Spiorad na Mara Offshore Wind Farm

Offshore Project

Environmental Impact Assessment Report

Appendix 13.2: Passive Acoustic Monitoring Survey Report, Volume 2c

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Cetacean presence and ambient sound at the proposed Spiorad na Mara offshore wind development site

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Spiorad na Mara Limited

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ACRONYMS & ABBREVIATIONS

ARU	Acoustic Recording Unit
AWSD	Atlantic white-sided dolphin
CBD	Common bottlenose dolphin
CMW	Common minke whale
D	Deployment
DAS	Digital Aerial Survey
EIA	Environmental Impact Assessment
Hi	High
HP	Harbour porpoise
HW	Humpback whale
KW	Killer whale
LFPW	Long-finned pilot whale
LTSA	Long-Term Spectral Average
Mod	Moderate
NBHF	Narrow-Band High-Frequency
PAM	Passive Acoustic Monitoring
PPM	Porpoise Positive Minute
RD	Risso's dolphin
S	Sylence
SAMS	Scottish Association for Marine Science
SAMS Enterprise	SAMS Applied Marine Science Enterprise Ltd.
SBCD	Short-beaked common dolphin
SnM / SNM	Spiorad na Mara
SPL	Sound Pressure Level
ST	SoundTrap
TOL	Third-Octave Band Level
UTC	Universal Time Coordinated
WBD	White-beaked dolphin

EXECUTIVE SUMMARY

Spiorad na Mara Limited has contracted SAMS Enterprise to undertake 12 months of passive acoustic monitoring (PAM) of the proposed Spiorad na Mara (SnM) offshore wind development site. The PAM data collection programme commenced in January 2024 and coincided with the final remaining two Digital Aerial Surveys (DAS) in February and March 2024.

The aim of the project is to collect and analyse year-round baseline data on cetacean seasonal occurrence and diel activity patterns, as well as ambient sound levels in and around the SnM site west of the Outer Hebrides, Scotland through the deployment of one (first deployment) to two (following two deployments) PAM moorings. PAM results will provide additional baseline data on cetacean occurrence of higher temporal resolution compared to the DAS and will provide an evidence base to feed into the development of the Environmental Impact Assessment (EIA) for the site.

This report provides a summary of cetacean presence and ambient sound results from the three deployments, undertaken between the 11th January 2024 and the 9th February 2025, including a seasonal comparison to the DAS results.

Consistent presence of several cetacean species was recorded throughout the deployment period. Harbour porpoises were frequently detected throughout the year and showed a diel pattern in their detections, with more detections made at nighttime during the months with distinct light/dark periods. Seven dolphin species were identified in the collected data, based on the application of a recently developed Northeast Atlantic delphinid classifier. Common bottlenose dolphins were most frequently detected, followed by white-beaked dolphins and Atlantic white-sided dolphins. These species were most frequently detected during summer (June-August), with bottlenose dolphins and Atlantic white-sided dolphin also having higher daily detection rates in winter (December-February), while while-beaked dolphins showed an additional increased occurrence in spring (March–May) and autumn (September–November). Killer whale and long-finned pilot whale presence revealed a constant, but more intermittent pattern with lower detection-positive days per week throughout the monitoring period. Short-beaked common dolphin and Risso’s dolphin detections also occurred throughout the year, although both species revealed an increased presence during summer and autumn. Humpback whales demonstrated the strongest seasonal pattern, and were only detected in winter and spring, while common minke whales were detected from mid-spring through to autumn.

With regards to the classification of the delphinid species, missing data on classifier performance overall and specific to this dataset, however, means that classification results presented in this report need to be interpreted with much caution.

Nevertheless, the results from this approximately year-long acoustic monitoring programme showed the presence of a larger number of species than were sighted by the DAS programme. Not only were more species identified to be present in and around the proposed SnM offshore wind development site, the acoustic monitoring also revealed year-round presence for all of these species, except humpback whales. This highlights the added value of long-term acoustic monitoring to report on seasonal species presence which can complement snapshot visual surveys, which can cover larger spatial areas.

Ambient sound levels at SNMPAM01 revealed some seasonal variation, with increased levels between January to April 2024, especially at lower frequencies. Ambient sound levels were generally

comparable between both recording locations with slightly elevated levels measured at SNMPAM01 compared to SNMPAM02. The overall soundscape was driven by weather events, tidal currents, vessel traffic, and cetacean presence, with SNMPAM02 also continuously detecting signals from oceanographic equipment deployed in the vicinity of the acoustic mooring.

1 INTRODUCTION

1.1 Project background

SAMS Enterprise has been contracted by Spiorad na Mara Limited to conduct 12 months of passive acoustic monitoring (PAM) in the Spiorad na Mara (SnM) Offshore Wind development site west of the Isle of Lewis, Outer Hebrides, Scotland. The aim of the monitoring is to provide site-specific baseline information on the long-term presence of cetaceans and on ambient sound levels within and adjacent to the development site. The results of the year-long PAM effort will also be compared to patterns in cetacean presence obtained from the DAS monitoring.

This information will feed into the Environmental Impact Assessment (EIA) for the proposed offshore windfarm by providing additional baseline data of a higher temporal resolution compared to DAS monitoring.

1.2 Document purpose

This report summarises the results of all three monitoring campaigns (January 2024 to February 2025), presenting an overview of the cetacean species detected by the two acoustic moorings deployed within the SnM project array.

2 METHODOLOGY

2.1 Deployment design

One (Deployment 1) to two (Deployments 2 & 3) static PAM moorings were deployed within the SnM proposed development site (Figure 1; Table 1). These moorings were equipped with a long-term acoustic recording unit (ARU) and a high-frequency click detector (C-POD; Chelonia Ltd., United Kingdom (UK)), both collecting data continuously.

Specifically, SoundTrap ST500STD and ST300HF broadband recorders (Ocean Instruments, New Zealand) were deployed on SNMPAM01, while SNMPAM02 was equipped with a Sylence-LP-400 recorder (RTSYS, France). The SoundTraps ST500STD had an end-to-end system sensitivity of -176.9, -177.0, and -163.2 dB re 1 V/µPa for the three successive deployments, and sensitivity of the ST300HF used in the third deployment was -173.0 dB re 1 V/µPa, with broadband data collected at a sampling rate of 96 kHz and 16-bit resolution. End-to-end sensitivity of the Sylence recorders were -168.0 dB re 1 V/µPa, with broadband data being collected at a sampling rate of 128 kHz and bit depth of 16 bits. For the final deployment, which was anticipated to be of longer duration than Deployments 1 and 2, the ST300HF was deployed at SNMPAM in addition to the ST500STD, and set to start recording on the 22nd December 2024. Calculations indicated that the RTSYS Sylence would be able to cover this longer deployment period, so no additional recorder was co-deployed with the Sylence on SNMPAM02.

For C-POD data collection, the tilt switch was activated, ensuring data collection only when the instrument is upright, and all other settings were left as default, including specification of a click limit of 4,096 clicks per minute to avoid memory loss during noisy events. For the third deployment, F-PODs (Chelonia Ltd., UK) were co-deployed with the C-PODs on both moorings to ensure coverage of the longer (compared to the previous two campaigns) deployment period. The F-PODs were programmed with a delayed start, scheduled to activate on the 14th October and had the tilt switch activated too. To minimise data loss due to noisy conditions, the F-POD's option to use automatic amplitude threshold control was applied. To be recorded by the instrument, clicks must exceed an amplitude threshold. Under noisy conditions, the F-POD automatically increased this threshold enabling data collection to continue, but at a reduced sensitivity as signals needed to be louder to be detected by the recorder.

All acoustic instruments were deployed approximately 5–7 m above the seafloor. The moorings were deployed with a sub-surface recovery system (VR2AR acoustic release; Innovasea, Canada, with an ARC rope canister; RS Aqua, UK). Data collection took place between the 11th January 2024 and the 9th February 2025 (Table 2).

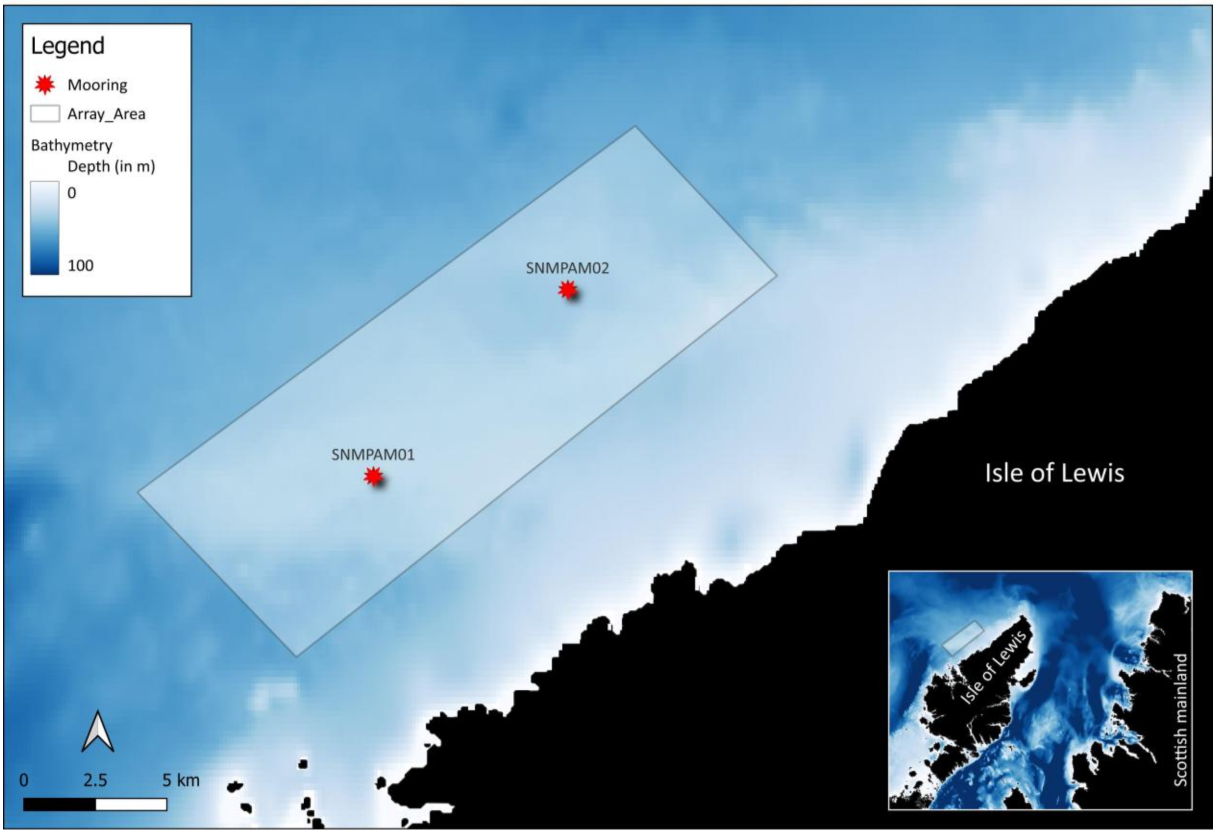

Figure 1. *Map of the study area, and locations of the SNMPAM01 and SNMPAM02 acoustic moorings (red stars) within the Spiorad na Mara site (semi-transparent rectangle) off western Scotland. Distance between the monitoring locations ~9.4 km.*

Table 1. *Spiorad na Mara passive acoustic monitoring deployment specifications during Deployments 1-3, detailing location, depth, and seabed substrate information (Substrate data source: Seabed substrate 1:250,000 – Europe © EMODnet Geology, European Commission, 2021).*

Acoustic mooring	***Latitude (°N)***	***Longitude (°E)***	***Depth (m)***	***Substrate (Folk 16 class)***
SNMPAM01	58.381	-6.838	52.1	Gravelly sand
SNMPAM02	58.440	-6.722	62.7	Gravel

2.2 Data analysis

2.2.1 Cetacean presence

After acoustic equipment recovery, all data were downloaded, quality checked, and securely stored on the SAMS server.

2.2.1.1 Harbour porpoises (*Phocoena phocoena*)

Harbour porpoises produce high-frequency echolocation clicks. The presence of these vocalisations, as well as other click-like sounds, were recorded by C-PODs/F-PODs, which log click detections rather than collecting actual sound files. The C-POD data were further processed using the analytical software package CPOD.exe (version 2.044) and F-POD data with FPOD.exe (version 2nd February 2024) for the presence of harbour porpoise echolocation click trains by applying the KERNO NBHF (Narrow-Band High-Frequency) species classifier and the 'Hi' (high) and 'Mod' (moderate) train filter detection quality settings (Chelonia Ltd., 2024). The resulting data were extracted on an hourly resolution and visualised as the percentage of days within a week during which porpoises were detected, corrected for the monitoring effort (in days; these can be fully or partially covered) within each week. In addition, the number of Porpoise Positive Minutes (PPM) per hour were also visualised.

