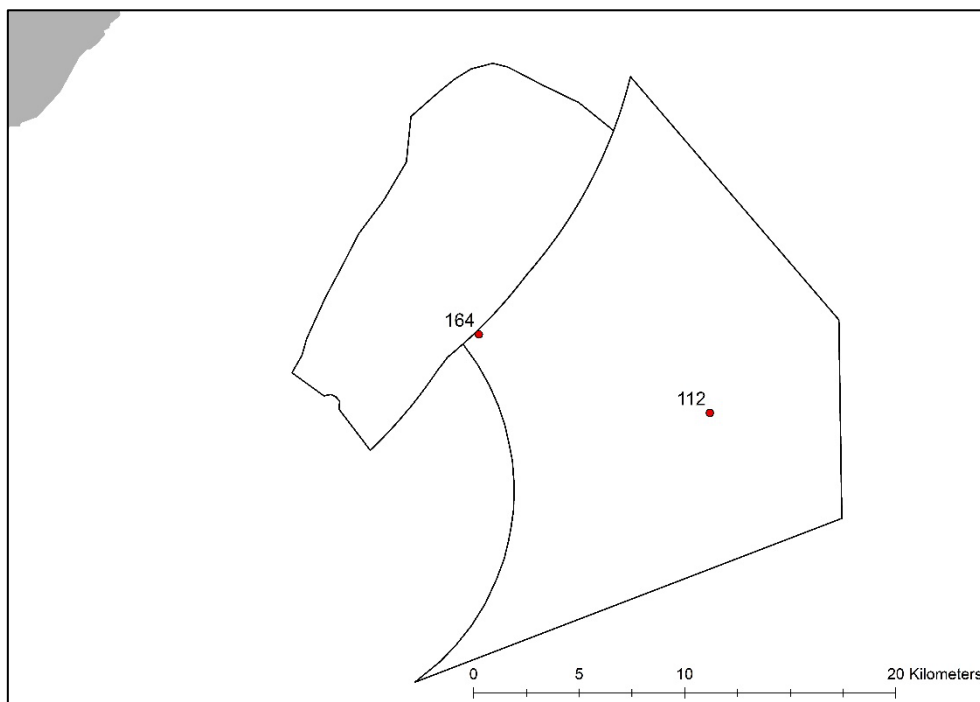

Figure 5. Location of the offshore SoundTrap deployments in 2020 (Annex 3).

ANNEX 1. Summary of PAM recordings during all piling events in 2019 and 2020.

Turbine	Start (GMT)	End (GMT)	Duration	CPOD	SOUNDTRAP	SM2M	LANDER
K17	20/05/2019 03:30:23	30/05/2019 00:28:11	236:57	✓	✓		
K16	31/05/2019 12:47:56	31/05/2019 21:51:56	9:04	✓	✓		
J17	02/06/2019 07:06:02	02/06/2019 16:10:44	9:04	✓	✓		
I19	04/06/2019 18:18:39	05/06/2019 02:26:32	8:07	✓	✓		
I20	06/06/2019 21:55:25	07/06/2019 05:12:10	7:16	✓	✓		
H19	08/06/2019 00:54:15	08/06/2019 10:20:57	9:26	✓	✓		
G19	09/06/2019 10:58:48	09/06/2019 18:23:01	7:24	✓	✓		
G18	15/06/2019 04:18:05	15/06/2019 20:43:21	16:25	✓			
G17	16/06/2019 19:15:52	17/06/2019 14:30:54	19:15	✓			
H17	18/06/2019 10:03:27	18/06/2019 20:21:27	10:18	✓			
J18	19/06/2019 21:34:24	20/06/2019 05:05:17	7:30	✓			
J16	20/06/2019 22:53:48	21/06/2019 12:55:41	14:01	✓			
H16	22/06/2019 14:52:35	23/06/2019 07:20:40	16:28	✓		✓	
G16	23/06/2019 22:19:48	24/06/2019 15:15:30	16:55	✓		✓	
G15	26/06/2019 21:11:41	27/06/2019 05:38:02	8:26	✓		✓	
H14	27/06/2019 23:47:28	28/06/2019 07:46:48	7:59	✓		✓	
J14	29/06/2019 19:11:07	30/06/2019 10:16:30	15:05	✓		✓	
J13	02/07/2019 00:16:13	02/07/2019 07:33:55	7:17	✓		✓	
H13	03/07/2019 20:04:11	04/07/2019 03:00:30	6:56	✓		✓	
G13	05/07/2019 02:33:00	05/07/2019 10:36:26	8:03	✓		✓	
E14	06/07/2019 22:05:01	07/07/2019 04:05:56	6:00	✓		✓	
C14	07/07/2019 20:47:35	08/07/2019 02:12:16	5:24	✓		✓	
B14	09/07/2019 03:04:01	09/07/2019 08:20:19	5:16	✓		✓	
C15	10/07/2019 00:27:00	10/07/2019 06:01:42	5:34	✓		✓	
D16	11/07/2019 07:04:15	11/07/2019 12:19:58	5:15	✓	✓	✓	✓

