PRESENCE OF HARBOUR PORPOISES AROUND THE DANISH OIL AND GAS PLATFORMS DAN F AND REGNAR DURING 2013-2025

Preliminary data overview

Technical Report from DCE – Danish Centre for Environment and Energy No. 399 2026

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Data sheet

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Abstract:	Aarhus University monitored harbour porpoise acoustic activity around active and inactive oil and gas platforms in the Danish North Sea during 2013 – 2025 using passive acoustic monitoring. While the aim is to determine the effect of decommission a platform, this preliminary report provides an overview of data collected until ultimo 2025.

Keywords:	Passive acoustic monitoring, PAM, harbour porpoise, C-POD, oil and gas platform, artificial reef.
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Preface

In 2013, Mærsk Oil & Gas (now Total Energies) and Aarhus University initiated a large-scale project to investigate the effect of oil and gas (O&G) activities on harbour porpoises, *Phocoena phocoena*. To date, the project has led to eight published studies including 1) effects of pile driving and ship presence (Teilmann et al., in press), 2) observations from platforms (Delefosse et al., 2018), 3) monitoring methodology (Clausen et al., 2019), 4) effects of a seismic survey (Sarnocińska et al., 2020), 5) fish abundance around platforms (Ibanez-Erquiaga et al., 2025), 6) the effect of operating platforms and noise (Clausen et al., 2021), 7) decommissioning and fish (Jeanbeyh et al., 2025), and 8) summary of the long-term monitoring program (Delefosse et al., 2020) (Fig. 1.1.). In addition, three leaflets and a summary report were made by Aarhus University in 2025 as an easy guideline to future attempts to reduce impacts on harbour porpoises from O&G activities.

This report describes passive acoustic monitoring (PAM) data of harbour porpoises collected around O&G platforms in the Danish North Sea carried out by Aarhus University for Total Energies. The monitoring took place between 2013-2015 and again between 2021-2025. The data collection method used in this report is a continuation of the method used in Clausen et al. (2021) where the attraction of harbour porpoises to O&G platforms was described.

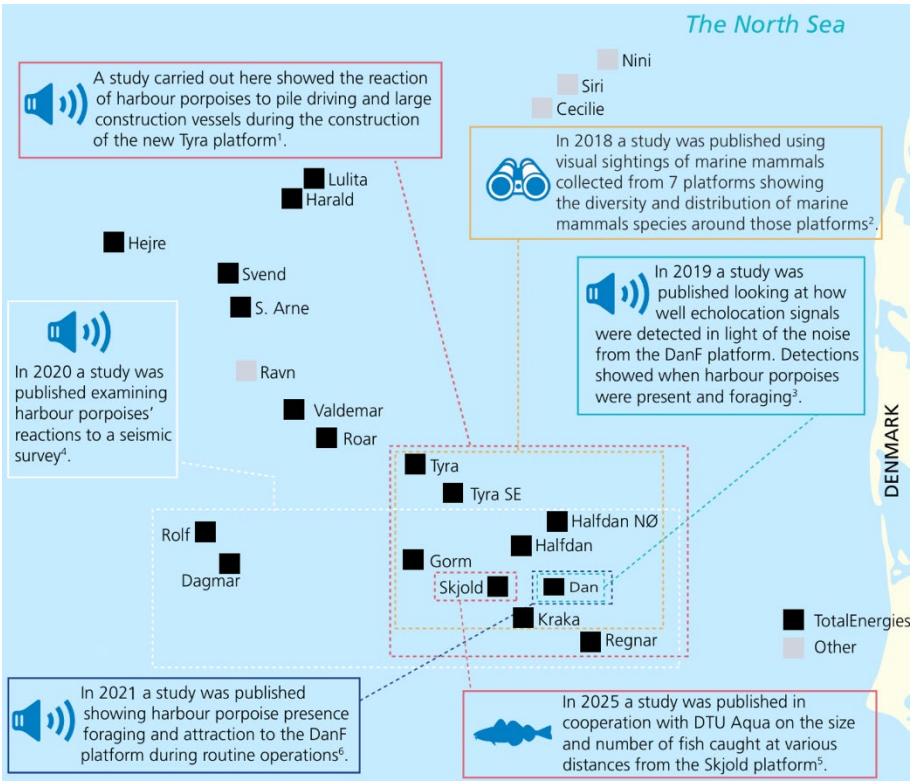

Figure 1. Map of marine mammal and fish studies (1-6) carried out around O&G platforms in the Danish North Sea in the past 14 years by Aarhus University and collaborators. Note that the map is not to scale but includes all the platforms in Danish waters. Studies 7 and 8 are not visualized on the map.

Sammenfatning

Dan F og Regnar er 2 af de 22 olie- og gasplatforme i den danske del af Nordsøen. Dan F er den største aktive platform i området, og Regnar er en inaktiv undersøisk brøndhovedinstallation, som var planlagt til dekommissionering i 2023. I forbindelse med dekommissionering af Regnar blev der udlagt PAM-stationer omkring Dan F og Regnar samt en kontrolstation mellem Dan F og Regnar i perioden 2021–2025.

Formålet med projektet er at vurdere effekterne på marsvin ved at fjerne den inaktive undersøiske brøndhovedinstallation Regnar. Fjernelsen af installationen afventer dd. stadig. I stedet giver denne rapport en status over PAM data indsamlet fra 2013–2025 fordelt på to moniteringsperioder, henholdsvis fra 2013–2015 og fra 2021–2025. Dette inkluderer data indsamlet fra de samme lokaliteter (Dan F, Regnar og kontrolstationen) i 2013–2015 til undersøgelsen af marsvins tiltrækning til olie- og gasplatforme (Clausen et al., 2021). I denne rapport præsenteres data for marsvins ekkolokaliseringsaktivitet, varighed af ophold (encounters) og fødesøgning på de forskellige lokaliteter i de to perioder. Egentlige statistiske analyser afventer, at Regnar fjernes.

Passiv akustisk monitorering i perioden 2013–2015 gav en datadækning på 77 %, mens den tilsvarende dækning i perioden 2021–2025 var 68 %. Perioder uden data skyldes f.eks. forsinkede eller tabte udlægninger. Marsvin blev registreret året rundt på alle stationer i begge overvågningsperioder. Sæsonmønstre viste højere aktivitet fra cirka juli til januar omkring begge platformslokaliteter i 2013–2015, mens dette mønster i perioden 2021–2025 primært blev observeret omkring Regnar. Marsvine-encounters havde en længere varighed omkring platformslokaliteter sammenlignet med kontrolstationen i begge perioder. Mens fødesøgning primært fandt sted om natten i den første periode (2013–2015) og hyppigere omkring platforme, var disse mønstre mindre udtalte i den anden periode (2021–2025). Der var betydelig variation mellem årene i begge perioder i marsvinenes tilstedeværelse og fødesøgning.

Summary

Dan F and Regnar are 2 of the 22 O&G platforms in the Danish North Sea. Dan F is the largest active platform in the area, and Regnar is an inactive subsurface wellhead, which was due for decommissioning in 2023. In relation to the decommissioning of Regnar, PAM stations were deployed around Dan F, Regnar and a control station between Dan F and Regnar during 2021-2025.

The purpose of the project is to assess the effects on harbour porpoises of decommissioning the inactive subsurface wellhead, Regnar, but the removal of the subsurface wellhead still awaits. Instead, this report gives a status of PAM data collected during 2013-2025 across two monitoring periods, 2013-2015 and 2021-2025, respectively. This includes data collected from the same sites (Dan F, Regnar, and the control) during 2013-2015 for the study on the attraction of harbour porpoises to O&G platforms (Clausen et al., 2021). In this report, harbour porpoise echolocation activity, encounter duration, and foraging effort in the different sites during the two monitoring periods are presented. Advanced statistical analysis awaits the removal of Regnar.

Passive acoustic monitoring during 2013-2015 yielded a data coverage of 77 % while the corresponding coverage between 2021-2025 was 68 %. Periods without data were caused by e.g. delayed or lost deployments. Harbour porpoises were present year-round at all stations in both monitoring periods. Seasonal patterns indicated higher activity from approximately July to January around both platform sites during 2013-2015, while during the second sampling period, 2021-2025, this pattern was primarily observed around Regnar. Harbour porpoise encounters had a longer duration around platform sites compared to the control site in both periods. While foraging predominantly occurred during the night in the first period (2013-2015), and more frequent around platforms, these patterns were less pronounced in the second period (2021-2025). There was considerable interannual variation within both periods in the presence of harbour porpoises and foraging effort.

1 Background

Harbour porpoises are the most common marine mammal in the Danish North Sea, and high densities of harbour porpoises in the central North Sea overlap with areas where Danish O&G platforms are located (Gilles et al., 2016). Harbour porpoises are attracted to platforms presumably due to higher prey abundance around the structures resulting from artificial reef dynamics and higher biological production merging on and around the structures (Birchenough & Degraer, 2020; Todd et al., 2016). The platforms' hard substrate serves as habitat for several fouling species such as mussels, barnacles, anemones, and macroalgae (Guerin et al., 2007; Todd et al., 2018) with associated increases in biodiversity, fish density, and fish size closer to the platforms (Ibanez-Erquiaga et al., 2025), thereby increasing prey availability for harbour porpoises. In combination with a 500-m fishing exclusion zone around each of the O&G platforms, which results in less disturbed seabed, they effectively comprise small marine protected areas in a heavily trawled area such as the North Sea.

As O&G platforms come to the end of their operational lives, the OSPAR Commission's decision 98/3 (www.ospar.org/convention) requires a complete removal of offshore installations in the North Sea. Nonetheless, the loss of hard substrate and its associated biodiversity in combination with the impacts on benthic communities after the termination of fishery exclusion zones following removal, should be considered in future O&G decommissioning (Fowler et al., 2019). If, instead, structures are cleaned and left fully or partially in place following decommissioning, the reef effect will persist while operation associated noise will disappear, rendering O&G structures likely to become even more attractive to marine life.

While the attraction of harbour porpoises to O&G platforms has been documented, harbour porpoises are also known to respond to loud impulsive noise and continuous noise, both of which are associated with operational O&G platforms (e.g. noise from construction work, vessels, and the operation of production- and processing equipment such as pumps, generators and turbines) (Teilmann et al., in press). Porpoise reactions to noise vary in severity depending on the sound pressure level and sound characteristics, and reactions may occur both at a physiological level (e.g. stress hormone increase, hearing damage) and lead to changes in behaviour (e.g. flee, stop feeding, avoid the area) (Elmegaard et al., 2023; Tougaard 2021).