The C-POD was programmed to log a maximum of 4,096 click-like sounds during any given minute of data collection. Under noisy conditions, such as during rough weather events, at times of close-by vessel presence, or when tidal currents cause sediment movement and acoustic mooring self-noise (e.g., flow noise over the hydrophone, and/or movement of mooring components), this limit may be reached prior to completing a full minute of monitoring. The C-POD then temporarily stops recording until the onset of the next minute, resulting in a temporary loss of recording capability, and thus reduced monitoring effort, during minutes where this 'buffering' occurs.

To take reduced monitoring effort into consideration, the fraction of each hour not monitored was also exported. As the maximum of 4,096 clicks that could be recorded in each minute was occasionally reached, only hours which were monitored for >90 % (i.e. ~ 5 minutes of monitoring effort was allowed to be lost each hour) were taken forward in the analysis with hours of ≤90 % monitoring effort excluded from the harbour porpoise analyses.

Despite the application of the automatic amplitude threshold control, data loss was experienced was also experienced by the F-PODs, and the >90 % correction was therefor also applied to the F-POD data.

2.2.1.2 Delphinids

To identify delphinid (e.g. short-beaked common dolphin (*Delphinus delphis*), Atlantic white-sided dolphin (*Lagenorhyncus acutus*), white-beaked dolphin (*Lagenorhynchus albirostris*), Risso's dolphin (*Grampus griseus*), common bottlenose dolphin (*Tursiops truncatus*), killer whale (*Orcinus orca*), and long-finned pilot whale (*Globicephala melas*)) echolocation clicks and tonal whistles, the broadband data were processed in PAMGuard (Gillespie et al., 2008), using the 'Whistle and Moan Detector' and generic 'Click Detector' modules for the general presence of delphinids (i.e. not classified to species level). All detection results were manually validated on a daily resolution and summarised as the percentage of days within a week during which delphinids were detected, corrected for the monitoring effort within each week.

To identify delphinids to species level, the data were analysed using the latest version (dated 20/01/2025) of the first open-source species-specific classifier for Northeast Atlantic dolphin species[1]. The classifier uses both whistles and clicks for species identification and was applied using the PAMGuard 'Rocca' module. The PAMGuard outputs were then processed using the associated 'eventClassifier' app (also dated 20/01/2025) in R to obtain species classification per event (i.e. per sound file). Classifications with a score[2] <0.05 were excluded, following the recommendations provided by the developer. This two-stage PAMGuard/R classification has been developed by Tristan Kleyn, a PhD candidate at the University of St Andrews co-supervised by SAMS staff member Dr Denise Risch. To our knowledge, this is the only automated tool currently publicly available to classify Northeast Atlantic delphinids to species level. Manual validation was subsequently undertaken to verify that non-delphinid detections, such as from echosounders, signals from nearby deployed instruments and their associated mooring noise, were excluded, and daily presence of individual species summarised. Finally, the presence of each species was computed as the percentage of days within a week during which individual species were detected and corrected for the monitoring effort within each week.

As several weeks in November and December were not covered by the broadband data collection at SNMPAM01, and there was a total lack of broadband data for SNMPAM02 during Deployment 3, daily delphinid detections for these periods were obtained from C-/F-POD data, by running the KERNO/KERNO-F classifier and exporting 'Other Cet' (all non-NBHF toothed whales except for sperm whale) click detections of 'Hi' (high) and 'Mod' (moderate) train filter detection quality settings. Note that these recorders only detect echolocation clicks trains and are not capable of recording whistle presence. Delphinid presence might therefor be expected to be lower. This could not be quantified here but potential differences could arise due to species-specific behaviour (whistle and echolocation rates differ between species and between behaviours delphinids are engaged in), as well as distance between delphinids and the recorder (whistles are of omni-directional and of higher source level, and can be detected over larger distances than the less loud directional echolocation clicks). Consequently, the presented F-POD data represent a minimal delphinid presence across these periods.

2.2.1.3 Common minke whale (*Balaenoptera acutorostrata*)

Minke whales produce well described stereo-typed low frequency (< 500 Hz) pulse train song (Mellinger et al., 2000; Risch et al., 2013). An automated machine learning based detector to identify the presence of minke whale song (Mouy et al., 2024) was applied to all data. Detections of minke whale song were manually validated and the results summarised as the percentage of days within a week during which minke whales were detected, corrected for the monitoring effort within each week.

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[1] The whistle and click model configuration files applied were updated versions of those in the Rocca Northeast Atlantic Classifier publicly available on: http://www.pamguard.org/rocca_nea.html.

[2] The score is defined as the product of the confidence (i.e. highest probability across all seven species) and the prominence (i.e. the difference between the probability of the first and seconds most likely species).

2.2.1.4 Humpback whale (*Megaptera novaeangliae*)

A humpback whale song detector, based on a trained Convolutional Neural Network (Kather et al., 2024) was applied to all available data to identify daily presence of stereo-typed humpback whale song (Payne and McVay, 1971). Effort-corrected results were summarised on a weekly resolution.

2.2.2 Ambient sound

2.2.2.1 Long-term spectral averages

Average sound levels were visualised using the 'Long Term Spectral Average' (LTSA) module in PAMGuard. Sound levels (power spectral density; in dB re 1 µPa/√Hz) were quantified on a 1-second resolution and averaged per minute.

2.2.2.2 Third-octave band level analysis

Ambient sound level analysis was carried out using the third-octave level (TOL) function in PAMGuide (Merchant et al., 2015), where root-mean-square sound pressure levels ($L_{p,\mathrm{rms}}$ (ISO, 2017); in dB re 1 µPa – hereafter referred to as SPL) were quantified in third-octave bands (base 10; also referred to as decidecade bands) (using a Hanning window, 0 % overlap, and 1-second resolution) across the full available frequency range (i.e. nominal centre frequencies 25 Hz – 40 or 50 kHz; for the SoundTrap and Sylence, respectively). Of these, median SPL and various percentiles were plotted for the third-octave bands centred at 63 and 125 Hz, and 1 and 8 kHz throughout the deployment period.

2.2.3 Fish tag data

Various organisations in the UK and Ireland have been fitting fish (e.g. salmon, sea bass, pollock, basking shark) with acoustic tags, with various individuals detected west of the Outer Hebrides (e.g. Rodger et al., 2024; Thorburn et al., 2024). Using the integrated hydrophone of the acoustic release system of our PAM moorings, monitoring for incidental fish tag signals was undertaken throughout the deployment period.

3 RESULTS

3.1 Monitoring effort

For Deployment 1, SNMPAM01 was deployed on the 11th January 2024, and retrieved on the 11th May 2024 (total of 122 days). Click detector data were collected until the 31st March, while acoustic broadband data collection continued until the 8th May, resulting in 81 (66.4 % coverage) and 119 (97.5 % coverage) monitoring days respectively, including the partially monitored deployment and retrieval days (Table 2; Figure 2).

For Deployment 2, the acoustic moorings were deployed on the 11th May and retrieved on the 1st September 2024 covering a total monitoring period of 114 days. Click detector data were collected until the 16th August for SNMPAM01 (98 days; 86 % coverage), while the SNMPAM02 recorder stopped the day prior to deployment. The acoustic broadband data collection continued until the 1st September for both moorings, resulting in 114 monitoring days (100 % coverage) (Table 2; Figure 2).

For the final Deployment 3, both acoustic moorings were deployed on the 1st September 2024, while retrieval took place on the 9th February 2025, resulting in a total deployment duration of 162 days. Click detector data were collected during all 162 days for SNMPAM01 (i.e. 100 % coverage), although the C-POD covered the first 101 days, and the F-POD the final 119, with overlap from the 14th October till the 10th December 2024 (58 days). SNMPAM01 broadband data were collected from the 1st September till the 9th November 2024 (70 days), and from the 22nd December 2024 till the 9th February 2025 (50 days), combined covering 120 days (74.1 % coverage). SNMPAM02 click detector data covered the entire deployment period (100 % coverage), with the C-POD collecting data throughout the entire deployment, while click detector data by the F-POD also continued till the end of the deployment after activation on the 14th December according to the pre-programmed delayed start (119 days). Due to issues with the brand-new RTSYS recorder, no broadband data were available for SNMPAM02 for the final deployment (Table 2; Figure 2).

Collectively, across all three deployments, POD click detector data thus covered 341 individual calendar days, while ARU broadband data were recorded on 352 calendar days.

For the data from both recorder types, the hour of deployment, as well as the first full hour after deployment were excluded from analysis to avoid inclusion of noise from the deployment vessel in the analysis. Likewise, the hour of retrieval, as well as the hour prior to recovery, were also excluded. Where an instrument ceased recording prior to recovery, the final full hour monitored was used as the end of data to be included in further analysis.

Table 2. *Deployments 1–3 monitoring effort overview. The time covered between the start and end of the recorders represent the monitoring effort used in analysis for the presence of marine mammals and quantification of ambient sound levels. The total days includes both full, as well as partially monitored days. Time in UTC. D = Deployment; ST = SoundTrap recorder; S = Sylence recorder. * Set-up with a delayed start date.*

Deployment	*Acoustic mooring*	*Deployed*	*Recovered*	*Recorder*	*Recording start*	*Recording end*	*Total days*
D1	SNMPAM01	11/01/2024 10:53	11/05/2024 08:32	C-POD #1655	11/01/2024 12:00:00	31/03/2024 12:59:59	81
				ST500HF #5122	11/01/2024 12:00:00	08/05/2024 03:59:59	119
D2	SNMPAM01	11/05/2024 09:46	01/09/2024 10.34	C-POD #1666	11/05/2024 11:00:00	16/08/2024 08:59:59	98
				ST500HF #5121	11/05/2024 11:00:00	01/09/2024 08:59:59	114
	SNMPAM02	11/05/2024 10:11	01/09/2024 11:43	C-POD #670	-	-	0
				S-LP-400 #2403016	11/05/2024 12:00:00	01/09/2024 09:59:59	114
D3	SNMPAM01	01/09/2024 11:09	09/02/2025 10:44	C-POD #1732	01/09/2024 13:00:00	10/12/2024 00:59:59	101
				F-POD * #8028	14/10/2024 00:00:00	09/02/2025 08:59:59	119
				ST500HF #5122	01/09/2024 13:00:00	09/11/2024 10:59:59	70
				ST300HF * #335843397	22/12/2024 00:00:00	09/02/2025 08:59:59	50
	SNMPAM02	01/09/2024 12:07	09/02/2025 11:19	C-POD #668	01/09/2024 14:00:00	09/02/2025 08:59:59	162
				F-POD * #8027	14/10/2024 00:00:00	09/02/2025 08:59:59	119
				S-LP-400 #2406001	-	-	0

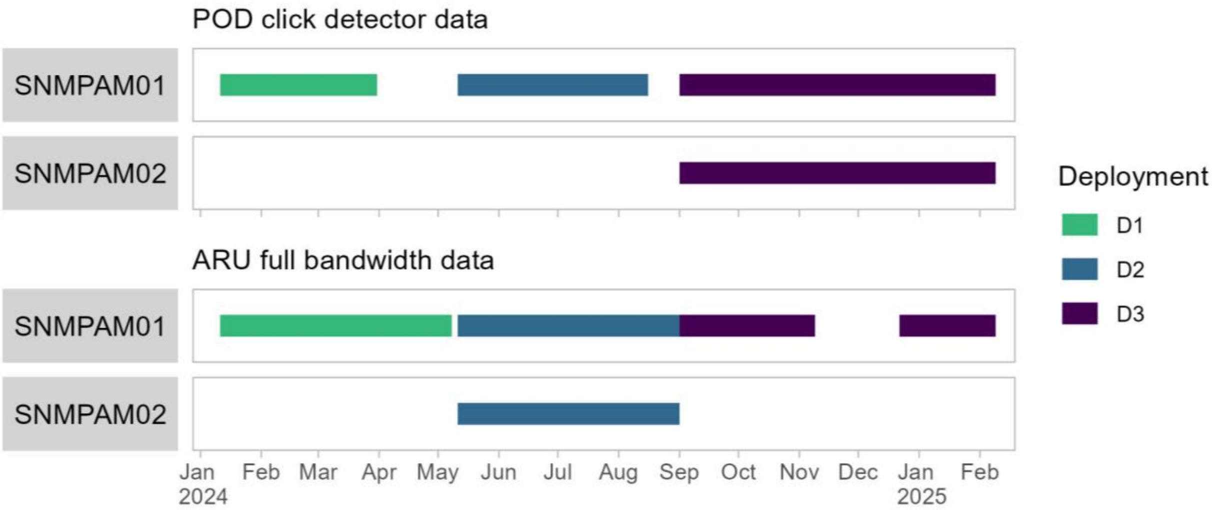

Figure 2. *Visualisation of the available POD click detector data and full broadband acoustic recorder unit (ARU) data from the SNMPAM01 and SNMPAM02 moorings deployed during Deployments 1–3.*

3.2 Cetacean presence

3.2.1 Spiorad na Mara site-specific overview

3.2.1.1 Summary of cetacean detections

Figure 3 summarises the overall presence of individual cetacean species in and around the development site for SNMPAM01 and SNMPAM02 combined (i.e. a species is present on any day when it is detected at one or both of these monitoring locations).