Turbine	Start (GMT)	End (GMT)	Duration	CPOD	SOUNDTRAP	SM2M	LANDER
C16	12/07/2019 02:15:06	12/07/2019 07:29:08	5:14	✓	✓	✓	✓
D17	13/07/2019 02:00:04	13/07/2019 06:45:53	4:45	✓	✓	✓	✓
E18	13/07/2019 23:06:54	14/07/2019 06:02:50	6:55	✓	✓	✓	
E19	15/07/2019 00:52:24	15/07/2019 07:42:20	6:49	✓	✓	✓	
F21	15/07/2019 20:14:40	16/07/2019 01:03:30	4:48	✓	✓	✓	
G22	16/07/2019 23:07:09	17/07/2019 03:53:51	4:46	✓	✓	✓	
H22	17/07/2019 23:52:07	18/07/2019 06:35:34	6:43	✓	✓	✓	
H21	21/07/2019 04:27:17	21/07/2019 09:50:10	5:22	✓	✓	✓	
G21	22/07/2019 16:04:56	22/07/2019 22:05:15	6:00	✓	✓	✓	
H20	24/07/2019 00:39:23	24/07/2019 05:36:46	4:57	✓		✓	
L12	25/07/2019 00:03:01	25/07/2019 04:49:14	4:46	✓		✓	
L11	26/07/2019 15:54:48	26/07/2019 20:41:19	4:46	✓		✓	
L09	27/07/2019 14:16:12	27/07/2019 19:01:55	4:45	✓		✓	
K10	28/07/2019 18:26:39	29/07/2019 00:04:36	5:37	✓		✓	
K11	29/07/2019 15:19:38	29/07/2019 19:51:27	4:31	✓		✓	
J10	30/07/2019 12:33:27	03/08/2019 21:18:36	104:45	✓		✓	
H09	05/08/2019 03:36:08	05/08/2019 14:45:53	11:09	✓		✓	
G09	06/08/2019 03:26:00	07/08/2019 11:05:39	31:39	✓		✓	
H18	08/08/2019 05:30:55	08/08/2019 10:56:24	5:25	✓		✓	
I18	17/08/2019 00:39:57	17/08/2019 05:49:51	5:09	✓		✓	
G10	17/08/2019 21:03:14	18/08/2019 02:39:07	5:35	✓		✓	
F15 (OSP2)	19/08/2019 02:52:12	19/08/2019 06:47:00	3:54	✓		✓	
A01	20/08/2019 03:19:12	20/08/2019 07:24:46	4:05	✓		✓	
I10 (OSP3)	21/08/2019 05:54:02	21/08/2019 12:23:35	6:29	✓		✓	✓
E06 (OSP1)	22/08/2019 05:27:17	23/08/2019 06:03:01	24:35	✓		✓	✓
J08	24/08/2019 02:45:22	24/08/2019 10:58:10	8:12	✓		✓	✓
J07	24/08/2019 22:38:23	25/08/2019 03:26:37	4:48	✓		✓	✓

