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# North Sea I - offshore surveys of birds, bats and marine mammals

## USBL detection study

Energinet

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# Preface

This study was jointly undertaken by NIRAS, DCE (Danish Centre for Environment and Energy, Aarhus University) and Energinet. The study was independently carried out by NIRAS and Aarhus University and funded by Energinet. The section of USBL analysis was primarily conducted by NIRAS and the statistical analysis was mainly performed by DCE. However, all co-authors agree on the results presented in this report. Energinet has commented on several drafts of this report. The comments can be found here: https://dce.au.dk/udgivelser/oevrige-dce-udgivelser/eksterne-udgivelser/2025.

# Executive summary

This study was jointly initiated by NIRAS, Aarhus University and Energinet. The study was independently carried out by NIRAS and Aarhus University and funded by Energinet. The objective of the study was to investigate whether the presence of active geophysical survey ships using USBL (Ultra-Short BaseLine) acoustic positioning systems had any impact on the baseline data regarding the presence of harbour porpoises in the North Sea I survey area. Geophysical surveys utilize USBL systems to keep track of their underwater equipment. USBL systems emit signals at frequencies and source levels known to cause displacement of harbour porpoises from the area. A previous study found modelled impact ranges of up to 3.0 km. If an effect was found, and the baseline data thus could not be said to represent the "natural" unaffected situation, this would need to be accounted for. Consequently, the purpose was further to quantify the effect and to develop a method to compensate for the impact on the baseline data.

A study examining effects of USBLs on presence of harbour porpoises has not previously been carried out and different approaches were therefore tested in this report *to find the most optimal method to possible correct for the impact on USBL on baseline data*. Data was collected with 42 F-PODs (porpoise loggers) and 6 broadband acoustic recorders (SoundTraps) from April 2023 to November 2023. Three of the broadband stations were located inside the geophysical survey area (impact stations) and three were located outside (control stations). Time-stamped GPS tracks of the geophysical survey vessels were obtained for the same time period from the geophysical survey operators. In the broadband data, USBL pulses were found and distance to nearest survey vessel calculated. For each pulse the source level was back-calculated and from that the potential impact range was calculated based on the harbour porpoise behaviour criterion $\mathrm{L}_{\mathrm{p,rms,125ms,VHF}} = 103\ dB\ re.1\mu Pa$. Predicted impact ranges between 1 km and 5.5 km were observed.

During the analysis, it became evident that USBL and USBL-like signals were not solely emitted by geophysical survey vessels. A significant portion of these signals was assigned to unidentified sources. It was found that some of these unknown vessels were likely trawlers, which utilize various USBL systems to monitor their trawls and measure their catch.

From the F-POD data, three indices of harbour porpoise presence were calculated: *porpoise positive minutes* (PPM), *clicks per minute* (CPM) and *waiting time* (time between consecutive porpoise acoustic encounters) and the effects of USBL use and received level were estimated using mixed-effect statistical models.

*The following hypothesis were tested*:

A) PPM and CPM both correlate negatively with presence of USBL signals from geophysical surveys.

B) Waiting time from geophysical USBL signal to first harbour porpoise encounter correlates positively with received level of USBL signal from geophysical surveys.

Results show that PPM and CPM decreased with increasing received level of USBL pulses. Oppositely, waiting time increased with increasing received level. The statistical models showed that waiting time from USBL pulse to first harbour porpoise encounter on average increased to 196 minutes (95% confidence intervals: 154 - 239) as opposed to periods without USBL pulses where the average waiting time between consecutive harbour porpoise encounters was 66 minutes (95% confidence intervals: 31-102).

In answer to the main objective of this study, it is concluded that the baseline data collected for harbour porpoises in the North Sea I survey area was biased during the presence of geophysical survey vessels. *To address this issue, different approaches for excluding affected baseline data were tested.* Five scenarios were tested in an attempt to compensate for the impact of geophysical survey vessel presence, on F-POD detections, evaluated in effectiveness by examining change in CPM and PPM.

First a basic approach was tested, where all days with an active geophysical survey vessel using USBL was present within 3.5 km distance of an F-POD station, were excluded. The 3.5 km distance was chosen as an assumed impact range based on a previous study where approximately 3.0 km predicted impact range was found. Next, we tested an approach where, in addition to the basic approach, the day following a geophysical survey vessel presence within 3.5 km distance was also excluded to account for geophysical survey vessel presence near midnight. Since the analysis of USBL detections showed potential impact ranges of up to 5.5 km, the two approaches were also tested using an increased exclusion distance of 5.5 km, as well as an approach where we also removed the following day. All four approaches showed an effect on PPM and CPM, however it was not consistent when analysed temporally and spatially over the three impact stations, indicating that both affected and unaffected data were excluded from the dataset.

Finally, waiting time was tested in an advanced approach, where the first 239 minutes (mean + 95% CI rounded to nearest minute) following geophysical survey vessel presence within 5.5 km distance of the F-POD stations, were removed from the impact stations. Hereafter, mean CPM and PPM per month was recalculated to test for effect on the entire dataset. The recalculated CPM and PPM for all tested F-POD datasets, consistently showed an increase in mean values, indicating that the approach had a compensating effect. Of the five approaches tested, the "advanced" approach also required the lowest amount of data to be excluded from the dataset; 18.3% of minutes in the dataset for the three tested impact stations. To apply the advanced approach to the remaining F-POD stations, geophysical survey vessel presence within 5.5 km of each individual F-POD station must be mapped, after which the active presence time + 239 minutes can be excluded from the individual F-POD datasets.

In conclusion, the advanced approach was found to be the best available approach for correcting for the baseline data which was impacted by the USBL systems used by geophysical survey vessels within the North Sea I survey area. Impacted data were removed because they provide a false negative impression of the presence of harbour porpoises in the area, when the geophysical survey vessels were present. Hence, when removing impacted data, the intention is to provide a more natural picture of the presence of harbour porpoises in the North Sea 1 area. While the approach is considered valid for the North Sea I survey area, the findings cannot be directly applied to other areas, species or time periods, without project specific studies.
It is difficult to generalize the validity of the advanced approach from this study to other cases, since this is the very first study trying to quantify the effect of USBL deterrence on harbour porpoise presence. It is therefore not possible to predict whether the increase in waiting time found here, will be similar in other areas.

# Contents

# 1. Introduction

To enable the political goal for more offshore wind in Denmark before the end of 2030, it was decided with the 'Climate Agreement June 2022', to initiate feasibility and pre-investigation studies for all the attractive offshore wind farm areas identified in the 2022 screening. Against this background, the Minister of Climate, Energy and Supply instructed Energinet Eltransmission to undertake environmental surveys in the areas allocated for the offshore wind build-out, which Energinet commissioned NIRAS and Aarhus University to do. NIRAS and Aarhus University are therefore conducting a two-year environmental baseline study in the North Sea I pre-investigation area. The survey program included two marine mammal monitoring methods: passive acoustic monitoring and aerial surveys. The passive acoustic monitoring program consisted of 42 F-POD harbour porpoise dataloggers (F-POD, CHELONIA Limited, UK) and six broadband high frequency acoustic recorders (SoundTraps, ST600HF, Ocean Instruments, Inc., NZ) for underwater noise and other cetaceans, deployed in a fixed grid in the survey area (which is the pre-investigation area and a 20 km buffer around it – please see Figure 2.1).

The passive acoustic monitoring program aiming to determine baseline conditions in the area overlapped in time and space with the execution of geophysical survey activities within the North Sea I pre-investigation area, and within the Thor windfarm project area just north of North Sea I pre-investigation area. The geophysical surveys use sound emitting equipment, not only to investigate the seabed, but also in supporting functions. In a previous sound source verification study for a geophysical survey in the North Sea (Pace, Robinson, Lumsden, & Martin, 2021) an 'ultra short baseline acoustic positioning system' (USBL) was identified as the most significant equipment type in terms of impact on harbour porpoise. USBL systems are used to track underwater objects, and for geophysical surveys, this includes the towed instruments used to profile the seabed. The objective is similar to using a GPS above water – to obtain an accurate position for profiling, which is essential for precise sea floor mapping. A signal is transmitted by the transceiver located on the vessel and received by a transponder situated on the towed equipment, which then emits its own acoustic signal in response. In configurations involving multiple towed objects, several transponders are employed. The return signal is subsequently detected by the transceiver aboard the ship. The USBL system operates at frequencies in the range of 18 kHz - 32 kHz and at high source levels. The frequency range of the USBL system overlaps with the frequency range where harbour porpoises hear well. This may lead to hearing impairment or behavioural reactions if the animal is too close to the vessel.

In the study by Pace et. al (2021), harbour porpoise behavioural disturbance distances up to ~3 km were found, based on the behavioural reaction criterion of $L_{p,rms,125ms,VHF} = 103\ dB\ re. 1\mu Pa$ (Tougaard, Thresholds for behavioural responses to noise in marine mammals. Background note to revision of guidelines from the Danish Energy Agency., 2021).

It is uncertain to which degree the use of USBL during geophysical surveys affect the baseline survey within the North Sea I survey area. Ideally, the baseline must represent the natural variability of marine mammal presence in the area, without being compromised by anthropogenic sound sources related to the offshore wind farm establishment. This study was initiated to determine whether harbour porpoise presence was affected by the simultaneous geophysical survey activities within the area, and if so, to quantify the extent.

## 1.1. Objectives

The main objective of this project was to assess whether the acoustic baseline data of harbour porpoise presence were affected by the geophysical surveys in the North Sea I pre-investigation area. This was investigated through the following questions:

1) To what extent and duration did the PAM stations potentially detect underwater noise levels surpassing the behavioral threshold for harbour porpoises?

2) To what extent were USBL signals detected in the broadband recordings?
3) Using underwater noise data from the six acoustic recorders and considering the presence of survey vessels, what was the actual impact range based on the harbour porpoise' behavioural threshold of $L_{p,rms,125ms,VHF} = 103\ dB\ re.1\mu Pa$?
4) Is there a statistically significant correlation between underwater noise from USBL from the geophysical surveys and the presence of harbour porpoises as recorded at the stations equipped with both a broadband recorder and an F-POD?
5) How can the North Sea I survey data be truncated to represent a baseline corresponding to a situation without geophysical surveys?

# 2. Description of available data

Data for this study were collected during the baseline survey program at the future offshore windfarm area North Sea I. Justification for number of instruments, type and brand of instruments as well as positioning of instruments can be found in the first year report concerning monitoring of marine mammals at North Sea I (Sveegaard, et al., 2024) . Since the purpose of the monitoring program was to collect baseline data on harbour porpoise presence in the area, and not to collect data to assess the effects of USBLs on harbour porpoise presence, there are limitations to which analysis can be carried out. Ideally, all 42 PAM stations should have had both a broadband recorder (e.g. SoundTrap, ST600HF) and a harbour porpoise datalogger (an F-POD), so presence of harbour porpoises at all stations could be directly correlated to received sound pressure level of USBL signals. However, only six such stations were included with the aim to collect data on underwater noise levels and presence of dolphins. The analysis is limited to these six PAM stations where three stations were placed outside the area where the geophysical surveys took place and three were placed inside the impacted area.

## 2.1. Passive acoustic monitoring (PAM) data

In the North Sea I baseline survey (Sveegaard, et al., 2024), 42 stations were deployed with passive acoustic monitoring (PAM) instruments: F-PODs for collecting harbour porpoise clicks were deployed on all stations, and ST600HF high frequency broadband recorders, or SoundTraps were deployed on six of these stations. Metadata for the dataloggers are shown in Table 2.1 and in Appendix 1. In this study, only the data from the six stations with both F-PODs and SoundTraps/ST600HF, hereafter labelled F-POD+ST stations, were included. These stations are NS02, NS06, NS13, NS14, NS16 and NS25 (see Figure 2.1). Stations NS13, NS16 and NS25 were in the middle of the active geophysical survey area while stations NS02, NS06 and NS14 were outside the active geophysical survey area. Data was included from April 2023 to November 2023, as this time period overlapped with collection of geophysical data in the area. Recordings were obtained in two separate deployments (A and B). Deployment B from station NS13 was lost and is therefore not present in the data, leading to a total of 11 recording series (Table 2.1).

The broadband recordings were duty cycled to prolong deployment time and began once every hour and ran for 45 minutes giving a duty cycle of 75%. For a full day of recording, the number of minutes recorded was therefore 24 (hours) x 45 (minutes) = 1080 minutes. The sample rate of the recordings was 384 kHz. The recording data collection stopped when the battery ran low giving a varying gap in the data between the two deployments (see Table 2.1). After retrieval of the six recorders, the raw wav-files were unloaded to external Solid-State Drives (SSD) for processing.

F-PODs recorded continuously throughout deployments. Data from F-PODs were analysed as explained in the first-year report for the North Sea I monitoring (Sveegaard, et al., 2024). FP3 file exports were made with the F-POD manufacturer's software F-POD.exe (Chelonia Ltd. UK) for the click train categories *High* and *Moderate* likelihood of arriving from a narrow band high frequency species such as a harbour porpoise. The exports consisted of clicks per minute (CPM) and porpoise detection positive minutes (PPM) which were used in analyses of harbour porpoise presence.

## 2.2. Tracks of geophysical vessels

Data on the geophysical vessels potentially using a USBL system was obtained from Energinet, including vessel tracks based on AIS. Additionally, the energy company RWE supplied tracks for the survey vessels within the Thor OWF project area north of the North Sea I pre-investigation area (but within the survey area). Vessel tracks were in local Danish time; UTC+2 for all measurements until 29.10.2023, and in UTC+1 for measurements after. Survey vessel metadata is provided in Table 2.1 including start date, end date, and a list of the equipment onboard each vessel.

*Table 2.1: Metadata for F-PODs and SoundTraps/ST stations included in the analysis. Last recording date applies to the SoundTraps, as this date marks the limits of the data collection period that was included in the analysis. Number of recordings are number of 45-minute files from SoundTraps.*

| Station | Deployment | SoundTrap ID | FPOD ID | Deployment date | Deployment time (UTC) | Recovery date | Recovery time (UTC) | Last recording date | Number of recordings |
|---|---|---|---|---|---|---|---|---|---|
| NS02 | A | 7433 | 6959 | 18-04-2023 | 08:45 | 05-08-2023 | 15:42 | 06-07-2023 | 1881 |
| NS06 | A | 7606 | 6995 | 20-04-2023 | 09:36 | 06-08-2023 | 14:09 | 02-07-2023 | 1717 |
| NS13 | A | 7444 | 6987 | 21-04-2023 | 07:58 | 02-08-2023 | 13:20 | 18-07-2023 | 2101 |
| NS14 | A | 7605 | 6997 | 19-04-2023 | 10:14 | 06-08-2023 | 11:21 | 30-07-2023 | 2160 |
| NS16 | A | 7435 | 6982 | 21-04-2023 | 05:23 | 02-08-2023 | 10:45 | 06-07-2023 | 1862 |
| NS25 | A | 7443 | 6990 | 19-04-2023 | 18:15 | 02-08-2023 | 08:33 | 28-05-2023 | 901 |
| | | | | | | | | | |
| NS02 | B | 7775 | 6997 | 02-08-2023 | 11:01 | 02-12-2023 | 09:39 | 24-10-2023 | 1913 |
| NS06 | B | 7763 | 6943 | 05-08-2023 | 15:50 | 08-01-2024 | 11:05 | 01-11-2023 | 1072 |
| NS13 | B | 7772 | 6944 | 06-08-2023 | 08:59 | na | na | na | na |
| NS14 | B | 7768 | 6940 | 06-08-2023 | 11:28 | 02-12-2023 | 10:58 | 31-11-2023 | 1995 |
| NS16 | B | 7771 | 6954 | 06-08-2023 | 14:17 | 01-12-2023 | 07:33 | 26-11-2023 | 1808 |
| NS25 | B | 7773 | 6980 | 02-08-2023 | 09:09 | 29-11-2023 | 14:44 | 24-10-2023 | 2154 |

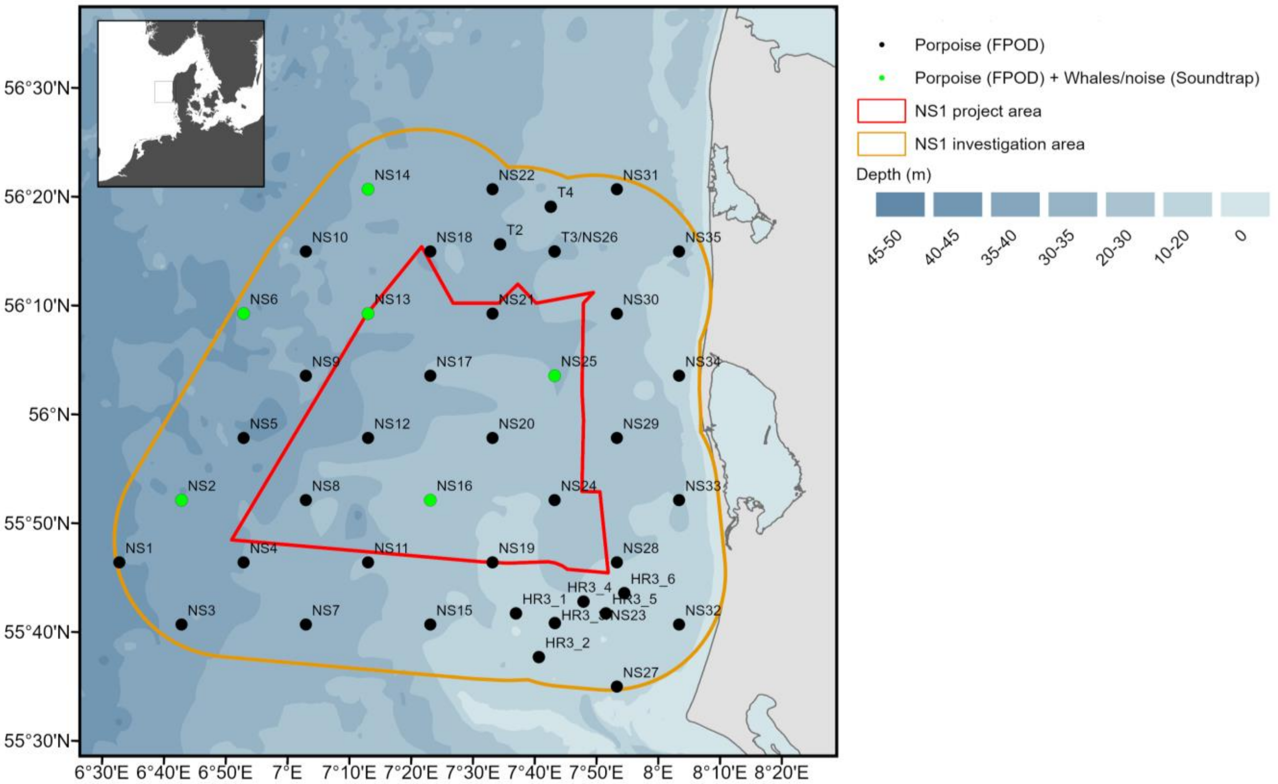


*Figure 2.1: Overview of positions for all PAM stations in the North Sea I survey area. The light green dots represent the F-POD+ST stations used in this project as they all have both an F-POD and a SoundTrap.*

*Table 2.2: Overview of survey vessel activities within the NS1 survey area during 2023 (Source: Energinet).*

| Activity ID | Work package task | Vessel name | MMSI | Start date | End date | Active survey days | Instruments | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sparker | SBP | MBES | SSS | USBL |
| 101 | 2D UHR seismic survey | Fugro Pioneer | 311000262 | 2023-06-18 | 2023-07-31 | 36 | Fugro Multi level stacked sparker | Innomar Medium 100 | Kongsberg EM2040 | | |
| 102 | 2D UHR seismic survey | MV Fugro Arctic | 245511000 | 2023-04-02 | 2023-04-19 | 8 | AAE Duraspark 400 | Innomar Medium 100 | Kongsberg EM2040C | | |
| 103 | Magnetometry box survey | Stril Explorer | 259006000 | 2023-06-15 | 2023-07-31 | 41 | | | R2Sonic 2024D | | Kongsberg HiPaP 502 + cNODE MiniS |
| 104 | Geophysical survey | Northern Maria | 219028965 | 2023-04-03 | 2023-07-31 | 112 | | Innomar Medium 100 | Kongsberg EM2040D | Edgetech 2200 | Kongsberg HiPaP 502 + cNODE MiniS |
| 105 | Geophysical survey | Northern Franklin | 219028268 | 2023-05-07 | 2023-07-31 | 76 | | Innomar Medium 100 | Kongsberg EM2040D | Edgetech 2200 | Ixblue GAPS 3 + MT9 |
| 106 | Geophysical survey | Geo Ranger | 245893000 | 2023-06-14 | 2023-07-31 | 37 | | Innomar Medium 100 | Kongsberg EM2040D | Edgetech 2200 | Kongsberg HiPaP 502 + cNODE MiniS |
| 107 | 2D UHR seismic survey | Fugro Pioneer | 311000262 | 2023-08-01 | 2023-11-14 | 77 | Fugro Multi level stacked sparker | Innomar Medium 100 | Kongsberg EM2040 | | |
| 108 | Magnetometry box survey | Stril Explorer | 259006000 | 2023-08-01 | 2023-09-07 | 33 | | | R2Sonic 2024D | | Kongsberg HiPaP 502 + cNODE MiniS |
| 109 | Geophysical survey | Northern Maria | 219028965 | 2023-08-01 | 2023-09-17 | 46 | | Innomar Medium 100 | Kongsberg EM2040D | Edgetech 2200 | Kongsberg HiPaP 502 + cNODE MiniS |
| 110 | Geophysical survey | Northern Franklin | 219028268 | 2023-08-01 | 2023-08-11 | 7 | | Innomar Medium 100 | Kongsberg EM2040D | Edgetech 2200 | Ixblue GAPS 3 + MT9 |
| 111 | Geophysical survey | Geo Ranger | 245893000 | 2023-08-24 | 2023-09-11 | 17 | | Innomar Medium 100 | Kongsberg EM2040D | Edgetech 2200 | Kongsberg HiPaP 502 + cNODE MiniS |

# 3. Methodology

## 3.1. Overview of geophysical survey vessel presence

To provide a list of days potentially affected by the presence of USBL signals from survey ships, a 3.5 km impact range for harbour porpoise disturbance was assumed based on the findings of Pace et al. (2021), where an impact range of approximately 3.0 km was calculated. All vessel tracks were plotted in QGIS on a daily basis, along with the F-POD and F-POD+ST stations, resulting in daily survey vessel presence maps. An impact zone of 3.5 km radius around each station was also plotted, representing the expected maximum USBL behavioural impact range for harbour porpoises (based on the harbour porpoise behavioural reaction threshold of $L_{p,rms,125ms,VHF} = 103\ dB\ re. 1\mu Pa$). An example of the daily maps is shown in Figure 3.1. A visual inspection of each daily map was conducted to determine whether any survey vessel had entered the 3.5 km zone on that day. The results of the visual examination were tabulated for each F-POD and F-POD+ST station across all survey dates. The table does not specify the duration of vessel presence within the 3.5 km zone, nor does it indicate which vessels or the number of vessel passes that occurred during the day, however it differentiates between survey vessels with and without active USBL systems, not counting the latter. Survey vessels with active USBL systems were assumed to always have the USBL on according to Table 2.2. The table also excludes survey vessels not linked to the North Sea I project. In the remainder of this report, "survey vessels" are used to describe North Sea I survey vessels. The initial objective was to provide an estimate of days potentially impacted in a simple and easy way. As an additional precaution, days with one or more survey vessels within a 3.5 km distance to a station were included, as well as the following day. The following day was included because it is unknown how long after a USBL event harbour porpoise occurrence would be impacted, and since the event could potentially occur just before midnight, it would likely affect detections on the following day.