Harbour porpoise presence revealed a consistent pattern, with detections throughout the year. Their weekly presence was persistently high during all seasons except for autumn when then the number of days the species was detected each week was lower.

To a lesser extent, Atlantic white-sided dolphins, common bottlenose dolphins, and white-beaked dolphins, were also consistently and frequently present at the site throughout the year, with an increased presence of these three dolphin species during the summer months (June–August). Additionally, Atlantic-white-sided dolphins and bottlenose dolphins were also more prevalent during the winter months (December–February), while white-beaked dolphin showed an additional increase in detections during spring (March–May) and autumn months (September–November).

Killer whales and long-fined pilot whales were detected less frequently but both species were identified throughout the year.

Risso’s dolphin and short-beaked common dolphin detections also occurred throughout the year; detections of both species revealed an increased presence during summer and autumn, which was more persistent for common dolphins compared to Risso’s dolphins.

Humpback whales were present in winter and spring and were detected on a nearly daily basis from February to early April. Except for three days in winter, minke whales were only detected from spring to autumn, with peaks in daily number of detections per week in late spring and early autumn (Figure 3).

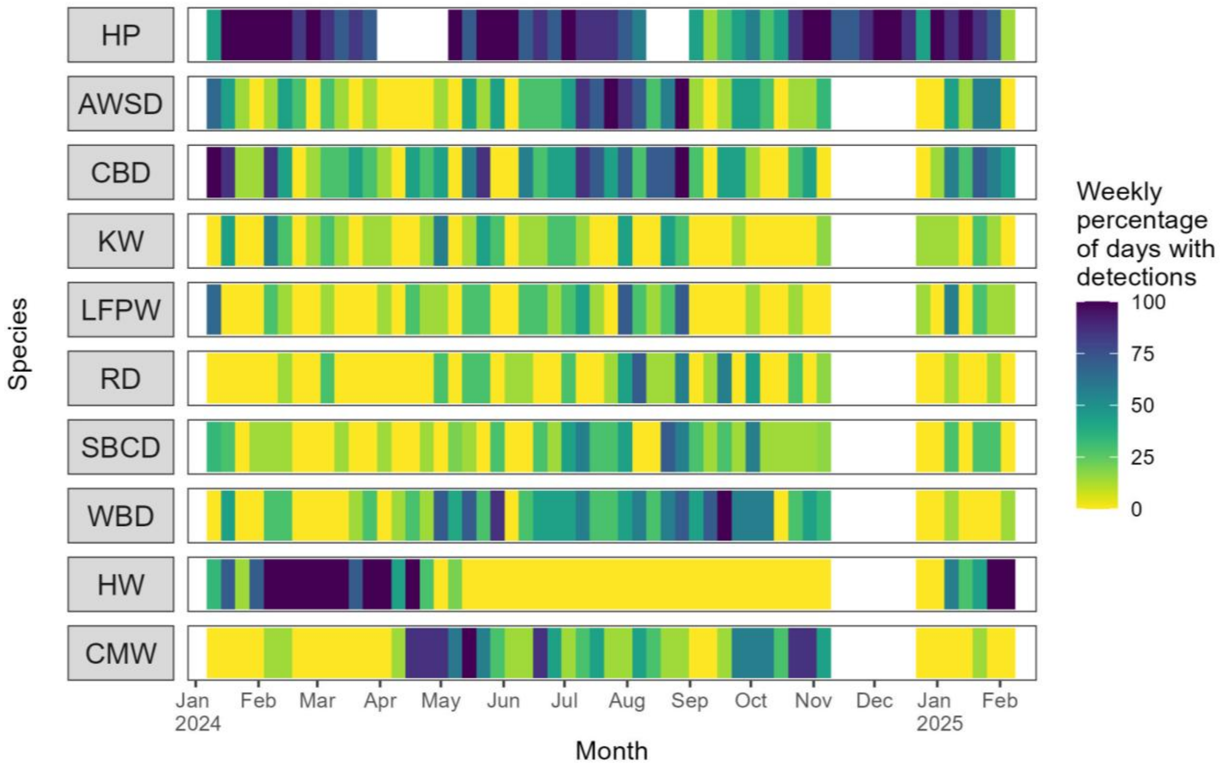

Figure 3. *Summary overview of daily presence per week, corrected for the number of full or partial days monitored in each week during Deployments 1–3, for each of the species detected at the Spiorad na Mara site. HP = Harbour porpoise; AWSD = Atlantic white-sided dolphin; CBD = Common bottlenose dolphin; KW = Killer whale; LFPW = Long-finned pilot whale; SBCD = Short-beaked common dolphin; RD = Risso's dolphin; WBD = White-beaked dolphin, CMW = Common minke whale; HW = Humpback whale. Harbour porpoise results based on C-POD data only. Absence of data is presented in white.*

3.2.2 Harbour porpoise

Porpoise data were available from SNMPAM01 for all three deployments, and for SNMPAM02 for Deployment 3 only.

At SNMPAM01, based on C-POD data only, harbour porpoises were detected on 192 of the 280 days monitored (68.6 %) across the three deployments. When combining both C-POD and F-POD data, their presence was detected on 251 of the total 341 monitoring days (73.6 %). At SNMPAM02, porpoises were detected on 88 of the 162 days (54.3 %) monitored by the C-POD during the final deployment, and on 91 days by the C-POD and/or F-POD (56.2 %).

Porpoises were detected throughout the monitoring period, with the species typically being detected on 5–7 days per week from late autumn to mid-summer; lower weekly detection rates occurred from late summer to early autumn (Figure 4). During Deployment 3, for which data were available from both monitoring locations and both C-POD and F-POD recorders, the gradual increase in weekly porpoise positive days from summer to autumn, and more consistent occurrence from late autumn onwards, was reflected by both the C-POD and F-POD data at both monitoring locations (Figure 4).

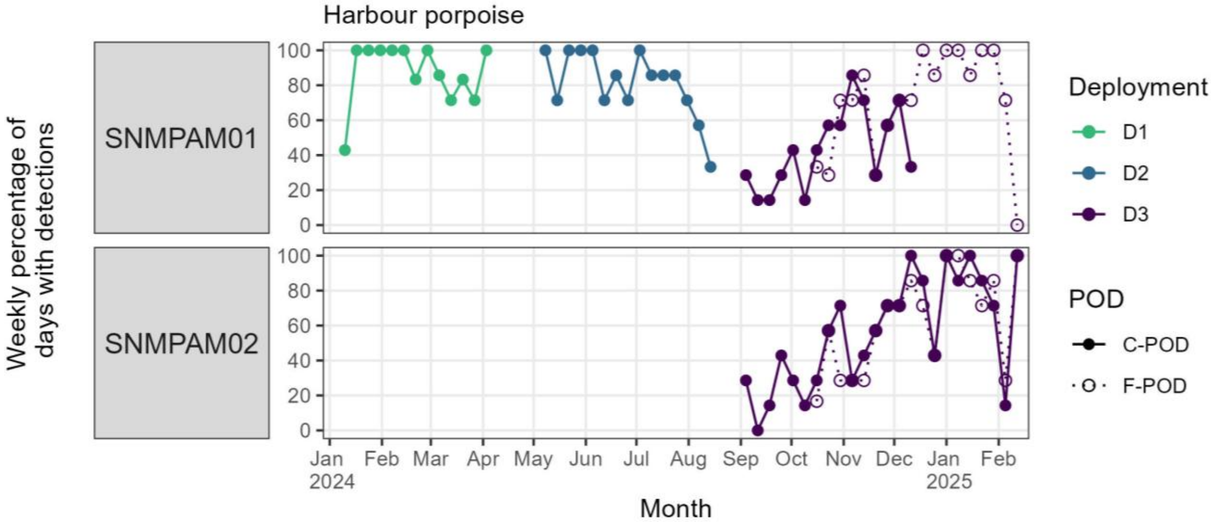

Figure 4. *Overview of daily harbour porpoise presence per week as detected by C-POD (solid line) and F-POD (dotted line) recorders, corrected for the number of full or partial days monitored in each week during Deployments 1–3. Note that weeks at the start and end of presented data typically do not represent a seven-day monitoring period.*

Throughout all three deployments, and across both monitoring locations, hourly harbour porpoise detection rates were low, with 0–1.54 daily average Porpoise Positive Minutes (PPM) per hour, and up to 22 PPMs for specific hours (Figure 5). On a daily basis, no specific period(s) of increased porpoise detections were identified for either monitoring location (Figure 5).

Based on C-POD data only, porpoises were detected at SNMPAM01 during 519 hours of the 6,635-hour period covered by Deployments 1–3. Exclusion of 435 hours that each were monitored for ≤90 % (see section 2.2.1.1), resulted in porpoises being detected during 480 of the 6,200 hours considered 'sufficiently' monitored (i.e. porpoises were detected during 7.7 % of the monitored time). At SNMPAM02, porpoise echolocation was detected on 256 of the 6,247 monitored hours, and in 233 of the 5,671 hours (4.1 %) after exclusion of 'insufficiently' monitored hours.

Diel assessment of porpoise presence at SNMPAM01 (Figure 6; top two panels), for which data were available for most months of the year, revealed that the species was more commonly detected at night between sunset and sunrise during periods with a distinct light/dark regime, while detections throughout spring and summer where generally more spread throughout the 24-hour cycle, with no distinct diel pattern in their occurrence.

For the period from September onwards, including data from both the C-POD and F-POD recorders and from across both monitoring locations, revealed that the more pronounced diel pattern of lower detection numbers during the day compared to between sunset and sunrise, was reflected in data from both recorders and present at both monitoring locations (Figure 6).

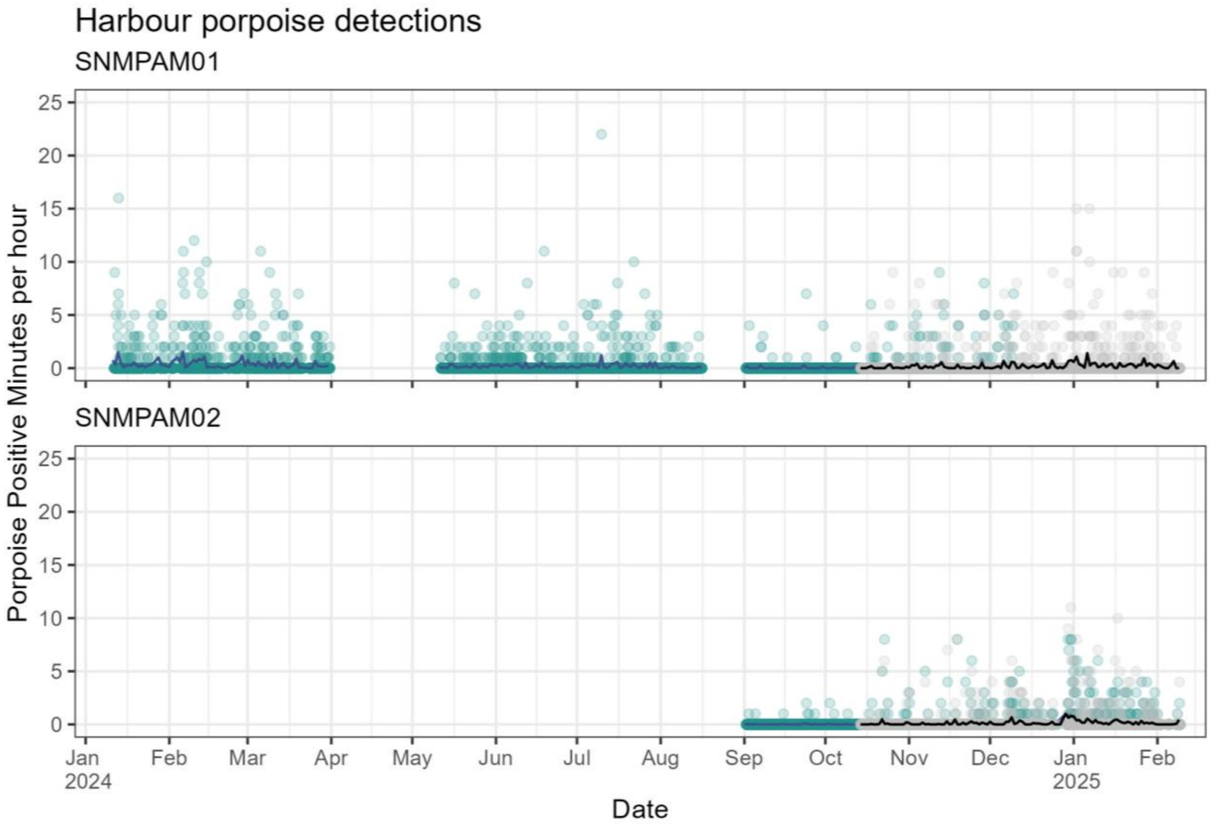

Figure 5. *Porpoise Positive Minutes per hour (C-POP: green circles; F-POD: grey circles), averaged for each day (C-POD: purple line; F-POD black line), throughout the monitoring periods of Deployments 1–3 for monitoring locations SNMPAM01 and SNMPAM02.*