Clausen et al. (2021) specifically set out to answer whether O&G platforms attract or deter harbour porpoises, addressing the trade-off between the noisy environment and the potential gain through higher prey abundance associated with platforms. The study used PAM during 2013-2015 and found that harbour porpoises were present year-round at all distances from Dan F, the largest O&G platform in the Danish North Sea, with two distinct seasonal high-activity periods. From July to January, harbour porpoises were more frequently detected near Dan F and Regnar, an inactive subsurface wellhead, compared to a control site located 6.4 km east of Dan F. Similarly, foraging rates during this period were higher at the two O&G structure sites compared to the control site 6.4 km from the platforms. In the high activity period, a strong diel pattern in harbour porpoise presence and foraging was found, with a higher relative foraging effort at night within 200 m of Dan F, and more

foraging during the day around Regnar. Thus, the study demonstrated an attraction of harbour porpoises to active platforms, possibly caused by the artificial reef effect, despite the noisy environment.

Building on Clausen et al. (2021), this report presents the harbour porpoise activity from 2013-2015 as well as from newer deployments of PAM from 2021-2025. The report gives an overview of data collected from stations around the active platform Dan F, the inactive subsurface wellhead, Regnar, and the control station 6.4 km from Dan F (Fig. 1.2.) during the entire period from 2013-2025. Thus, the report provides a status of data and illustrates patterns of harbour porpoise echolocation activity, encounter duration, and foraging behaviour around active and inactive O&G structures in the Danish North Sea. The removal of the inactive subsurface wellhead Regnar, due in 2023, still awaits due to company priorities. Thus, the effects of the removal will be determined, once the structure has been removed.

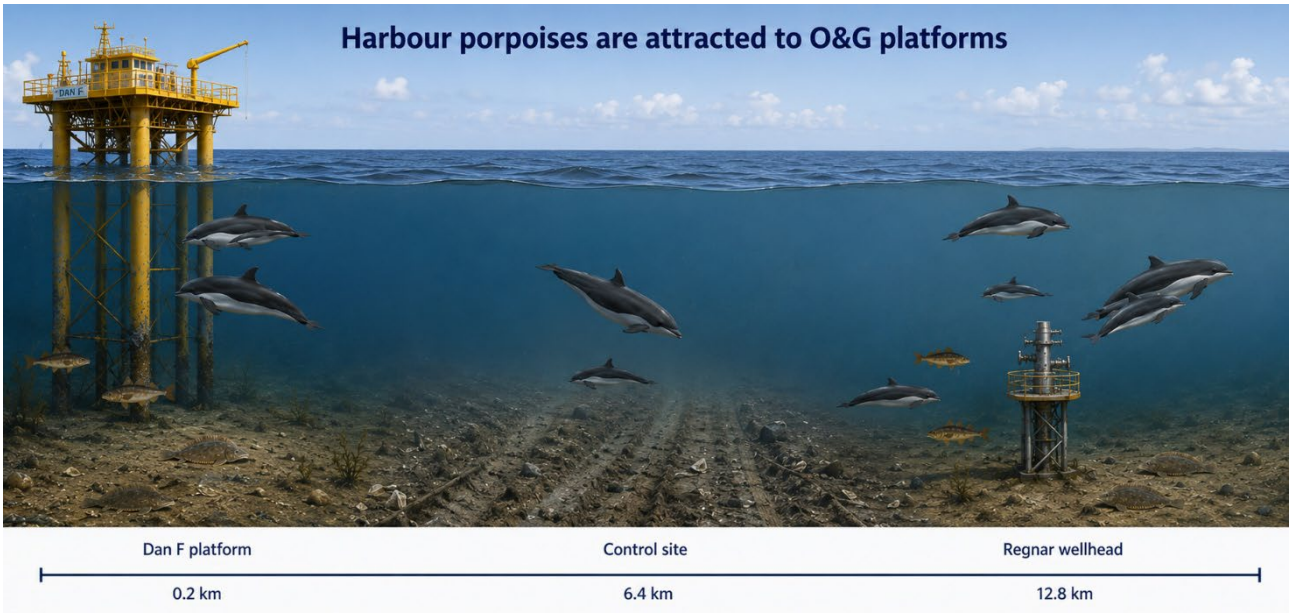

Figure 1.1. Conceptual illustration of harbour porpoise and fish abundance around the active oil and gas platform, Dan F, the inactive subsurface wellhead Regnar, and a control site 6.4 km east of Dan F in the Danish North Sea. Modified from illustration by Jamie Testa (AI generated).

2 Materials and methods

2.1 Study sites and experimental design

Dan F is a large operational O&G complex with a seabed footprint of 6996 m², while Regnar, the inactive subsurface wellhead has a footprint of 93 m² (Delefosse et al., 2018). The installations are located in the North Sea approximately 200 km west of the Danish Westcoast (Fig. 2.1.), in an area characterized by sandy sediments and relatively flat bathymetry ranging from 40 – 46 m.

PAM was carried out during two periods: the first from July 2013 to July 2015 and the second from May 2021 to November 2025. PAM stations were deployed around Dan F, Regnar, and a control site 6.4 km east of Dan F. Data collection at Regnar is ongoing and will continue until it is removed and a period after removal to uncover the effect of platform removal (decommissioning).

At the three study sites, harbour porpoise presence was monitored using acoustic harbour porpoise detectors C-PODs (Chelonia Ltd, Penzance, UK). From 2013-2015, 2 acoustic monitoring stations were deployed at Dan F, while 1 station was deployed at Regnar and the 6.4 km-control site, respectively. From 2021-2025, 2 acoustic monitoring stations were deployed at Dan F and Regnar, respectively, while 1 station was deployed at the 6.4 km-control station (Fig. 2.1.). Data was collected at each station in a series of successive C-POD deployments: 7 during 2013-2015 (named Alfa-Golf) and 8 during 2021-2025 (named A-H) (Appendix A). The exact positions used during the two monitoring periods are slightly different due to platform operation issues and therefore also named differently. However, all positions were either placed 200 m from a platform or 6400 m from Dan F and should therefore be comparable between years.

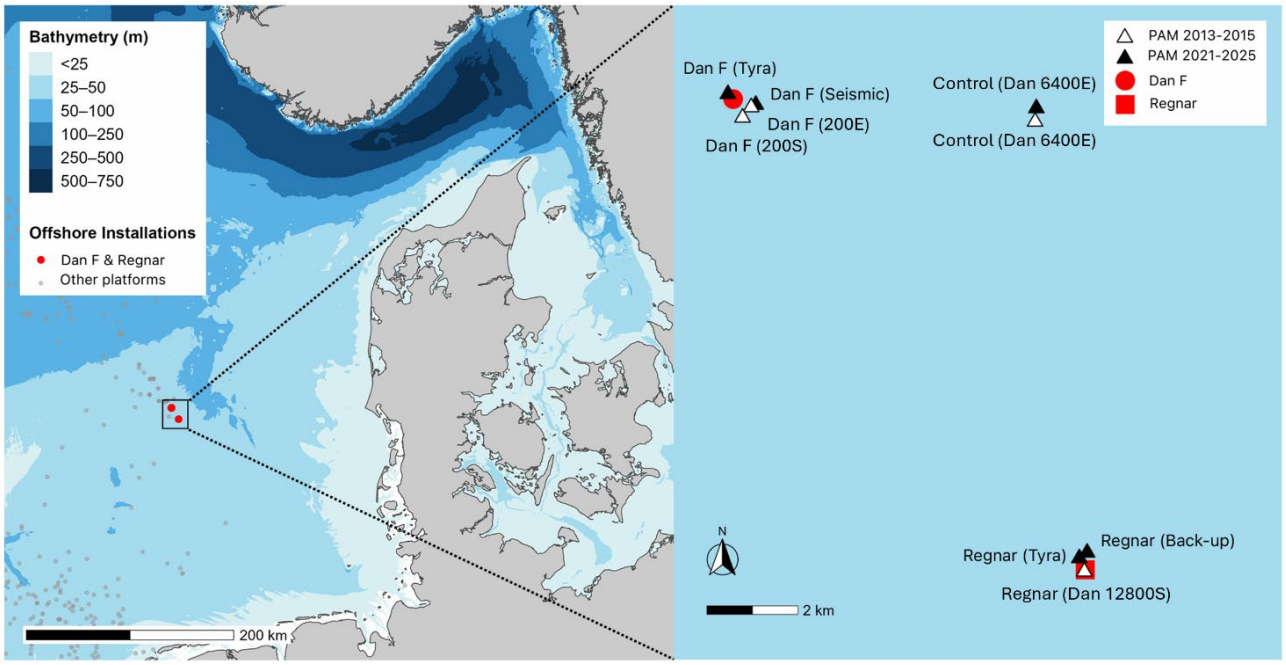

Figure 2.1. Study site map showing the location of passive acoustic monitoring stations (PAM, triangles) during the 2013-2015 and 2021-2025 monitoring periods. Stations were deployed around the active platform, Dan F (red circle), the submerged wellhead, Regnar (red square), and at the control site located 6.4 km east of Dan F.

2.2 Data analysis

Data processing

C-POD data were processed with CPOD.exe (v2.048). CP1 files were processed to CP3 files via the built-in KERNO classifier. The click train filter was set to include only 'NBHF' and 'unclassed' click trains of all qualities with a minimum of five clicks, a click frequency of 100 – 160 kHz, and a minimum duration of 10 cycles (Figure 2.2.). These settings were used by Clausen et al. (2021) and have been shown to perform slightly better than a standard filter for harbour porpoise detection (HiMod) in the noise environment around offshore installations in the North Sea (Clausen et al., 2019). Fig. 2.3. shows a comparison of filter performance on harbour porpoise detection.