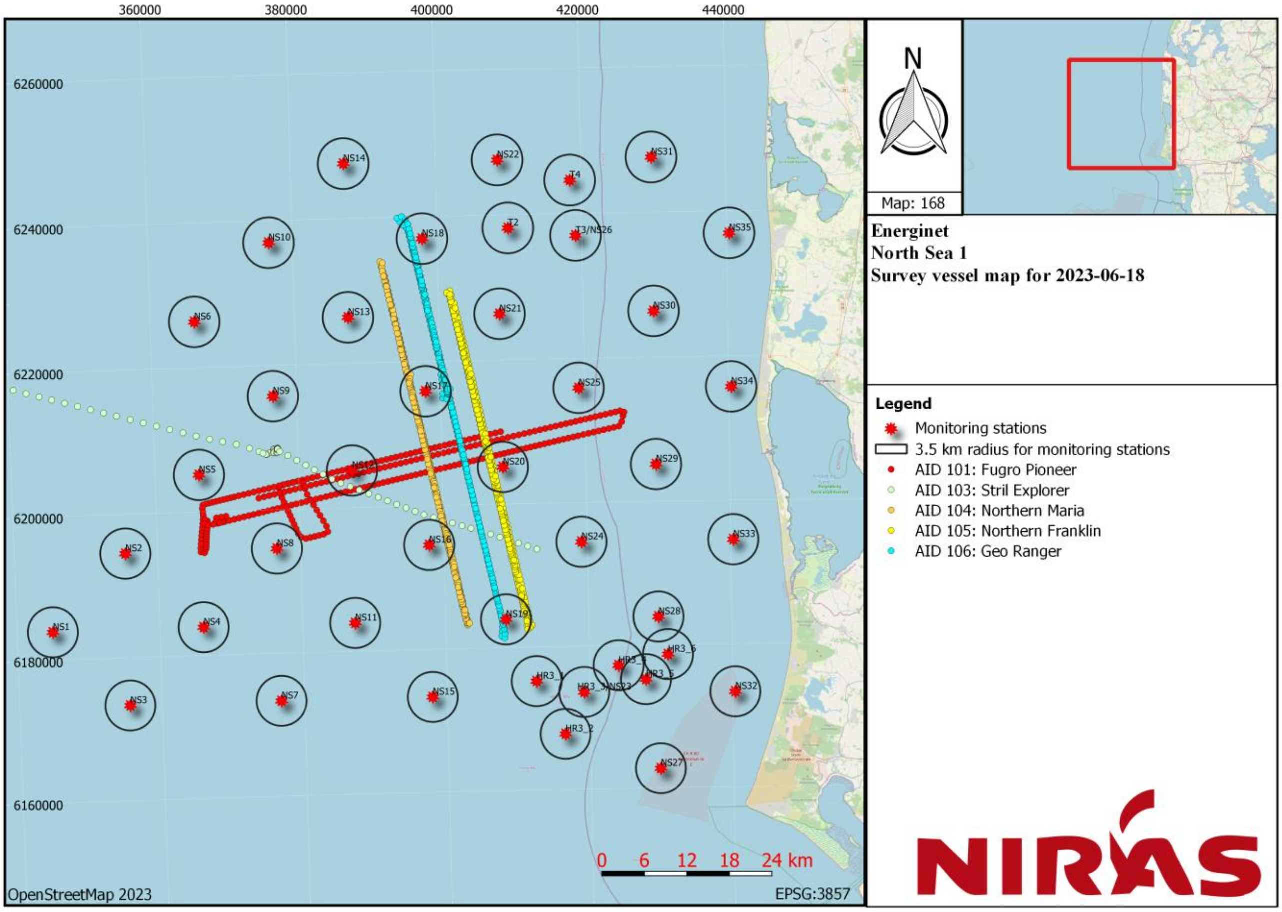


*Figure 3.1: Example of day-map for June 18, 2023. The position data for active survey vessels are shown by individually coloured tracks. Red stars indicate the F-POD and F-POD+ST stations labelled with the station ID. The black circles around each measurement station indicate the 3.5 km expected maximum USBL impact zone.*

## 3.2. USBL signal detection in broadband recordings

To provide an overview of the actual contribution of underwater noise from active USBL systems (used during the geophysical survey) to the overall sound scape, acoustic data recorded at the six F-POD+ST stations was utilized to identify the underwater noise levels received on the recordings. This provided a database listing all identified USBL signals within the recordings along with their corresponding sound pressure levels ($L_{p,rms,125ms,VHF}$).

The detection of USBL signals, was achieved through the following steps (explained in detail in the sections below):

- Filtering with bandpass filtered time domain signal and autocorrelation function
- Detection of repeated signals using the autocorrelation function
- Detection of signal peaks through bandpass filtered time domain signals
- Extraction of USBL signals from original recording
- Analysis in 1/3-Octave bands

#### 3.2.1. Filtering with bandpass filtered time domain signal and autocorrelation function

Each 45-minute recording was loaded into MATLAB and analysed in frames of 10 seconds. The Fourier transform was applied to each 10 second frame. A rectangular window[1] was used to filter the data to only look at frequencies in the range between 18 kHz and 32 kHz (main frequency range of the USBL systems). Using the inverse Fourier transform, a bandpass filtered time domain signal was obtained.

The power spectrum was calculated from the bandpass filtered spectrum, and through inverse Fourier transform resulted in the autocorrelation function.

#### 3.2.2. Detection of repeated signals using the autocorrelation function

Due to the repeating nature of the USBL system (approximately 1-2 pulses per second), the autocorrelation function was used as a first step to detect USBL signals within the recordings. The autocorrelation function always has a peak at zero time lag no matter the input data. If there is a repetitive signal contained in the input, there will also be a peak at a time lag corresponding to the interval of repetition. In case of a USBL signal where the signal repeats approximately once every second, there will be a peak at a time lag corresponding to the signal repetition rate and multiples thereof. As USBL systems consist of one transceiver and one or more transponder units, all repeating approximately every second, this leads to two or more pulses per second.

To judge if there were peaks in the signal, a threshold was used based on an estimate of the background noise level within the frame. The background noise level was estimated based on the autocorrelation function at a time lag between 0.1 and 0.6 seconds, to choose an area where only minor peaks were expected due to overlap of USBL pulses. Further, the standard deviation within the same area was found. The threshold was set to 4*(bg+3*std), where bg is the background noise level and std is the standard deviation. If any peaks above the threshold were detected, the frame was processed further as a possible USBL signal. At this stage, the threshold was set low to make sure that all frames with USBL signals were detected, accepting that some frames without USBL signals were also included.

#### 3.2.3. Detection of signal peaks through bandpass filtered time domain signal

If the frame was chosen for further processing in the autocorrelation step, the bandpass filtered time domain signal was used to further qualify the peaks. This was done by setting an overall lower threshold criterion for the power level of the noise. First, the signal was converted into absolute pressure units. Every signal power value above an initial threshold of $L_p = 96\ dB\ re\ 1\mu Pa^2$was then marked as a peak value.

The USBL signals are modulated pulses, with a duration of several milliseconds. Multiple peaks above the threshold criterion can therefore occur from the same USBL signal. To separate individual USBL signals, a gap of at least 5 ms between consecutive peak detections above 96 $dB\ re\ 1\mu Pa^2$ was used to determine individual USBL signals. The time gap of 5 ms was chosen through trial and error to detect as many peaks as possible, accounting for closely spaced transponder pulses following a transceiver pulse.

[1] *Applying the rectangular window in the frequency domain introduces some minor artifacts in the time domain, but the filtered signal was only used to judge if there was a repetitive signal contained in the frame and localise peaks, and for this purpose, the approach is considered acceptable.*

For frames with very high overall noise level, this detection method resulted in one continuous peak throughout the entire frame. For such frames, the threshold was increased in steps of 4 dB until individual pulses could be identified. The timestamp of all detected individual peaks was stored in MATLAB.

### 3.2.4. Extraction of USBL signals from original recording

Based on the peak detection timestamps, 125 ms frames of the original (non-bandpass filtered) signal were extracted. The frames were centred around the peak and converted into absolute pressure units using the hydrophone calibration signal, based on pistonphone calibration. Along with the USBL signal frames, frames with background noise were extracted as well, in 125 ms frames occurring before the USBL signal frame, using a Hanning window, centred on the peak. The frames were Fourier transformed and 1/3-octave band levels from 25 Hz – 160 kHz, (base 10) in line with IEC 61260-1 were saved in a table with and without weighting for porpoise hearing. Porpoises, which echolocate at very high frequencies (VHF), above 100 kHz, are more sensitive to sounds directly in those frequencies. Therefore, sound pressure level (SPL) can be weighted according to porpoise hearing sensitivity. See (Southall, et al., 2019) for more information. A table for each 45 min recording with unweighted and VHF-weighted noise band values was saved.

### 3.2.5. Analysis in 1/3-Octave bands

Through the previous steps, peak detection was focused on identifying peaks in sound pressure level, both absolute, and relative to the background noise level. A bandpass filter (see section 3.2.1) was used to concentrate on peaks in the 18 kHz – 32 kHz frequency range where USBL systems emit sound. However, detected peaks within the USBL frequency range could also be caused by higher harmonics of lower frequencies, or from broadband noise signals, and thereby not from USBL systems. The mean and variance over all peak detections per 45-minute recording for the 16 kHz, 20 kHz, 25 kHz, and 32 kHz 1/3-octave bands were calculated. If both mean and twice the variance for the 16 kHz band exceeded mean and variance for each of the USBL relevant 1/3-octave bands (20 – 32 kHz), this was considered a strong indicator of non-USBL sources resulting in the peak detections, and the entire 45-minute recording was excluded.

To avoid incorrect detections due to higher frequency noise sources (sonars, anti-fouling and echo sounders etc), an additional comparison was carried out peak by peak. The sound level of 40 kHz – 63 kHz 1/3-octave bands was compared to the USBL bands. If the mean of the 40 – 63 kHz 1/3-octave bands in dB was more than 3 dB higher than the highest level of the three USBL bands, the peak was excluded.

The next step in the peak selection process, was to exclude peaks that did not follow the repetition pattern of a USBL system. USBL signals repeat approximately every one – two seconds. A moving average of time interval between pulses over nine consecutive detections was calculated for all peaks in the entire 45-minute recording. For each moving average (of nine peaks), if the average time interval between peaks was higher than 5 seconds, the centre peak was excluded.

As a final step, the number of peaks within each 45-minute recording was examined. If the number of peaks remaining in a 45 min recording was less than 20, the recording was excluded entirely. If the number of peaks was between 20 and 100, the median of the distance between peaks was calculated, and if below 0.5 seconds or above 5 seconds, meaning that the peaks had a very narrow spacing or a very large spacing, the 45-minute recording was excluded entirely. If more than 100 peaks remained, no further peak elimination took place.

The results from the data analysis were saved for each station with information about number of USBL detections per minute. The mean, minimum and maximum broadband VHF-weighted SPL ($L_{p,rms,125ms,VHF}$) of all USBL detections, during each minute were also given. Vessel position log files, which were originally in local Danish time, were converted to UTC before analyses began.

## 3.3. Impact range from USBL signals

For each identified USBL pulse from the previous step, the time of the event and the sound pressure level (filtered with the VHF-weighting appropriate for harbour porpoises) was extracted. The survey vessel data was then combined with the USBL database, to link the USBL pulses to a survey vessel, where possible. The distance vs. sound pressure level information was extracted, to determine actual impact range for the harbour porpoise behavioural reaction criterion.

The timestamp for each identified USBL pulse was used to find the distance to every survey vessel, based on the supplied survey vessel location data. The survey vessel location data was supplied in a 5-minute resolution between location data points. To get an accurate survey vessel distance matching each USBL pulse, the two survey vessel data points closest in time were found and the position of the vessel was interpolated to match the timestamp of the USBL data. Afterwards, the great circle distance between the survey vessel and the F-POD+ST station was calculated. If a survey vessel was within a 5 km radius from the station, it was linked to the corresponding USBL pulses at that point in time.

From the list of linked data points, some periods in time were picked out where one ship had multiple passes over a specific station. These passes were used to make curve fits linking the sound pressure level of the USBL pulse to the distance of the survey vessel. The used curve fit equation was:

$$L_{p,rms,125ms,VHF} = SL - x * log10(dist) - \alpha * dist$$

where *SL* is the VHF frequency weighted source level in 1 m, *x* is the sound propagation coefficient (loss of acoustic energy as a function of distance), *dist* is distance to the USBL vessel and α is the absorption coefficient. Constraints on the curve fitting parameters were used to limit the curve fit to values considered within reasonable environmental and USBL operational parameter ranges. The curve fit was then used to find the expected impact range of the pass.

## 3.4. Effect of USBL noise on harbour porpoise presence

To determine whether a statistically significant correlation between underwater noise from USBL from the geophysical surveys and the presence of harbour porpoises as recorded at the F-POD+ST stations exists, the following two hypotheses were tested:

A) Porpoise positive minutes (PPM) and clicks per minute (CPM) will correlate negatively with presence of USBL signals from geophysical surveys:
- $H_0$: Presence (PPM)/activity (CPM) of harbour porpoises is not affected by presence of USBL signals from geophysical surveys.
- $H_1$: Presence (PPM)/activity (CPM) of harbour porpoises is affected and falls with presence of USBL signals from geophysical surveys.

B) Waiting time (USBL-HP) from geophysical USBL signal (the last of a sequence) to first harbour porpoise encounter (i.e. a click) will correlate positively with received level of USBL signal from geophysical surveys:
- $H_0$: Waiting time (USBL-HP) to first porpoise encounter is not affected by received level of USBL signals from geophysical surveys.
- $H_1$: Waiting time (USBL-HP) to first harbour porpoise encounter is affected and increases with received level of USBL signals from geophysical surveys.

### 3.4.1. Integrating porpoise detections and broadband acoustic data

F-POD and broadband recorded data were combined into one dataset. The combined dataset (n = 1,704,310 rows with a row for each minute providing information on porpoise presence (PPM), activity (CPM), USBL detections/level, and type of vessel (unknown and survey)) was then used to visualize the spatial and temporal variation in the recorded clicks per minute (CPM) over the entire period (from 2023-04-19 to 2023-11-30), also indicating the minutes when broadband recordings were available, and the minutes with USBL positive detections (Figure 3.2). Visualization of these data was also done on a daily scale to crudely assess how often porpoise detections were lacking between successive USBL detection events (see e.g. Figure 3.3). All data were screened for potential outlier values (e.g. unrealistically high CPM values or duplicated timestamps), but none were detected. Since the SoundTrap recorders were on a 75% duty cycle (see section 2.1), the combined dataset was reduced to only those minutes in which the SoundTrap was active (n = 877 407 rows).

For each minute in the integrated data, the number of porpoise clicks (CPM) and thus whether a porpoise was detected (PPM = 1) or not (PPM = 0) were known, as well as whether a USBL signal was detected, and if so by which vessel (i.e. survey vessel or other source) and the SPL level recorded (the mean 125 ms VHF-weighted SPL was used throughout the analyses). When a USBL signal was detected, this lasted for multiple minutes. From these data, a third harbour porpoise activity metric was calculated as either the waiting time from a received USBL signal to the first porpoise encounter following the USBL signal , which is termed Waiting time (USBL-HP), or as normal waiting time which is defined as the time between two consecutive harbour porpoise encounters, here defined as waiting time (HP-HP) (Thompson, et al., 2013). Hence, in this report, the waiting time (USBL-HP) metric in the presence of USBL signals indicates the time (in minutes) it took to detect a harbour porpoise after a given USBL event. If no porpoises were detected between two USBL events, the waiting time counter was reset until a harbour porpoise was detected. During the calculation of waiting time (USBL-HP), the received SPL level and the ship number of the USBL event preceding the porpoise detection was recorded allowing for a comparison of waiting time (USBL-HP) after noise-disturbance events from survey vessels and those from unknown vessels. To calculate waiting time (HP-HP) in the absence of USBL signals, the porpoise echolocation data collected prior to the first USBL detection at each station were used. Thus, waiting time (HP-HP) indicates the time (in minutes) elapsed between successive porpoise detections. Because the variable waiting time is in essence a time counter, it was not available for each minute. As such, all statistical analyses done on this variable were performed on a reduced dataset (n = 10 894 rows), compared to analyses performed on the metrics CPM and PPM. Overall, this analytical approach differs from the waiting time analyses described in Tougaard et al (2009) and is therefore not directly comparable.

Finally, the stations NS02, NS06, and NS14 were classified as Control stations (i.e. no USBL signals from geophysical survey activity recorded) and stations NS13, NS16 and NS25 were classified as Impact stations (i.e. USBL signals from geophysical survey activity recorded), which were used in the control-impact analyses described below.