Turbine	Start (GMT)	End (GMT)	Duration	CPOD	SOUNDTRAP	SM2M	LANDER
G07	28/08/2019 13:09:15	28/08/2019 18:10:00	5:00	✓		✓	✓
F08	29/08/2019 09:13:53	29/08/2019 19:13:52	9:59	✓		✓	✓
C05	30/08/2019 11:44:54	30/08/2019 16:04:11	4:19	✓		✓	✓
B04	01/09/2019 10:22:01	01/09/2019 14:20:43	3:58	✓		✓	✓
A02	13/10/2019 12:13:01	13/10/2019 16:44:07	4:31	✓			
B05	14/10/2019 08:26:23	14/10/2019 13:36:33	5:10	✓			
C07	16/10/2019 23:40:24	17/10/2019 04:49:46	5:09	✓			
C09	17/10/2019 15:02:57	17/10/2019 20:09:14	5:06	✓			
C04	21/10/2019 05:19:47	21/10/2019 13:37:09	8:17	✓			
I06	22/10/2019 18:44:39	23/10/2019 07:13:16	12:28	✓			
C10	28/10/2019 04:13:05	28/10/2019 09:10:54	4:57	✓			
C11	30/10/2019 03:09:02	30/10/2019 07:32:19	4:23	✓			
C12	31/10/2019 10:23:45	31/10/2019 14:32:39	4:08	✓			
B13	01/11/2019 03:42:42	01/11/2019 08:37:59	4:55	✓			
C02	07/11/2019 08:17:17	08/11/2019 09:24:40	25:07	✓	✓		
D15	13/11/2019 16:47:12	13/11/2019 20:51:34	4:04	✓	✓		
E04	17/11/2019 09:39:37	17/11/2019 14:22:56	4:43	✓	✓		
E05	18/11/2019 08:40:26	18/11/2019 19:05:41	10:25	✓	✓		
B03	19/11/2019 17:55:36	20/11/2019 00:52:39	6:57	✓	✓		
H05	29/11/2019 19:55:12	30/11/2019 00:29:46	4:34	✓	✓		
G05	30/11/2019 21:45:20	01/12/2019 16:38:45	18:53	✓	✓		
B02	02/12/2019 11:31:37	02/12/2019 16:50:14	5:18	✓	✓		
D10	03/12/2019 18:27:17	03/12/2019 22:56:59	4:29	✓	✓		
D13	05/12/2019 21:22:50	06/12/2019 02:37:30	5:14	✓	✓		
D09	07/12/2019 02:13:32	07/12/2019 06:06:42	3:53	✓	✓		
D08	07/12/2019 16:59:35	07/12/2019 21:38:04	4:38	✓	✓		
D06	14/12/2019 21:49:04	15/12/2019 01:45:25	3:56	✓	✓		
D05	16/12/2019 18:26:58	16/12/2019 22:36:59	4:10	✓	✓		