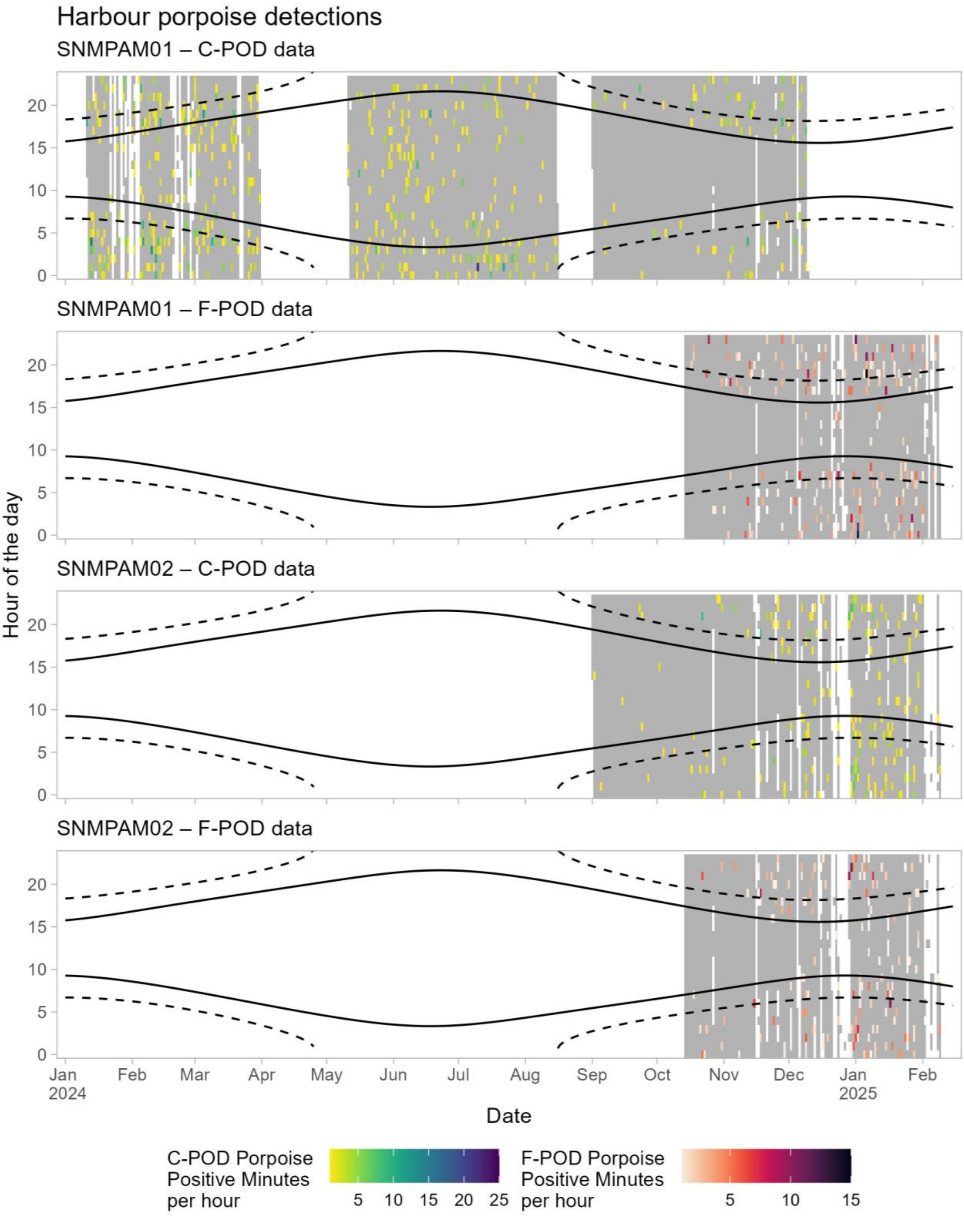

Figure 6. *Hourly Porpoise Positive Minutes (colour scale) as detected by C-POD and F-POD recorders in relation to effective hourly monitoring effort throughout the monitoring periods of Deployments 1–3 at monitoring location SNMPAM01 (top two panels) and SNMPAM02 (bottom two panels). Grey areas indicate an absence of porpoise detections. White areas represent a lack of data at the start and end of the monitoring period, as well as hours that were excluded as they were insufficiently (i.e. ≤90 %) monitored. The black solid lines show times of sunrise and sunset, while the black dashed lines indicate dusk and dawn based on astronomical twilight (note that there is no complete darkness approximately from May to mid-August).*

3.2.3 Delphinids

3.2.3.1 General delphinid presence

Delphinid whistles and/or echolocation clicks, of any delphinid species, were detected throughout the Deployment 1–3 monitoring periods, with delphinid detections showing considerable weekly variability. Overall, no clear monthly/seasonal pattern in general delphinid occurrence was present at either of the two monitoring sites (Figure 7).

Monitoring between May and August, when comparable broadband data from both acoustic moorings were available, revealed delphinids to be more frequently detected at SNMPAM02 than at SNMPAM01. The variability in the number of days per week on which delphinids were detected at SNMPAM01 was larger than for SNMPAM02 (Figure 7).

The largest differences between both monitoring locations were in September and early October, during which, in contrast to the May-August period, delphinids were detected on a daily basis at SNMPAM01 but at substantial lower weekly detection rates at SNMPAM02. As SNMPAM01 results were based on broadband data while SNMPAM02 were collected by PODs during these months, and considering above-mentioned caveat of POD data, it is unclear whether this difference reflects a real difference in delphinid presence between locations during September/October or whether this may be resulting from differences in data origin (or a combination of these factors).

Although highly variable, the number of detections were overall low, with regular occurrence of a single encounter within a day, and encounters were typically of short duration (although may last up to several hours on occasion), indicating animals move though the area rather than remaining within detection distance of the recorder for prolonged periods of time.

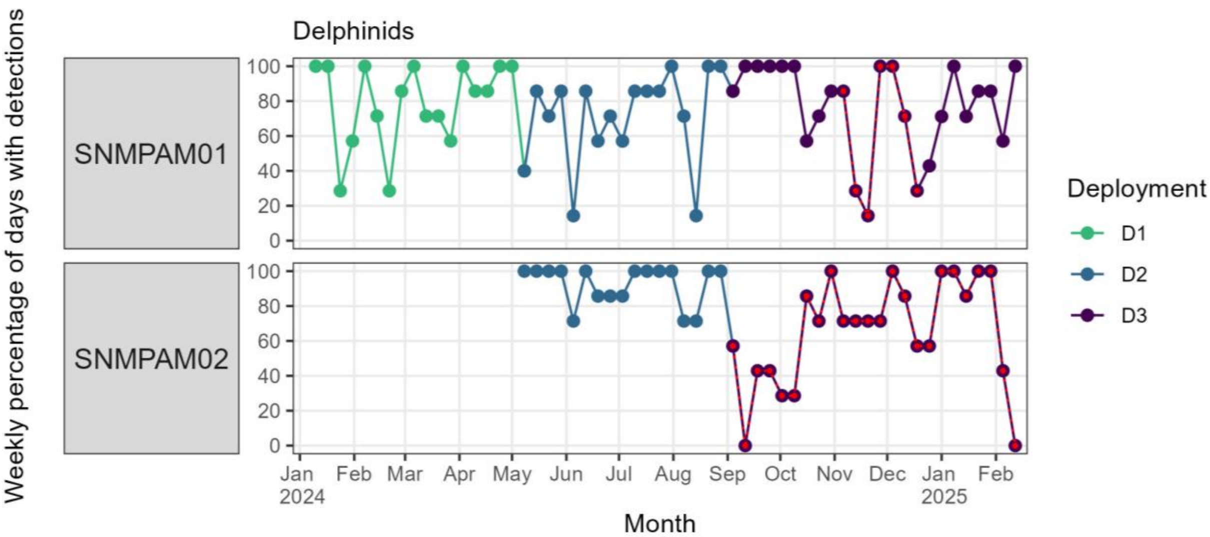

Figure 7. *Overview of daily delphinid presence per week, corrected for the number of full or partial days monitored in each week during Deployments 1–3. Results from C-/F-POD data (in red) were used to provide a minimal presence of delphinids during periods for which broadband data were absent (SNMPAM01 is based on F-POD data; SNMPAM02 till week of the 9th October is based on C-POD data only, with subsequent SNMPAM02 results presenting detections by the C-POD and/or F-POD). Note: for SNMPAM01, broadband monitoring effort in the first week of Deployment 1 covered three days, the first week of Deployment 2 covered five days (the last three*

days of Deployment 1 and the first day of Deployment 2), while the last week of Deployment 3 is based on one day only. For SNMPAM02, broadband monitoring effort in both the first and last weeks of Deployment 2 both comprised of only one day of effort.

3.2.3.2 Atlantic white-sided dolphin

Atlantic white-sided dolphins were detected on a total of 100 days (detections at both monitoring locations combined) out of the 352 days (28.4 %) monitored across Deployments 1–3. The number of days the species was detected on a weekly basis was highest at the start of Deployment 1 and nearer the end of Deployment 2, with results for both monitoring locations showing a similar pattern when data were available for both SNMPAM01 & 02 (Figure 8).

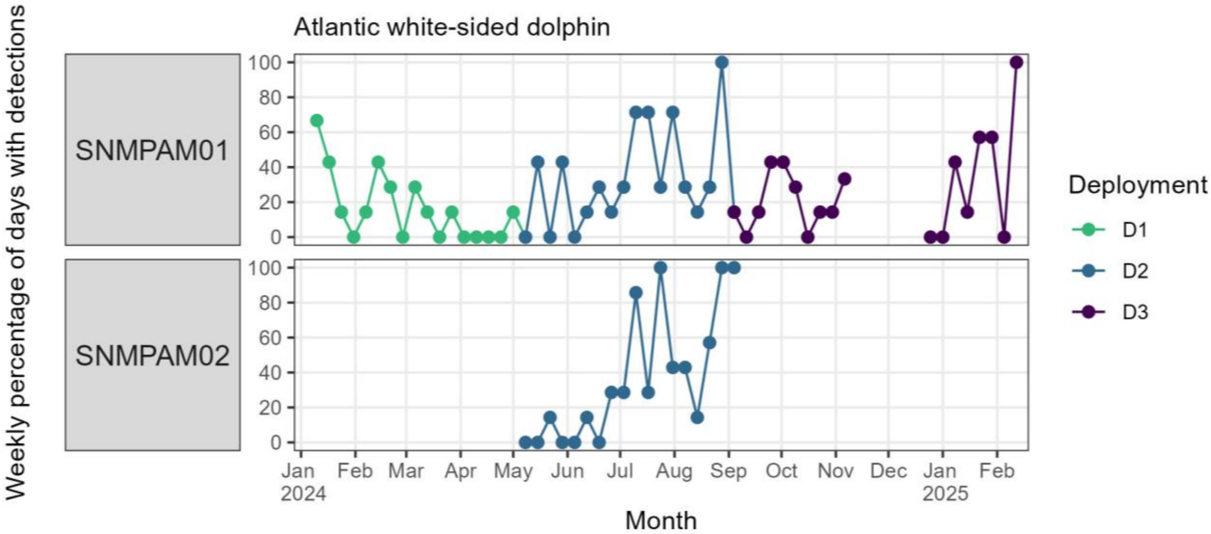

***Figure 8.** Overview of Atlantic white-sided dolphin presence per week, corrected for the number of full or partial days monitored in each week during Deployments 1–3. For specifics on monitoring effort during the first and last week of these deployments where these were not fully covered, see Figure 7.*

3.2.3.3 Common bottlenose dolphin

Bottlenose dolphins were the most frequently detected species, with a presence on 140 days (39.8 %) of the 352-day monitoring period covered by Deployments 1–3 across both monitoring locations. Although the number of days the species was detected on a weekly basis varied through time, these were higher during some weeks in January and February at SNMPAM01, and at the end of August at SNMPAM02 (Figure 9).