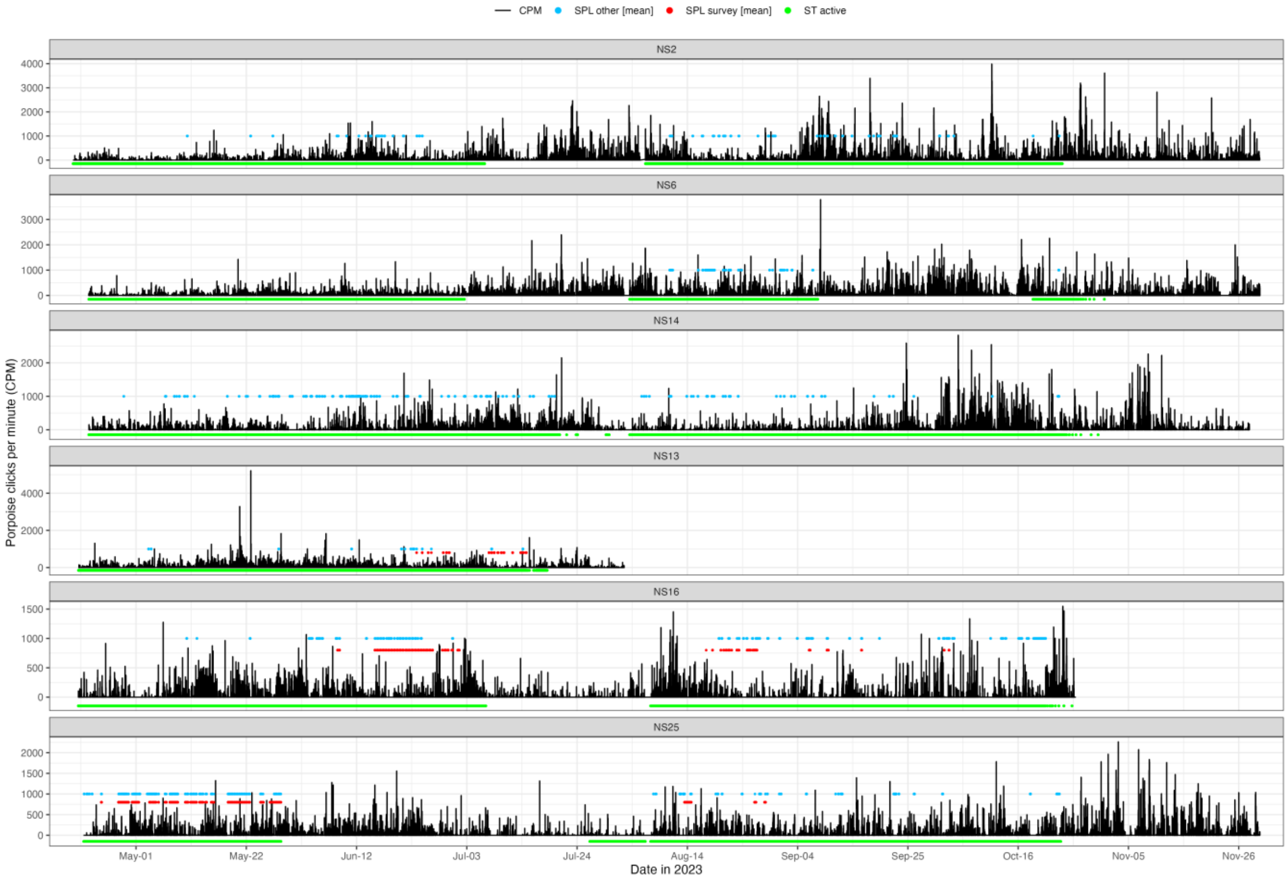


*Figure 3.2: Overview of the integrated F-POD and broadband recorded data, showing for each of the six stations (control stations: NS2, NS6, NS14 and impact stations: NS13, NS16 and NS25) the recorded porpoise clicks per minute (CPM) as black bars, the time that the SoundTraps (ST) were actively recording (green circles), the time during which USBL signals from survey vessels were detected (red circles) and the time during which USBL signals from other sources were detected (blue circles). Red and blue circles do not correspond to the y-axis but purely indicate at which point in time a USBL signal was detected.*

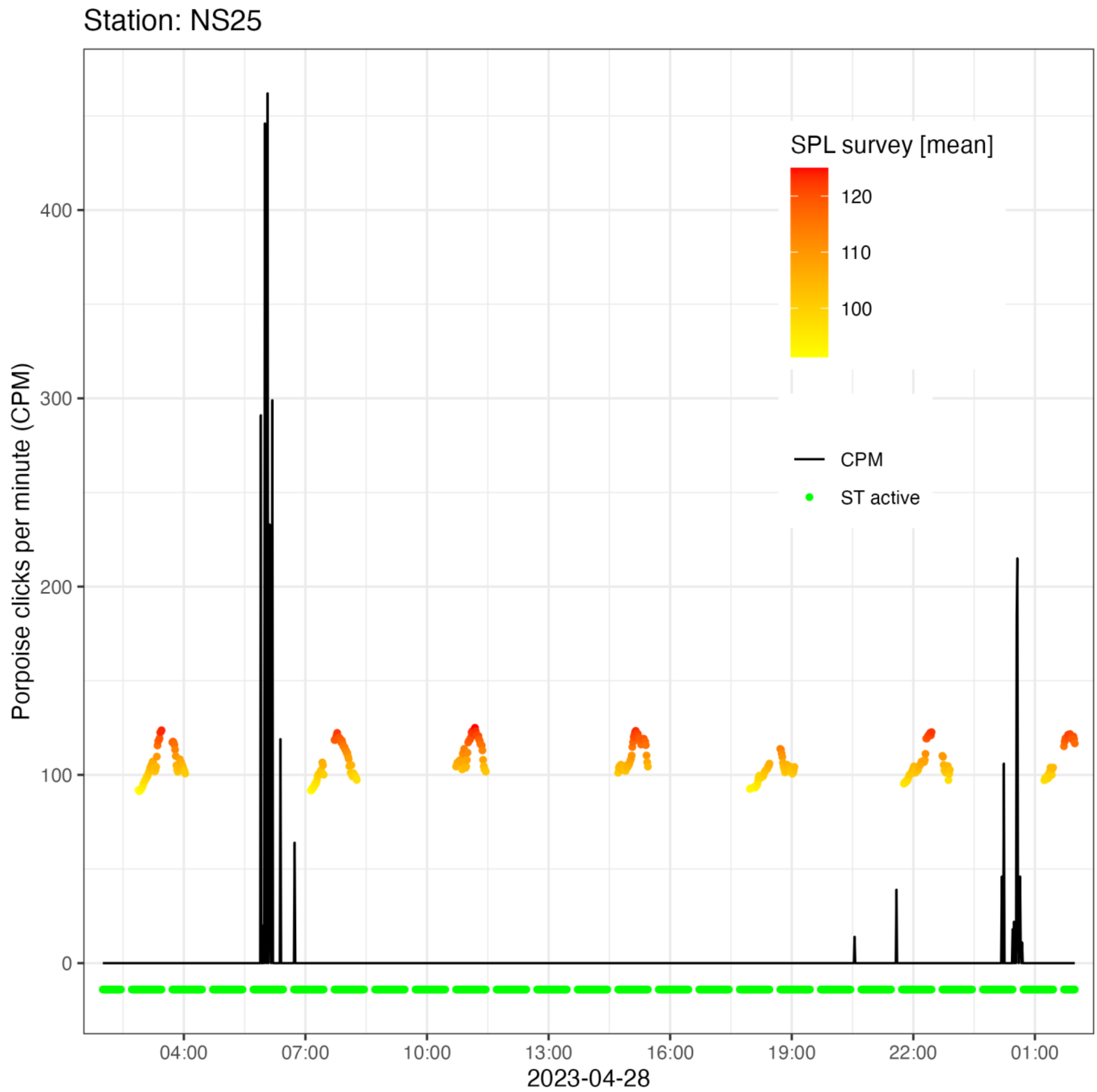


*Figure 3.3: Example of a zoomed in overview of the integrated F-POD and broadband recorded data for the 28th of April 2023 for station NS25, showing the recorded porpoise clicks per minute (CPM) as black bars, the time that the ST600HF units (ST) were actively recording (green circles), and the SPL level of USBL signals from survey vessels (yellow to red circles).*

### 3.4.2. Diel variation in harbour porpoise echolocation activity with and without USBL signals

To assess diel variation in harbour porpoise echolocation activity between stations and, moreover, to assess differences in harbour porpoise echolocation activity between minutes with and without USBL signals, CPM and PPM were fitted as response variables in separate generalized additive mixed models (GAMMs) fitted through the mgcv package (Wood, 2006) in the statistical software package R (R_Core_Team, 2024). In each GAMM, the continuous variable “hour of the day” and the categorical variable “USBL type” were fitted as random factor smooth interactions. The advantage of this approach is that it allows for a separate smoother to be fitted to each

"USBL type" while accounting for unbalanced data design between groups and over time. The disadvantage of this smoothing construct is that it does not force estimates at hours 0 and 23 to be matched as through a cyclic cubic regression spline. However, the models with random factor smooth interactions explained more of the variation in the data than models fitted with cyclic cubic regression splines. The variable "USBL type" categorized minutes without USBL signals detected, minutes with USBL signals from other sources, and minutes with USBL from survey vessels. The model with CPM as the response variable was fitted using a negative binomial error structure to account for overdispersion and zero inflation in model residuals. The model with PPM as the response variable was fitted using a binomial error structure.

### 3.4.3. Statistical analyses of porpoise echolocation activity as a function of USBL signals

To test hypotheses A and B, a series of generalized linear mixed effect models (GLMERs) fitted through the R package glmmTMB (Brooks, et al., 2017) were used to relate CPM, PPM or waiting time to the SPL level of USBL signals. In these initial models USBL signals from both survey vessels and other sources were combined. GLMERs were preferred over simple correlation tests to reduce the risk of bias in the results due to zero-inflation and over/under dispersion of the data. Following these tests, control-impact analyses (Larsen, Meng, & Kendall, 2019) were performed again using CPM, PPM or waiting time as the response variable in separate GLMERs. In each GLMER, the interaction between the variables "Control or Impact stations" and "USBL type" were fitted as the fixed effect and "Station ID" was fitted as a random variable to account for unbalanced data over space and time. All models with CPM as the response variable were fitted using a negative binomial error structure to account for overdispersion and zero inflation in model residuals. The models with PPM as the response variable were fitted using a binomial error structure, while models with waiting time as the response variable were fitted using a gaussian error structure.

Building on the results of the control-impact GLMERs, any change in harbour porpoise echolocation activity as a function of USBL exposure was estimated by calculating the mean CPM, PPM or waiting time for each rounded SPL value. The mean SPL value at which a 50% decrease in harbour porpoise echolocation activity occurred, was then determined by finding the SPL value at which the CPM or PPM was reduced by half relative to mean CPM or PPM estimates during minutes without USBL signals (following hypothesis 1, H1). For the metric waiting time, the same procedure was used, but here a 50% decrease in harbour porpoise presence was estimated by finding the SPL value at which waiting time doubled relative to the mean estimate in periods without USBL signals (following hypothesis 2, H1). The 50% decrease values were estimated for the Control (considering only USBL signals from other sources) and Impact area (considering USBL signals from survey vessels and other sources combined) separately.

### 3.4.4. Estimating and correcting for the impact of USBL signals to assess baseline data of harbour porpoise presence

To assess how the baseline data on harbour porpoise presence in the North Sea I survey area was affected by ongoing geophysical survey activity in the same area, the mean and variation in CPM and PPM were quantified for each station using different datasets that varied in the number of minutes and type of USBL signals included. Specifically, five different datasets were considered.

1. The first dataset was the full dataset with all USBL signals included and that formed the base of all following analyses.
2. The second dataset was a subset of the full dataset from which all minutes with USBL signals from survey ships were removed. This subset only affected the stations present in the "impact" area where USBL signals from the geophysical surveys were detected.
3. The third dataset was also a subset of the full dataset from which all minutes with USBL signals from survey ships were removed as well as the minutes that fell within the predicted upper 95% CI of porpoise waiting

time at impact stations (NS13, NS16 and NS25). As such, this subset only affected the stations present in the “impact” area where USBL signals from the survey were detected.

4. The fourth dataset was a subset of the full dataset from which all minutes with USBL signals from all detected sources were removed. As such, in stations from the “control” area, this included minutes with USBL signals from other sources than the geophysical survey, while for stations in the “impact” area this included minutes with USBL signals from the geophysical survey and other sources.
5. Finally, the fifth dataset was a subset of the full dataset from which all minutes with USBL detections were removed as well as the minutes that fell within the predicted upper 95% CI of porpoise waiting time following USBL signals from other sources (affects both impact and control stations) and USBL signals from survey vessels (affects impact stations only).

# 4. Results

## 4.1. Overview of geophysical survey vessel presence

The daily maps with active surveys are provided as part of the digital delivery in .png files labelled with the date. Only days with active surveys are included. A summary of affected days across the study period from 4. April to 18. November 2023 is provided in Table 4.1, including a basic approach, only counting days directly affected by a North Sea I survey vessel passing within 3.5 km of a PAM station, and a more conservative approach also counting the day following a North Sea I survey vessel passing within the 3.5 km radius. For further details, see Appendix 2.

Table 4.1: Summary table showing the total number of days where a North Sea I geophysical survey vessel was within a 3.5 km distance of individual PAM station positions, at least once. The summary includes both the basic approach, where only the day with survey presence is included, and a more conservative approach where also the day following a survey presence is included.

| **PAM station** | **Total number of days affected by USBL presence within 3.5 km** | |
|---|---|---|
| | Basic approach (survey day counted) | More conservative approach (survey day + following day counted) |
| NS01 | 1 | 2 |
| NS02 | 0 | 0 |
| NS03 | 0 | 0 |
| NS04 | 7 | 13 |
| NS05 | 2 | 4 |
| NS06 | 0 | 0 |
| NS07 | 0 | 0 |
| NS08 | 37 | 52 |
| NS09 | 4 | 7 |
| NS10 | 0 | 0 |
| NS11 | 22 | 38 |
| NS12 | 38 | 54 |
| NS13 | 39 | 51 |
| NS14 | 0 | 0 |
| NS15 | 15 | 28 |
| NS16 | 44 | 57 |
| NS17 | 51 | 62 |
| NS18 | 37 | 52 |
| NS19 | 50 | 67 |
| NS20 | 50 | 64 |
| NS21 | 53 | 73 |
| NS22 | 0 | 0 |
| NS24 | 67 | 88 |
| NS25 | 62 | 82 |
| NS27 | 0 | 0 |
| NS28 | 5 | 10 |
| NS29 | 16 | 26 |
| NS30 | 4 | 8 |
| NS31 | 0 | 0 |
| NS32 | 0 | 0 |
| NS33 | 0 | 0 |
| NS34 | 0 | 0 |
| NS35 | 0 | 0 |
| HR3_1 | 0 | 0 |
| HR3_2 | 13 | 24 |
| HR3_3/NS23 | 0 | 0 |
| HR3_4 | 24 | 42 |
| HR3_5 | 23 | 41 |
| HR3_6 | 4 | 8 |
| T2 | 0 | 0 |
| T3/NS26 | 0 | 0 |
| T4 | 0 | 0 |
| **Total over all stations** | **668** | **953** |

## 4.2. Impact ranges from USBL signals

The results from linking of USBL pulses and survey vessels is a database available in ".csv" format, with one file per F-POD+ST station, as part of the digital delivery package for this project. An example of the content from one station is shown in Table 4.2. The .csv files have a row for each minute of the full year of 2023. Aside from a timestamp, there is a flag indicating whether there is a recording available from the SoundTrap recorder for that minute (ST_active). The flag is zero (0) before, after and between deployment A and B, but also for one quarter every hour since the duty cycle for recordings was 75%. When the flag is zero (0), there is no information about USBL pulses and survey vessels, and the rest of the rows for that minute are therefore "Not A Number" (NaN). When the flag is one (1), there can either be zero detected pulses (N = 0) or a given number of pulses detected during that minute (N > 0). For the case with zero detected pulses, the rest of the columns will also be NaN whereas, when pulses are detected, there is information available about sound pressure levels, mean as well as minimum and maximum (SPL_VHF_mean/min/max). If a geophysical survey ship is linked to the pulses, the ID of the ship is shown in the last column (ship).

*Table 4.2: Example from one of the .csv files in the database. The .csv file has minute-by-minute information for each minute in 2023. The columns are a flag indicating if the SoundTrap recorder is active (ST_active), the number of detected USBL pulses per minute (N), the mean, minimum and maximum VHF-weighted SPL (L_(p,rms,125ms,VHF), SPL_VHF_mean/min/max) and the ship number (if any) linked to the detected USBL pulses.*

| timestamp | ST_active | N | SPL_VHF_mean | SPL_VHF_min | SPL_VHF_max | ship |
|---|---|---|---|---|---|---|
| 07-07-2023 04:57 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 04:58 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 04:59 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:00 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:01 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:02 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:03 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:04 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:05 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:06 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:07 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:08 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:09 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:10 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:11 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:12 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:13 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:14 | 1 | 0 | NaN | NaN | NaN | NaN |
| 07-07-2023 05:15 | 1 | 36 | 91.3 | 90.7 | 92.4 | 104 |
| 07-07-2023 05:16 | 1 | 50 | 91.4 | 90.7 | 95.4 | 104 |
| 07-07-2023 05:17 | 1 | 25 | 91.3 | 90.7 | 91.9 | 104 |
| 07-07-2023 05:18 | 1 | 16 | 91.4 | 90.8 | 91.9 | 104 |
| 07-07-2023 05:19 | 1 | 40 | 91.9 | 90.8 | 95.7 | 104 |
| 07-07-2023 05:20 | 1 | 60 | 92.9 | 91.1 | 95.8 | 104 |
| 07-07-2023 05:21 | 1 | 60 | 92.2 | 90.9 | 96.7 | 104 |
| 07-07-2023 05:22 | 1 | 61 | 94.0 | 92.4 | 97.1 | 104 |
| 07-07-2023 05:23 | 1 | 61 | 93.6 | 92.5 | 94.4 | 104 |
| 07-07-2023 05:24 | 1 | 61 | 92.2 | 90.9 | 93.5 | 104 |
| 07-07-2023 05:25 | 1 | 46 | 91.4 | 90.8 | 92.3 | 104 |
| 07-07-2023 05:26 | 1 | 48 | 91.7 | 90.6 | 95.0 | 104 |

From the full database, a table summing the daily number of minutes with recorded USBL pulses over 103 dB was created (Appendix 3). An example for the month of August 2023 is provided in Table 4.3, which shows that for station NS2, NS6 and NS14, none of the recorded USBL pulses could be linked to a known survey vessel within a 5 km radius. NS13 was not actively recording during August, as it was lost, and therefore all dates for station NS13 are shown in yellow. For stations NS16 and NS25, a mix of known and unknown USBL sources were observed.

*Table 4.3: Example of summary table on number of minutes per day with USBL pulses recorded: On a day-by-day basis, the table shows the total number of minutes where USBL signals were recorded at the station in the header. For each station there are three columns. One for occurrences that could not be linked to an ongoing geophysical survey (Unknown), one for occurrences that show significant correlation with a survey vessel path (Survey), and a "Total." The **SUM** row tallies the total number of minutes per month with USBL pulses recorded. Fields marked "**RECORDING STARTED**" indicate the date where the SoundTrap recorder was deployed and turned on. Corresponding fields labelled "**RECORDING ENDED**" indicate that the SoundTrap recorder was either retrieved or ran out of battery, whichever occurred first. Fields in yellow background indicate days without active broadband recordings.*

| STATION | NS2 | | | NS6 | | | NS13 | | | NS14 | | | NS16 | | | NS25 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** |
| 2023-08-01 | | | | | | | | | | | | | | | | | | |
| 2023-08-02 | | | | | **RECORDING STARTED** | | | | | | **RECORDING STARTED** | | | | | | | |
| 2023-08-03 | | | | | | | | | | | | | | | | | | |
| 2023-08-04 | | | | | | | | | | | | | | | | | | |
| 2023-08-05 | | **RECORDING STARTED** | | | | | | | | 5 | | 5 | | | | | | |
| 2023-08-06 | | | | | | | | | | 13 | | 13 | | **RECORDING STARTED** | | | | |
| 2023-08-07 | | | | | | | | | | | | | | | | 13 | | 13 |
| 2023-08-08 | | | | | | | | | | | | | | | | 17 | | 17 |
| 2023-08-09 | | | | | | | | | | | | | | | | | | |
| 2023-08-10 | 34 | | 34 | 20 | | 20 | | | | 98 | | 98 | | | | | | |
| 2023-08-11 | 85 | | 85 | 92 | | 92 | | | | | | | | | | | | |
| 2023-08-12 | | | | | | | | | | | | | | | | 211 | | 211 |
| 2023-08-13 | | | | | | | | | | 38 | | 38 | | | | 285 | 255 | 540 |
| 2023-08-14 | | | | | | | | | | 14 | | 14 | | | | 11 | 474 | 485 |
| 2023-08-15 | 7 | | 7 | | | | | | | | | | | | | | | |
| 2023-08-16 | 135 | | 135 | 48 | | 48 | | | | 45 | | 45 | | | | | | |
| 2023-08-17 | 33 | | 33 | 97 | | 97 | | | | 106 | | 106 | | | | | | |
| 2023-08-18 | 11 | | 11 | 427 | | 427 | | | | 89 | | 89 | | | | | | |
| 2023-08-19 | 57 | | 57 | 85 | | 85 | | | | 8 | | 8 | | | | 96 | | 96 |
| 2023-08-20 | 134 | | 134 | 1 | | 1 | | | | 38 | | 38 | 126 | 2 | 128 | 68 | | 68 |
| 2023-08-21 | 21 | | 21 | 50 | | 50 | | | | 51 | | 51 | 13 | 26 | 39 | | | |
| 2023-08-22 | 46 | | 46 | 23 | | 23 | | | | 94 | | 94 | | 3 | 3 | | | |
| 2023-08-23 | 45 | | 45 | 26 | | 26 | | | | 42 | | 42 | 15 | 25 | 40 | | | |
| 2023-08-24 | | | | 1 | | 1 | | | | | | | 13 | | 13 | 63 | | 63 |
| 2023-08-25 | | | | | | | | | | | | | 8 | 257 | 265 | | | |
| 2023-08-26 | | | | | | | | | | | | | 2 | 477 | 479 | | 5 | 5 |
| 2023-08-27 | | | | | | | | | | | | | 47 | 2 | 49 | 62 | 121 | 183 |
| 2023-08-28 | | | | | | | | | | | | | | | | 11 | 8 | 19 |
| 2023-08-29 | 104 | | 104 | | | | | | | | | | 85 | | 85 | | | |
| 2023-08-30 | 33 | | 33 | 5 | | 5 | | | | 1 | | 1 | | | | | | |
| 2023-08-31 | | | | 96 | | 96 | | | | | | | 90 | | 90 | 16 | | 16 |
| **SUM** | **745** | **0** | **745** | **971** | **0** | **971** | **0** | **0** | **0** | **642** | **0** | **642** | **399** | **792** | **1191** | **853** | **863** | **1716** |

Based on the full table in Appendix 3, a summary is provided in Table 4.4.