Turbine	Start (GMT)	End (GMT)	Duration	CPOD	SOUNDTRAP	SM2M	LANDER
H08	17/12/2019 21:41:11	18/12/2019 11:38:59	13:57	✓	✓		
H11	22/12/2019 05:22:13	22/12/2019 20:35:15	15:13	✓	✓		
G08	23/12/2019 15:34:22	23/12/2019 20:35:57	5:01	✓	✓		
H07	24/12/2019 07:30:20	24/12/2019 11:59:34	4:29	✓	✓		
H06	25/12/2019 03:33:28	25/12/2019 08:31:46	4:58	✓	✓		
I07	25/12/2019 19:08:38	26/12/2019 00:24:15	5:15	✓	✓		
K09	28/12/2019 19:43:31	29/12/2019 15:54:36	20:11	✓	✓		
L13	30/12/2019 05:05:56	30/12/2019 09:51:01	4:45	✓	✓		
H10	31/12/2019 07:40:37	31/12/2019 12:53:12	5:12	✓	✓		
G11	31/12/2019 23:57:05	05/01/2020 00:02:31	96:05	✓	✓		
G06	10/01/2020 09:13:26	11/01/2020 21:41:31	36:28	✓	✓		
C13	19/01/2020 00:30:35	21/01/2020 01:55:28	49:24	✓	✓		
D07	21/01/2020 19:54:30	22/01/2020 00:47:50	4:53	✓	✓		
C08	22/01/2020 17:29:27	22/01/2020 21:49:56	4:20	✓	✓		
D11	23/01/2020 23:59:13	24/01/2020 17:47:12	17:47	✓	✓		
D04	25/01/2020 18:50:19	26/01/2020 09:52:23	15:02	✓	✓		
F04	28/01/2020 06:32:59	28/01/2020 15:40:49	9.107	✓	✓		
D12	30/01/2020 01:00:49	31/01/2020 12:59:50	35:59	✓	✓		
D14	01/02/2020 18:54:43	02/02/2020 03:43:20	8:48	✓	✓		
J09	04/02/2020 19:27:26	05/02/2020 10:46:13	15:18	✓	✓		
J12	05/02/2020 23:21:52	06/02/2020 08:57:36	9:35	✓	✓		
G20	13/02/2020 00:42:50	13/02/2020 09:04:54	8:22	✓	✓		
J19	26/02/2020 08:55:18	27/02/2020 01:46:03	16:50	✓	✓		

ANNEX 2. Details of CPOD deployments during 2019 and 2020.

Deployment number	CPOD number	Data Start Date	Location	Latitude	Longitude	Data End Date	Array
977	561	17/03/2019	89	57.9343	-3.63715	26/08/2019	Offshore long-term
978	568	17/03/2019	17	57.96282	-3.52055	26/08/2019	Offshore long-term
979	587	17/03/2019	161	58.21665	-2.93322	26/08/2019	Offshore long-term
980	606	17/03/2019	45	57.95445	-3.26802	26/08/2019	Offshore long-term
981	616	17/03/2019	164	58.21518	-2.86408	26/08/2019	Offshore long-term
982	903	17/03/2019	162	58.30301	-2.90103	26/08/2019	Offshore long-term
983	1620	17/03/2019	42	57.87245	-3.48395	26/08/2019	Offshore long-term
984	2946	17/03/2019	160	58.29458	-2.83188	26/08/2019	Offshore long-term
985	634	01/04/2019	239	58.20405	-2.83078	20/08/2019	Offshore long-term
986	600	01/04/2019	110	58.12777	-2.75607	20/08/2019	Offshore long-term
987	626	01/04/2019	112	58.17983	-2.67538	20/08/2019	Offshore long-term
988	1619	01/04/2019	55	58.26697	-2.66593	20/08/2019	Offshore long-term
1011	2944	20/04/2019	227	57.73398	-3.4199	17/10/2019	South Coast
1012	2947	20/04/2019	64	57.70883	-3.50302	17/10/2019	South Coast
1014	609	20/04/2019	226	57.75203	-3.33508	Missing	South Coast
1015	2949	20/04/2019	65	57.72473	-3.41962	06/08/2019	South Coast
1016	2951	20/04/2019	3	57.7347	-3.32973	09/10/2019	Coastal long-term
1017	598	20/04/2019	4	57.68998	-3.09358	05/10/2019	Coastal long-term
1018	593	20/04/2019	67	57.70117	-3.1671	30/09/2019	South Coast
1019	1623	20/04/2019	225	57.72607	-3.24105	17/10/2019	South Coast
1020	2950	20/04/2019	228	57.727	-3.50293	Missing	South Coast
1021	563	20/04/2019	66	57.71795	-3.24963	No Data	South Coast
1025	564	20/04/2019	224	57.71705	-3.15307	01/10/2019	South Coast
1026	586	20/04/2019	223	57.69905	-3.08807	29/09/2019	South Coast
989	592	21/04/2019	150	58.27762	-2.85135	02/10/2019	Medium-scale array