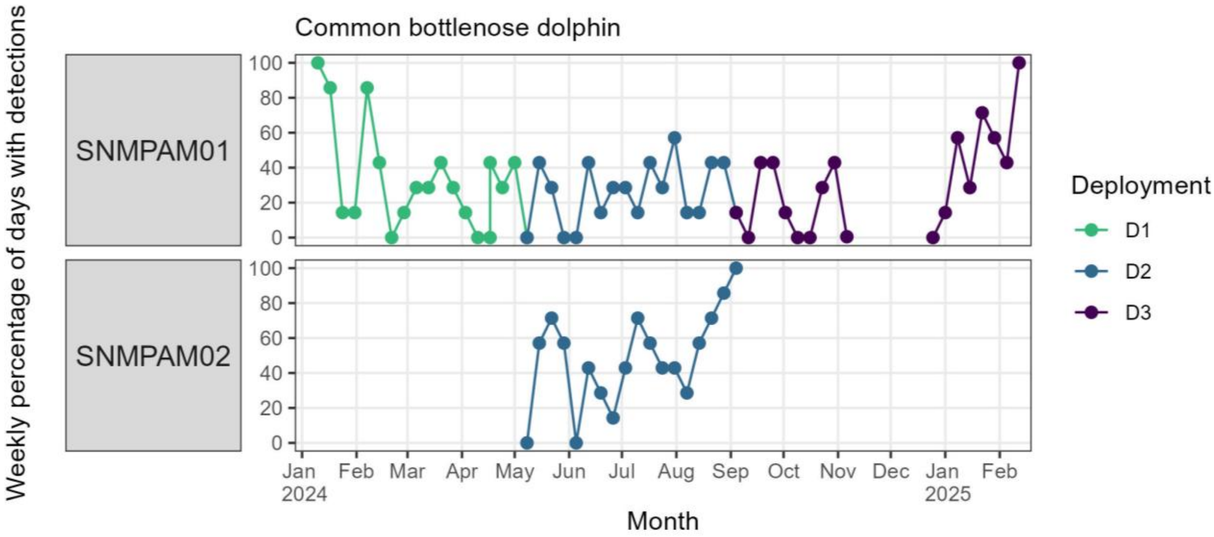

__Figure 9.__ Overview of common bottlenose dolphin presence per week, corrected for the number of full or partial days monitored in each week during Deployments 1–3. For specifics on monitoring effort during the first and last week of these deployments where these were not fully covered, see Figure 7.

3.2.3.4 Killer whale

Killer whale presence was identified on 50 days (14.2 % of monitored time) across each of the monitored months at both sites. Their weekly presence was typically low, although on occasion the species was detected up to 4 days per week. There was no clear seasonal pattern in killer whale occurrence, and for the period that monitoring coincided between both locations, their presence revealed a similar pattern (Figure 10).

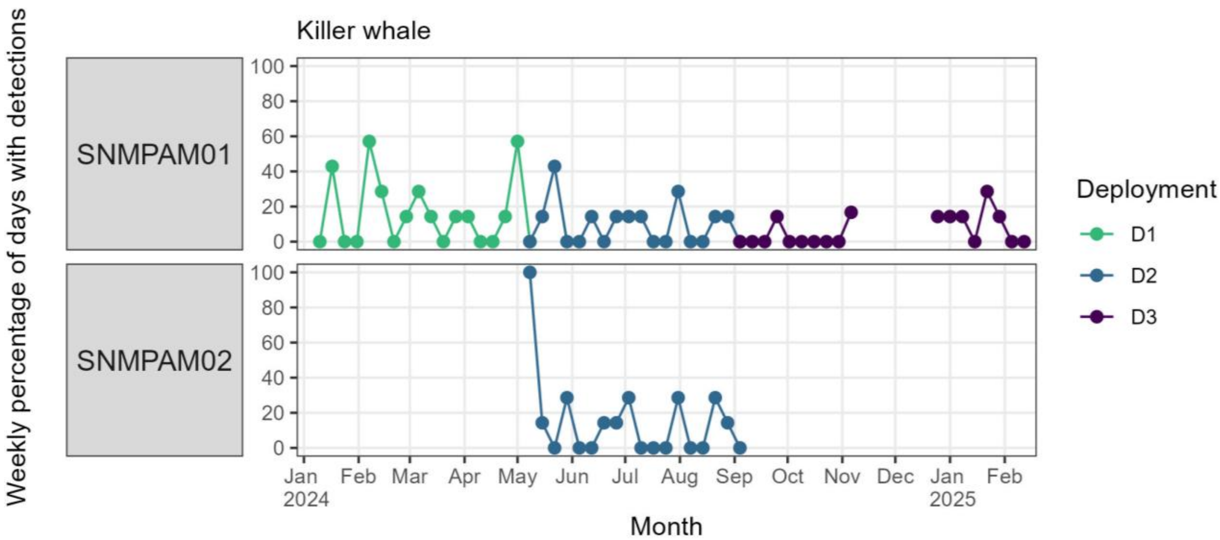

__Figure 10.__ Overview of killer whale presence per week, corrected for the number of full or partial days monitored in each week during Deployments 1–3. For specifics on monitoring effort during the first and last week of these deployments where these were not fully covered, see Figure 7.

3.2.3.5 Long-finned pilot whale

Detected on 53 days (15.1 %) across both monitoring locations throughout the monitoring periods of Deployments 1–3, the number of days within a week with long-finned pilot whale detections were generally relatively low, with increased presence detected at SNMPAM01 during two fully monitored weeks in August. For SNMPAM02, detections were low throughout (Figure 11).

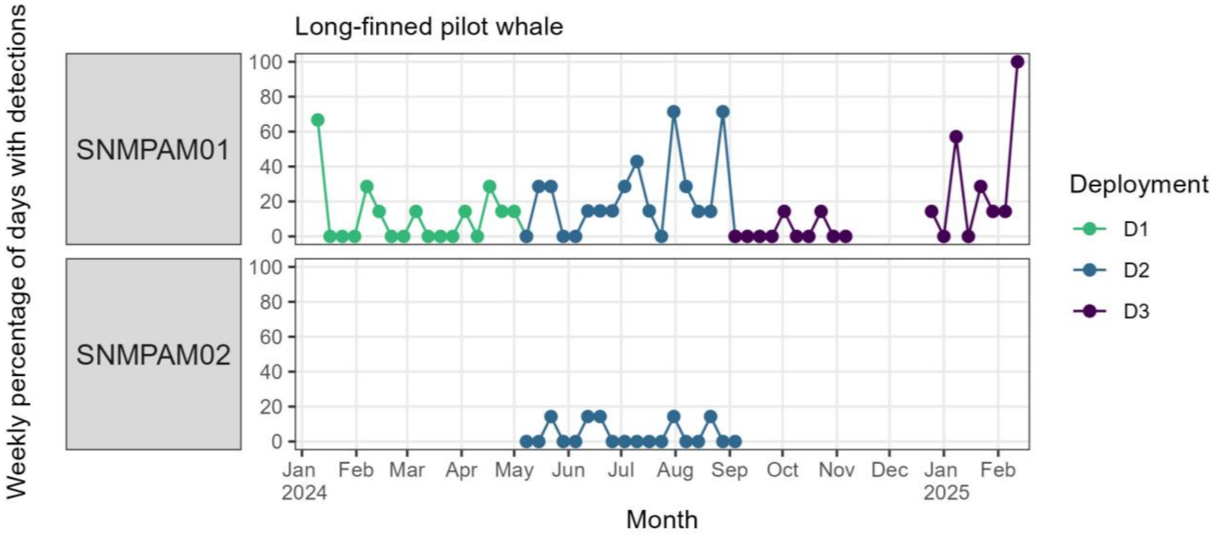

Figure 11. Overview of long-finned pilot whale presence per week, corrected for the number of full or partial days monitored in each week during Deployments 1–3. For specifics on monitoring effort during the first and last week of these deployments where these were not fully covered, see Figure 7.

3.2.3.6 Risso's dolphin

Risso's dolphin were the least frequently identified delphinid species, with their presence detected on 41 days (11.6 %) across both monitoring locations during Deployments 1–3. The number of days within a week with positive Risso's dolphin detections were generally low, but became a bit more variable during August and September at SNMPAM01, with some weeks revealing a slight increase in their occurrence (Figure 12).

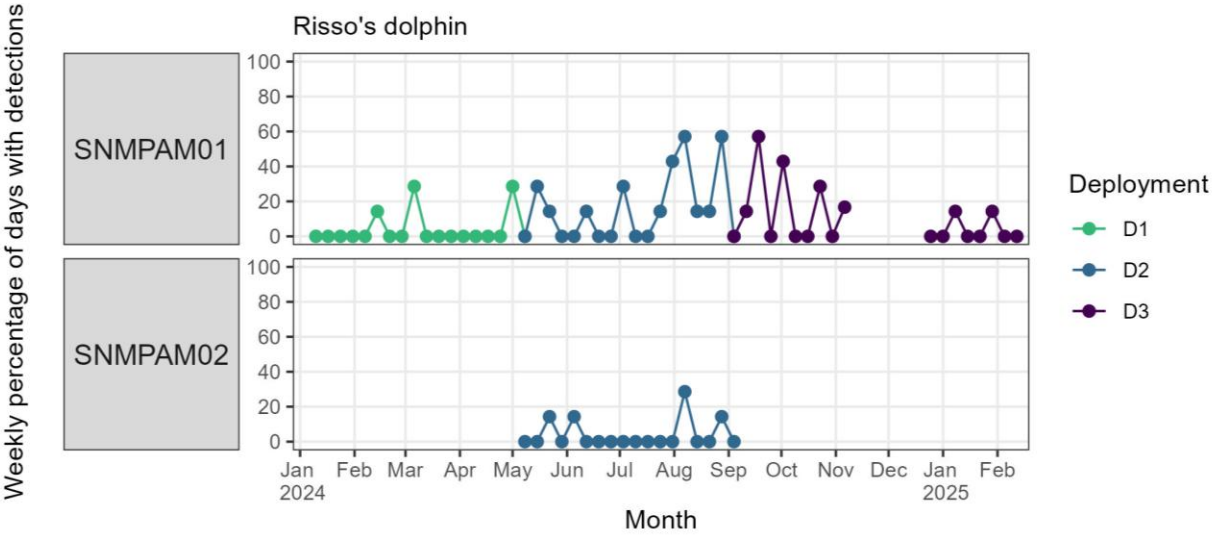

Figure 12. *Overview of Risso's dolphin presence per week, corrected for the number of full or partial days monitored in each week during Deployments 1–3. For specifics on monitoring effort during the first and last week of these deployments where these were not fully covered, see Figure 7.*

3.2.3.7 Short-beaked common dolphin

Overall presence of short-beaked common dolphins was low, with infrequent detections on 60 days (17.0 %) throughout the monitoring period and no clear seasonal pattern in their occurrence. Although typically detected on one or two days a week, the species was identified up to four days per week during four weeks in July, August and October at SNMPAM01 (Figure 13).

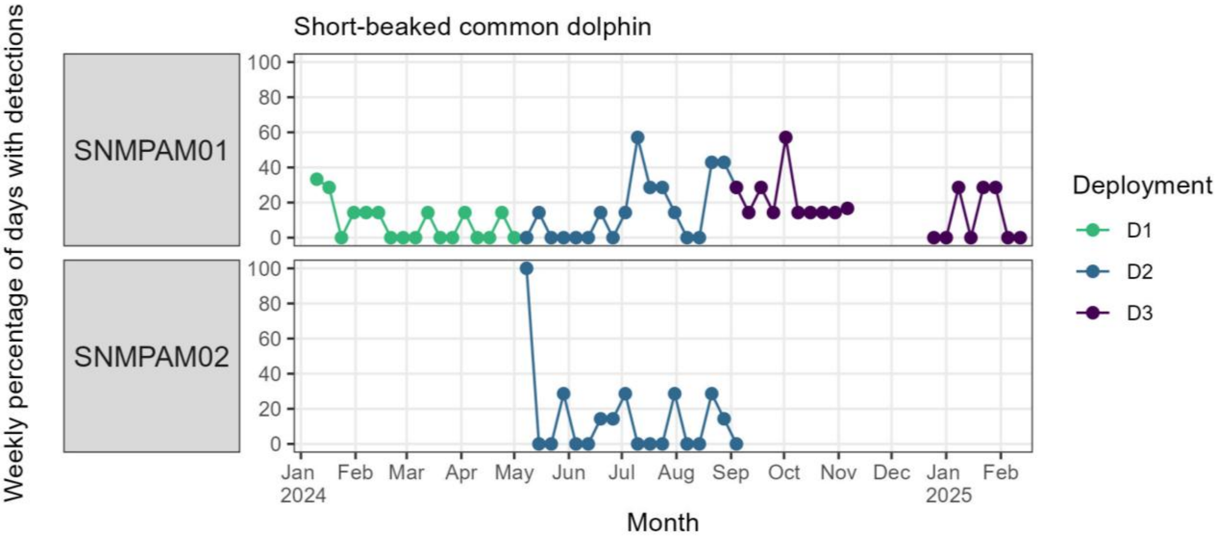

Figure 13. *Overview of short-beaked common dolphin presence per week, corrected for the number of full or partial days monitored in each week during Deployments 1–3. For specifics on monitoring effort during the first and last week of these deployments where these were not fully covered, see Figure 7.*

3.2.3.8 White-beaked dolphin

White-beaked dolphins were regularly detected throughout the monitoring period covered by Deployments 1–3, with the species identified on a total of 107 days (30.4 % of monitored time). While there was no clear seasonal pattern, most of the weeks with higher number of white-beaked dolphin positive days at SNMPAM01 were between May and October. An increased number of detections at the start of the second deployment was particularly noticeable for SNMPAM02, while the species was generally more frequently detected on a daily basis throughout this deployment at SNMPAM01 (Figure 14).