*Table 4.4: Summary of USBL detections, by number of days and minutes with active USBL detections, as well as percentagewise calculations of detections compared to overall recording time. The row names S1-S8 are explained in the text below the table. "Survey" denotes USBL signals linked to the geophysical survey ships active in the North Sea I survey area and "Unknown" for those from other vessels.*

| | F-POD+ST station: | NS2 | | NS6 | | NS13 | | NS14 | | NS16 | | NS25 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | USBL Source: Unknown/Survey: | Unknown | Survey | Unknown | Survey | Unknown | Survey | Unknown | Survey | Unknown | Survey | Unknown | Survey |
| S1 | Number of days with USBL detected | 41 | 0 | 18 | 0 | 6 | 3 | 69 | 0 | 49 | 28 | 44 | 34 |
| S2 | Number of minutes with USBL detected | 1631 | 0 | 1251 | 0 | 111 | 30 | 4204 | 0 | 2228 | 2772 | 2012 | 4688 |
| S3 | Number of days with active broadband recording (Deployment A + B) | 160 | 160 | 164 | 164 | 90 | 90 | 190 | 190 | 160 | 160 | 130 | 130 |
| S4 | Number of minutes with active broadband recording (Deployment A + B) | 172800 | 172800 | 177120 | 177120 | 97200 | 97200 | 205200 | 205200 | 172800 | 172800 | 140400 | 140400 |
| S5 | Percentage of days in 2023 with active broadband recordings (S3/365) | 44% | 44% | 45% | 45% | 25% | 25% | 52% | 52% | 44% | 44% | 36% | 36% |
| S6 | Percentage of days with USBL detected, out of days with active broadband recordings (S1/S3) | 26% | 0% | 11% | 0% | 7% | 3% | 36% | 0% | 31% | 18% | 34% | 26% |
| S7 | Percentage of minutes with USBL detected, out of minutes with active broadband recordings (S2/S4) | 0,94% | 0,00% | 0,71% | 0,00% | 0,11% | 0,03% | 2,05% | 0,00% | 1,29% | 1,60% | 1,43% | 3,34% |
| S8 | Distribution of USBL signals from geophysical and unknown sources | 100% | 0% | 100% | 0% | 79% | 21% | 100% | 0% | 45% | 55% | 30% | 70% |

The USBL detections were summarized for each F-POD+ST station, divided into unknown sources and identified survey vessels (Table 4.4). The number of days where one or more USBL events were detected is provided in (S1) and the number of total USBL detection minutes in (S2). From row S1 it can be observed, that for all stations, the number of days with USBL detections is higher for unknown vessels, than for survey vessels. For NS2, NS6, NS13 and NS14, this is also the case when examining the number of minutes with USBL detections (row S2). For NS16 and NS25, the survey vessels had a higher number of USBL detection minutes, compared to unknown vessels, despite the lower number of days with active USBL detections. The active recording time[2] is also listed in both days (S3) and in minutes (S4).

The percentage of days out of the 365 days of 2023, where active recordings took place at each F-POD+ST station, are listed in row S5. For NS13, deployment B was lost, and a total coverage of 25% therefore represented a single

[2] *For the number of recorded minutes, the duty cycle of the SoundTrap recorder was 45 minutes per hour (75%). For a full day of recording, the number of minutes recorded was therefore 24 (hours) x 45 (minutes) = 1080 minutes.*

deployment (A). For NS25, the battery expired after just 39 days of deployment A and therefore resulted in a low total coverage of just 36%. For NS2, NS6, NS14 and NS16, coverage was at 44 – 52% of 2023.

The broadband recordings did not provide full coverage of the entire survey duration, and significant variation in number of recording days between stations was observed. The results in row S1 and S2 are therefore not deemed suitable to determine potential impact extent.

In Table 4.4, the number of days (row S6) and minutes (row S7), with USBL detections are shown as a percentage of the total active broadband recording time. For number of days (row S6), the percentage is divided into unknown vessels and geophysical survey vessels. For each day with USBL detections, it is possible that both unknown vessels and geophysical survey vessels were registered. The percentage of days (row S6) can therefore not simply be added to measure the total impact, as was initially tested. For percentage of minutes (row S7), the percentages can be summed, as these are on a minute-by-minute basis, rather than covering a full day. The percentages of USBL detections between unknown and survey vessels are provided in row S8.

The broadband recording data are divided into:

- Control stations, with no survey activity and thereby no survey USBL detections, but with USBL detections from unknown sources (NS02, NS06, and NS14).
- Impact stations, with both survey and unknown USBL detections (NS13, NS16 and NS25).

Based on the information in Table 4.4, the following can be deduced for the individual control and impact F-POD+ST stations:

1. Station NS2 (control): 100% (S8) of the USBL detections were attributed to unknown vessels, as the station was outside the geophysical survey area. A total of 1631 USBL minutes (S2), corresponding to 0.94% of active broadband recording time were found.
2. Station NS6 (control): While a survey vessel came within a 4 km distance of the station on 2023-08-13, it did not result in any USBL detections from that pass and is therefore considered a control station. A total of 1251 USBL minutes from other sources (S2), corresponding to 0.71% of active broadband recording time, were found.
3. Station NS13 (impact): Located inside the survey area, a total of 141 USBL detection minutes were found at this station. Survey vessels were primarily near station NS13 during August – October, during deployment B, which was lost. The USBL detections for station NS13, thus only represents the period in the spring with fewer USBL detections. Thirty of the 141 total USBL detection minutes were linked to survey vessels, however there were also days where survey vessel tracks showed presence inside the 3.5 km radius of NS13, where no USBL detections were made. Examples of this were on 2023-07-14 (day map 193) and 2023-07-15 (day map 194). It is uncertain why no USBL detections were recorded during these passes, as detections were made successfully during previous passes at longer ranges. It could not be determined through examination of operational logs, whether any changes to the USBL system were made in between the passes (pers. comm. Energinet). Of the active broadband recording time, only 0.14% contained USBL detections.
4. Station NS14 (control): 100% of the 4204 USBL detection minutes were attributed to unknown vessels, corresponding to 2.05% of active broadband recording time.
5. Station NS16 (impact): This station was located inside the survey area and was exposed to a large number of survey vessel passes during both deployment A and B. A total of 5000 USBL detection minutes were found, corresponding to 2.89% of active broadband recording time. 55% of the recorded USBL detection

minutes were linked to survey vessels, primarily AID 104: Northern Maria, which on several occasions came within less than a kilometre distance from the station.

6. Station NS25 (impact): This station was located inside the survey area and was exposed to a large number of survey vessel passes during both deployment A and B. A total of 6700 USBL detection minutes were found, corresponding to 4.77% of the active broadband recording time. Survey vessels were linked to 70% of all USBL detection minutes.

Due to the significant number of USBL detections from unknown sources, a test was performed, taking six randomly selected unidentified vessel passes at NS25, and attempting to match it to any nearby vessels within a 5 km radius using AIS data provided by Energinet. The findings are outlined below, with detailed information on USBL detections, vessel matching and distance provided in Appendix 4:

- Vessel pass 1: 12-08-2023, station NS25, USBL detections from 12:57 UTC – 13:41 UTC.
    - For the first 30 minutes of the recording, no correlation between AIS data and USBL pulse levels was found.
    - For the last 15 minutes of the recording, the sound level of USBL detections correlated well with the distance to a fishing vessel (MMSI: 219015362: "Well Bank"), and it is assessed as very likely to be the source of the USBL detections.
    - While the location of the "Well Bank" was not available for the first 30 minutes of the recording, the entire recording would indicate a single passing vessel, with the last 15 minutes representing the time after the closest point of approach (CPA). It is considered likely that all USBL detections of the 45-minute recording result from a pass of the Well Bank. However, without a complete log of the vessel location, this could not be confirmed.
- Vessel pass 2: 12-08-2023, station NS25, USBL detections from 14:57 UTC – 15:41 UTC.
    - There were no vessels with active AIS within 5 km of the station within the timeframe, and no correlation could therefore be established.
- Vessel pass 3: 19-08-2023, station NS25, USBL detections from 17:57 UTC – 18:41 UTC.
    - There were no vessels with active AIS within 5 km of the station within the first 27 minutes.
    - During the last 18 minutes a fishing vessel (MMSI: 219010989: "Westbank") showed good correlation between distance to NS25 and USBL sound levels recorded.
    - At the beginning of the detection, the fishing vessel was entering the 5 km search zone, and it is considered likely, that if the AIS data for the same fishing vessel was examined to distances further from NS25, the first part of the USBL detections might also have shown correlation with the identified fishing vessel.
- Vessel pass 4: 22-09-2023, station NS25, USBL detections from 15:57 UTC – 16:41 UTC.
    - A Hopper dredger was identified through AIS as being within the 5 km search zone, during the first 10 minutes as the only vessel, however there was no correlation between USBL detection levels and vessel distance.
    - A fishing vessel (MMSI: 219793000: "RI457 Kirsten Fjord) showed good correlation between vessel distance and USBL pulse sound levels for the last 35 minutes of the recording.
    - The fishing vessel identified for the last 35 minutes of the recording "started" registering the AIS position at a distance of 3.4 km to the NS25 station. It is considered likely that if AIS positioning data had been available for the first 10 minutes, it could be matched to the remaining USBL pulses. This could however not be confirmed.
- Vessel pass 5: 26-09-2023, station NS25, USBL detections from 04:57 UTC – 05:41 UTC.
    - No vessels could be identified as being within a 5 km radius for the first 19 minutes of the recording.

    - During the last 26 minutes of the recording, a fishing vessel (MMSI: 219015362: "Well bank") was identified. This is the same vessel identified during pass 1. Similarly, for pass 5 the vessel showed good correlation between distance and USBL detection sound levels.
- Vessel pass 6: 18-10-2023, station NS25, USBL detections from 07:57 UTC – 08:41 UTC.
    - For the first 36 minutes of the recording, a fishing vessel (MMSI: 219021428: "HG 165 SOUTH OCEAN") showed good correlation between distance and USBL detection sound levels.
    - The AIS data showed no vessel presence for the last 9 minutes of the recording, however the fishing vessel from the first 36 minutes reached a distance of 5 km at the 36th minute, and it is considered likely that it was also the source of the USBL detections in the last 9 minutes, despite the range increasing to over 5 km, as the trend in the source levels showed a continuing decline from the first 36 minutes.

### 4.2.1. Curve fitting

Individual survey vessel passes were analysed, to determine actual impact ranges with respect to the harbour porpoise behavioural reaction criterion. This to evaluate the assumption of a 3.5 km harbour porpoise behaviour impact range.

Curve fits were initially attempted for all identified survey vessel passes, however, only a few passes had enough USBL detections to reliably establish a regression line. In Figure 4.1, one such example shows a pass from vessel "Northern Maria" (AID 104), with the Closest Point of Approach (CPA) of ~300 m, and the furthest distance with USBL detections of ~3.3 km from July 1, 2023.

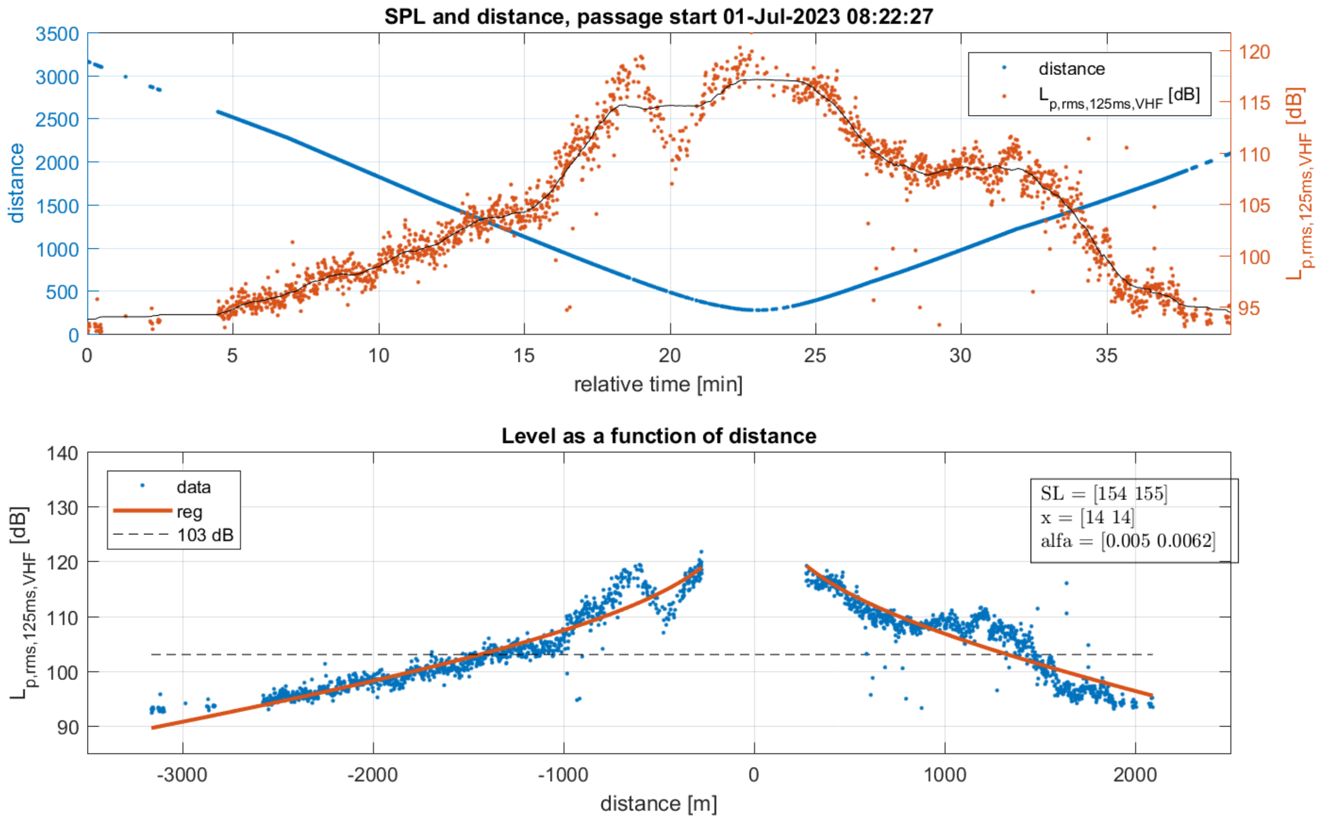


Figure 4.1: Survey vessel "Northern Maria" pass at F-POD+ST station NS16 on July 1, 2023. Vessel distance and recorded USBL SPL ($L_{p,rms,125ms,VHF}$) are shown in top plot as a function of the time. In the bottom plot, $L_{p,rms,125ms,VHF}$ for individual USBL pulses, is plotted as a function of vessel distance to NS16. A regression line (orange) was established based on the custom equation "$L_{p,rms,125ms,VHF} = SL - x * log10(dist) - \alpha * dist$". The

empty space between the two series of data is equal to the minimum distance between survey vessel and the NS16 station. A horizontal line at 103 dB is also shown to indicate the harbour porpoise behavioural reaction threshold of $L_{p,rms,125ms,VHF} = 103\ dB\ re\ 1\mu Pa$.

From Figure 4.1 (bottom plot), two regression lines were calculated. One for the approach (negative distances) and the departure (positive distances). In the example shown, the regression lines are broadly in agreement on both the source level (SL) and the sound propagation coefficient "x". While variations from the regression lines are observed, such as around -600 to -400 m (approach), this could be due to a number of factors, such as local environmental parameters, bathymetry, salinity, or temperature, or due to changes in source behaviour. It is not possible to determine the exact cause, and it may be a combination of multiple factors.

In another example (Figure 4.2), the data points gave a very good regression line, however with large differences in SL and x for approach and departure. Such a large change could possibly indicate equipment that does not have an omnidirectional radiation pattern, however without more data points closer to the NS25 station (CPA ~1700 m), it is not possible to establish if this was the reason, or just due to an insignificant data range (recorder duty cycle state OFF).

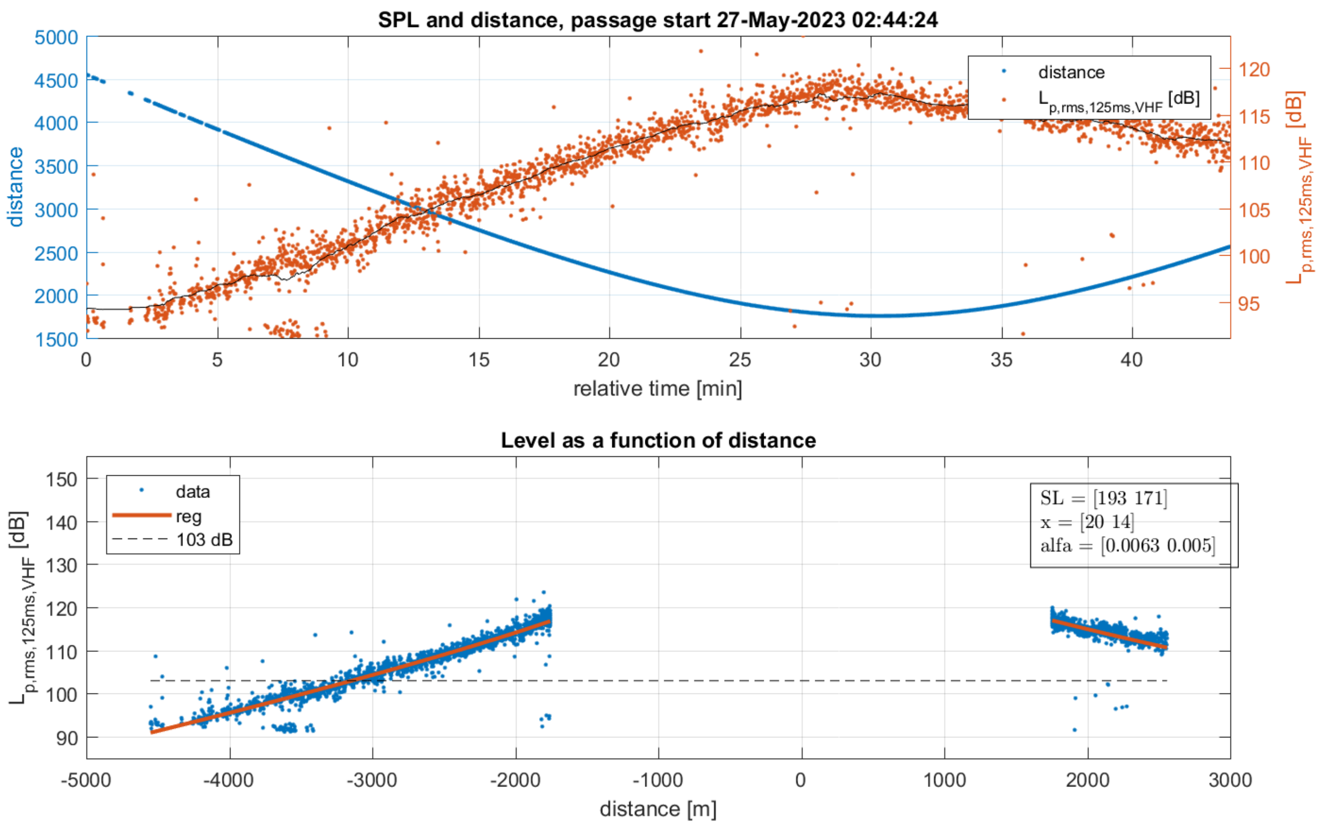


*Figure 4.2: Survey vessel "Northern Maria" pass at F-POD + ST station NS25 on May 27, 2023. Vessel distance and recorded USBL SPL ($L_{p,rms,125ms,VHF}$) are shown in the top plot as a function of the time. In the bottom plot, $L_{p,rms,125ms,VHF}$ for individual USBL pulses are plotted as a function of vessel distance to NS25. A regression line (orange) was established based on the custom equation "$L_{p,rms,125ms,VHF} = SL - x * log10(dist) - \alpha * dist$". The empty space between the two series of data is equal to the minimum distance the survey vessel had to the NS25 station. A horizontal line at 103 dB is also shown to indicate the harbour porpoise behavioural reaction criterion of $L_{p,rms,125ms,VHF} = 103\ dB\ re\ 1\mu Pa$.*

Vessel pass regression lines also showed significant variations in the SL parameter for the same vessel, and thereby for the same USBL equipment. In the first example (Figure 4.1), the regression line indicates a source level of 154 – 155 dB, while for another pass from the same vessel (Northern Maria), a source level of 193 dB was observed (Figure 4.3). In the first example (Figure 4.1), the regression line showed an intersection with the 103 dB harbour porpoise behavioural reaction criterion at approximately 1400 m on both approach and departure. In the second example (Figure 4.3) on the approach, it was approximately 4000 m. There was not enough data available for the departure to establish intersection with 103 dB. A factor ~2.9 between impact ranges (intersection with 103 dB) for the same vessel on two different days (Figure 4.1 vs Figure 4.3), indicates differences in the USBL source level, however since detailed logs for the USBL system were not available, this could not be confirmed.