Deployment number	CPOD number	Data Start Date	Location	Latitude	Longitude	Data End Date	Array
990	584	21/04/2019	218	58.24593	-2.77107	14/10/2019	Medium-scale array
991	590	21/04/2019	159	58.15595	-2.875	28/09/2019	Medium-scale array
992	614	21/04/2019	233	58.24602	-2.72693	14/10/2019	Medium-scale array
993	603	21/04/2019	48	58.06703	-3.12495	08/10/2019	Medium-scale array
994	554	21/04/2019	52	58.18493	-2.855	17/09/2019	Medium-scale array
995	559	21/04/2019	240	58.10898	-2.8278	02/10/2019	Medium-scale array
996	558	21/04/2019	238	58.23195	-2.80088	13/09/2019	Medium-scale array
997	583	21/04/2019	146	58.25382	-2.88873	04/10/2019	Medium-scale array
998	615	21/04/2019	222	58.26395	-2.737	18/09/2019	Medium-scale array
999	602	21/04/2019	47	58.011	-3.14915	30/09/2019	Medium-scale array
1000	618	21/04/2019	163	58.29935	-2.7498	04/10/2019	Medium-scale array
1001	622	21/04/2019	242	58.18098	-2.591	03/10/2019	Medium-scale array
1002	625	21/04/2019	111	58.15023	-2.62005	21/09/2019	Medium-scale array
1003	628	21/04/2019	219	58.20398	-2.66702	02/10/2019	Medium-scale array
1004	633	21/04/2019	184	58.25735	-2.79412	14/10/2019	Medium-scale array
1005	1025	21/04/2019	234	58.23402	-2.767	02/10/2019	Medium-scale array
1006	1023	21/04/2019	243	58.148	-2.72007	01/10/2019	Medium-scale array
1007	635	21/04/2019	217	58.22998	-2.6551	26/08/2019	Medium-scale array
1008	1028	21/04/2019	221	58.25697	-2.69702	20/08/2019	Medium-scale array
1009	1094	21/04/2019	54	58.22527	-2.69953	18/08/2019	Medium-scale array
1010	711	21/04/2019	216	58.23105	-2.60412	19/10/2019	Medium-scale array
1023	565	21/04/2019	241	58.15197	-2.67202	12/09/2019	Medium-scale array
1024	1621	21/04/2019	220	58.20197	-2.69603	17/10/2019	Medium-scale array
1013	1618	23/04/2019	1	57.69018	-3.98217	21/10/2019	Coastal long-term
1022	629	23/04/2019	2	57.5853	-4.09792	19/09/2019	Coastal long-term
1058	2948	22/08/2019	112	58.17992	-2.6755	07/03/2020	Offshore long-term