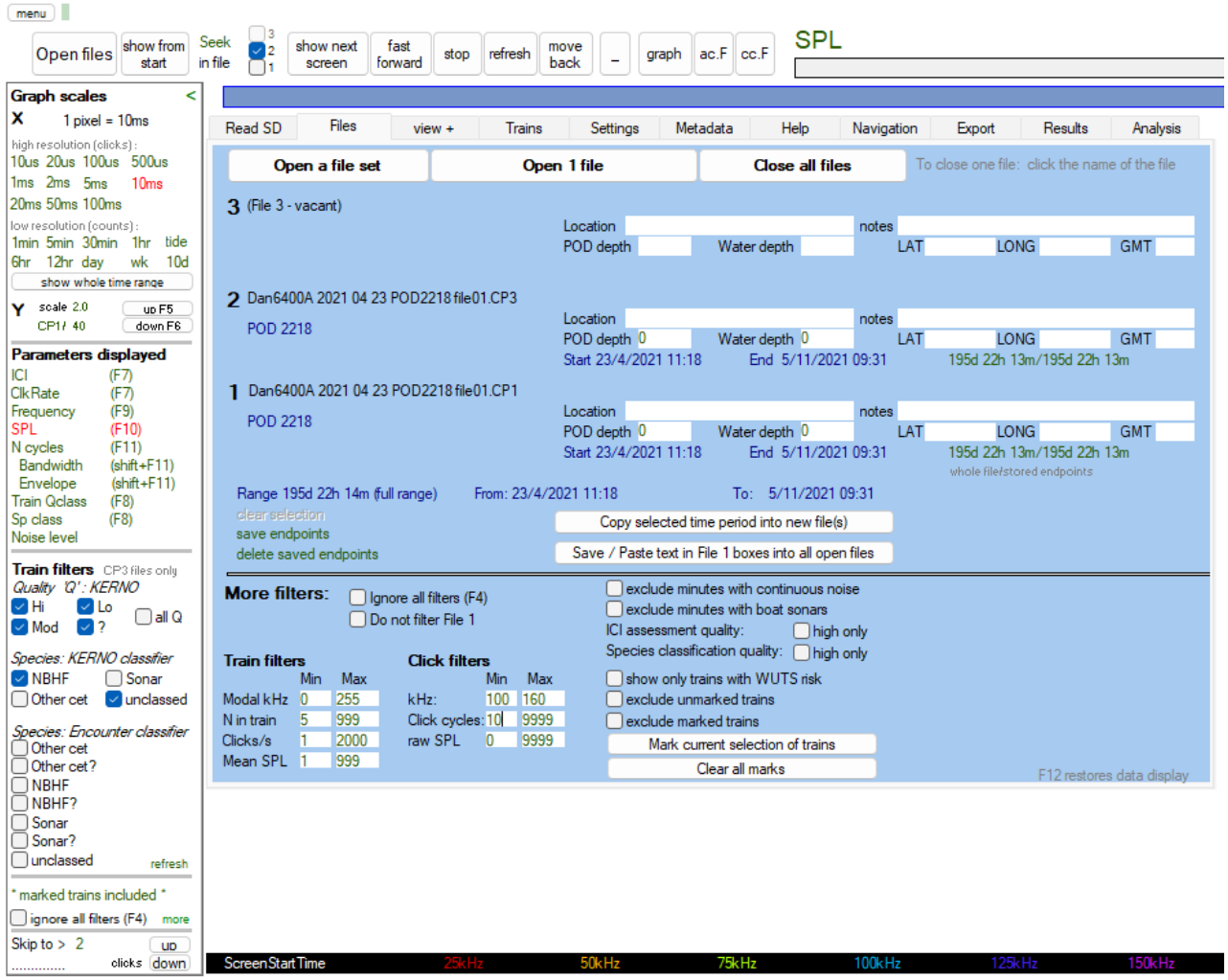

Figure 2.2. Click train filter settings for PPM (porpoise positive minutes) extraction in CPOD.exe following the 'PorpFilter' in Clausen et al. (2019, 2021).

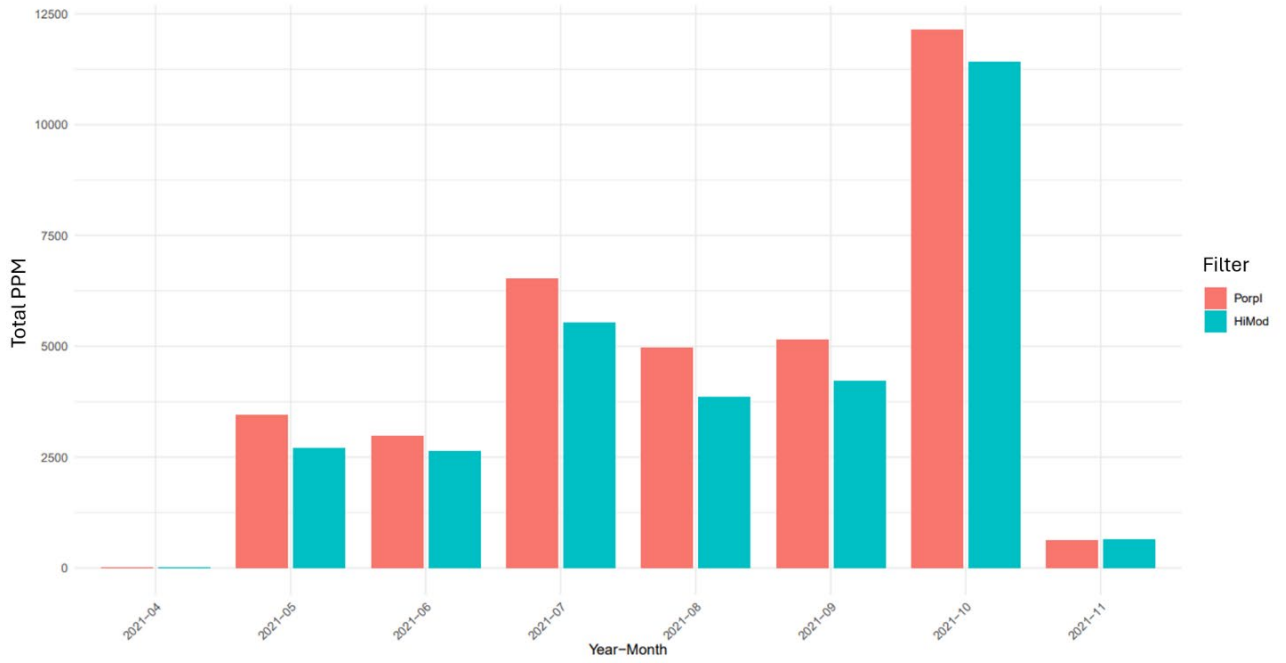

Figure 2.3. Example of difference in detected harbour porpoise positive minutes (PPM) across months using 'PorpFilter' (PorpI, red) and the standard filter 'HiMod' (blue), respectively. Data are from deployment A in 2021 around the control site 6.4 km from Dan F.

Data were exported as porpoise positive minutes (PPM, i.e. a minute with at least one click train detected) following Clausen et al. (2021). All inter-click intervals (ICI) were extracted with the ICI assessment quality set to 'high only' to match the extraction of Clausen et al. (2021) and therefore only click trains with ICIs shorter than 15 ms were extracted. These trains are most frequently characteristic of echolocation buzzes (Sørensen et al., 2018), which are used during prey pursuits (Verfuss et al., 2009; Wisniewska et al., 2016), although a fraction of these trains (26 %) are associated with social communication (Sørensen et al., 2018). Nonetheless, in this context we assume that the majority of such click trains are a measure of foraging (Sørensen et al., 2018) represented as buzzing positive minutes (BPM, i.e. a minute with a click train with ICIs < 15 ms). In the unlikely event that only ICIs < 15 ms are recorded, PPM and BPM will be the same. The duration of harbour porpoise encounters was calculated after classifying clicks into click train events. These were defined as the occurrence of at least one click train separated by a minimum of 10 minutes to the next click train detection.

Prior to analysis, data were filtered to include only full recording days (1440 min). Thus, the start date was the day after deployment and the end date was the day before retrieval or detachment of the C-POD due to a storm or trawling. Furthermore, only months with a data coverage of minimum 10 days were included from each C-POD deployment. Given instrument settings to prevent memory overload, recordings were set to stop when reaching a maximum of 4095 clicks within a minute. Thus, all minutes with more than 4095 clicks were subsequently excluded from all analyses, as this truncation yielded saturated minutes. Days with saturated minutes were still regarded as full recording days, while the reduced number of minutes were used in the data analyses. To explore diel patterns, each minute in a day was assigned to either 'day' or 'night' using civil twilight (UTC) in the 'suncalc' package (Thieurmel & Elmarhraoui, 2022) in R software (R Core Team, 2025).

Data gaps

Some stations have data gaps within the monitoring periods (Appendix A, Fig. 6.1.). For 2013-2015, data from June 2014 were excluded due to a production shutdown of 12 days at all platforms in the Danish North Sea. During shutdown, the noise from platforms would change and probably affect harbour porpoise behaviour and therefore not be comparable to the rest of the data collection. Furthermore, Dan F (200E) in deployment Charlie and the control station (Dan 6400E) in deployment Foxtrot were never deployed due to logistic challenges. Stations Regnar (Dan 12800S) in deployment Echo and Dan F (200E) in deployment Golf were lost. For 2021-2025, the control station (Dan 6400E) in deployment C was lost, while deployments G and H at the same station had no or only 3 days of data on the C-POD. Dan F (Tyra) in deployment H was excluded from the analysis given concerns about data validity. Finally, the data gap from the end of 2024 to mid-2025 was due to a delay of deployment H.

Analysis of echolocation, encounter duration, and foraging effort

For the present analysis, only descriptive statistics were used to explore patterns of harbour porpoise presence, encounter duration, and foraging in the data.

To investigate how much time harbour porpoise echolocation was present, we calculated the mean percentage of PPM out of all possible recorded minutes (excluding saturated minutes) per day and night at each station pooled across years within the two periods 2013-2015 and 2021-2025. Interannual variation is shown in Appendix B (Figs. 7.1. & 7.2.).

To explore how long the encounters were, we calculated the mean and median duration of harbour porpoise encounters per station pooled across years within the two periods. Diel patterns of encounter duration are shown in Appendix B (Figs. 7.3. & 7.4.). Note, however, that imposing day/night grouping led to encounters around dusk and dawn being split up into two separate encounters, the durations of which were then determined by how many minutes of that encounter occurred during day and night, respectively.

To explore the relative time with echolocation that was dedicated to buzzing, and thereby foraging, we calculated the mean percentage of BPM to PPM (%BPM/PPM) per day and night at each station pooled across years within the two periods. Interannual variation is shown in Appendix B (Figs. 7.5. & 7.6.).

3 Results

3.1 Data coverage

The theoretical maximum of recording days across the 4 acoustic monitoring stations from July 2013 to July 2015 was 3000 days. After filtering data and excluding the two station deployments that were lost, the two station deployments that were never deployed, along with the month of June 2014 due to the production shutdown, 2311 days were included in the analysis out of the 3000 possible days. This corresponds to an effective data coverage of 77% (Fig. 3.1.).