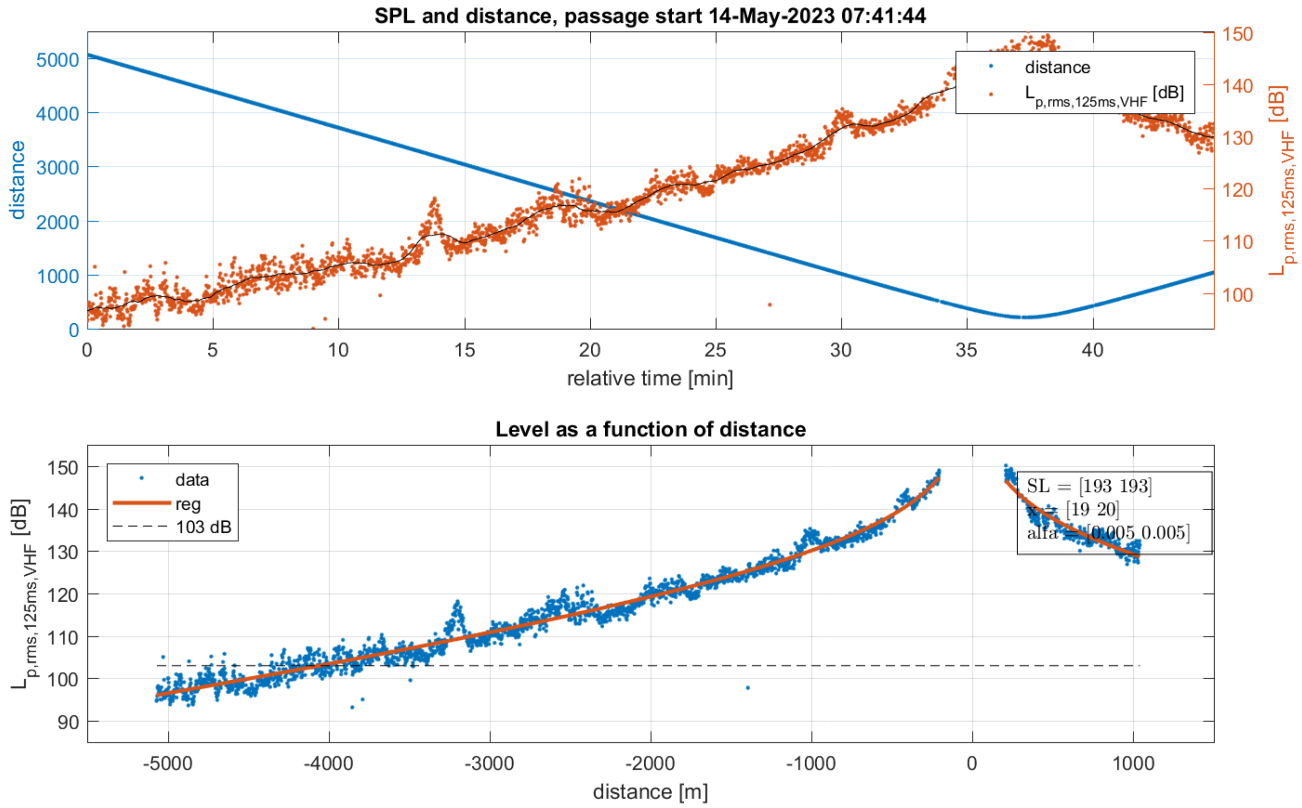


*Figure 4.3: Survey vessel "Northern Maria" pass at F-POD+ST station NS25 on May 14, 2023. Vessel distance and recorded USBL SPL ($L_{p,rms,125ms,VHF}$) are shown in top plot as a function of the time. In the bottom plot, $L_{p,rms,125ms,VHF}$ for individual USBL pulses is plotted as a function of vessel distance to NS25. A regression line (orange) was established based on the custom equation "$L_{p,rms,125ms,VHF} = SL - x * log10(dist) - \alpha * dist$". The empty space between the two series of data is equal to the minimum distance the survey vessel had to the NS25 station. A horizontal line at 103 dB is also shown to indicate the harbour porpoise behavioural reaction threshold of $L_{p,rms,125ms,VHF} = 103\ dB\ re\ 1\mu Pa$.*

### 4.2.2. Variation in impact ranges of the same vessel

To further study variations in impact ranges, four comparative plots each containing multiple passes of the same vessel, and same F-POD+ST station were created (Figure 4.4 – Figure 4.7).

From Figure 4.4, four passes at NS16 on June 7, 2023, by the Northern Maria showed intersections of the USBL $L_{p,rms,125ms,VHF}$ and the 103 dB criterion at distances of ~3.6 km to ~4.5 km. The spread could be a result of slightly different propagation paths, or weather-related impact. However, the four passes all occurred within a total timespan of 16 hours, and with less than 100 m distance between the individual survey lines. There is no clear indication of the differences being a result of changes to the USBL source level in between passes.

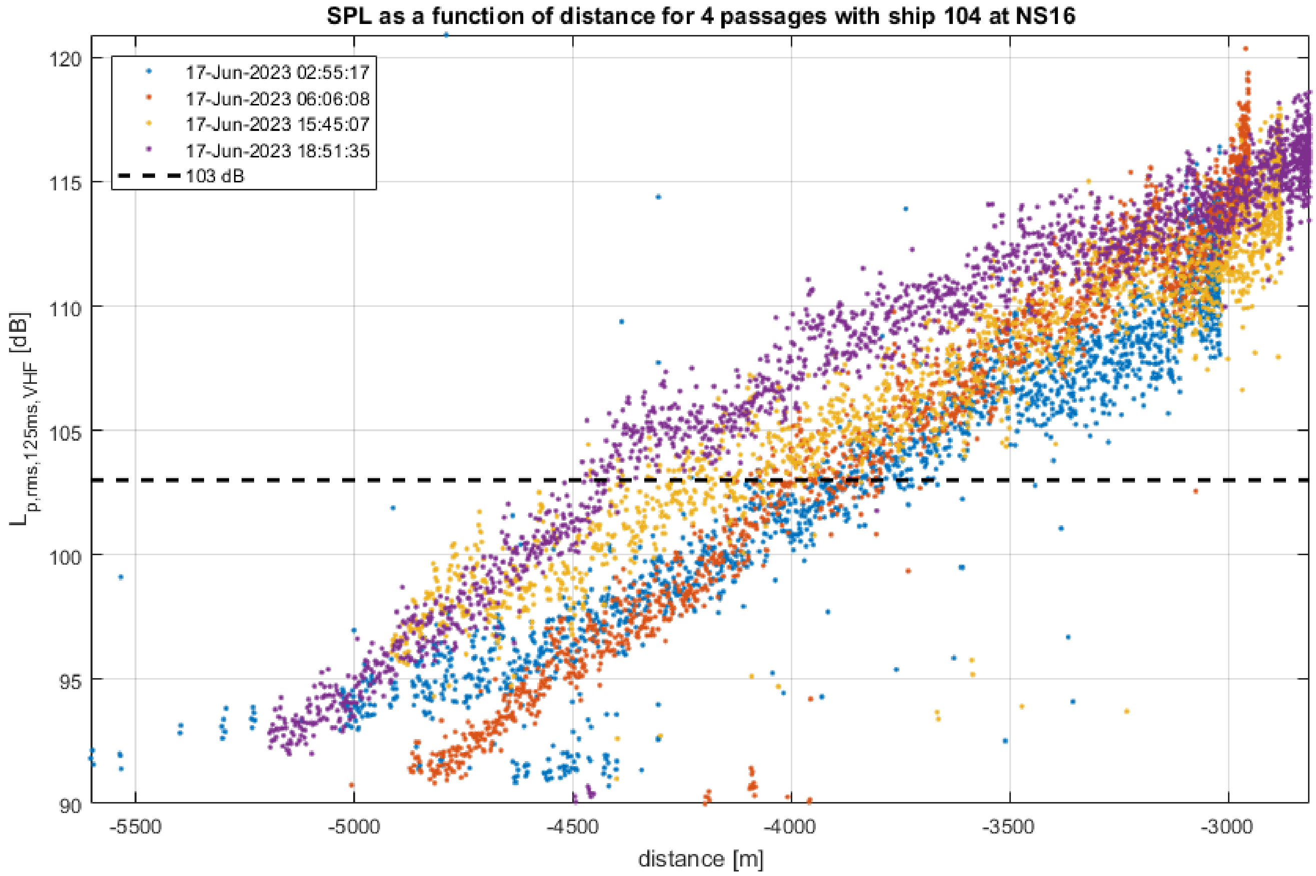


*Figure 4.4: SPL ($L_{p,rms,125ms,VHF}$) as a function of vessel distance, for four passes by the same vessel (Northern Maria) on the same day (2023-06-07) at measurement station NS16. Each pass has different coloured data points.*

In Figure 4.5, six passes at NS16 are shown for the Northern Maria during June 20, 2023 – July 1, 2023. This is a significantly longer timespan than in the first example and also represents larger distances between the represented individual vessel passes. A significant variation in intersection distance to the 103 dB behavioural reaction criterion was observed, from ~1.1 km to ~5.5 km.

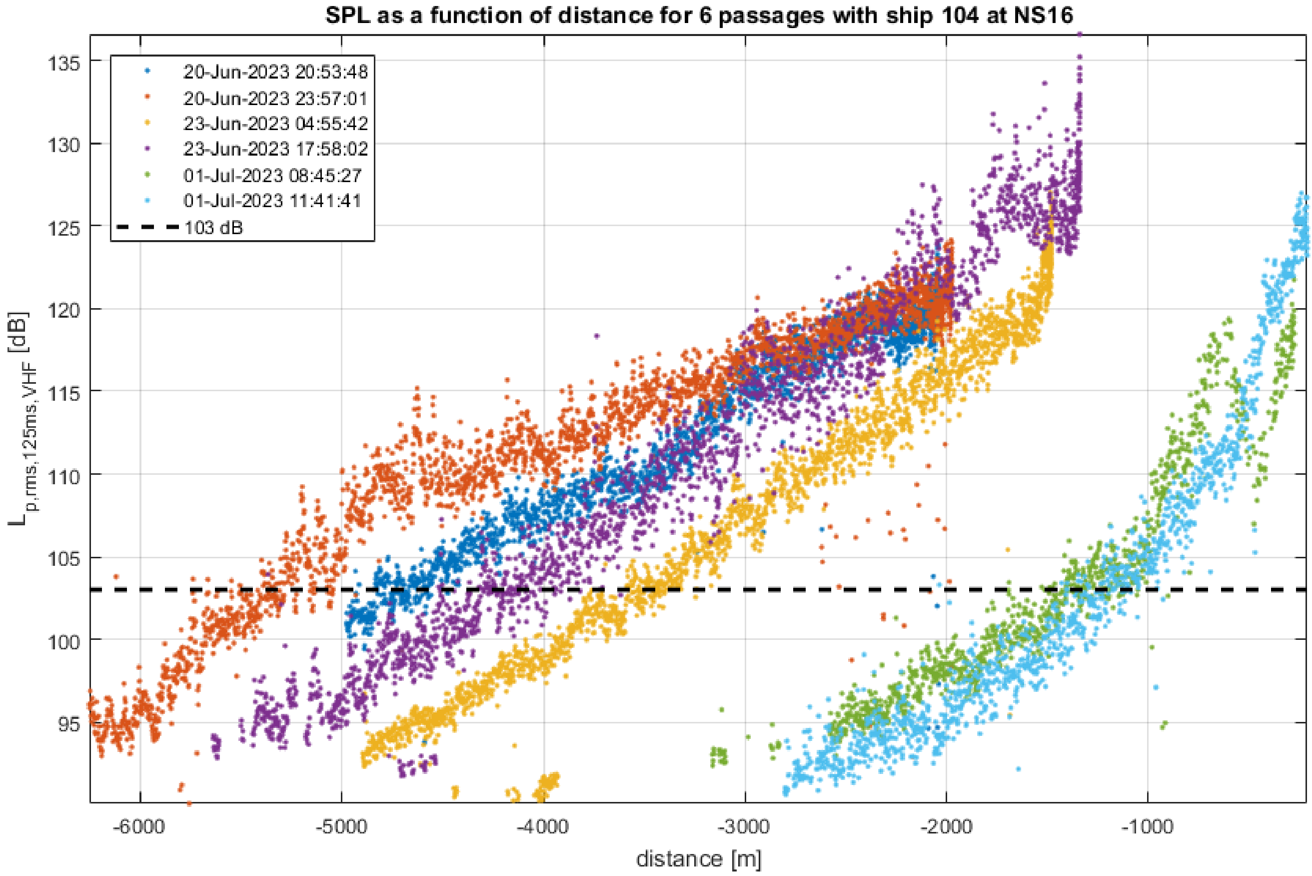


*Figure 4.5: SPL ($L_{p,rms,125ms,VHF}$) as a function of vessel distance, for 6 passes by the same vessel (Northern Maria) on 3 different days at measurement station NS16. Each pass has different coloured data points.*

It was uncertain to what degree the environmental conditions played a role in this variation. Wave height data from NIRAS inhouse model, as an indicator of sea state, was examined for the individual passes. This showed no significant differences that could explain the observed range of distances to the behavioural threshold criterion. It is instead considered a more likely scenario that the source level of the USBL equipment was changed in between June 23, and July 1. This could however not be confirmed as no detailed logs of USBL parameters was available.

In Figure 4.66, six passes for the Northern Maria survey vessel on 5 consecutive days (May 11 - May 15, 2023) are shown. At short range (< 1 km) there is correlation between the passes on May 11, 12, and 14. At ranges above 1 km, there is a significant spread in observed sound levels, where May 12 represents the highest levels over distance, and May 11 and 13, show the lowest levels over distance. Examining vessel tracks for the five survey days, reveal very close survey lines, all east of the measurement station. Especially on May 12 and 13, the survey tracks are indistinguishable. The vessel did not depart from the survey area in between the shown passes, nor did the weather change significantly. Yet, a difference of up to 20 dB was observed between the two data sets. It is unclear what causes have contributed to a difference of this magnitude. One contributing cause could be a change of source level of the USBL system, however this could not be confirmed.

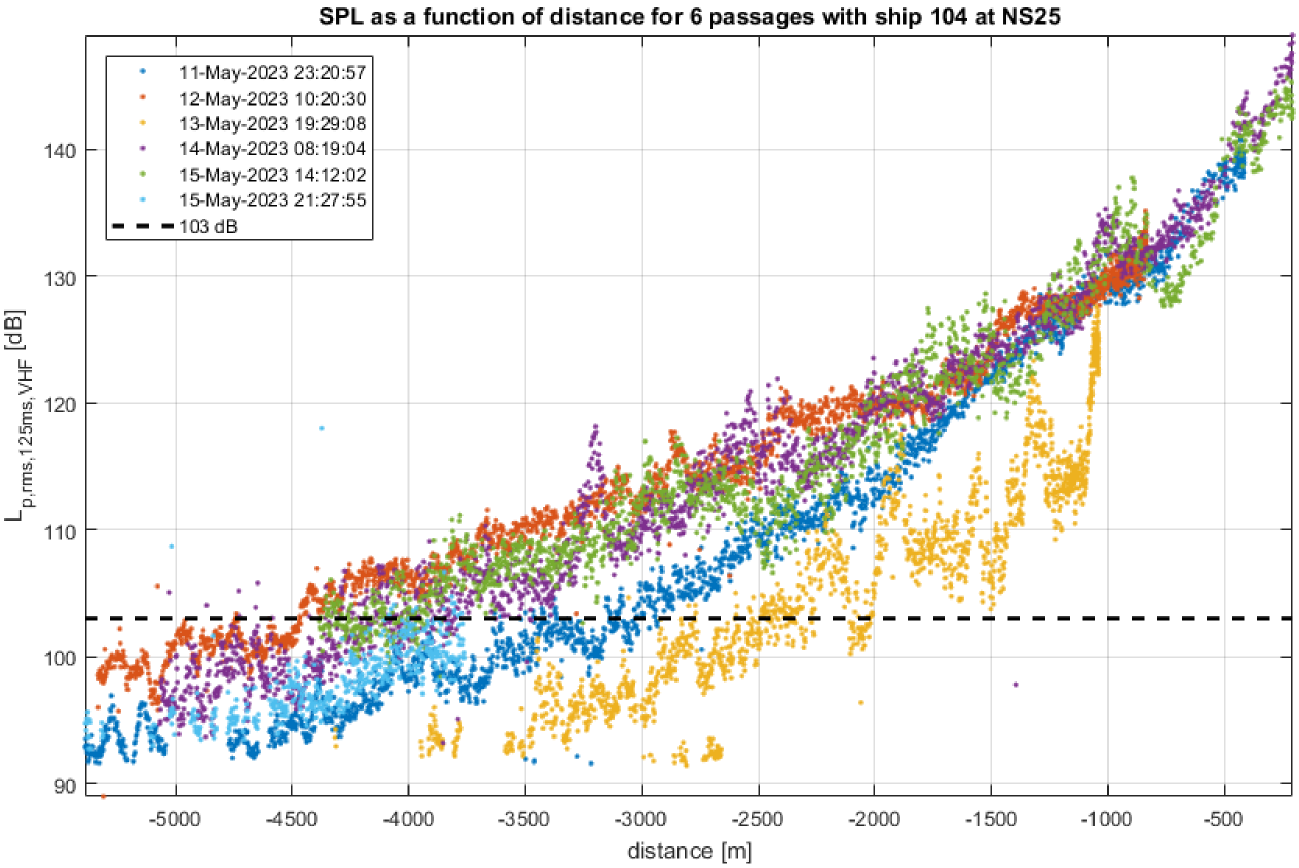


*Figure 4.6: SPL ($L_{p,rms,125ms,VHF}$) as a function of vessel distance, for six passes by the same vessel (Northern Maria) on five different days at measurement station NS25. Each pass has different coloured data points.*

In Figure 4.7, an example of five different passes within a time span of four days, with the same survey vessel (Northern Maria) at NS25, showed series with significantly fluctuating sound levels over distance. While the data points from the pass on May 21 showed almost no spread in sound level vs distance, all other passes showed a significant spread. Again, this could not be contributed to weather conditions. It could be speculated that the peaks and dips observed in the data sets (apart from May 21) could reflect a directional source side lobe pattern for a USBL system aimed backwards. This is however not something that could be confirmed and would require more detailed measurements and additional information about the USBL system handling and operational parameters.

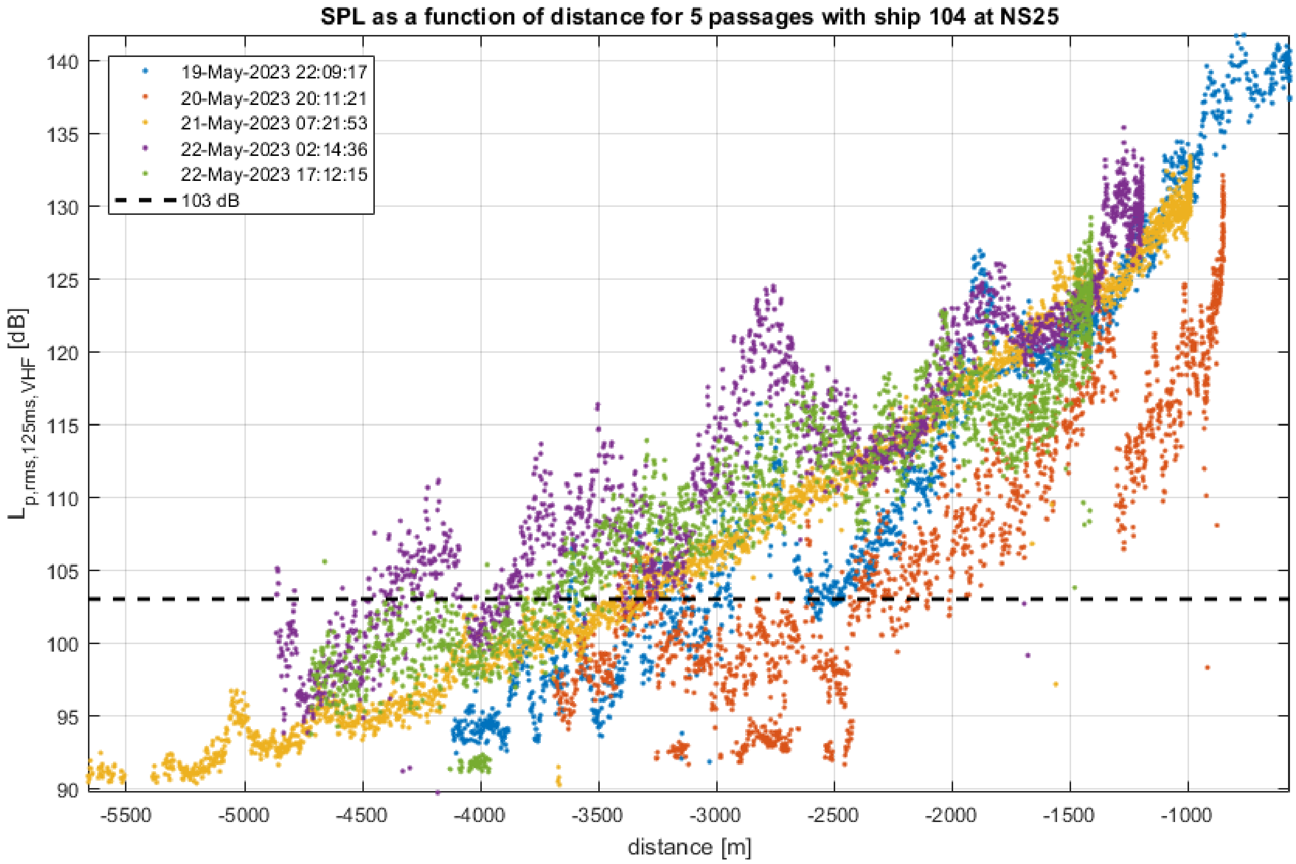


*Figure 4.7: SPL ($L_{p,rms,125ms,VHF}$) as a function of vessel distance, for 5 passes by the same vessel (Northern Maria) on four different days at measurement station NS25. Each pass has different coloured data points.*

## 4.3. Effect of USBL noise on harbour porpoise presence

### 4.3.1. Diel variation in porpoise echolocation activity with and without USBL signals

The GAMM analyses clearly revealed variation in diel echolocation activity between stations and, moreover, between periods with and without USBL signals (Figure 4.8 and Figure 4.9).