Deployment number	CPOD number	Data Start Date	Location	Latitude	Longitude	Data End Date	Array
1059	2952	22/08/2019	239	58.20405	-2.8308	08/03/2020	Offshore long-term
1060	2945	22/08/2019	110	58.12765	-2.75608	13/03/2020	Offshore long-term
1061	2943	22/08/2019	55	58.2668	-2.66585	12/03/2020	Offshore long-term
1070	600	28/08/2019	42	57.87247	-3.48392	29/02/2020	Offshore long-term
1071	634	28/08/2019	17	57.96282	-3.52062	26/02/2020	Offshore long-term
1072	588	28/08/2019	89	57.9343	-3.63703	25/02/2020	Offshore long-term
1073	610	28/08/2019	161	58.21673	-2.9332	08/03/2020	Offshore long-term
1074	1022	28/08/2019	162	58.30313	-2.90107	27/08/2019	Offshore long-term
1075	605	28/08/2019	45	57.95445	-3.26802	05/03/2020	Offshore long-term
1076	1619	28/08/2019	160	58.29453	-2.83188	09/03/2020	Offshore long-term
1077	626	28/08/2019	164	58.21517	-2.86403	21/02/2020	Offshore long-term
1091	561	19/10/2019	4	57.6896	-3.09312	20/03/2020	Coastal long-term
1088	606	09/11/2019	2	57.5853	-4.09792	Missing	Coastal long-term
1089	1620	18/11/2019	3	57.73455	-3.32997	18/03/2020	Coastal long-term
1090	2946	20/11/2019	1	57.69018	-3.98217	19/03/2020	Coastal long-term
1095	629	20/03/2020	3	57.7346	-3.33003	22/08/2020	Coastal long-term
1096	711	20/03/2020	4	57.6896	-3.09312	20/08/2020	Coastal long-term
1097	1618	20/03/2020	1	57.6903	-3.9822	23/09/2020	Coastal long-term
1100	2951	20/03/2020	2	57.5853	-4.09785	23/09/2020	Coastal long-term
1101	554	29/04/2020	164	58.2152	-2.86405	15/09/2020	Offshore long-term
1102	559	29/04/2020	112	58.1799	-2.6755	09/08/2020	Offshore long-term
1103	561	29/04/2020	110	58.1277	-2.75607	22/09/2020	Offshore long-term
1108	614	29/04/2020	55	58.2668	-2.66585	18/10/2020	Offshore long-term
1109	615	29/04/2020	239	58.2041	-2.83083	Missing	Offshore long-term
1110	616	29/04/2020	161	58.2167	-2.93312	27/10/2020	Offshore long-term
1112	628	29/04/2020	45	57.9545	-3.26808	08/10/2020	Offshore long-term

Deployment number	CPOD number	Data Start Date	Location	Latitude	Longitude	Data End Date	Array
1113	633	29/04/2020	17	57.9628	-3.52062	06/10/2020	Offshore long-term
1114	635	29/04/2020	89	57.9343	-3.6371	28/08/2020	Offshore long-term
1116	2946	29/04/2020	42	57.8725	-3.4837	13/10/2020	Offshore long-term
1111	618	30/04/2020	160	58.2946	-2.83187	25/09/2020	Offshore long-term
1115	903	30/04/2020	162	58.3032	-2.9011	Missing?	Offshore long-term
1104	565	04/05/2020	64	57.7088	-3.50283	20/08/2020	South Coast
1105	583	04/05/2020	65	57.7247	-3.41993	02/10/2020	South Coast
1106	593	04/05/2020	66	57.718	-3.24965	02/10/2020	South Coast
1107	603	04/05/2020	67	57.7012	-3.1672	Found ashore	South Coast
1132	2945	24/09/2020	2	57.5853	-4.09785		Coastal long-term
1133	2948	24/09/2020	1	57.6903	-3.9822		Coastal long-term
1134	600	03/10/2020	3	57.7346	-3.33003		Coastal long-term
1135	605	03/10/2020	4	57.69	-3.09358		Coastal long-term
1138	1618	14/10/2020	42	57.8725	-3.29032		Offshore long-term
1143	558	14/10/2020	89	57.9343	-3.63708		Offshore long-term
1144	584	14/10/2020	17	57.9628	-3.52065		Offshore long-term
1145	588	14/10/2020	45	57.9545	-3.26807		Offshore long-term
1137	1028	27/10/2020	112	58.1799	-2.67552		Offshore long-term
1139	1619	27/10/2020	162	58.30301	-2.90103		Offshore long-term
1141	2947	27/10/2020	55	58.2668	-2.66585		Offshore long-term
1142	2951	27/10/2020	110	58.1277	-2.75607		Offshore long-term
1146	602	27/10/2020	160	58.2946	-2.83188		Offshore long-term
1136	634	06/01/2021	164	58.2152	-2.86427		Offshore long-term
1140	2944	06/01/2021	161	58.2167	-2.93312		Offshore long-term
1147	610	06/01/2021	239	58.2041	-2.83075		Offshore long-term

ANNEX 3. SoundTrap and SM2M deployments in 2019 and 2020.

The SoundTraps recorded continuously, except for deployments 1092, 1093, 1101, 1102, 1136 and 1137, which along with the SM2Ms recorded for 10 minutes in every hour. Deployments 1033-1038 were over the side recordings on a vertical array, with a 4-channel SoundTrap in the middle with its four hydrophones at different depths, one single channel SoundTrap at the surface and another at depth.