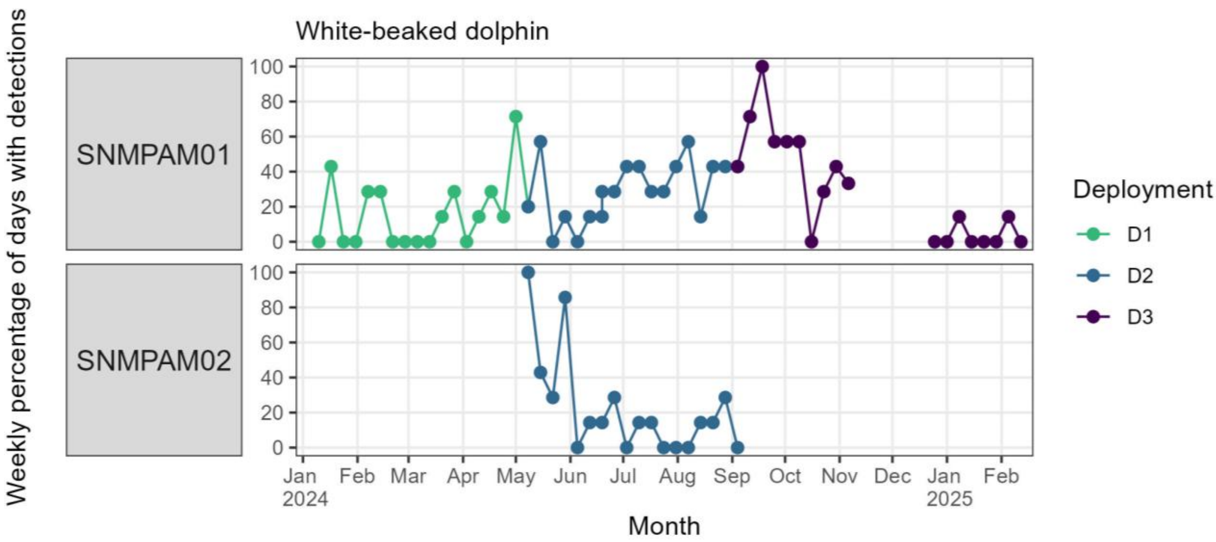

Figure 14. *Overview of white-beaked dolphin presence per week, corrected for the number of full or partial days monitored in each week during Deployments 1–3. For specifics on monitoring effort during the first and last week of these deployments where these were not fully covered, see Figure 7.*

3.2.3.9 Discussion on individual delphinid presence

Other than being developed and used by Tristan Kleyn as part of his PhD work, this is the first time the Northeast Atlantic delphinid classifier is applied to an unseen dataset. The classifier is based on acoustic data from visually verified single-species encounters and has been validated on an independent dataset. However, performance results on the ground-truthed validation dataset are still worked on as part of Tristan Kleyn's PhD and are not publicly available yet.

Performance of all automated classifiers might vary when applied to other environments, or data collected using other recorder types or monitoring platforms. However, without coinciding visual data in this study classifier performance on this dataset could not be assessed.

The missing data on classifier performance overall and specific to this dataset, means that classification results presented in this report need to be interpreted with much caution. While more information is forthcoming from the developers once the classifier is made publicly available, in the next few paragraphs we highlight a few important points in relation to the current classifier and its potential performance on the present dataset, which should be carefully considered when interpreting the results shown within this report.

- The amount of available data to contribute to classifier development and testing varied per species, with Risso's dolphin being one of the species with relatively limited input data. Results of an earlier version of the classifier thus indicated lower performance in correctly classifying this species. Although performance of the current version of the classifier is unknown, the potentially lower performance of the classifier in identifying this species might be a reason why Risso's dolphin presence at the monitoring location was lower than expected, given the close vicinity of the North-east Lewis Marine Protected Area, designated for the protection of Risso's dolphin. As Risso's dolphins have frequency-banded echolocation clicks (Soldevilla et al., 2008) that are similar to those of white-beaked dolphins, it is reasonable to assume that some Risso's dolphin events were misclassified white-beaked dolphin.
- Little is known about Atlantic white-sided dolphin presence in Scottish coastal waters. The species is generally found in more offshore waters to the north and west of the Outer Hebrides. The large number of days the species was identified at the relatively coastal SnM offshore wind development site appears high and may also be related to false classifications. As for Risso's dolphins, a limited amount of visually verified Atlantic white-sided dolphin recordings was available for classifier development.
- Despite infrequent detections, there were more killer whale and long-finned pilot whale detections than expected. Several of these were identified in recordings with few and very short low frequency whistle snippets. As described in the Methods sections some of these likely false detections were manually removed but false classifications for these species are still likely. As mentioned above, the lack of visually verified acoustic recordings for this dataset makes a final determination of classifier performance impossible at this time.
- Finally, as recommended by the developer of the classifier, a score ≥0.05 was used to accept classification of a certain species over the second-best alternative. If none of the seven candidate species reached that score, an event remained unclassified. As such, a subset of detected delphinid events were not classified, including some of long duration and containing good quality (i.e. high signal-to-noise) whistles and/or echolocation clicks. According to the classifier developer, a score of 0.05 may result in good accuracy (>75 %) while retaining at least 60-70 % of events being classified. Similarly to classification accuracy this classifier performance metric could vary between datasets. However, estimating it was out of scope for the present study.

To conclude, the latest available version of the Northeast Atlantic delphinid classifier was applied to the acoustic data collected at the proposed SnM offshore wind development site. Classifier performance is unknown and its estimation was outside the scope for this study. The misclassification rate therefore has an unquantified effect on the identification of acoustically detected delphinid species as presented in this report.

3.2.4 Baleen whales

3.2.4.1 Common minke whale

Minke whales were detected on 95 days across acoustic moorings throughout the entire monitoring period (27.0 % of days monitored) and were predominantly present from April to November. Their seasonal presence revealed a bi-modal pattern, with peaks in their weekly occurrence in April-May, as well as in September-November. Although generally not detected outside of the main April-November period, minke whale presence was identified during one week in January and two weeks in February. In between the two distinct peaks, weekly detection rates ranged between 0 to 7 days per week. Data from both monitoring locations revealed very similar patterns in minke whale weekly detections during this period (Figure 15).

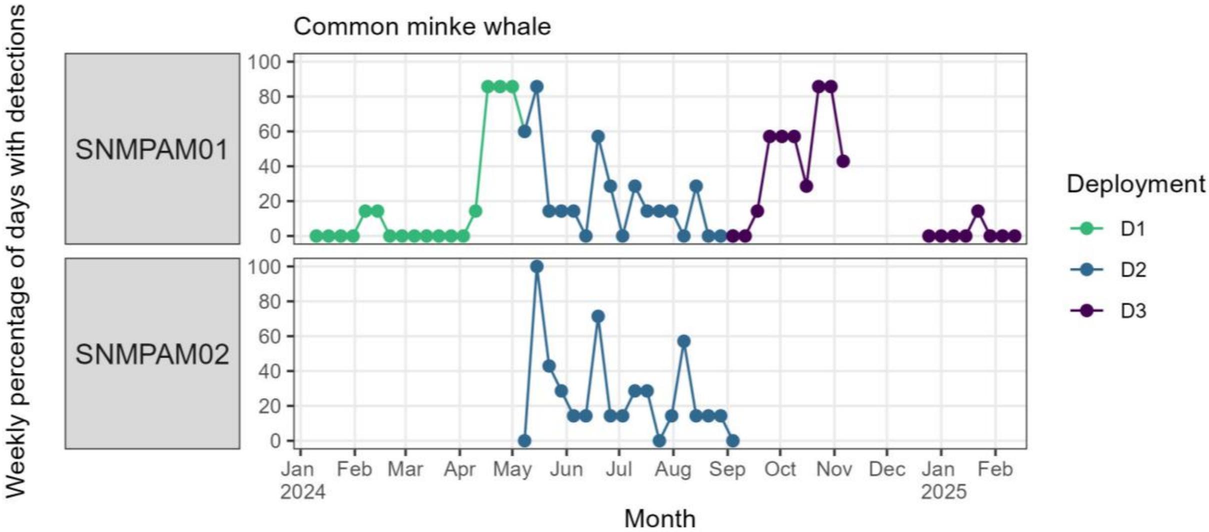

Figure 15. *Overview of daily common minke whale presence per week, corrected for the number of full or partial days monitored in each week during Deployments 1–3. For specifics on monitoring effort during the first and last week of these deployments where these were not fully covered, see Figure 7.*

3.2.4.2 Humpback whale

There was a clear seasonal pattern in the detection of humpback whale presence, with their song being detected on 110 days (31.2 % of monitored time) between January and early May only. The species was detected throughout the first deployment but was particularly prevalent between early February and mid-April during which it was detected on every day of the week, except for two weeks (Figure 16).

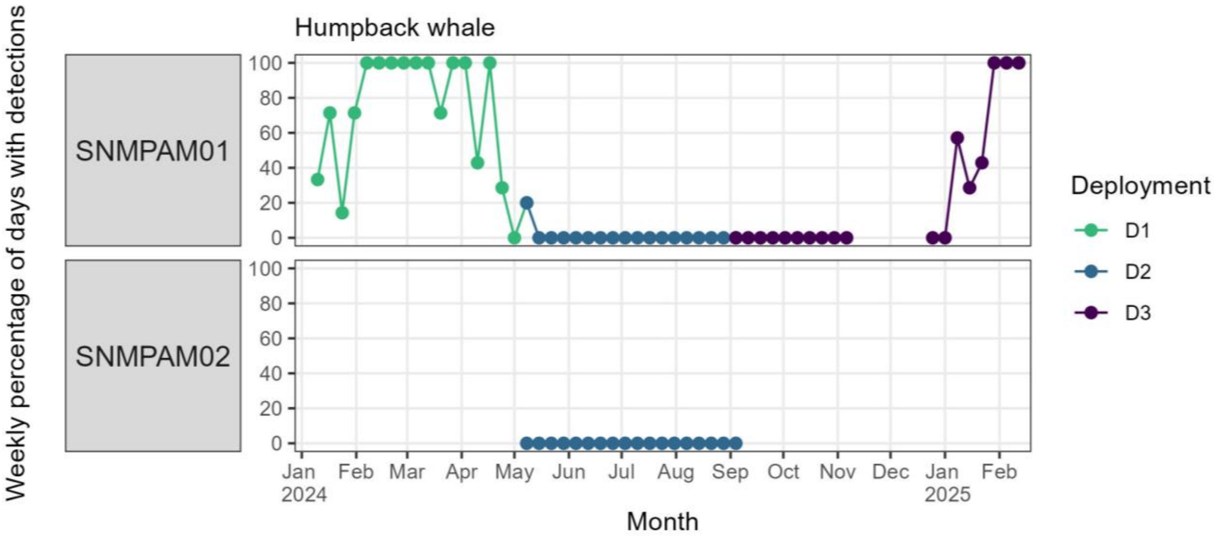

Figure 16. *Overview of daily humpback whale presence per week, corrected for the number of full or partial days monitored in each week during Deployments 1–3. For specifics on monitoring effort during the first and last week of these deployments where these were not fully covered, see Figure 7.*

3.2.4.3 Seasonal comparison of PAM to DAS results

Table 3 provides an overview of the relative seasonal presence of the detected species as obtained from the acoustic monitoring, with the seasonal sightings and derived abundance estimates for cetacean species identified from the visual aerial surveys presented in Table 4. The months included in each season have been aligned to facilitate comparison of seasonal patterns across both approaches. Note that results for the second deployment combined daily presence from both monitoring stations (i.e. a species is present on any day when it is detected at one or both monitoring locations), whereas the results for the periods covered by Deployments 1 & 3 originated from data collected at SNMPAM01 only. Additionally, harbour porpoise presence is based on C-POD detections only.

Analyses of the acoustic data revealed the presence of a range of porpoise, dolphin, and baleen whale species to be present within detection distance of the monitoring locations (Table 3). Of these, harbour porpoise, bottlenose dolphin, killer whale, Risso's dolphin, short-beaked common dolphin, white-beaked dolphin, and minke whale were identified in both the acoustic data and during the Digital Aerial Surveys (Table 4).

Harbour porpoises were detected visually and acoustically across all seasons (Table 3). The species was acoustically detected almost daily from winter to summer, with a reduced number of porpoise positive days in autumn. Despite monthly variability within seasons, the aerial surveys suggest a higher abundance of porpoises in winter and spring than in summer (Table 4). Overall, the number of porpoise acoustic detections were relatively low and of short duration and there was no pronounced seasonal pattern in terms of the number of detections on an hourly or daily scale (Figure 4). The diel pattern differed between seasons, with more acoustic detections at night during periods with a distinct light/dark regime, and a more diffuse presence throughout the diel cycle in spring and summer (Figure 5).

The above-mentioned delphinid species were all acoustically detected across all four seasons. Although some species revealed low relative seasonal presence for some seasons.

On a daily basis, bottlenose dolphins were most frequently detected in the PAM data during summer, and this was also the only season the species was sighted during the DAS monitoring. Acoustic detections were high relative to other delphinid species, with lowest bottlenose dolphin vocalisations detected on a daily resolution in autumn.