Specifically, at stations NS2, NS6 and NS14 (i.e. control stations without USBL signals from survey vessels), the model-based predicted mean CPM and PPM was generally highest during the nighttime hours 20:00 to 02:00. Moreover, the predicted mean CPM and PPM were generally higher during periods without USBL signals than during periods with USBL signals detected from sources other than survey ships. In contrast, at stations NS13, NS16 and NS25 (i.e. impact stations with USBL signals detected from survey ships and other sources), the model-based predicted mean CPM and PPM were generally highest during the daytime hours 10:00 to 15:00. Also at these impact stations, the predicted mean CPM and PPM were much higher during periods without USBL signals than during periods with USBL signals from survey vessels as well as other sources. During periods with USBL signals from survey vessels, CPM and PPM did not show any clear diel pattern and instead were consistently low across all 24-hours.

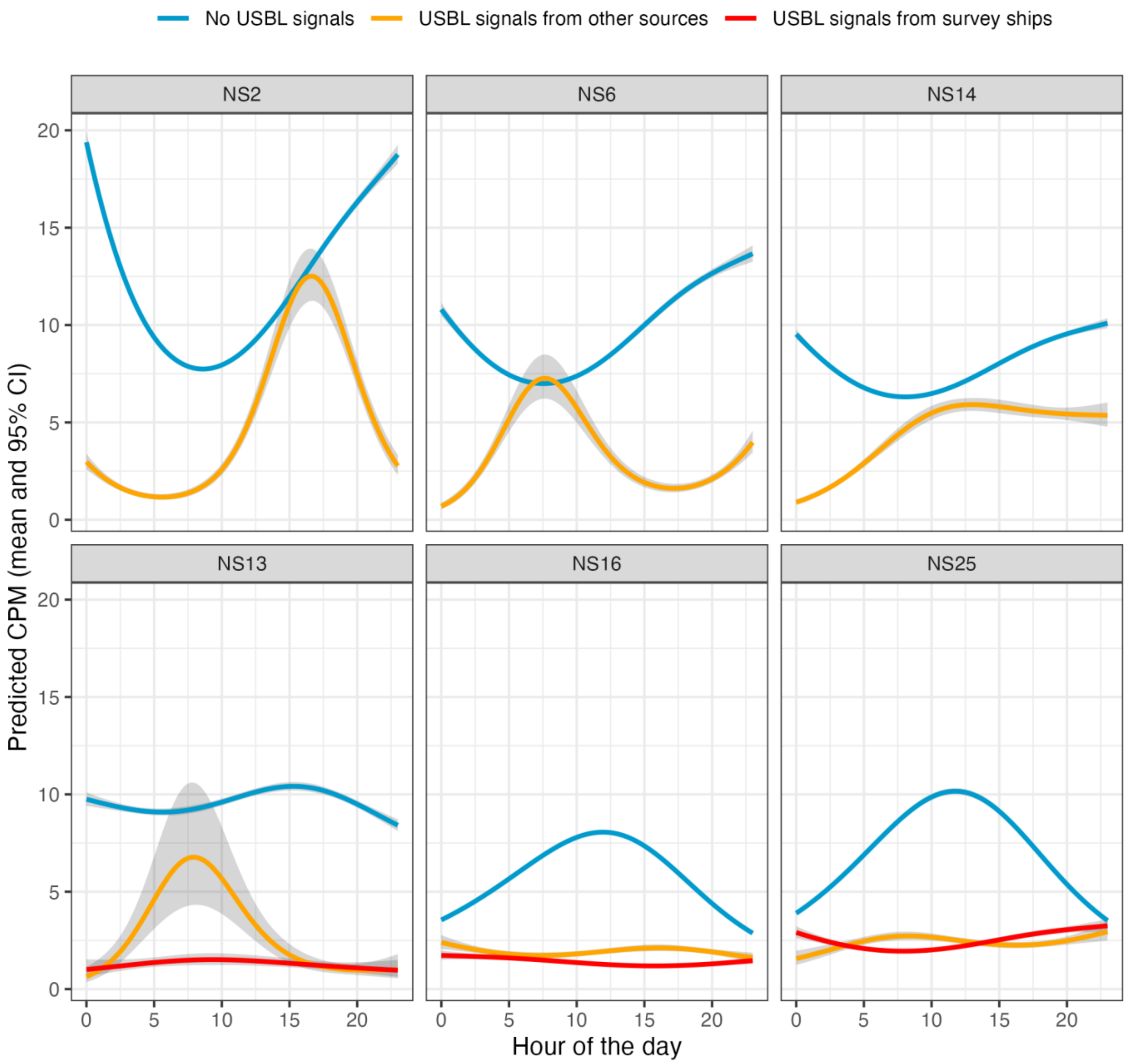


*Figure 4.8: Graphical output of the GAMM analysis estimating diel variation in the mean clicks per minute (CPM) for each of the 6 stations, and for each USBL type (no USBL signals in blue, USBL signals from other sources in orange, and USBL signals from survey ships in red) The 95% confidence interval around the predicted mean CPM is given in grey. Results for control stations (NS2, NS6, NS14) are provided in the top row, while results for the impact stations (NS13, NS16, NS25) are provided in the bottom row of the figure.*

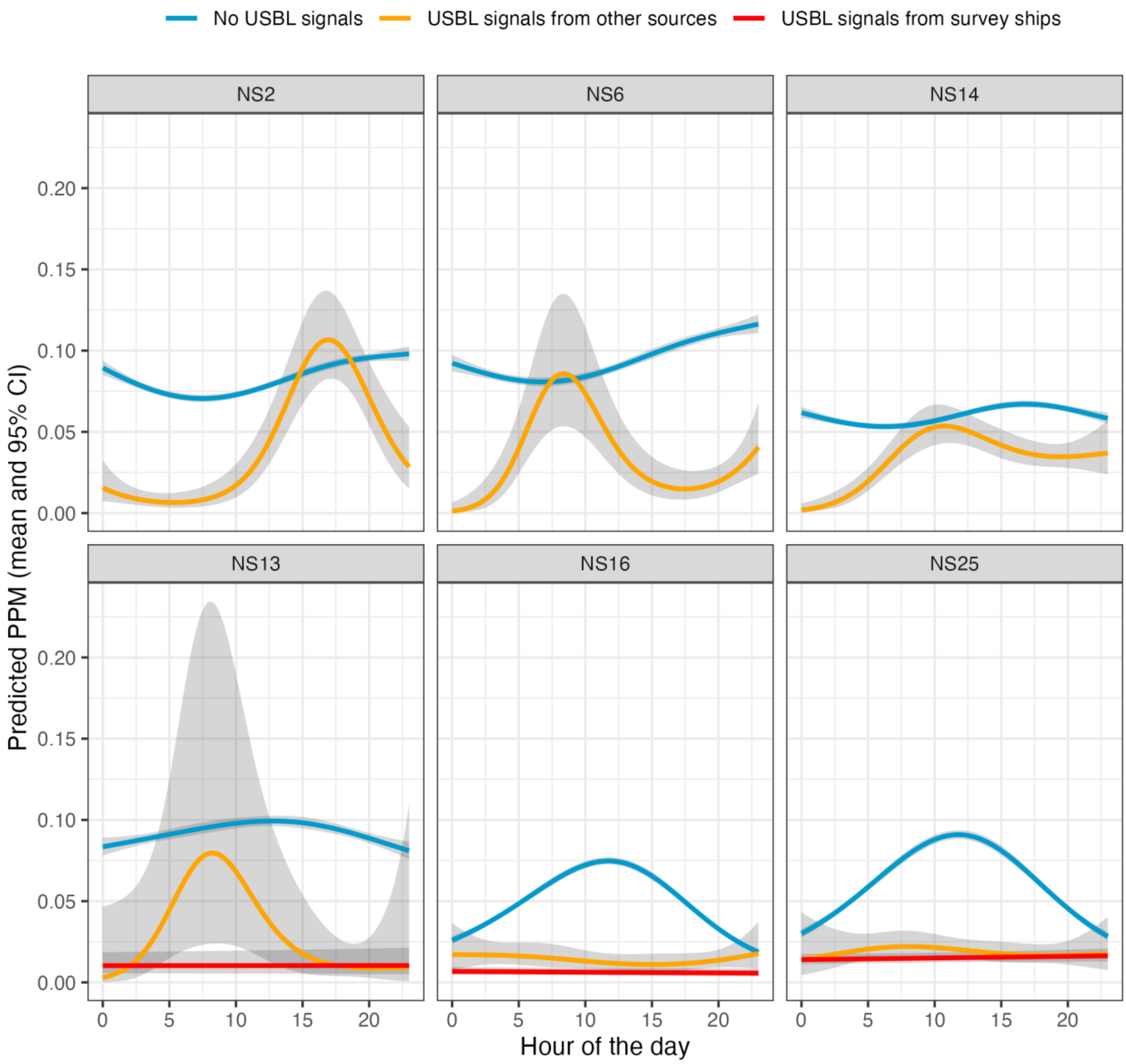


*Figure 4.9: Graphical output of the GAMM analysis estimating diel variation in the mean probability of porpoise positive minutes (PPM) for each of the 6 stations, and for each USBL type (no USBL signals in blue, USBL signals from other sources in orange, and USBL signals from survey ships in red) The 95% confidence interval around the predicted mean PPM is given in grey. Results for control stations (NS2, NS6, NS14) are provided in the top row, while results for the impact stations (NS13, NS16, NS25) are provided in the bottom row of the figure.*

#### 4.3.2. Correlations, Control-Impact analyses, and 50% change points

The output of the GLMERs revealed that both CPM and PPM declined with increasing SPL values ($\beta_{CPM}$ = -0.145, SD = 0.001, $p < 0.001$ and $\beta_{PPM}$= -0.125 , SD = 0.009, $p < 0.001$ respectively), while waiting time (USBL-HP) increased with increasing SPL values ($\beta_{waiting\ time}$ = 0.871, SD = 0.08, $p < 0.001$). These results support $H_1$ of hypotheses A and B i.e. that the presence of harbour porpoises is affected and falls with presence of USBL signals from geophysical surveys (A), and that waiting time (USBL-HP) is affected and increases with received level of USBL signals from geophysical surveys (B).

The GLMER-based control-impact analysis on the CPM metric revealed no statistical differences in the predicted mean CPM at control stations between periods without USBL signals and periods with USBL signals from sources other than the geophysical survey vessels (Figure 4.10). Moreover, the mean CPM at impact stations during minutes without USBL signals also did not differ significantly from those at the control stations. However, the mean CPM at the impact stations during minutes with USBL signals detected from survey vessels and other sources were substantially lower and differed significantly from all other groups. The SPL value at which CPM decreased with 50% compared to the predicted mean during periods without USBL signals was 100 SPL at control stations and 91 SPL at impact stations (Figure 4.11).

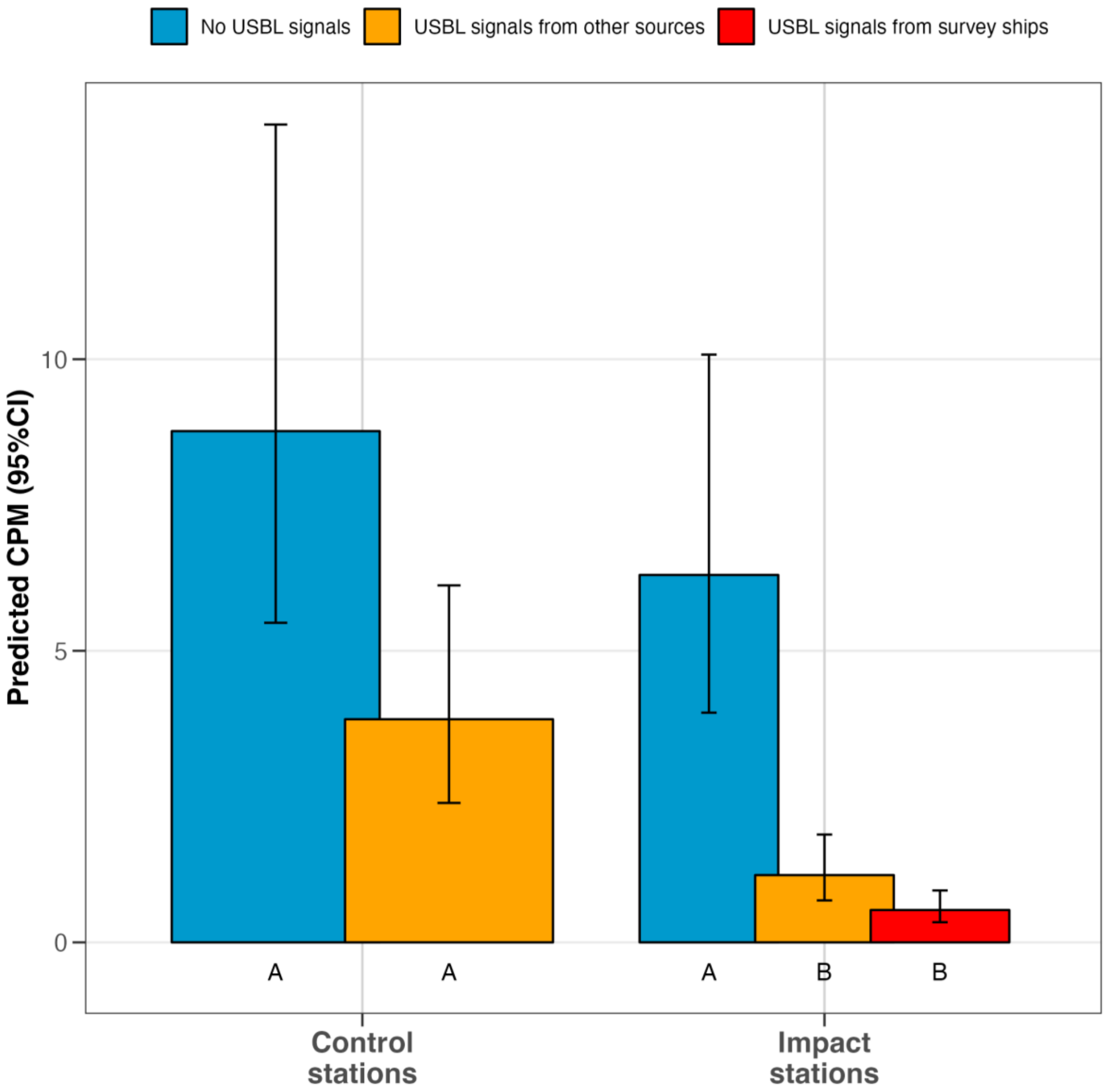


*Figure 4.10: Results of the Control-Impact analyses on clicks per minute (CPM). Model predicted mean and 95% CI intervals (in black) are provided for control and impact stations contrasting CPM between periods without USBL signals (blue bar), periods with USBL signals from other sources (orange bar) and USBL signals from survey vessels (red bar). The letters below the bars indicate whether the predicted mean between groups is significantly different at a p-value of 0.05. As such, bars with similar letters indicates that the mean CPM between groups do not differ from each other, while bars with different letters indicates that the mean CPM between groups differ from each other.*

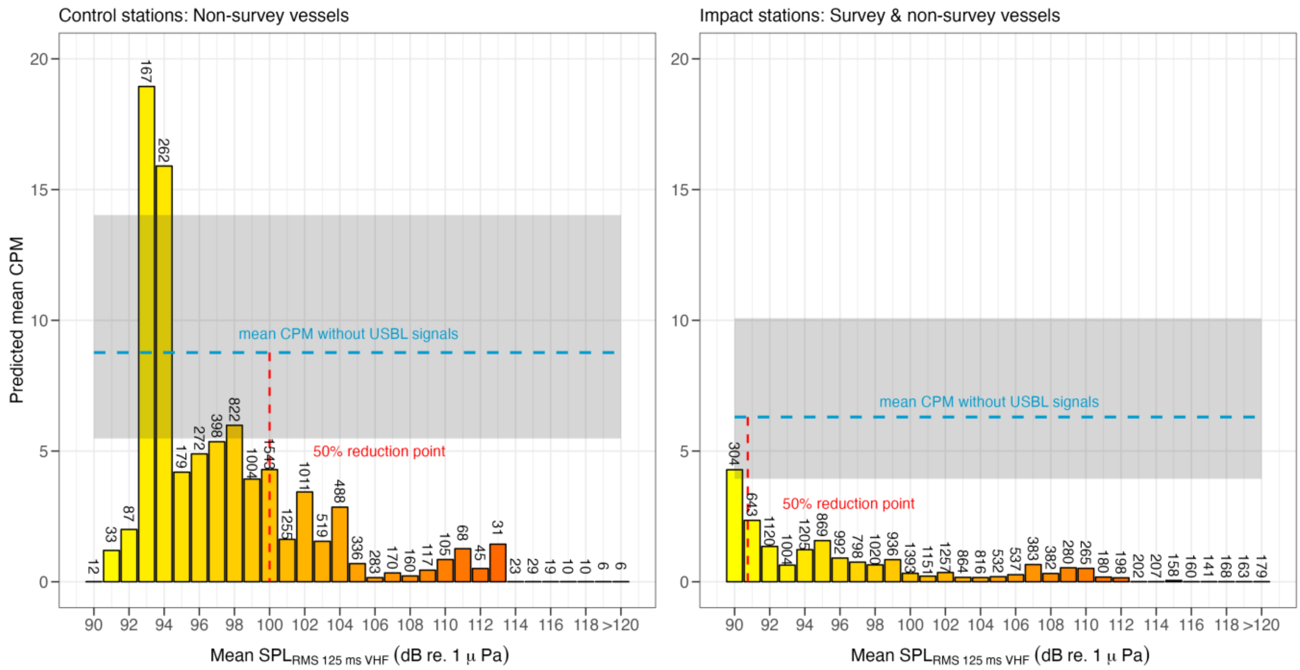


*Figure 4.11: Bar plots showing the predicted mean CPM (using output of the* control-impact GLMERs*) for each rounded SPL value for non-survey vessels at control stations (left panel) and for survey and non-survey vessels at impact stations (right panel). Also shown is the mean predicted CPM during periods without USBL signals (horizontal dashed blue line) with the corresponding 95% CI (grey area) for both control and impact stations, which correspond to Figure 4.10. The vertical dashed red line indicates the SPL value at which the CPM declined by 50% compared the mean predicted CPM during periods without USBL signals. The number above each bar is n, i.e. number of minutes included in that bar.*

Control-impact analysis on the PPM metric revealed a statistically significant difference in the predicted mean PPM at control stations between periods without USBL signals and periods with USBL signals from sources other than the survey vessels (Figure 4.12). As with the CPM results, the mean PPM at impact stations during minutes without USBL signals did not differ significantly from those at the control stations. However, the mean PPM at the impact stations during minutes with USBL signals detected from survey vessels and other sources were substantially lower and differed significantly from all other groups. Comparable to the CPM results, the SPL value at which PPM decreased with 50% compared to the predicted mean during periods without USBL signals was 100 SPL at control stations and 92 SPL at Impact stations (Figure 4.13).