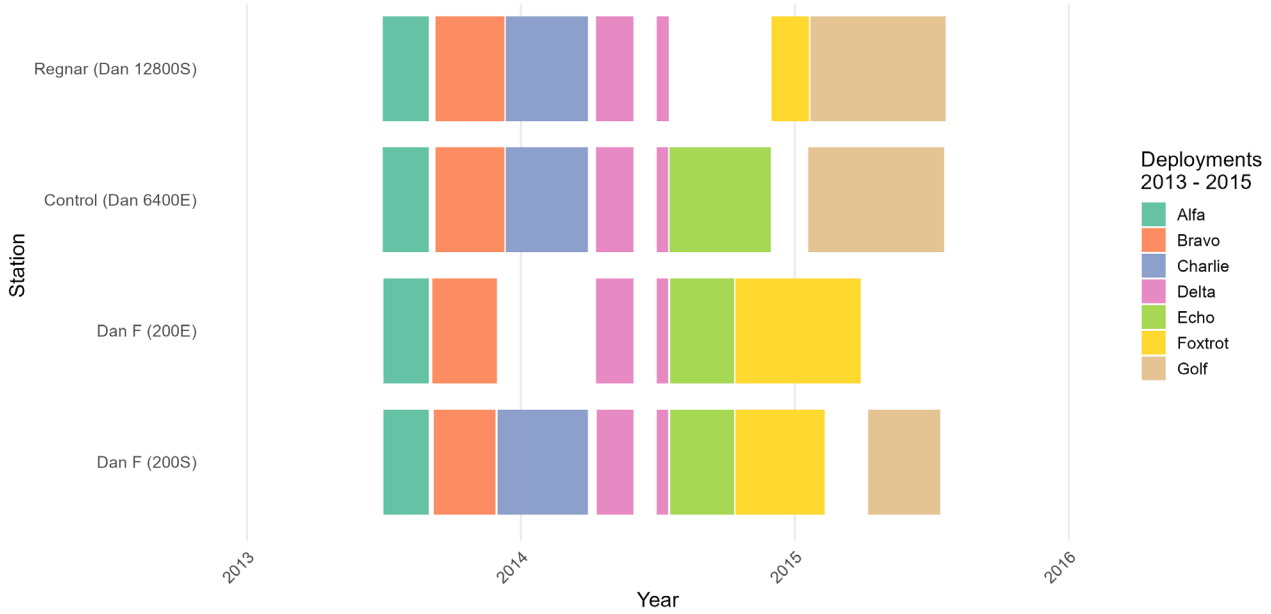

Figure 3.1. Acoustic monitoring periods during 2013 – 2015 from four stations around Dan F (200E & 200S), the control site (Dan 6400E), and Regnar (Dan 12800S). Monitoring started in July 2013 and ran until July 2015. June 2014 was excluded due to the production shutdown at O&G rigs in the Danish North Sea. See Appendix A for specific dates of deployments.

The theoretical maximum of recording days across the 5 acoustic monitoring stations from May 2021 to November 2025 was 8270 possible days. After filtering data and excluding the lost and questionable station deployments, along with CPODS without data, 5633 days were included in the analyses out of the 8270 possible days. This corresponds to an effective data coverage of 68% (Fig. 3.2.).

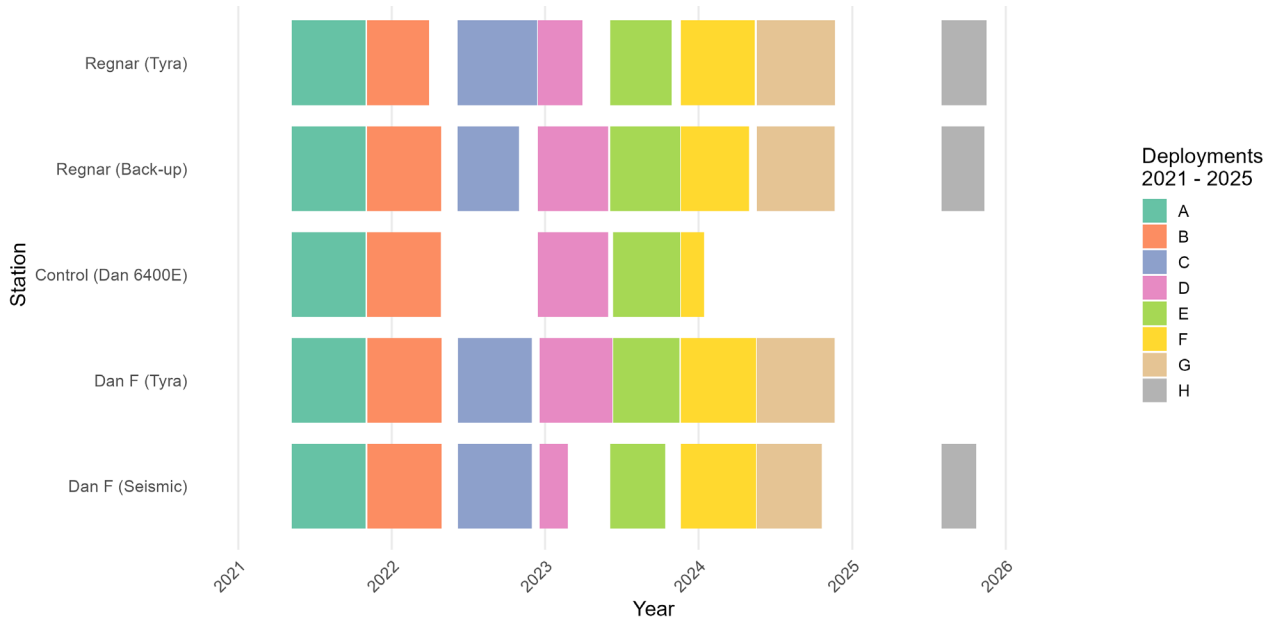

Figure 3.2. Acoustic monitoring periods during 2021 – 2025 from five stations around Dan F (Seismic & Tyra), the control site (Dan 6400E), and Regnar (Back-up & Tyra). Monitoring started in May 2021 and ended in November 2025. Dan F (Tyra) deployment H was excluded from the analysis given concerns about data validity. Deployment H was delayed. See Appendix A for specific dates of deployments.

3.2 Spatial and diel patterns of echolocation

Harbour porpoise echolocation was present year-round at all stations in both monitoring periods (Figs. 3.3. & 3.4.), with seasonal patterns generally indicating higher harbour porpoise activity approximately from July to January.

In the high activity months during 2013-2015, harbour porpoises were more frequently detected at platform sites, Dan F and Regnar. Dan F stations showed higher activity during the night, while Regnar showed higher activity during the day (Fig. 3.3.). This pattern, however, was strongly influenced by very high nighttime activity at Dan F in 2013 (Appendix B, Fig. 7.1). The control site showed no clear seasonal- or diel patterns of harbour porpoise activity (Fig. 3.3.).

In the high activity months during 2021-2025, harbour porpoises were most frequently detected at Regnar during the day, while activity was relatively lower around Dan F and the control site (Fig. 3.4.). At these stations, the diel pattern switched from more daytime activity from August to October to more nighttime activity from November to February (November to December at the 6.4 km control) (Fig. 3.4).

There was considerable interannual variation in harbour porpoise activity within each of the monitoring periods (Appendix B, Figs. 7.1. & 7.2.).

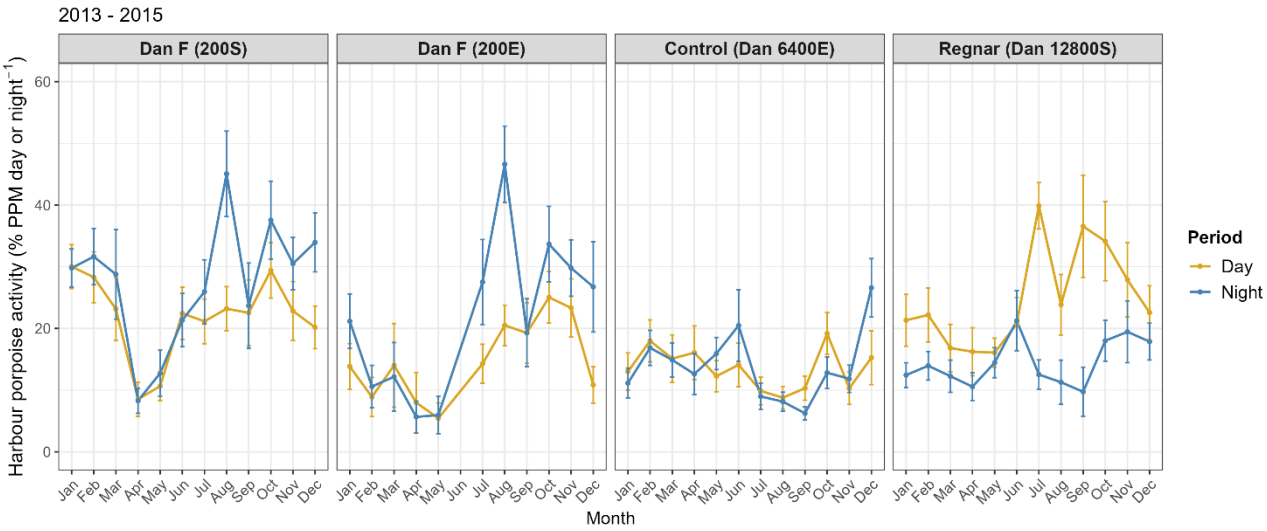

Figure 3.3. Harbour porpoise echolocation activity between 2013-2015 (percentage porpoise positive minutes per day or night, %PPM) across months per station. Error bars show the 95 % confidence intervals around the mean. See Fig. 7.1. (Appendix B) for echolocation activity at each station each year.

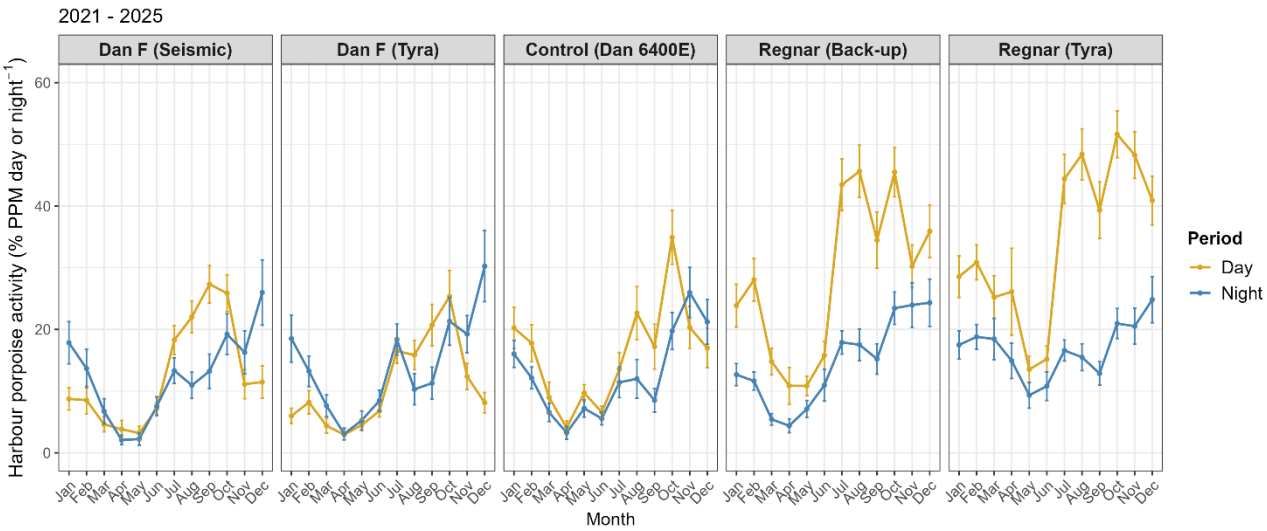

Figure 3.4. Harbour porpoise echolocation activity during 2021-2025 (percentage porpoise positive minutes per day or night, %PPM) across months per station. Error bars show the 95 % confidence intervals around the mean. See Fig. 7.2. (Appendix B) for echolocation activity at each station each year.