Killer whales were visually sighted only once during the winter. Although the species was also acoustically detected in this season, killer whale presence was most often detected acoustically in spring. The species' relative acoustic presence was relatively constant across winter to summer, with substantial lower presence in autumn.

While Risso's dolphins were only sighted during spring and summer in the aerial surveys, acoustic monitoring revealed the presence of this species across all seasons, with higher relative acoustic presence detected in summer and autumn compared to winter and spring. Both the visual and acoustic data indicate an increasing pattern in the species' relative presence from winter to spring to summer, after which it decreases again.

Short-beaked common dolphin daily acoustic detection rates were highest in summer followed by spring, while most individuals were visually encountered during winter and autumn during the aerial surveys.

White-beaked dolphins were predominantly acoustically detected during summer and autumn seasons, followed by spring, with peak presence during autumn. In contrast, white-beaked dolphins were only sighted in winter and spring during the second survey year.

Almost all minke whales were acoustically detected between spring and autumn. The species was also visually identified in spring and summer, although the spring encounter related to a dead individual.

Atlantic-white-sided dolphins were acoustically detected across all seasons, with highest numbers of daily detections in summer when their relative presence was over twice as high compared to winter. However, Atlantic-white-sided dolphins were not visually identified during DAS surveys and as mentioned above, it is possible that this species has been misclassified more often than others in the current data set (see discussion in 3.2.3.9).

Long-finned pilot whale presence revealed increased daily detections during the summer although the species was acoustically detected across all seasons; no identifications of this species were made visually.

Finally, humpback whale presence was strongly seasonal with song detected throughout the winter and spring months, but this species was not sighted during the visual surveys.

The fact that certain species were acoustically detected, but were not identified in the Digital Aerial Survey data might be related to one, or a combination, of the following factors:

- cetaceans being submerged at the time of the DAS overfly, and therefore not present at, or just below, the surface to be identified,
- the presence of cetaceans might be missed as both the airplane and animals move independently, and their 2D-paths might therefor not have crossed,

- cetacean presence might have been missed in the ~90% of DAS data not analysed,
- animals might have been outwith the aerial survey area, but within acoustic detection distance.

In case of the first three options, the animals could still have been within the SnM project area. Of the species acoustically detected but not visually sighted, the humpback whale is likely the only species that can be detected beyond the SnM array area and 10 km buffer covered by the aerial surveys.

Table 3. *Relative seasonal presence of cetacean species identified through passive acoustic monitoring. The number of full or partial days of monitoring effort within each season is provided in brackets. * Based on C-POD data only.*

Species	***Percentage of days with detections relative to total monitoring effort per season***			
	Winter (Dec–Feb)	***Spring (Mar–May)***	***Summer (Jun–Aug)***	***Autumn (Sep–Nov)***
Harbour porpoise *	86.3 (117 days)	91.5 (47 days)	85.7 (77 days)	59.3 (91 days)
Common bottlen. dolphin	41.0 (100 days)	35.9 (90 days)	54.3 (92 days)	24.3 (70 days)
Killer whale	16.0 (100 days)	18.9 (90 days)	16.3 (92 days)	2.9 (70 days)
Risso's dolphin	3.0 (100 days)	8.9 (90 days)	20.7 (92 days)	15.7 (70 days)
Short-b. common dolphin	12.0 (100 days)	7.8 (90 days)	28.3 (92 days)	21.4 (70 days)
White-beaked dolphin	9.0 (100 days)	28.9 (90 days)	41.3 (92 days)	48.6 (70 days)
Common minke whale	3.0 (100 days)	38.9 (90 days)	29.3 (92 days)	42.9 (70 days)
Atl. white-sided dolphin	25.0 (100 days)	13.3 (90 days)	53.3 (92 days)	20.0 (70 days)
Long-finned pilot whale	15.0 (100 days)	11.1 (90 days)	28.3 (92 days)	2.9 (70 days)
Humpback whale	62.0 (100 days)	53.3 (90 days)	0.0 (92 days)	0.0 (70 days)

Table 4. *Overview of the number of individuals across species sighted during the two Digital Aerial Survey (DAS) years, and associated seasonal abundance estimates. Estimate intervals represent the range across the different reported months within a specific season. Note: DAS data analysed represents ~10-12 % of the total surveyed area. Data from APEM (2023 & 2024). * = Deceased individual.*

Species	***DAS year***	***Raw number of individuals per quarter (abundance estimate for total survey area)***				***Total count***
		Winter (Dec–Feb)	***Spring (Mar–May)***	***Summer (Jun–Aug)***	***Autumn (Sep–Nov)***	
Harbour porpoise	Year 1	37 (17-298)	16 (9-86)	4 (0-25)	4 (0-34)	61
	Year 2	58 (102-402)	17 (9-112)	14 (26-97)	3 (9-17)	92
Common bottlenose dolphin	Year 1	0	0	1 (9)	0	1
	Year 2	0	0	0	0	0
Killer whale	Year 1	7 (60)	0	0	0	7
	Year 2	0	0	0	0	0
Risso's dolphin	Year 1	0	5 (9-34)	11 (0-93)	0	16
	Year 2	0	0	2 (17)	0	2
White-beaked dolphin	Year 1	0	0	0	0	0
	Year 2	3 (26)	6 (52)	0	0	9
Common minke whale	Year 1	0	1*	0	0	1*
	Year 2	0	0	1 (9)	0	1

3.3 Ambient sound

3.3.1 Long-term spectral averages (LTSA)

LTSA plots present averaged noise levels (averaged over one minute here) over a certain time period (x-axis) and across a range of frequencies (y-axis), with noise levels colour-coded following the associated colour bar.

Despite data collection using a newly procured and tested hydrophone on the ST500HF recorder deployed at SNMPAM01 during the final deployment, the long-term ambient sound analyses revealed an issue with this hydrophone, which could not be captured during equipment testing. The erroneous data, while correctly recording lower frequency sounds, showed too little variation in certain frequency bands to be considered accurate. The reason for this is unclear and is currently being investigated with the help of the manufacturer.

Because it was unclear which frequencies were affected by this error, it was considered safest to exclude all data recorded with this hydrophone (1st September - 9th November 2024) from the noise level measurements and plots (i.e. LTSA and TOL) below.

Despite this issue, manual checking of sound files from this recorder revealed that lower frequency signals and louder sounds like those from cetaceans, were still correctly represented in the data. We are therefore confident that cetacean detection results from this deployment are unlikely to be compromised.

LTSA visualisation of the long-term acoustic data collected between January 2024 and February 2025 revealed higher noise levels during the first deployment at SNMPAM01, and to a lesser extent also during the final deployment, compared to the second deployment. The results also show the presence of several noisy, likely weather-related, events with increased noise levels across the frequency range monitored during the winter months of 2024 and 2025 (Figure 17). However, for both sites, highest noise levels were present in the lower frequencies (approx. up to 200 Hz) with clear tidal patterns at both monitoring locations. Inspection at these low frequencies (not presented here) also revealed a more pronounced lunar pattern (i.e. relating to the spring-neaps cycle) at SNMPAM02 than at SNMPAM01 when co-deployed during Deployment 2.

Overall, higher noise levels were measured at SNMPAM01 compared to SNMPAM02 across the frequency range (Figure 18). The sounds recorded at SNMPAM02 contained continuous signals actively transmitted by other locally deployed equipment (Figure 18; bottom panel; see horizontal lines at various frequencies throughout the deployment).

Opportunistic inspection of sound files revealed at least the following contributors to the soundscape:

- Marine mammals
- Weather events
- Vessels, including engine noise, single- and multi-frequency echosounders / fish-finders, and fishing activity
- Mooring self-noise from the deployed acoustic moorings, as well as noise from one or multiple other moorings
- SNMPAM02 recorded signals from other deployed instruments throughout the deployment.

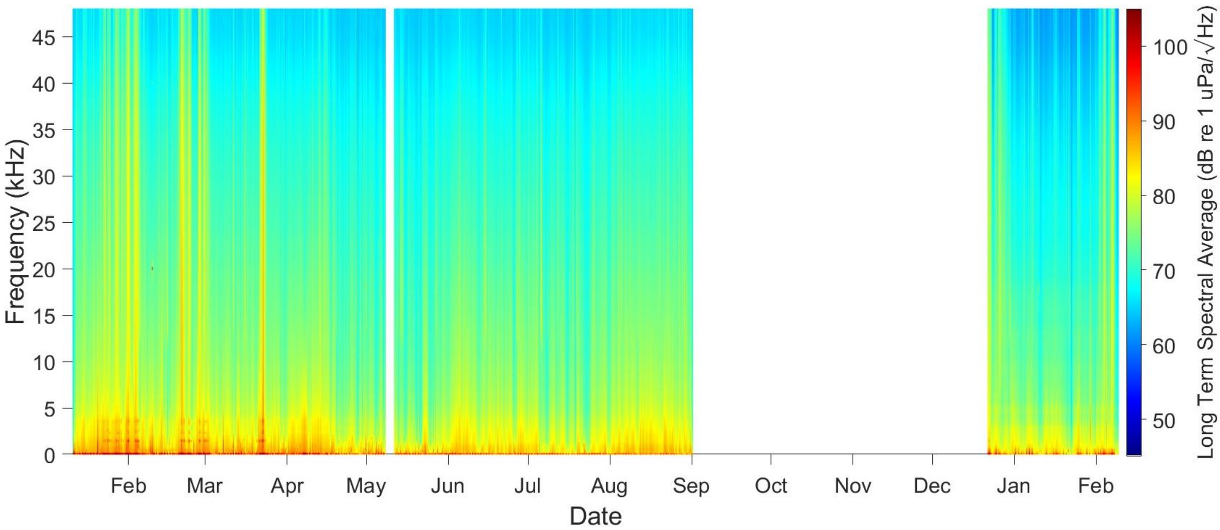

Figure 17. *Long-term spectral averaging plot for the acoustic data collected at SNMPAM01 during Deployments 1–3 across the entire frequency range monitored.*

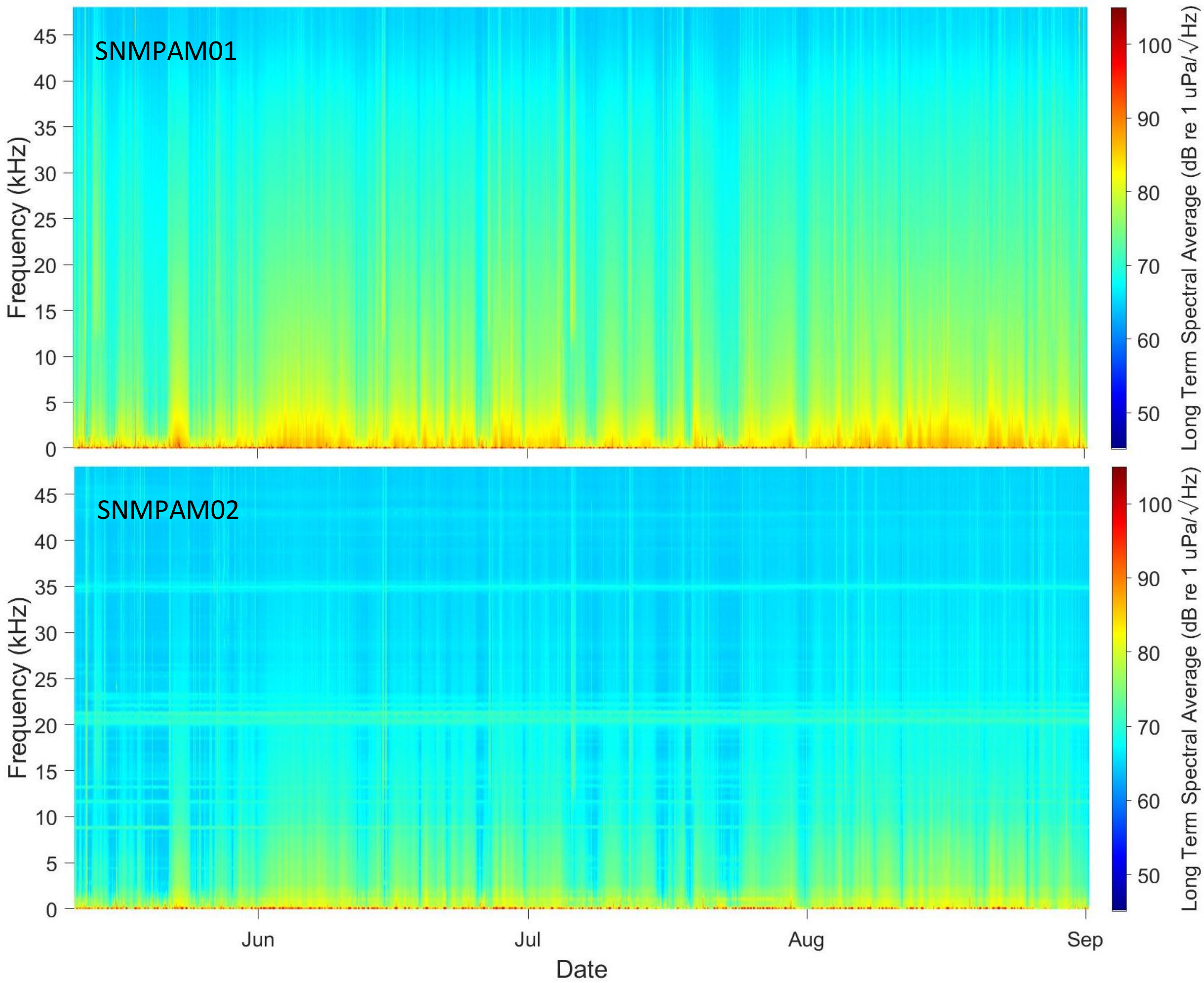

Figure 18. *Long-term spectral averaging plot for the acoustic data collected at SNMPAM01 (top panel) and SNMPAM02 (bottom panel) during Deployment 2 for the frequency range of 0-48 kHz.*

3.3.2 Third-octave band levels

Focussing in on discrete frequencies (63, 125, 1,000 and 8,000 Hz third-octave bands), monthly median SPLs ranged from 74.5 (May; 63 Hz; SNMPAM02; excluding the few hours monitored in September at this location) to 98.1 dB re 1 µPa (January; 1 kHz; SNMPAM01) (Table 5). Across the entire monitoring period covered at each site, median sound levels ranged between 79.3 and 93.8 dB re 1 µPa (63 Hz for SNMPAM02, and 1 kHz for SNMPAM01, respectively). A summary overview of ambient sound statistics across all third-octave bands is provided in embedded '04887 DORIS-PAM_Ambient_sound_statistics_FINAL_Issue01.xlsx' file below, which also provided information about the amount of data available for each month and across the entire monitoring period.