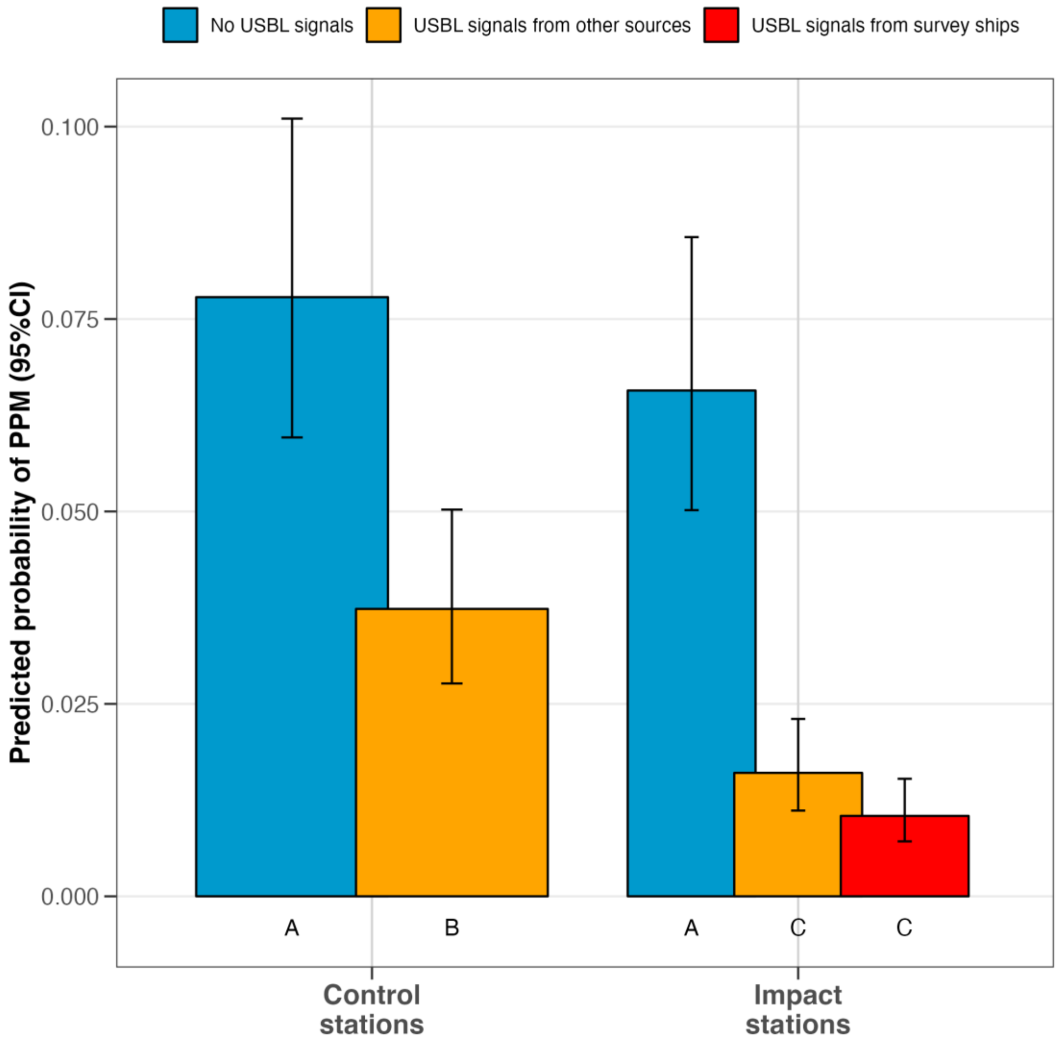


*Figure 4.12: Results of the Control-Impact analyses on porpoise positive minutes (PPM). Model predicted mean and 95% CI intervals (in black) are provided for control and impact stations contrasting PPM between periods without USBL signals (blue bar), periods with USBL signals from other sources (orange bar) and USBL signals from survey vessels (red bar). The letters below the bars indicate whether the predicted mean between groups is significantly different at a p-value of 0.05. As such, bars with similar letters indicates that the mean PPM between groups do not differ from each other, while bars with different letters indicates that the mean PPM between groups differ from each other.*

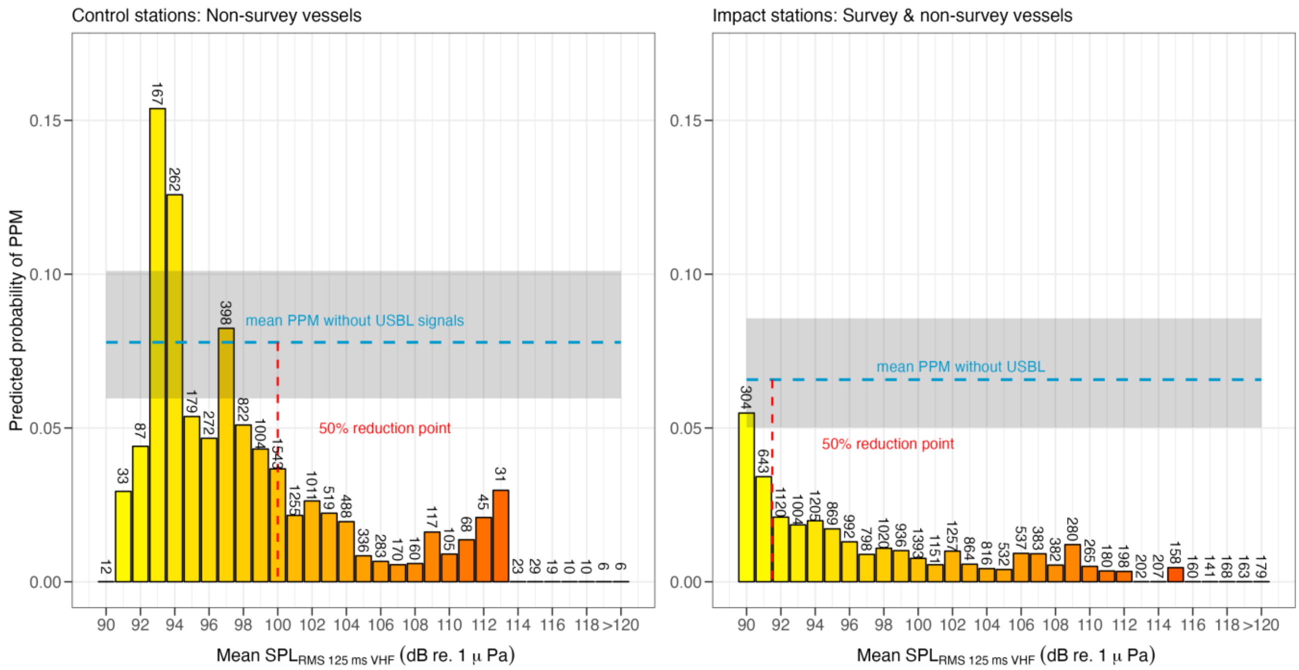


*Figure 4.13: Bar plots showing the predicted mean PPM (using output of the* control-impact GLMERs*) for each rounded SPL value for non-survey vessels at control stations (left panel) and for survey and non-survey vessels at impact stations (right panel). Also shown is the mean predicted PPM during periods without USBL signals (horizontal dashed blue line) with the corresponding 95% CI (grey area) for both control and impact stations, which correspond to Figure 4.13. The vertical dashed red line indicates the SPL value at which the PPM declined by 50% compared the mean predicted PPM during periods without USBL signals. The number above each bar is n, i.e. number of minutes included in that bar.*

Control-impact analysis was performed on waiting time. Waiting time (HP-HP) was used for periods without USBL and waiting time (USBL-HP) was used for periods with USBL (regardless of source). The control-impact analysis revealed a statistically significant difference in the predicted mean waiting time at control stations comparing periods without USBL signals to periods with USBL signals from sources other than the survey vessels (Figure 4.14). Again, the mean waiting time (HP-HP) at impact stations during minutes without USBL signals did not differ significantly from those at the control stations. However, the mean waiting time (USBL-HP) at the impact stations during minutes with USBL signals detected from survey vessels and other sources were substantially higher and differed significantly from all other groups. The model predicted mean (lower-upper 95% CI) waiting time (USBL-HP) at impact stations during periods with USBL signals detected as 196.3 minutes (153.7- 238.9) for survey vessels and 218.7 minutes (175.9-261.4) for other sources. The SPL value at which waiting time (HP-HP) increased with 50% compared to the predicted mean during periods without USBL signals was 102 dB SPL at control stations and 99 dB SPL at Impact stations (Figure 4.15).

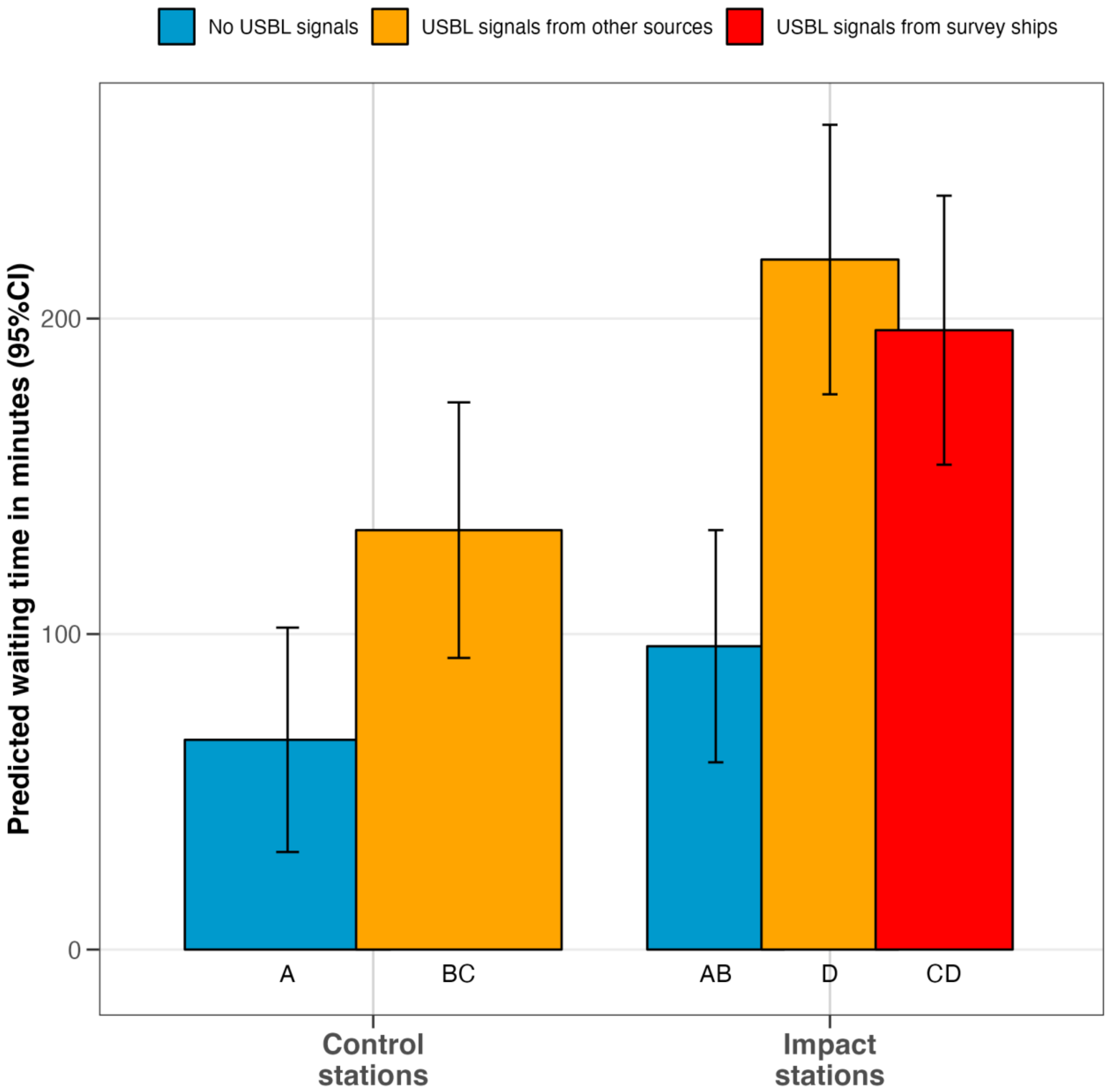


*Figure 4.14: Results of the Control-Impact analyses on porpoise waiting time. Waiting time is presented in minutes, with blue bars (HP-HP) representing no USBL signals, while both yellow and red (USBL-HP), represent USBL from other sources and USBL from survey ships, respectively. Model predicted mean and 95% CI intervals (in black) are provided for control and impact stations contrasting waiting time between periods without USBL signals (blue bar), periods with USBL signals from other sources (orange bar) and USBL signals from survey vessels (red bar). The letters below the bars indicate whether the predicted mean between groups is significantly different at a p-value of 0.05. As such, bars with similar letters indicate that the mean waiting time between groups do not differ from each other, while bars with different letters indicates that the mean PPM between groups differ from each other.*

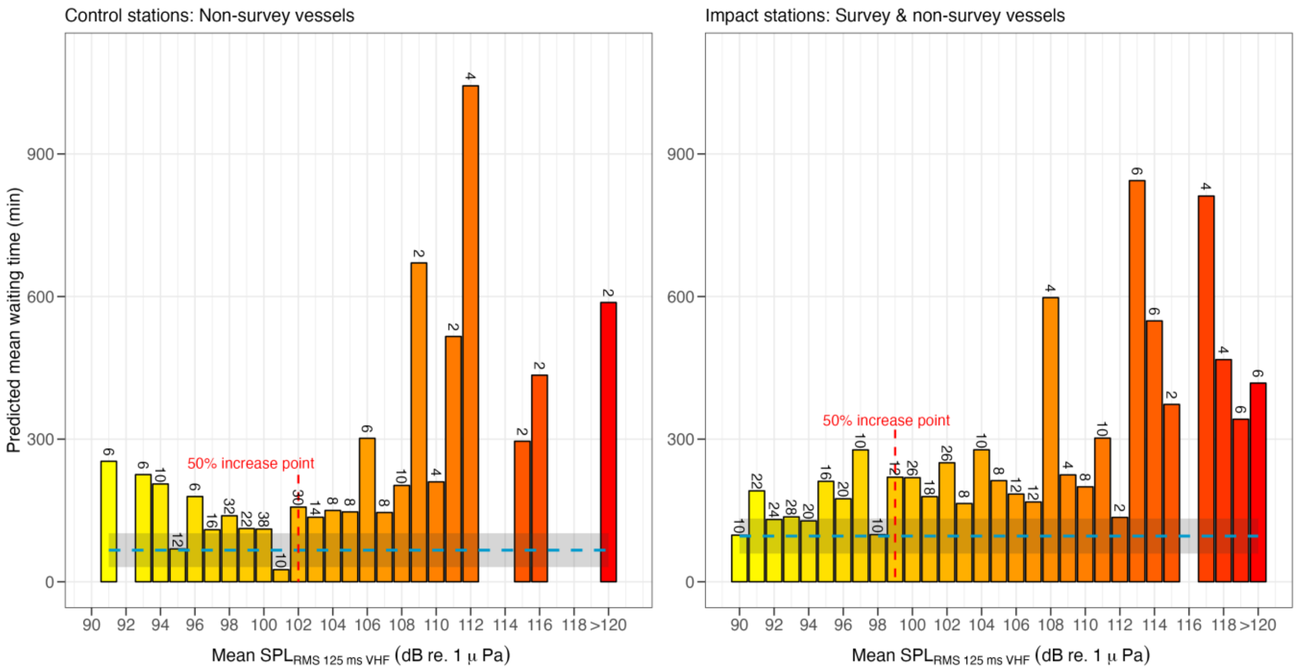


*Figure 4.15: Bar plots showing the predicted mean waiting time (USBL-HP) in minutes for each rounded SPL value for non-survey vessels at control stations (left panel) and for survey and non-survey vessels at impact stations (right panel). Also shown is the mean predicted waiting time (HP-HP) during periods without USBL signals (horizontal dashed blue line) with the corresponding 95% CI (grey area) for both control and impact stations, which correspond to Figure 4.14. The vertical dashed red line indicates the SPL value at which the waiting time (USBL-HP) increased by 50% compared to the mean predicted waiting time (HP-HP) during periods without USBL signals. The number above each bar is n, i.e. number of minutes included in that bar.*

### 4.3.3. Estimating and correcting for the impact of USBL signals to assess baseline data of harbour porpoise presence

To estimate the overall effect of the geophysical surveys on harbour porpoise presence, the mean PPM and CPM were calculated for each station using dataset with varying levels of USBL signals and compared to the mean PPM and CPM from datasets that were truncated with observed porpoise waiting times (USBL-HP). The results showed that the modelled predictive means of CPM and PPM in each station were always lowest in the full dataset as collected during the study period (Figure 4.16 and Figure 4.17). Reducing the full dataset by removing all minutes with USBL detections of survey ships increased the predicted mean PPM and CPM at all impact stations (NS13, NS16 and NS25). The predicted mean PPM and CPM of impact stations increased even further when also removing 238.9 minutes after the last survey-based USBL detection, and as such corrected for the upper 95% CI of the predicted mean waiting time (USBL-HP) as shown in Figure 4.14. When removing all minutes with USBL signals (irrespective of the source) from the full dataset the mean PPM and CPM increased substantially across all stations. This increase in mean PPM and CPM was even higher and evident across all stations when also correcting for waiting time for each USBL source. For example, the mean probability of a PPM at station NS02 increased from 0.04 in the full dataset to 0.11 in the USBL-detection corrected dataset, which is a 175% increase in the probability of detecting a harbour porpoise at any given minute. The change in mean CPM and PPM between datasets and stations also highlights that the baseline level of harbour porpoise presence was lower at the impact stations compared to the control stations, even after correcting for porpoise waiting time. The confidence intervals around the mean PPM and CPM calculated across all stations were rather large and highlight that the variability of harbour porpoise presence at each station was substantial over time, with periods of hardly any detections to rather high detections in others, as is also evident in Figure 3.2.

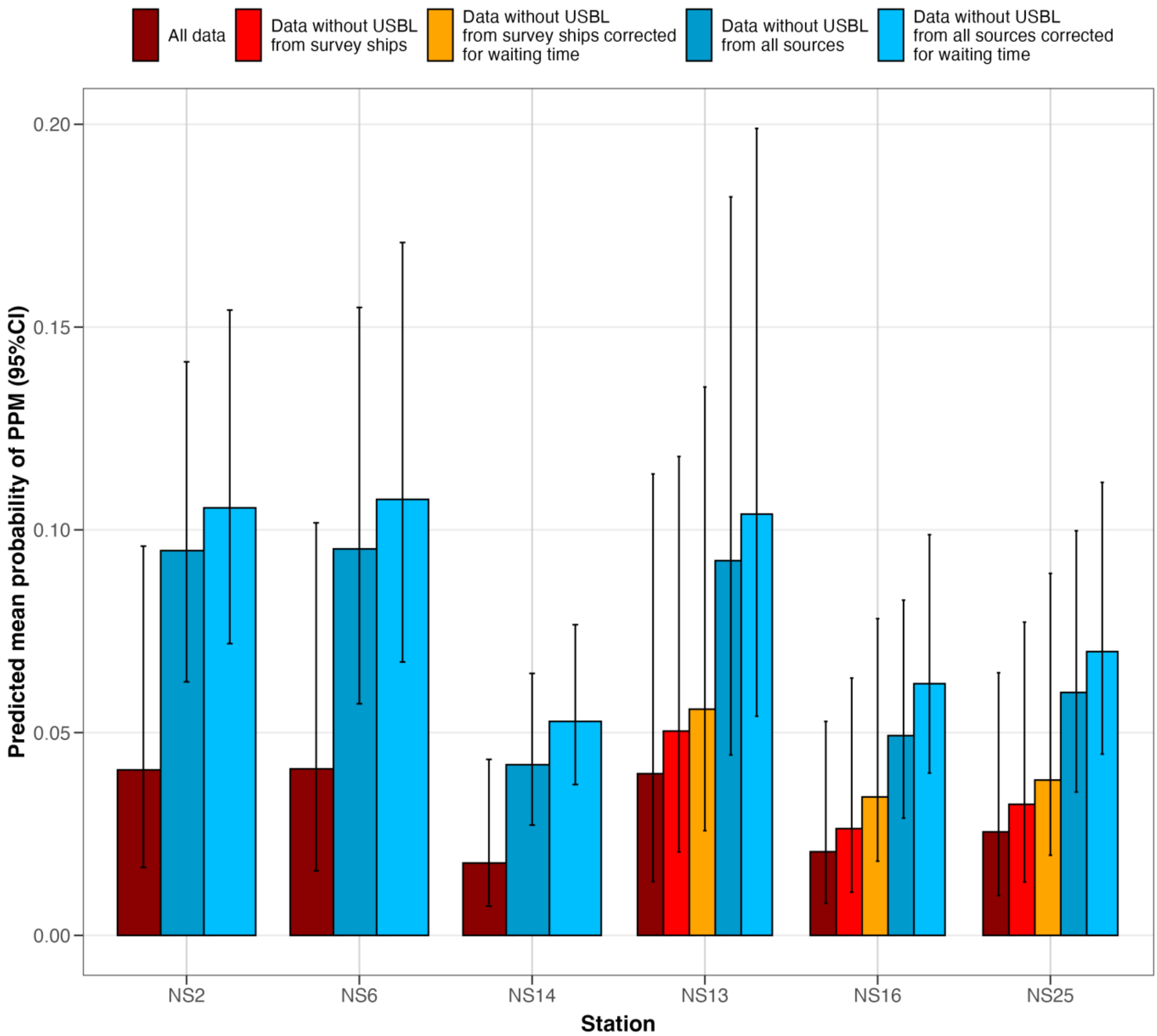


*Figure 4.16: Bar plot showing the predicted mean (95% CI in black) probability of porpoise positive minutes (PPM) for each dataset and station. Stations NS02, NS06 and NS14 were part of the control area (i.e. no survey vessels detected and only other sources emitting USBL signals), while NS13, NS16 and NS25 were part of the impact area (i.e. survey vessels detected as well as other sources emitting USBL signals). The five different datasets that were considered included "All data" (dark red bars) representing the full dataset with all USBL signals included. The dataset indicated with red bars is a subset of the full dataset from which all minutes with USBL signals from survey vessels were removed. The dataset indicated with orange bars is a subset of the full dataset from which all minutes with USBL signals from survey vessels were removed as well as the 238.9 minutes following the last USBL detection of a survey vessel (based on the predicted upper 95% CI of harbour porpoise waiting time at impact stations shown in Figure 4.14.). The dataset indicated with dark blue bars is a subset of the full dataset from which all minutes with USBL signals from all detected sources were removed. Finally, the dataset indicated with light blue bars is a subset of the full dataset from which all minutes with USBL detections were removed as well as the 238.9 minutes following the last USBL detection of a survey vessel and the 261.4 minutes following a the last USBL detection from another source (based on the predicted upper 95% CI of porpoise waiting time (USBL-HP) at impact stations shown in Figure 4.14).*