3.3 Harbour porpoise encounter duration

The duration of harbour porpoise encounters was longer at platform sites, Dan F and Regnar, compared to the control site in both periods (Figs. 3.5. & 3.6.). Mean encounter durations were notably higher than the medians due to occasional very long encounters (>1000 minutes) across all stations.

From 2013 – 2015, mean and median encounter durations were longest at the Dan F stations (Fig. 3.5.), while from 2021 – 2025, mean and median encounter durations were longest at the Regnar stations (Fig. 3.6.).

Mean and median encounter durations were longer during the day at Regnar, and longer by night at Dan F (Tyra), while only median encounter duration was slightly longer during night at the control site (Appendix B, Figs. 7.3. & 7.4.).

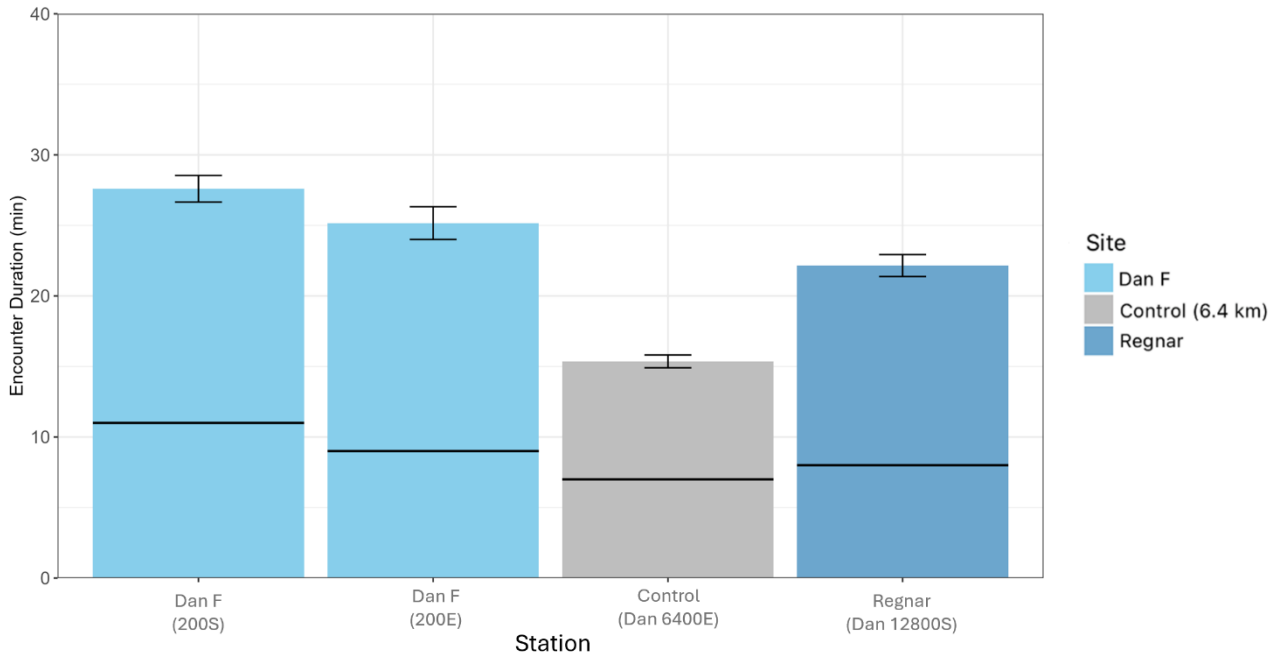

Figure 3.5. Harbour porpoise encounter duration in minutes per station during 2013 – 2015 with error bars showing 95 % confidence intervals around the mean. Median encounter duration is indicated by the horizontal line. See Fig. 7.3. (Appendix B) for encounter duration during day and night at each station.

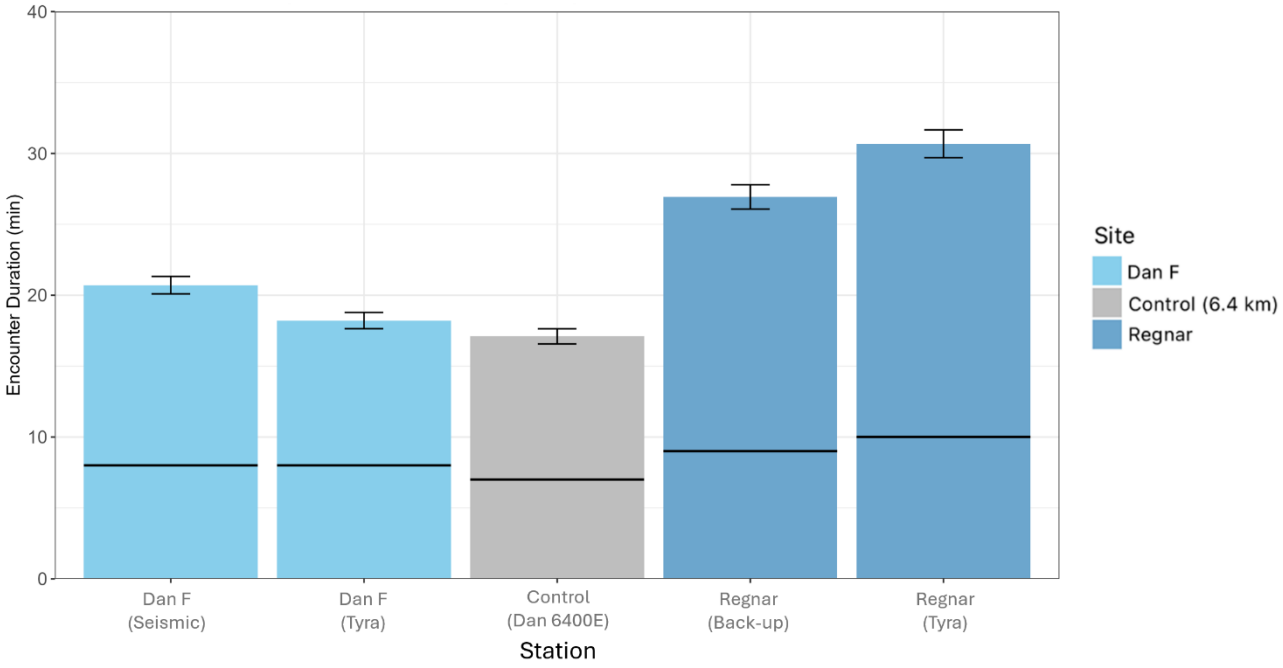

Figure 3.6. Harbour porpoise encounter duration in minutes per station during 2021 – 2025 with error bars showing 95 % confidence intervals around the mean. Median encounter duration is indicated by the horizontal line. See Fig. 7.4. (Appendix B) for encounter duration during day and night at each station.

3.4 Spatial and diel patterns of foraging

Harbour porpoise foraging (Figs. 3.7. & 3.8.) generally followed the pattern of high harbour porpoise echolocation activity (Figs. 3.3. & 3.4.) approximately from July to January.

Between 2013 – 2015, foraging occurred more frequently around platforms, Dan F and Regnar, compared to the control site. Foraging was highest during nighttime at all stations.

Between 2021 – 2025, spatial patterns between stations and also diel variation of foraging were less pronounced. Highest foraging rates were observed at the control site during October and November. However, this was based on only two years of data due to data gaps at this station, and when inspecting interannual variation in foraging, those two years had high levels across all sites compared to other years, which may have caused the high foraging rate at the control station (Appendix B, Fig. 7.6.).

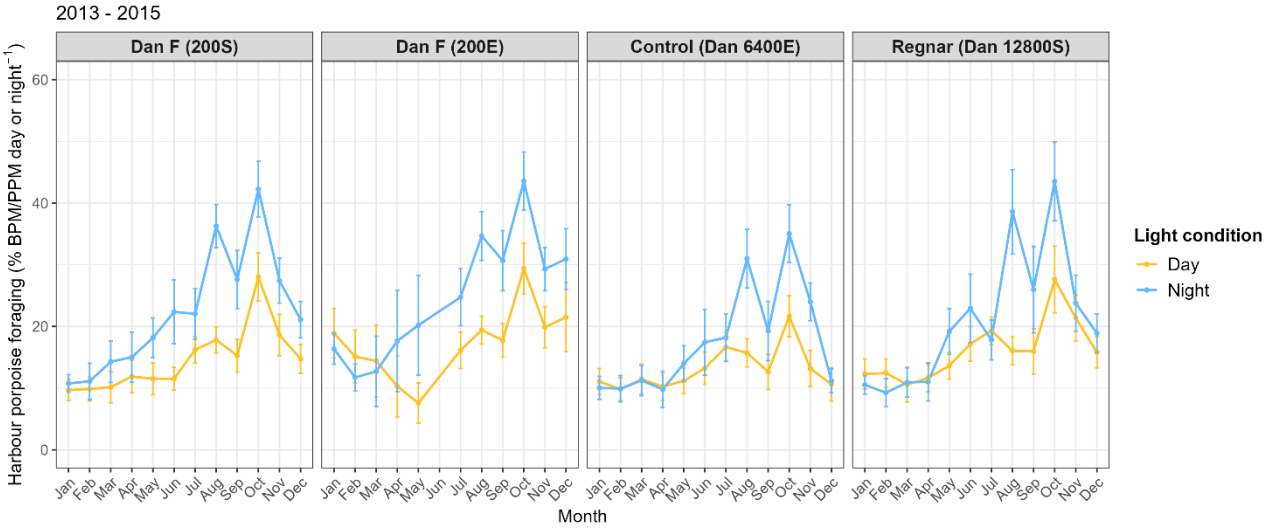

Figure 3.7. Harbour porpoise foraging activity during 2013 – 2015 (percentage buzzing positive minutes to porpoise positive minutes per day or night, %BPM/PPM) across months per station. Error bars show the 95 % confidence intervals around the mean. See Fig. 7.5. (Appendix B) for foraging activity at each station each year.