As presented for the LTSA above, at SNMPAM01 noise levels were typically higher during the January to April months of the first deployment compared to subsequent months, especially for the lower third-octave band, with increased sound levels measured again in December of the following winter.

Similar temporal noise level patterns were recorded at both monitoring locations during overlapping monitoring periods, although variability (difference between 5th and 95th percentiles) was slightly larger at SNMPAM02 for the lower two third-octave bands, and to a lesser extent also for the1 kHz frequency band. Sound levels were comparable for the highest third-octave band presented here (Figure 19).

Table 5. *Median ambient sound level (third-octave SPL in dB re 1 µPa) during Deployments 1–3 for the four third-octave bands centred around 63, 125, 1,000 and 8,000 Hz. The 5th and 95th percentiles are presented in brackets.*

Location	***Month***	***63 Hz***	***125 Hz***	***1 kHz***	***8 kHz***
SNMPAM01	January '24	92.2 (77.2 – 108.9)	92.8 (82.9 – 102.4)	98.1 (91.8 – 103.2)	91.8 (87.0 – 97.5)
	February	89.9 (72.0 – 107.9)	90.7 (79.2 – 107.1)	95.7 (84.2 – 101.9)	90.8 (80.2 – 99.7)
	March	84.7 (71.8 – 103.3)	88.4 (78.3 – 103.2)	94.8 (86.0 – 102.2)	89.4 (80.2 – 95.7)
	April	84.2 (71.6 – 99.7)	88.3 (78.1 – 99.7)	95.0 (81.8 – 101.9)	89.4 (75.1 – 93.9)
	May	76.9 (71.9 – 92.2)	88.4 (78.3 – 103.2)	87.2 (75.3 – 97.5)	81.9 (75.1 – 91.3)
	June	80.5 (73.2 – 91.1)	85.8 (75.5 – 93.0)	94.1 (81.9 – 98.8)	89.3 (78.0 – 93.1)
	July	77.5 (72.4 – 89.6)	81.7 (74.3 – 90.6)	89.9 (79.4 – 96.2)	85.8 (76.3 – 90.9)
	August	81.9 (72.9 – 92.8)	87.6 (77.4 – 94.5)	95.3 (87.2 – 99.9)	90.4 (83.6 – 93.8)
	September	75.7 (70.4 – 86.3)	77.3 (73.8 – 85.8)	83.5 (73.6 – 87.9)	79.7 (76.8 – 84.2)
	October	-	-	-	-
	November	-	-	-	-
	December	85.2 (71.5 – 102.4)	88.1 (77.1 – 98.1)	94.0 (87.2 – 99.6)	89.7 (84.7 – 96.7)
	January '25	82.2 (69.1 – 97.8)	86.7 (75.8 – 95.7)	93.1 (82.4 – 98.5)	87.6 (77.1 – 91.4)
	February	86.2 (69.1 – 103.0)	88.9 (75.0 – 112.6)	94.0 (81.6 – 99.6)	89.7 (77.5 – 102.7)
	Total	**82.5 (71.7 – 100.5)**	**86.9 (75.9 – 98.7)**	**93.8 (80.6 – 100.8)**	**88.8 (76.4 – 94.7)**
SNMPAM02	May '24	74.5 (66.2 – 93.4)	78.4 (71.1 – 96.1)	87.0 (75.0 – 98.4)	84.0 (81.8 – 91.9)
	June	81.9 (68.8 – 96.8)	84.9 (72.4 – 93.6)	94.4 (83.0 – 100.9)	90.0 (81.8 – 93.5)
	July	76.6 (67.0 – 91.9)	80.3 (79.9 – 90.5)	91.2 (77.4 – 100.7)	86.6 (79.6 – 91.2)
	August	82.3 (69.9 – 93.1)	86.0 (74.2 – 93.5)	95.2 (87.4 – 100.1)	90.7 (84.4 – 94.1)
	September	71.8 (66.5 – 83.7)	73.8 (70.5 – 83.9)	85.0 (77.4 – 90.6)	83.9 (79.7 – 85.5)
	Total	**79.3 (67.6 – 94.1)**	**83.0 (71.3 – 93.3)**	**93.0 (78.8 – 100.1)**	**88.4 (80.7 – 93.3)**

04887
DORIS-PAM_Ambient

Embedded file 1. *'04887 DORIS-PAM_Ambient_sound_statistics_FINAL_Issue01.xlsx' providing an overview of ambient sound statistics across all third-octave bands for monitoring locations SNMPAM01 and SNMPAM02, summarised across the entire monitoring period covered by Deployments 1–3, as well as per month.*

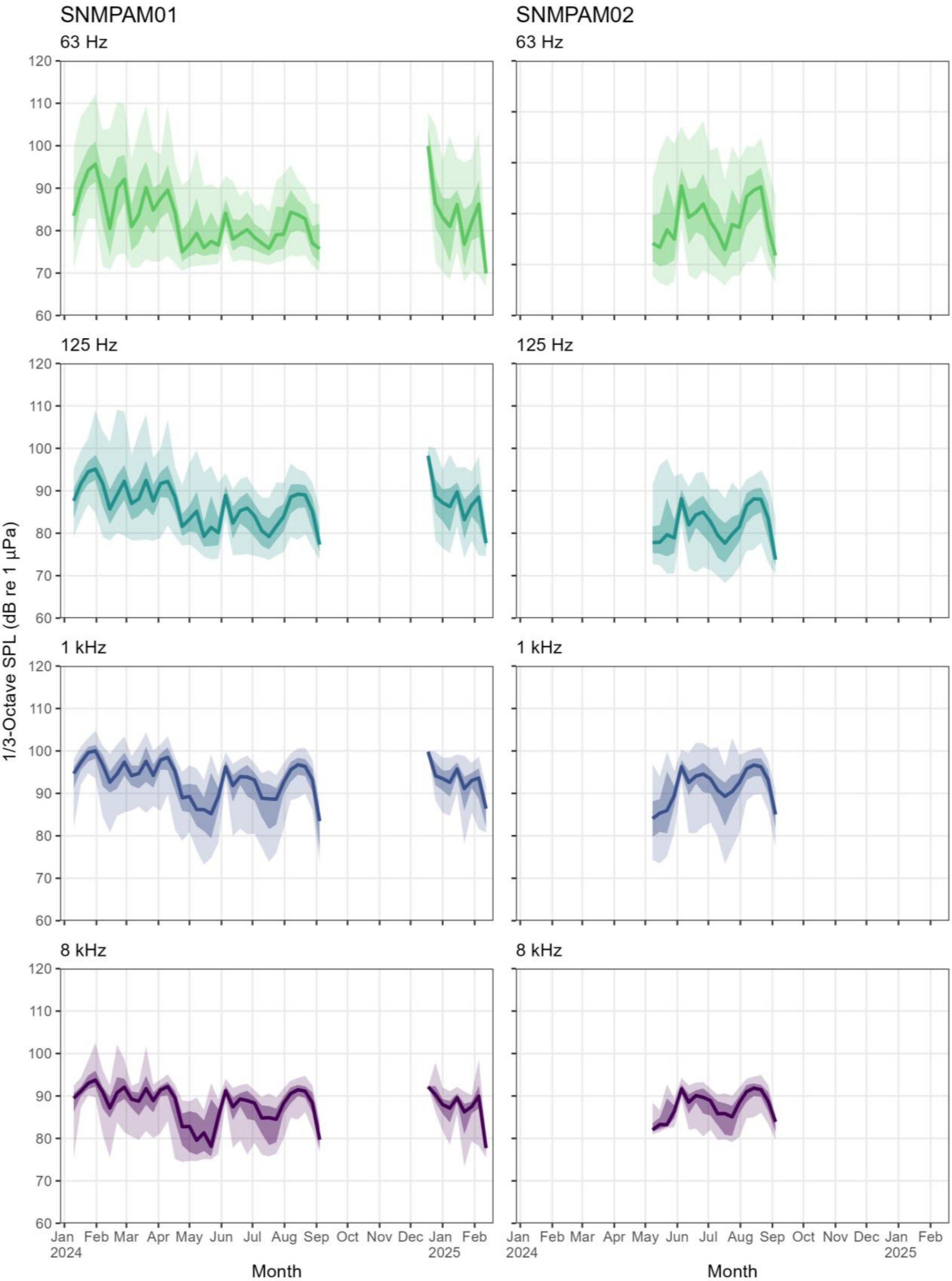

Figure 19. *Median (dark line) and 5th, 25th, 75th, and 95th percentiles (sharded ribbons) for third-octave band sound pressure levels with centre frequencies of 63 Hz, 125 Hz, 1 kHz, 8 kHz as measured at SNMPAM01 and SNMPAM02 during Deployments 1–3.*

3.4 Fish tag data

During Deployment 1, no signals transmitted by fish tags were received at SNMPAM01. On the 24th April 2024, signals from another Acoustic Release receiver unit were detected for about 20 minutes (Table 6). This may have been one of the fish acoustic tagging receivers deployed within the proposed Spiorad na Mara offshore windfarm array area over the summer period (~April – September).

During Deployment 2, signals transmitted by two fish tags were received at SNMPAM01 and SNMPAM02 (Table 6). Tag transmitter ID A69-9001-3153 was detected on SNMPAM02 on the 15th July, and relates to a basking shark (*Cetorhinus maximus*) tagged off Achill (Ireland) on the 3rd April 2024 by the Marine Institute (Ireland). The spiny dogfish (*Squalus acanthias*) associated with tag transmitter ID A69-9002-3472 was detected on five days between the 13th May and 25th August across both acoustic moorings. This individual was tagged several years ago in the Minas Basin, Bay of Fundy, Nova Scotia, Canada by the Confederacy of Mainland Mi'kmaq (Nova Scotia, Canada).

Additionally, signals from another Acoustic Release receiver unit (A69-1601-60683) were detected at 09:02 and 09:12 UTC on the 11th May 2024 by SNMPAM01, and subsequently from 09:12 to 10:04 UTC by SNMPAM02 (Table 6). As before, this may have been one of the fish acoustic tagging receivers within the proposed Spiorad na Mara offshore windfarm array area.

The third fish tag detection was made at SNMPAM02 during the final deployment. Tag A69-9001-3154 was detected on the 19th September 2024 and revealed to be deployed on a male basking shark of over 8m in length that was also tagged in Dooagh Bay, Achill, Ireland on the 3rd April 2024 by the Marine Institute.

Table 6. *Overview of detected fish tags and Acoustic Release receiver units at SNMPAM01 and SNMPAM02 during Deployments 1 & 2.*

Equipment	Transmitter ID	Species	Date and Time (UTC)	Acoustic mooring
Fish tag	A69-9002-3472	Spiny dogfish	13/05/2024 04:46	SNMPAM02
			14/05/2024 22:08 – 22:34	SNMPAM01
			18/05/2024 06:01 – 06:10	SNMPAM01
			06/08/2024 18:25 – 18:35	SNMPAM02
			25/08/2024 20:34 – 20:45	SNMPAM01
	A69-9001-3153	Basking shark	15/07/2024 08:03 – 08:09	SNMPAM02
	A69-9001-3154	Basking shark	19/09/2024 00:29	SNMPAM02
Acoustic Release	A69-1604-17383	N/A	24/04/2024 07:27 – 07:49	SNMPAM01
	A69-1601-60683	N/A	11/05/2024 09:02 – 09:12	SNMPAM01
			11/05/2024 09:12 – 10:04	SNMPAM02

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