Deployment Number	Device	Device Number	Sample Rate (kHz)	Pre-amp Gain	Data Start Date	Data Start Time (GMT)	Location	Latitude	Longitude	Data End Date	Data End Time (GMT)
1027*	SoundTrap	1677725722	48	LOW	30/03/2019	00:00	235	57.82415	-2.64898	16/04/2019	14:46
1028*	SoundTrap	1678254119	48	LOW	30/03/2019	00:00	236	57.89905	-2.66397	16/04/2019	01:21
1029*	SoundTrap	134541352	48	LOW	30/03/2019	00:00	237	57.94420	-2.66593	10/04/2019	03:06
986	SoundTrap	1678036995	48	HIGH	31/03/2019	23:00	110	58.12777	-2.75607	23/04/2019	08:34
987	SoundTrap	134742051	48	HIGH	31/03/2019	23:00	112	58.17983	-2.67538	11/06/2019	01:07
1031	SoundTrap	135012390	48	HIGH	31/03/2019	23:00	184	58.25707	-2.79382	13/06/2019	02:28
1032	SoundTrap	1678508072	48	HIGH	31/03/2019	23:00	164	58.21358	-2.86132	23/05/2019	13:35
1033, * 1034, 1035	SoundTrap	671133737, 1208000543, 671137832,	144	-	02/04/2019	05:34	Over the side	57.83318 to 57.83572	-2.63420 to -2.63587	02/04/2019	07:09
1036, * 1037, 1038	SoundTrap	671133737, 1208000543, 671137832	144	-	02/04/2019	12:46	Over the side	57.83572 to 57.82505	-2.63587 to -2.62290	02/04/2019	13:59
1040	SM2M	597	96	-	22/06/2019	14:27	164	58.21388	-2.86143	No data	
1041	SM2M	607	96	-	22/06/2019	10:35	112	58.1798	-2.67557	11/11/2019	11:40
1055	SoundTrap	1678036995	48	HIGH	10/07/2019	09:41	247	58.23463	-2.76537	23/07/2019	14:15
1056	SoundTrap	1678254119	48	HIGH	10/07/2019	09:43	248	58.23487	-2.76492	23/07/2019	14:37
1057	SoundTrap	1677725722	48	HIGH	10/07/2019	09:57	249	58.23522	-2.76410	23/07/2019	13:55
1092	SoundTrap	1678036995	96	HIGH	06/11/2019	14:50	112	58.17985	-2.67552	29/04/2020	09:27
1093	SoundTrap	1677725722	96	HIGH	06/11/2019	16:08	164	58.21513	-2.86403	26/04/2020	12:06

Deployment Number	Device	Device Number	Sample Rate (kHz)	Pre-amp Gain	Data Start Date	Data Start Time (GMT)	Location	Latitude	Longitude	Data End Date	Data End Time (GMT)
1101	SoundTrap	134541352	96	HIGH	01/05/2020	00:00	164	58.21517	-2.86405	27/07/2020	11:11
1102	SoundTrap	1678254119	96	HIGH	01/05/2020	00:00	112	58.17993	-2.67550	16/10/2020	09:06
1136	SoundTrap	1677725722	96	HIGH	06/01/2021	00:00	164	58.21517	-2.86427		
1137	SoundTrap	1678508072	96	HIGH	15/10/2020	00:00	112	58.17988	-2.67552		

* SoundTraps deployed to record the UXO explosions (see the 2019 Construction MMMP Fieldwork report for details).

NOTE: See Annexes 6 and 7 for the Lander SoundTrap deployments in 2019.

ANNEX 4. 2019 Harbour Seal Photo-Identification Surveys and Counts

Number of harbour seal counts made at each of the five focal haul-out sites from March to December 2019 (see the 2019 Construction MMMP Fieldwork report for details).