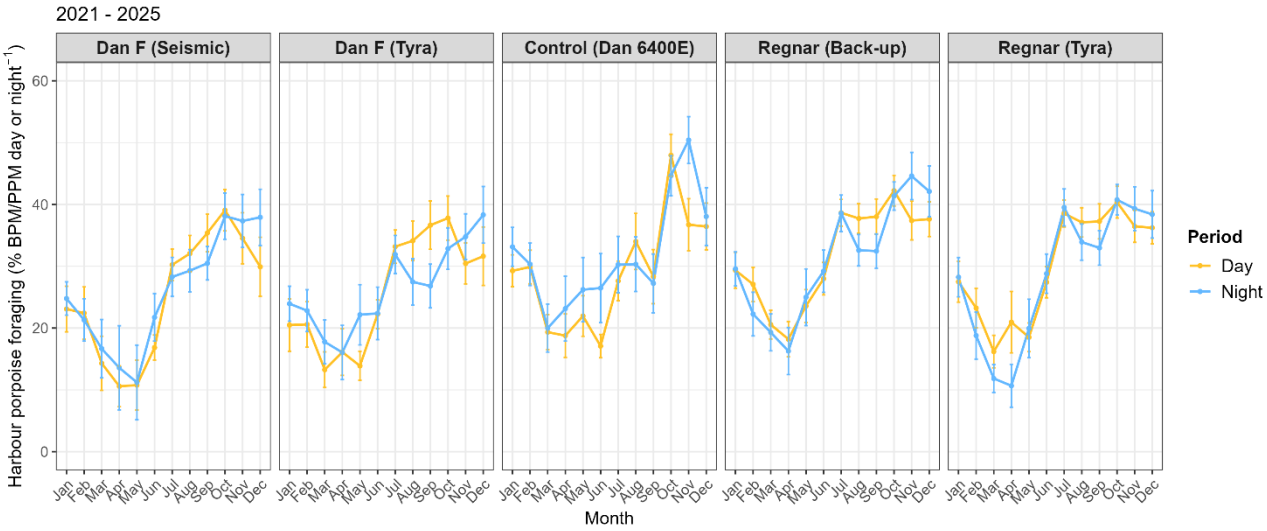

Figure 3.8. Harbour porpoise foraging activity during 2021 – 2025 (percentage buzzing positive minutes to porpoise positive minutes per day or night, %BPM/PPM) across months per station. Error bars show the 95 % confidence intervals around the mean. See Fig. 7.6. (Appendix B) for foraging activity at each station each year.

4 Conclusion

The purpose of this report was not to analyze changes in patterns of harbour porpoise activity, but rather to give an overview of all data that has been collected between 2013-2025 around Dan F, Regnar, and the control site 6.4 km from Dan F (see summary below). The removal of Regnar is yet to take place, and therefore effects of removing the structure remain unknown. However, the report provides a solid data foundation for assessing harbour porpoise activity in the area before determining the impact of removing the inactive subsurface wellhead from the seabed.

4.1 Summary of patterns in the data

Data from the two periods (2013-2015 and 2021-2025) of passive acoustic monitoring reveal patterns of (1) echolocation activity, (2) encounter duration, and (3) relative foraging effort around the active platform, Dan F, the inactive subsurface wellhead platform, Regnar, and the control site 6.4 km from Dan F:

1. Echolocation activity increased around the inactive subsurface wellhead in the second period, especially during the day, while activity was lower around the active platform in the second period. The control site showed an increase in echolocation activity in the second period, reaching levels comparable to the active platform.
2. Harbour porpoise encounters were generally longer at platform sites compared to the control site. Encounters were shorter around the active platform in the second period compared to the first, while the encounters were longer at the inactive subsurface wellhead platform in the second period compared to the first, and remained at similar levels at the control site.
3. Foraging predominantly occurred during the night in the first period, and foraging was also more frequent around platforms, but these patterns were less pronounced in the second period.

Even though the results from 2013-2015 were based on the same data as Clausen et al. (2021), levels of foraging in 2013-2015 in the present analysis were higher than those reported by Clausen et al. (2021). We tried to replicate the results from Clausen et al. (2021) but the ICI definition for buzzing that should have been set to 15 ms as written in the manuscript was accidentally set to 10 ms. In this report, we present higher BPM and thereby higher relative foraging efforts, as we have now correctly used the 15 ms definition for BPM.

4.2 Methodological considerations

Data coverage implications

Data gaps from locations with only one CPOD deployed (Figs. 2.1.) resulted in uncertainty around the visual comparison of mean estimates given the large interannual variation of data (Appendix B, Figs. 7.1. – 7.6.). Especially in 2021-2025, when estimates for Dan F stations were based on 4 – 5 years of data in the high activity period compared to only 2 years of data from the control site. Therefore, the patterns of harbour porpoise activity and foraging in this report should be interpreted with this caveat in mind until more sophisticated statistics are used.

Effects of station location on porpoise activity

Within the two periods of acoustic monitoring, stations from the same site showed more similar patterns of harbour porpoise activity than stations from different sites (Figs. 3.3 – 3.6.). This indicates that while stations in 2021-2025 were placed at slightly different locations than in the first period (2013-2015) (Fig. 2.1. & Appendix A), results from neighbouring stations are replicating the trend in harbour porpoise activity at each specific site.

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6 Appendix A

Deployment	Station	Depl at Lat Position WGS84 (DDM)	Depl at Long Position WGS84 (DDM)	First full day with data	Last full day with data	CPOD
Alfa	Dan F (200E)	55°28.602'N	005°06.707'E	02-07-2013	03-09-2013	2244
Alfa	Dan F (200S)	55°28.467'N	005°06.549'E	02-07-2013	05-09-2013	2200
Alfa	Control (Dan 6400E)	55°28.467'N	005°12.555'E	01-07-2013	07-09-2013	2218
Alfa	Regnar (Dan 12800S)	55°23.073'N	005°13.740'E	01-07-2013	07-09-2013	2243
Bravo	Dan F (200E)	55°28.596'N	005°06.723'E	05-09-2013	04-12-2013	2238
Bravo	Dan F (200S)	55°28.473'N	005°06.543'E	07-09-2013	28-11-2013	2206
Bravo	Control (Dan 6400E)	55°28.425'N	005°12.659'E	09-09-2013	10-12-2013	2245
Bravo	Regnar (Dan 12800S)	55°23.060'N	005°13.720'E	09-09-2013	10-12-2013	2214
Charlie	Dan F (200E)	Never deployed				
Charlie	Dan F (200S)	55°28.434'N	005°06.551'E	28-11-2013	09-04-2014	2200
Charlie	Control (Dan 6400E)	55°28.449'N	005°12.688'E	12-12-2013	09-04-2014	2218
Charlie	Regnar (Dan 12800S)	55°23.142'N	005°13.765'E	12-12-2013	09-04-2014	2243
Delta	Dan F (200E)	55°28.605'N	005°06.718'E	11-04-2014	16-07-2014	2244
Delta	Dan F (200S)	55°28.468'N	005°06.550'E	12-04-2014	16-07-2014	2240
Delta	Control (Dan 6400E)	55°28.364'N	005°12.673'E	11-04-2014	16-07-2014	2245
Delta	Regnar (Dan 12800S)	55°23.118'N	005°13.788'E	11-04-2014	17-07-2014	2214
Echo	Dan F (200E)	55°28.608'N	005°06.706'E	19-07-2014	12-10-2014	2244
Echo	Dan F (200S)	55°28.461'N	005°06.542'E	19-07-2014	12-10-2014	2240
Echo	Control (Dan 6400E)	55°28.465'N	005°12.658'E	18-07-2014	04-12-2014	2218
Echo	Regnar (Dan 12800S)	55°23.132'N	005°13.709'E	Lost CPOD		2239
Foxtrot	Dan F (200E)	55°28.606'N	005°06.697'E	14-10-2014	30-03-2015	2202
Foxtrot	Dan F (200S)	55°28.465'N	005°06.548'E	14-10-2014	10-02-2015	2203
Foxtrot	Control (Dan 6400E)	Never deployed				
Foxtrot	Regnar (Dan 12800S)	55° 23.097'	05° 13.689'	27-11-2014	20-01-2015	2252
Golf	Dan F (200E)	55° 28.602'	05° 06.709'	Lost CPOD		2243
Golf	Dan F (200S)	55° 28.463'	05° 06.546'	09-04-2015	14-07-2015	2220
Golf	Control (Dan 6400E)	55° 28.465'	05° 12.577'	19-01-2015	19-07-2015	2245
Golf	Regnar (Dan 12800S)	55° 23.073'	05° 13.711'	22-01-2015	21-07-2015	2443

Deployment	Station	Depl at Lat Position WGS84 (DDM)	Depl at Long Position WGS84 (DDM)	First full day with data	Last full day with data	CPOD/Acoustic release/Argos ID
A	Dan F (Tyra)	55°28.753`	05°06.237`	08-05-2021	31-10-2021	2219/3542/141976
A	Dan F (Seismic)	55°28.570`	005°06.710`	08-05-2021	02-11-2021	2206/1264/141975
A	Control (Dan 6400E)	55°28.572`	005°12.717`	08-05-2021	01-11-2021	2218/2264/141980
A	Regnar (Tyra)	55°23.255`	005°13.592`	08-05-2021	01-11-2021	2443/0780/141981
A	Regnar (Back-up)	55°23.310`	005°13.762`	08-05-2021	01-11-2021	2240/*/141982
B	Dan F (Tyra)	55°28.749`	05°06.236`	04-11-2021	02-05-2022	2250/2669/141975
B	Dan F (Seismic)	55°28.621`	05°06.816`	04-11-2021	30-04-2022	2245/2608/*(presumably 141976)
B	Control (Dan 6400E)	55°28.583`	05°12.683`	03-11-2021	28-04-2022	2207/2895/141977
B	Regnar (Tyra)	55°23.254`	05°13.581`	03-11-2021	02-04-2022	2445/2399/141981
B	Regnar (Back-up)	55°23.319`	05°13.746`	03-11-2021	29-04-2022	2447/2209/141980
C	Dan F (Tyra)	55°28.744`	05°06.250`	08-06-2022	07-12-2022	2443/3542/141982
C	Dan F (Seismic)	55°28.627`	05°06.818`	08-06-2022	06-12-2022	2218/3275/141980
C	Control (Dan 6400E)	55°28.584`	05°12.675`	Lost CPOD		2206/2969/141976
C	Regnar (Tyra)	55°23.258'	05°13.586	07-06-2022	13-12-2022	2238/1264/141979
C	Regnar (Back-up)	55°23.332	05°13.756'	07-06-2022	31-10-2022	2219/2756/141978
D	Dan F (Tyra)	55°28'6402	005°06'1432	19-12-2022	10-06-2023	2446/3262/226081
D	Dan F (Seismic)	55°28'6270	005°06'8189	19-12-2022	24-02-2023	2455/3348/226083
D	Control (Dan 6400E)	55°28'4732	005°12'5924	15-12-2022	03-06-2023	2207/1422/235834
D	Regnar (Tyra)	55°23'1432	005°13'4875	15-12-2022	03-04-2023	2203/3807/235831
D	Regnar (Back-up)	55°23'2117	005°13'6537	15-12-2022	03-06-2023	2250/1741/235829
E	Dan F (Tyra)	55°28'6403	005°06'1432	12-06-2023	17-11-2023	2214/2977/244548
E	Dan F (Seismic)	55°28'6270	005°06'8189	05-06-2023	14-10-2023	2218/0266/244549
E	Control (Dan 6400E)	55°28'4733	005°12'5917	12-06-2023	18-11-2023	2238/3456/244547
E	Regnar (Tyra)	55°23'1431	005°13'4878	05-06-2023	29-10-2023	2219/0473/244546
E	Regnar (Back-up)	55°23'2117	005°13'6539	05-06-2023	18-11-2023	2252/2644/244545
F	Dan F (Tyra)	55-28-7442	005-06-2491	20-11-2023	17-05-2024	2207/0115/226081
F	Dan F (Seismic)	55-28-6272	005-06-8178	20-11-2023	17-05-2024	2446/0435/235829
F	Control (Dan 6400E)	55-28-4734	005-12-5905	20-11-2023	14-01-2024	2250/3478/235831
F	Regnar (Tyra)	55-23-1424	005-13-4884	20-11-2023	14-05-2024	2455/2614/141978
F	Regnar (Back-up)	55-23-2102	005-13-6532	20-11-2023	06-05-2024	2203/1998/235834
G	Dan F (Tyra)	55-28.7440 N	005-06.2498 E	19-05-2024	20-11-2024	2456/1608/244551/2395
G	Dan F (Seismic)	55-28.6270 N	005-06.8180 E	19-05-2024	20-10-2024	2220/1918/226076/2401
G	Control (Dan 6400E)	55-28.4732 N	005-12.5911 E	Only 3 days of data on CPOD		2457/0950/226083/ -
G	Regnar (Tyra)	55-23.1430 N	005-13.4888 E	19-05-2024	21-11-2024	2445/1594/244560/ -
G	Regnar (Back-up)	55-23.2110 N	005-13.6539 E	19-05-2024	20-11-2024	2454/1719/226086/2398
H	Dan F (Tyra)	55°28.639`	05°06.143`	27-07-2025	11-12-2025	2453/1403/244554/134774808
H	Dan F (Seismic)	55°28.627`	05°06.819`	27-07-2025	23-10-2025	2444/0266/239551
H	Control (Dan 6400E)	55°28.473`	05°12.591`	No data on CPOD		2449/1794/141982
H	Regnar (Tyra)	55°23.142`	05°13.489`	26-07-2025	16-11-2025	2458/2279/244557/67407875
H	Regnar (Back-up)	55°23.211`	05°13.655`	27-07-2025	11-11-2025	2452/0505/141981

Figure 6.1. Overview of deployments of passive acoustic monitoring stations during 2013-2015 (top) and 2021-2025 (bottom) around Dan F, Regnar and a control station 6.4 km east of Dan F. Data gap reasons are shown in the overview. Coordinates of each station deployment, first and last full day of data, and the CPOD/ Acoustic release/ Argos ID are shown.

7 Appendix B

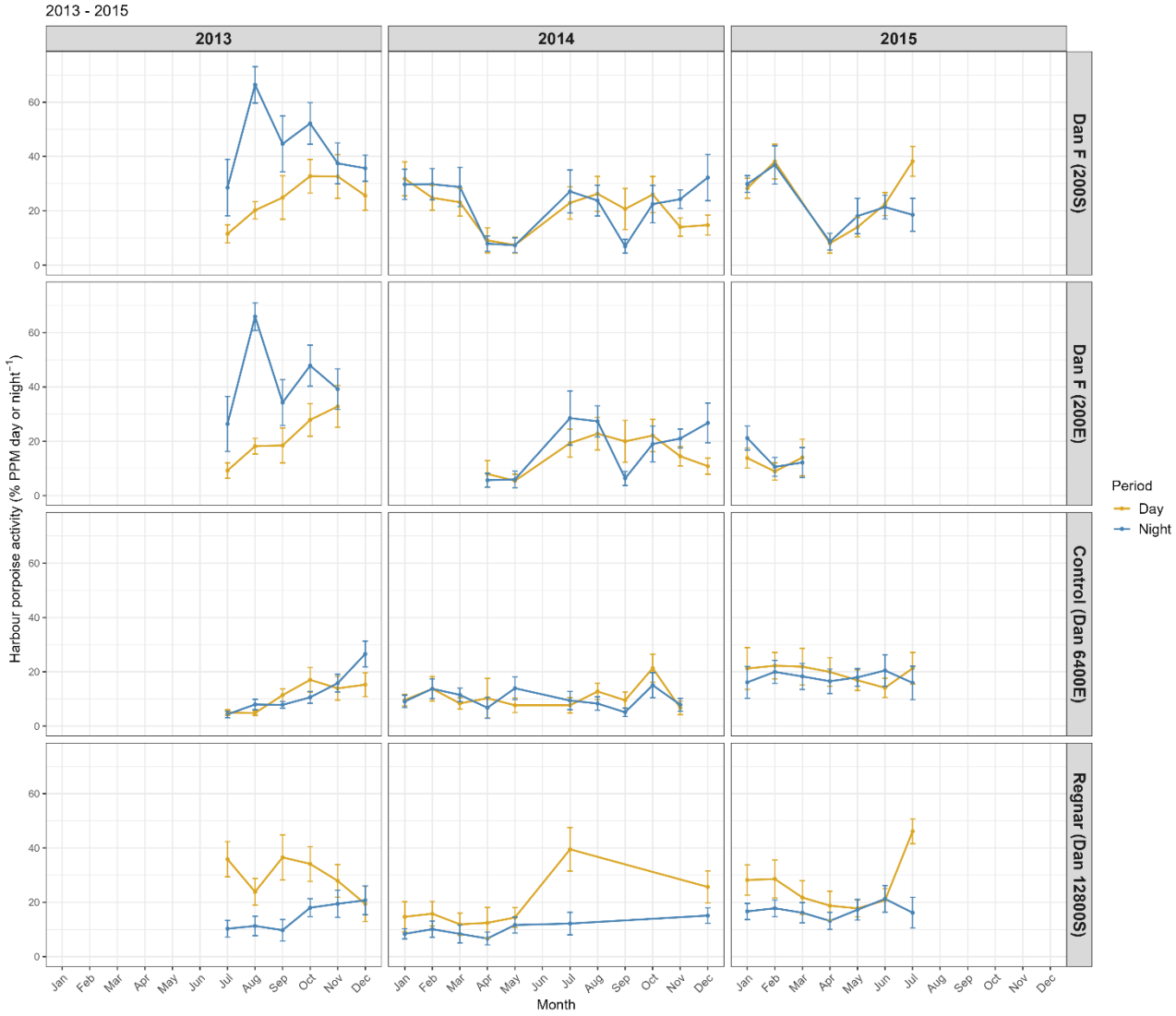

Figure 7.1. Monthly harbour porpoise echolocation activity (percentage porpoise positive minutes per day and night, %PPM) across years (2013 – 2015), stations, and day (yellow) and night (blue). Error bars show the 95 % confidence intervals around the mean. Monitoring started in July 2013 and ended in July 2015. Longer data gaps at Dan F (200E) and Regnar (Dan12800S) were due to lost or never deployed deployments, while the complete gap in data for June 2014 is explained by the production shutdown.

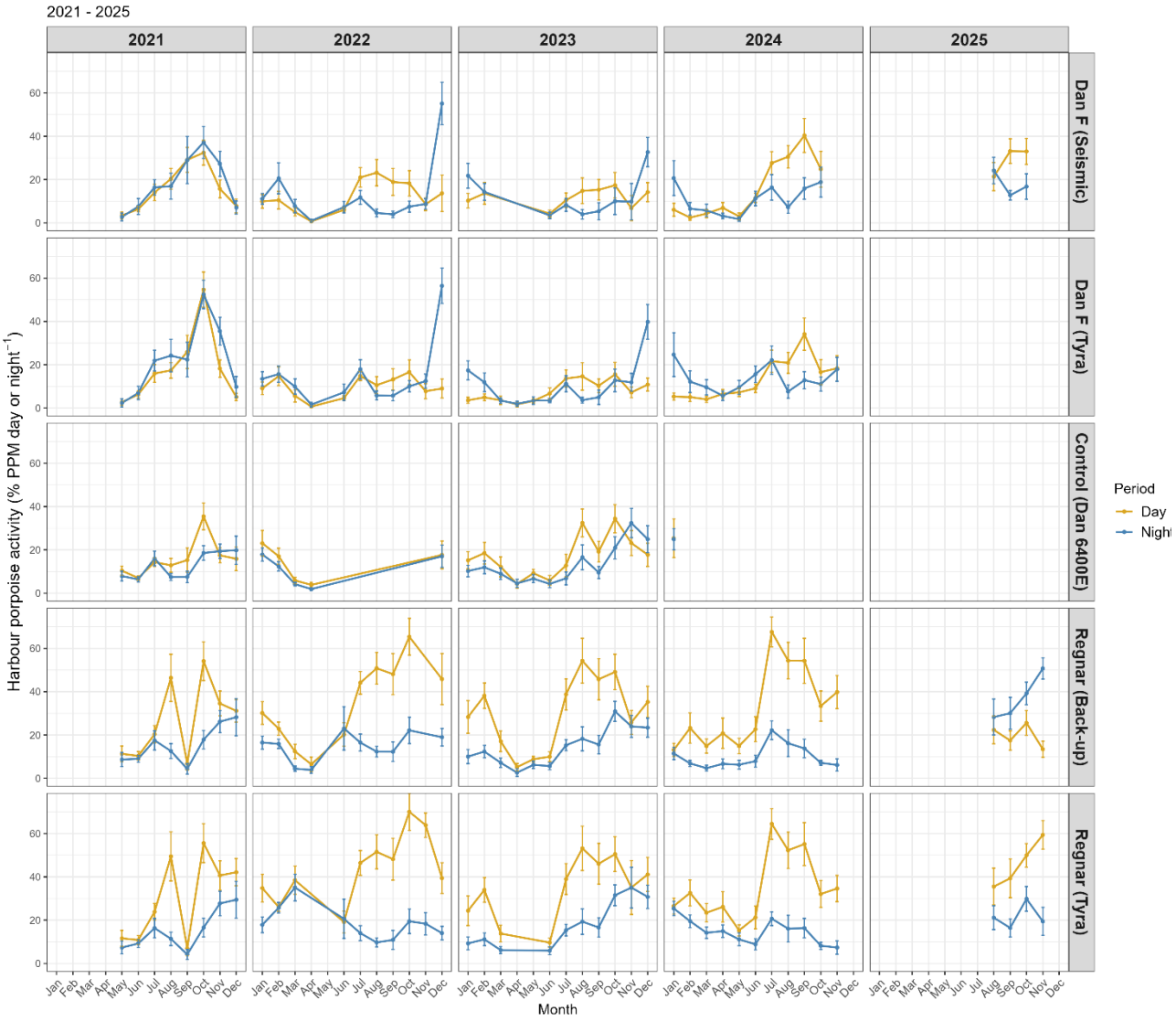

Figure 7.2. Monthly harbour porpoise echolocation activity (percentage porpoise positive minutes per day and night, %PPM) across years (2021 – 2025), stations, and day (yellow) and night (blue). Error bars show the 95 % confidence intervals around the mean. Monitoring started in May 2021 and ended in November 2025. Longer data gaps at control station, Dan 6400E, were due to lost deployments, while the complete data gap from November 2024 to August 2025 was due to a delay of deployment H.