	Lothmore	Lothbeg	Sputie Burn	Dunrobin	Loch Fleet
March	0	0	1	0	1
April	0	0	1	0	1
May	0	0	1	0	5*
June	0	0	2	0	25
July	0	0	2	0	8
Aug	4	4	4	4	4
Sept	0	0	1	0	1
Oct	0	0	1	0	1
Nov	0	0	1	0	1
Dec	0	0	1	0	1

* included 1 trip made to Loch Fleet for non-cMMMP fieldwork activities

ANNEX 5. 2019 Bottlenose Dolphin Photo-Identification Surveys

2019 photo-identification survey details, by month, for the Moray Firth (see the 2019 Construction MMMP Fieldwork report for details).

	Number of surveys	Survey duration (hours)	Number of encounters	Time on encounters (hours)	% of survey time with dolphins
May	4	25.18	15	4.67	19%
June	3	18.38	20	7.10	39%
July	4	28.95	25	11.27	39%
August	4	26.30	8	4.88	19%
September	4	24.93	15	10.40	42%
TOTAL	**19**	**123.75**	**83**	**38.32**	**31%**

ANNEX 6. First Lander array.

Landers included 4 channel SoundTraps recording continuously and set at 384 kHz with no adjustment to pre-amp gain (see the 2019 Construction MMMP Fieldwork report for details).

Deployment Number	Device	Device Numbers	Location	Data Start Date	Data Start Time (GMT)	Latitude	Longitude	Data End Date	Data End Time (GMT)
1047	Lander	1342222348	252	10/07/2019	11:12	58.31618	-2.73317	13/07/2019	08:08
1048	Lander	1409839155	250	10/07/2019	10:54	58.31712	-2.73458	13/07/2019	07:57
1049	Lander	67129360*	256	10/07/2019	11:43	58.31608	-2.73478	13/07/2019	14:06
1050	Lander	67170319	257	10/07/2019	12:51	58.31565	-2.73387	13/07/2019	08:45
1051	Lander	1342222349	253	10/07/2019	11:19	58.31608	-2.73390	13/07/2019	08:12
1052	Lander	67379215	254	10/07/2019	11:25	58.31655	-2.73472	13/07/2019	08:25
1053	Lander	1342455819	251	10/07/2019	11:14	58.31660	-2.73393	13/07/2019	08:04
1054	Lander	67153936	255	10/07/2019	11:32	58.31660	-2.73560	13/07/2019	08:10
1042 1043 1044	3 CPODs	2943 2948 2945	258	10/07/2019	10:33	58.31637	-2.73433	23/07/2019	12:15
1045 1046	2 CPODS 2 SoundTraps	046 & 048 134541352 1678508072	259	10/07/2019	10:27	58.31792	-2.73693	11/07/2019	14:31

*Note only 3 channels were working on this SoundTrap

ANNEX 7. Second Lander array.

Landers included 4 channel SoundTraps recording for 30 secs every 2 mins and were set at a sample rate of 384 kHz with no adjustment to the pre-amp gain (see the 2019 Construction MMMP Fieldwork report for details).

Deployment Number	SoundTrap Number	Data Start Date	Data Start Time (GMT)	Location	Latitude	Longitude	Data End Date	Data End Time (GMT)
1062	1409839155	21/08/2019	08:22	260	58.1204	-2.7144	01/09/2019	02:16
1064	1342222348	21/08/2019	08:44	261	58.1291	-2.7186	31/08/2019	23:02
1065	1342222349	21/08/2019	08:59	262	58.1379	-2.7209	31/08/2019	20:04
1066	67379215	21/08/2019	09:10	263	58.1467	-2.7245	27/08/2019	06:18
1067	67153936	21/08/2019	09:21	264	58.1557	-2.7282	27/08/2019	09:54
1068	67129360*	21/08/2019	09:32	265	58.1645	-2.7311	02/09/2019	06:59
1069	67170319	21/08/2019	09:42	266	58.1732	-2.7340	01/09/2019	05:20

*Note only 3 channels were working on this SoundTrap