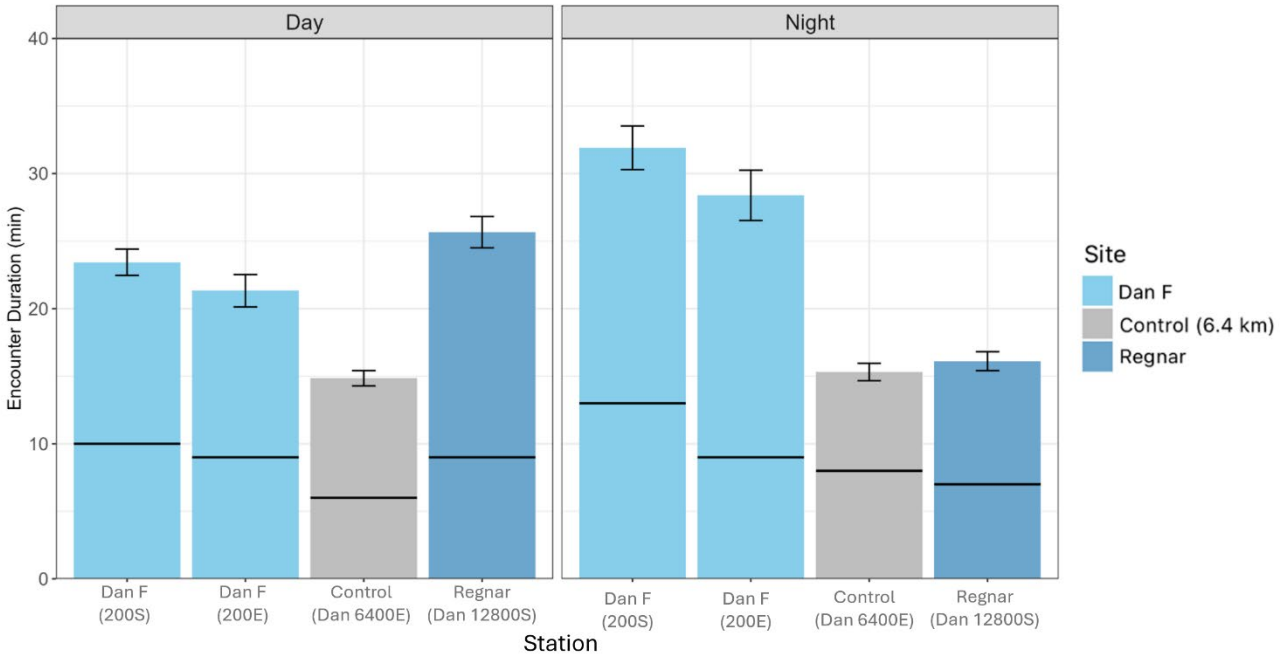

Figure 7.3. Harbour porpoise encounter duration in minutes per station during 2013 – 2015 separated by day (left) and night (right) with error bars showing 95 % confidence intervals around the mean. Median encounter duration is indicated by the horizontal line.

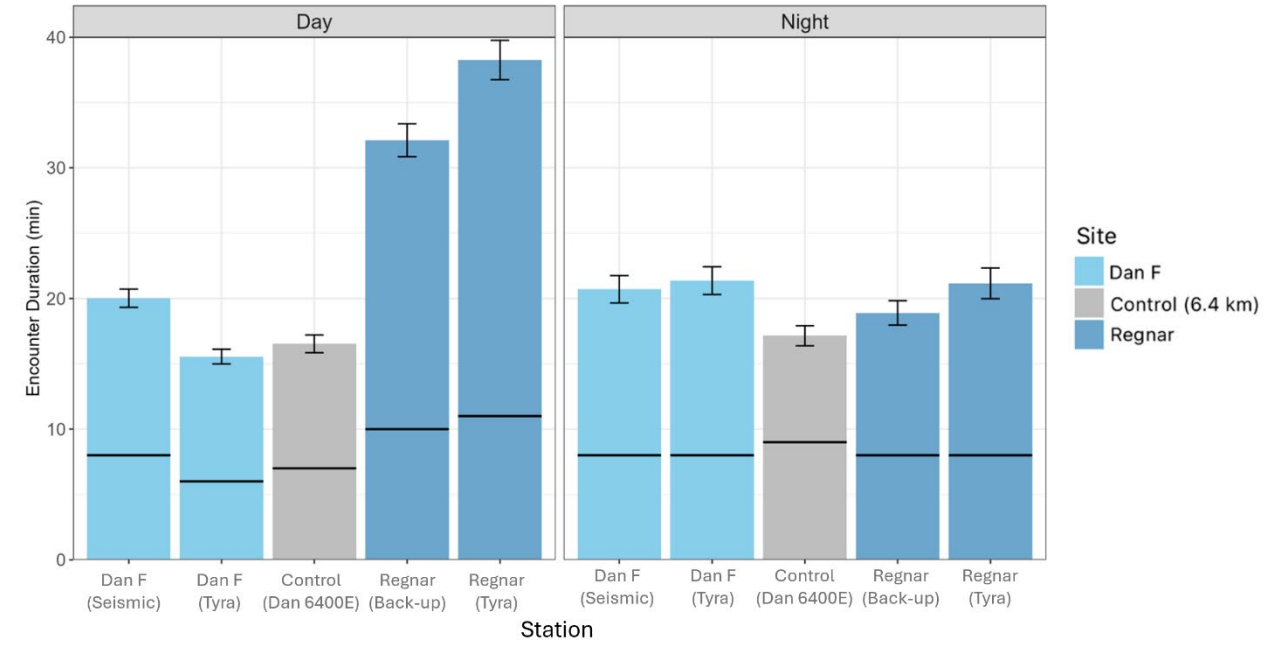

Figure 7.4. Harbour porpoise encounter duration in minutes per station during 2021 – 2025 separated by day (left) and night (right) with error bars showing 95 % confidence intervals around the mean. Median encounter duration is indicated by the horizontal line.

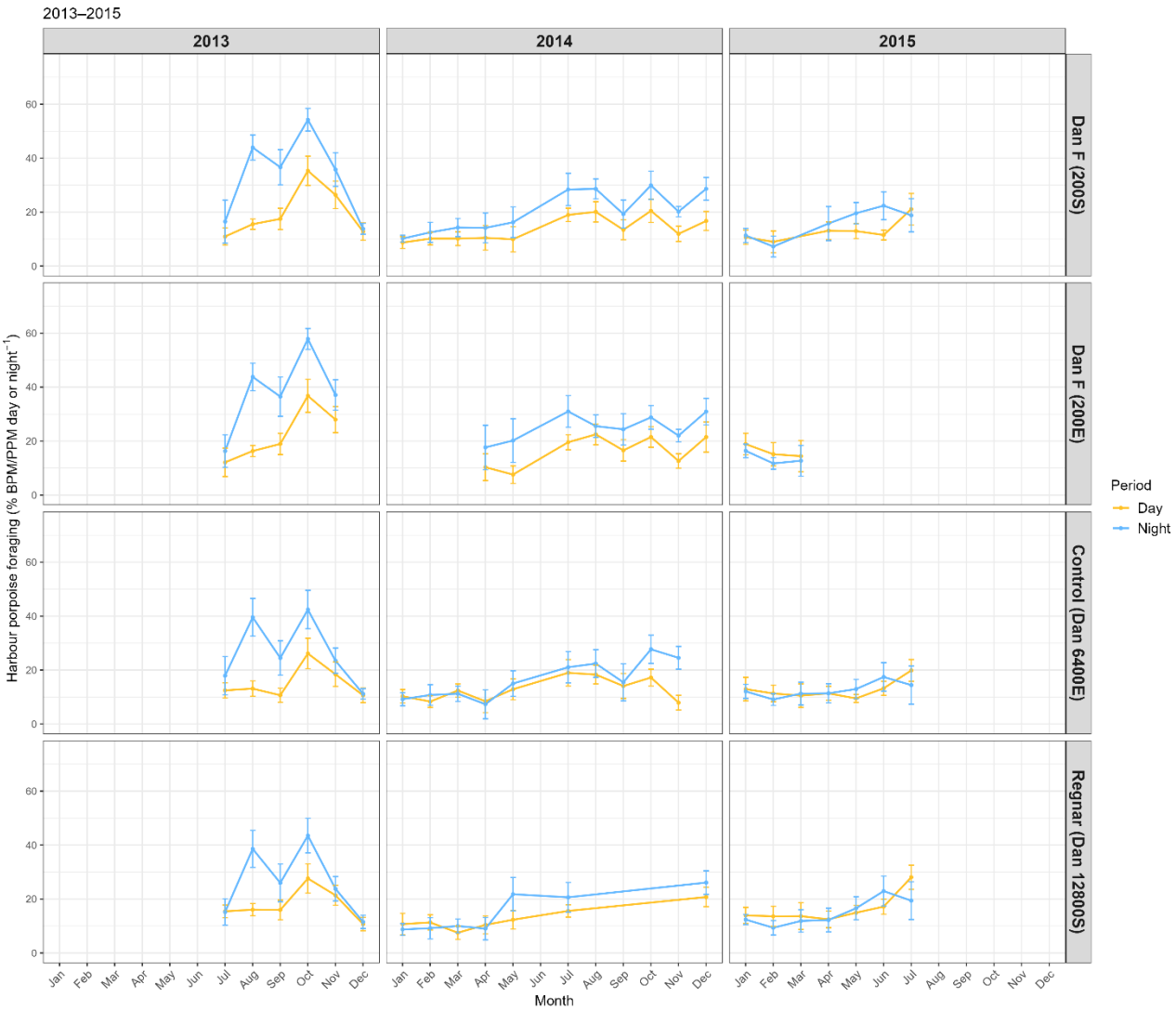

Figure 7.5. Monthly harbour porpoise foraging effort (percentage buzz positive minutes out of porpoise positive minutes per day and night, %BPM/PPM) across years (2013 – 2015), stations, and day (yellow) and night (blue). Error bars show the 95 % confidence intervals around the mean. Monitoring started in July 2013 and ended in July 2015. Longer data gaps at Dan F (200E) and Regnar (Dan 12800S), were due to lost or never deployed deployments, while the complete gap in data for June 2014 is explained by the production shutdown.

Figure 7.6. Monthly harbour porpoise foraging effort (percentage buzz positive minutes out of porpoise positive minutes per day and night, %BPM/PPM) across years (2021 – 2025), stations, and day (yellow) and night (blue). Error bars show the 95 % confidence intervals around the mean. Monitoring started in May 2021 and ended in November 2025. Longer data gaps at the control station, Dan 6400E, were due to lost deployments, while the complete data gap from November 2024 to August 2025 was due to a delay of deployment H.

PRESENCE OF HARBOUR PORPOISES AROUND THE DANISH OIL AND GAS PLATFORMS DAN F AND REGNAR DURING 2013-2025

Preliminary data overview

Aarhus University monitored harbour porpoise acoustic activity around active and inactive oil and gas platforms in the Danish North Sea during 2013 – 2025 using passive acoustic monitoring. While the aim is to determine the effect of decommission a platform, this preliminary report provides an overview of data collected until ultimo 2025.

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