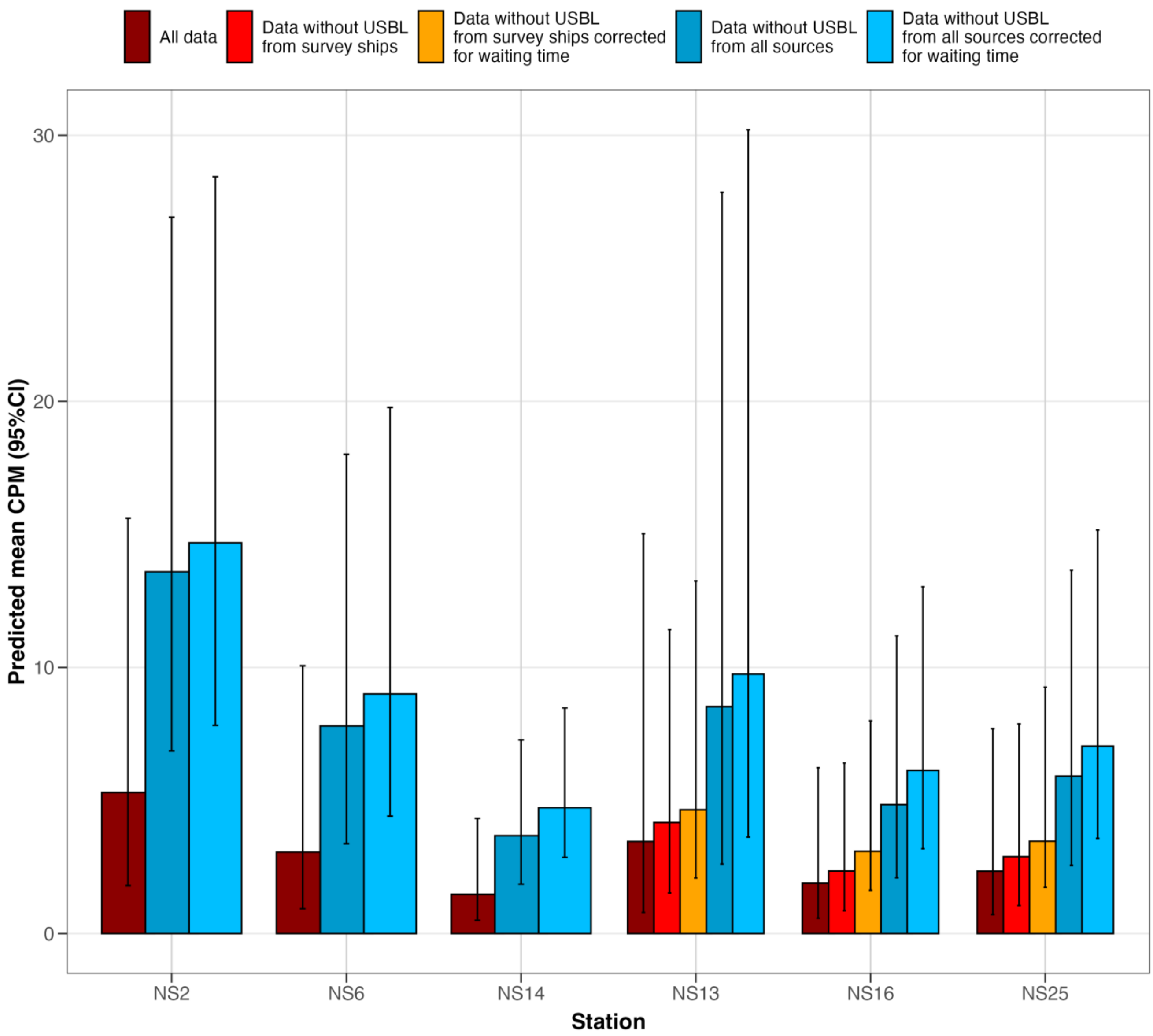


*Figure 4.17: Bar plot showing the predicted mean (95% CI in black) porpoise clicks per minute (CPM) for each dataset and station. Stations NS02, NS06 and NS14 were part of the control area (i.e. no survey ships detected and only other sources emitting USBL signals), while NS13, NS16 and NS25 were part of the impact area (i.e. survey ships detected as well as other sources emitting USBL signals). The five different datasets that were considered included "All data" (dark red bars) representing the full dataset with all USBL signals included. The dataset indicated with red bars is a subset of the full dataset from which all minutes with USBL signals from survey ships were removed. The dataset indicated with orange bars is a subset of the full dataset from which all minutes with USBL signals from survey ships were removed as well as the 238.9 minutes following the last USBL detection of a survey ship (based on the predicted upper 95% CI of porpoise waiting time at impact stations shown in Figure 4.14. The dataset indicated with dark blue bars is a subset of the full dataset from which all minutes with USBL signals from all detected sources were removed. Finally, the dataset indicated with light blue bars is a subset of the full dataset from which all minutes with USBL detections were removed as well as the 238.9 minutes following the last USBL detection of a survey ship and the 261.4 minutes following a the last USBL detection from another source (based on the predicted upper 95% CI of porpoise waiting time (USBL-HP) at impact stations shown in Figure 4.14.*

# 5. Discussion

This is to our knowledge the first study trying to quantify effects of USBL usage during geophysical surveys on the presence of harbour porpoises as measured with a PAM device. This study was not intended to be part of the baseline survey but was commissioned when the spatial and temporal overlap between the geophysical surveys and biological baseline surveys became clear. We studied the effects by comparing tracks of geophysical surveys, recordings of USBL sounds on broadband recorders (SoundTrap) and recordings of harbour porpoises from F-PODs simultaneously on six stations in the Danish North Sea. The analysis was conducted in stages to determine if the baseline data on harbour porpoise presence from F-PODs in the survey area represents an unaffected baseline situation, despite ongoing geophysical survey activity in the same area.

## 5.1. Overview of geophysical survey vessel presence

We first identified the dates on which the different F-POD and F-POD+ST stations in the survey area (see Figure 2.1) were potentially affected by the geophysical survey vessels' USBL equipment. This was done using a simplified approach, assuming behavioural effects on harbour porpoises at distances up to 3.5 km from any survey vessel with active USBL equipment, based on Pace et al. (2021).

This approach indicated that PAM stations were impacted by the USBL signals between 3-87% of days per month under the basic approach (see Appendix 2), where only days with active survey vessel presence within 3.5 km distance were counted. For the approach, where also the day following a survey vessel presence was counted, the impact percentage ranged between 7-97% of days per month (see Appendix 2). This suggests that if this approach was used for excluding USBL impacted data, a large portion of the baseline data set would have to be discarded. Furthermore, this simplified approach had limitations:

- It did not specify the timing, duration, or prevalence of station impact within affected days.
- It could not determine if the vessel was near the station or at the edge of the 3.5 km buffer zone.
- It did not consider the specifics of the USBL equipment used by the vessel nor could it account for other vessels' USBL usage in the area.
- The analysis only considered a 3.5 km impact range.

In conclusion, this approach seemed overly conservative. If each affected day (and also the day after) was omitted from the baseline study on marine mammal presence, results from several stations would largely need to be excluded for certain months. To address these limitations, we analysed the actual underwater noise from the use of USBL obtained at the six broadband recorders before examining the temporal impact on F-POD detections. The majority of detected USBL pulses (60%) could *not* be linked to a known survey vessel. Of the six F-POD+ST stations, three were outside the active geophysical survey area (control stations), with 100% of USBL detections comprising pulses from unknown vessels. For the three stations inside the active survey area (impact stations), unknown vessels accounted for 37% of the total USBL detection minutes.

## 5.2. Impact ranges from USBL signals

Analysis of individual survey vessel passes showed significant variation in impact ranges for the harbour porpoise behavioural reaction criterion ($L_{p,rms,125ms,VHF} = 103\ dB\ re.1\mu Pa$), ranging from ~1 km to ~5.5 km. These variations were observed from the same vessel (Northern Maria) which used a Kongsberg 502 USBL system, the same make and model studied in Pace et al. (2021), where impact ranges were below 3 km. It is unclear why the equipment sometimes operated at a setting resulting in a 1 km impact range, and other times a 5.5 km impact range. Variations occurred from day to day in the same area, and with varying signal-to-noise ratio over ambient noise. A general examination of USBL system operation, indicated multiple sources of uncertainties with regards to live operational parameters (pers. comm. Energinet), leading to continued uncertainty regarding any variations in observed sound levels. The USBL system tracks towed objects (e.g. the geophysical investigation equipment or trawling gear) deployed behind the vessel at up to a few hundred meters. Whether the source level was set manually by an operator, or automatically adjusted by the USBL system is unknown. If the USBL pulses can be clearly detected by acoustic recorders at distances beyond 5 km, the received sound level at tow distance is guaranteed to be orders of magnitude above the background noise level.

This study has made it clear that there should be more focus on the use and impact of USBL systems and especially that it should be a target to keep the source level as low as possible. This is currently not the case, however a first step could be to include maximum USBL source levels as a technical criteria in tenders, along with requirements for detailed documentation of the operation of USBL in order to avoid unexpected and undocumented variations in source levels.

Another observation from our analysis is that the previously assumed impact range of 3.5 km, chosen based on findings in Pace et al. (2021), might not be conservative. It remains unclear why the impact ranges, as a function of received level by distance varied to the relatively large extent observed in this study. To establish a connection between the USBL operating parameters and recorded levels, operating parameters are needed. A general examination of USBL system log files, did not contain information on source levels (pers. comm. Energinet). It is not possible to estimate the overall level of noise pollution from USBL systems without the use of broadband recorders deployed in a close grid in a specific area.

## 5.3. Effect of USBL noise on harbour porpoise presence

To obtain a better understanding of the differences in source levels between the geophysical survey in the North Sea I pre-investigation area, and that of the Pace study (Pace, Robinson, Lumsden, & Martin, 2021), it would be necessary to obtain a better understanding of the equipment and operating parameters used. However, this is not included in the present study. Without more knowledge, a conservative approach, would be to increase the assumed impact range of the USBL system based on the findings in this report to 5.5 km. This is currently assessed to be the best possible approach as the impact range is difficult to estimate, due to the uncertainty of operational parameters used for different USBL systems.

After having calculated the impact ranges based on the harbour porpoise behavioural threshold criterion, $L_{p,rms,125ms,VHF} = 103\ dB\ re\ 1\mu Pa$, and observed received levels from USBL, we compared these levels to harbour porpoise detections on the F-PODs. We analysed PPM, CPM and waiting time between harbour porpoise encounters to test our hypothesis (please see chapter 3.4) that:

1) Porpoise positive minutes (PPM) and clicks per minute (CPM) would correlate negatively with presence of USBL signals from geophysical surveys.

2) Waiting time (USBL-HP) would correlate positively with received level of USBL signal from geophysics.

To test these hypotheses, the dataset was divided into two categories based on the presence of USBL signals from geophysical surveys: 1) Impact stations: NS13, NS16, NS25 with USBL signals from both geophysical surveys and unknown sources; and 2) control stations: NS2, NS6 and NS14 with USBL signals from unknown vessels only. The analysis demonstrated that the null hypothesis ($H_o$) for both hypotheses could be rejected, and the alternative hypothesis ($H_1$) accepted, as there was a decrease in both CPM (clicks per minute) and PPM (porpoise presence minutes) in the presence of geophysical USBL signals. Furthermore, it was found that higher received levels of USBL signals corresponded to lower CPM and PPM recorded.

Waiting time was significantly longer following a USBL signal from geophysical surveys (USBL-HP) compared to waiting time between harbour porpoise detections during periods without USBL signals from geophysical surveys (HP-HP). Moreover, waiting time following a USBL signal from geophysical surveys (USBL-HP) increased with increasing received levels.. The mean waiting time (USBL-HP), measured as the period from the last geophysical USBL signal to the first harbour porpoise signal was 196.3 minutes (95% confidence intervals: 153.7- 238.9) during periods with geophysical survey vessels. In contrast, the mean waiting time (HP-HP) in periods without geophysical USBL signals was 66 minutes (95% confidence intervals: 30.9-102) at control stations and 96.14 (95% confidence intervals: 59.3-132.9) at impact stations. This indicates that the simplified approach of removing data from the entire day (where a geophysical survey vessel was within 3.5 km from the station), as well as the more conservative approach removing data also from the following day, were both too conservative.

We examined the effect of geophysical surveys using USBL on harbour porpoise presence and activity by comparing mean levels of PPM and CPM with available broadband data for periods with and without geophysical USBL detection minutes excluded. The mean levels were higher when excluding USBL detection minutes, and even higher when also excluding the 238.9 minutes post-detection (mean plus standard deviation). This indicates a negative impact of USBL signals on harbour porpoise presence in the survey area during geophysical surveys with active USBL. However, when also excluding periods with USBL detections from unknown sources, a more pronounced impact on PPM and CPM was observed, both with and without the 238.9 minutes post-detection periods excluded. This would indicate that all USBL signals, regardless of source, have a negative impact on harbour porpoise presence both inside (impact stations) and outside (control stations) the survey area.

Most of the recorded USBL signals could not be linked to the presence of a geophysical survey vessel. For six randomly selected unidentified vessel passes, AIS data was obtained by Energinet, and the distance between nearby AIS vessels was noted for the duration of the USBL detection pass. For five out of six passes, fishing vessels were identified nearby the station at the time of the USBL detections, with a matching trend between distance and sound levels recorded. Fishing trawlers use a number of different acoustic systems to 1) accurately position the opening of their trawl, 2) measure the position of the trawl opening over the sea floor, 3) measure how many tons of fish enters the trawls, and 4) measure how filled the trawl is. The systems are collectively termed *catch control systems,* and they all make use of signals in a frequency band where harbour porpoises hear well. The system that keeps track of the trawl opening has transceivers on each trawl door that emits signals back to a synchronizing module on the vessel. This is essentially the same as the USBL systems used by geophysical survey vessels. Since trawlers can use twin and triple trawls there can be up to six transponder replies to each synchronizing signal from the vessel, and such examples were found during analysis, where the number of USBL detections per minute were as high as 326, likely corresponding to 1 USBL transceiver and 6 transponders each operating with a ~0.8 Hz pulse repetition rate. In comparison, geophysical survey vessels typically operate with a single transceiver and one transponder per tow, totalling 2 – 3 USBL units with approximately 1 Hz pulse repetition rate per unit, leading to ~120 - 180 USBL detections per minute. The analysis of the broadband recordings was not designed to separate USBL signals from USBL-like signals, that is, signals with frequency and pulse characteristics similar to that of USBL. It is therefore likely, but currently unknown, whether catch control systems were misidentified as USBL systems.

The North Sea I survey area and most of the Danish North Sea is intensively trawled, and it must therefore be assumed that harbour porpoises in the area previously have been exposed to catch control system signals from trawlers, since harbour porpoises and trawlers catch the same fish species and therefore prefer the same areas. This is a potential explanation for the higher number of PPM in Figure 4.13 at 93 and 94 dB re 1 µPa rms, but it may also be a spurious effect due to the low number of data points.

Before this study, we had not realized that trawlers use USBL systems to such a large extent and the impact on marine mammals from this aspect of the fishing industry has to our knowledge never been studied. To examine whether the baseline data collected in North Sea I was affected by presence of geophysical surveys using USBLs, it was thus assumed that the trawlers' various noise emissions were part of the 'natural' or perhaps more appropriately phrased 'normal' soundscape of harbour porpoises and thus included in the "control" dataset. Since trawlers are very frequent in general in the North Sea and in the survey area specifically, it is possible that harbour porpoises are more accustomed to this noise type as used by trawlers that move differently than geophysical vessels, but this is speculation. Our knowledge and understanding of this impact is new and very little is known about how individual harbour porpoises react to these signals, and how this affects their behaviour, hearing and energy expenditure. Based on our findings, we suggest the noise emissions as found from geophysical vessels and trawlers are examined further.

It should also be noted that this study only focused on USBL signals from geophysical surveys and effects thereof. However, many other acoustic signals and noise sources were emitted/present during the geophysical surveys, and likely also from the unknown sources. Effects of these on marine mammals, were not part of this study. The dataset is hence more impacted by anthropogenic sound sources than described here.

## 5.4. Baseline compensation due to the presence of geophysical surveys

Considering that the majority of the USBL signals detected on the six stations originated from unknown sources, it is unclear what constitutes the baseline. It is clearly impacted by several anthropogenic sound sources and this complicates the question of how to compensate for the presence of USBL from geophysical survey activities.

The question is therefore how to account for the decrease in presence of harbour porpoises when the geophysical surveys were active near stations without a broadband recorder, i.e. on stations where the received level of the USBL signals was not measured. One approach, based on the results of this study, could be to remove the 238.9 minutes after vessels with active USBL systems has been within 5.5 km, based on survey vessel GPS logs. However, to clarify this approach cannot account for the influence from unknown sources, as we do not have the required position logs from these unidentified vessels. It should also be noted that this approach is conservative in that 5.5 km was the worst-case impact range from the analysis, and that not all geophysical vessels had an active USBL system during survey activities. This would, however, allow for maintaining a larger part of the baseline dataset compared to the simplified approach (basic and more conservative approaches).

To test how much data would have to be excluded for the simplified approaches and for the statistically based approach, a comparison of how many minutes would have to be removed in total for each approach was made for stations NS13, NS16 and NS25. This test only considers survey vessel presence within certain distance thresholds, based on the survey vessels GPS logs, and does not include any broadband recordings, and thereby detections of USBL or received SPL levels.

The comparison included the following approaches:

i. The basic simplified approach excluding any day with survey vessel presence within a 3.5 km radius of a station (approach 1).
ii. The basic simplified approach, like approach 1, however with an increased exclusion radius of 5.5 km. (approach 2).
iii. The simplified approach where, in addition to survey vessel presence days within a 3.5 km exclusion radius, also the following day was excluded (approach 3).
iv. The more conservative simplified approach, like approach 3, however with an increased exclusion radius of 5.5 km (approach 4).

v. The advanced approach where the vessel presence was examined on a minute-by-minute basis, and any minutes with USBL detections were excluded. In addition, after any USBL detection minute, the following 239 minutes were also excluded, to represent the conservative outcome of the statistical analysis of the waiting time (USBL-HP) (Figure 4.14).

For each approach, the total number of minutes to be excluded is listed in Table 5.1.

*Table 5.1: Comparison of the excluded minutes for stations NS13, NS16 and NS25, based on 5 different approaches to exclusion methodology (see text in report for definitions of the 5 approaches). "% of all 2023 data" denotes the percentage of the combined excluded minutes in three stations of the total F-POD recording minutes for the three stations from 4. April – 16. November 2023.*

| Approach | Description | Exclusion radius | Exclusion minutes by station | | | % of all 2023 data |
|---|---|---|---|---|---|---|
| | | | NS13 | NS16 | NS25 | |
| **Basic** | Survey day excluded | 3.5 km | 30.120 | 60.480 | 84.960 | 23.7% |
| | | 5.5 km | 41.640 | 95.040 | 106.560 | 32.8% |
| **More conservative (+1 day)** | Survey day and following day excluded | 3.5 km | 37.320 | 74.880 | 110.880 | 30.1% |
| | | 5.5 km | 51.720 | 109.440 | 128.160 | 39.0% |
| **Advanced** | Vessel presence + 239-minute exclusion | 5.5 km | 19.523 | 52.952 | 62.848 | 18.3% |

To assess the effect of the different exclusion approaches on PPM, five new datasets were generated in which minutes that fit the criteria of each exclusion approach provided in Table 5.1 were excluded. For each exclusion dataset, the mean and 95% CI of PPM were then calculated for each month and impact station separately. For comparison, the same calculations were done for the "All dataset" from which no minutes were removed. The monthly scale was chosen here to visualize any changes in PPM between exclusion approaches and highlight the months in which USBL ships were present within the defined criteria. Effects may be clearer if smaller time scales are examined, but that has not been tested.

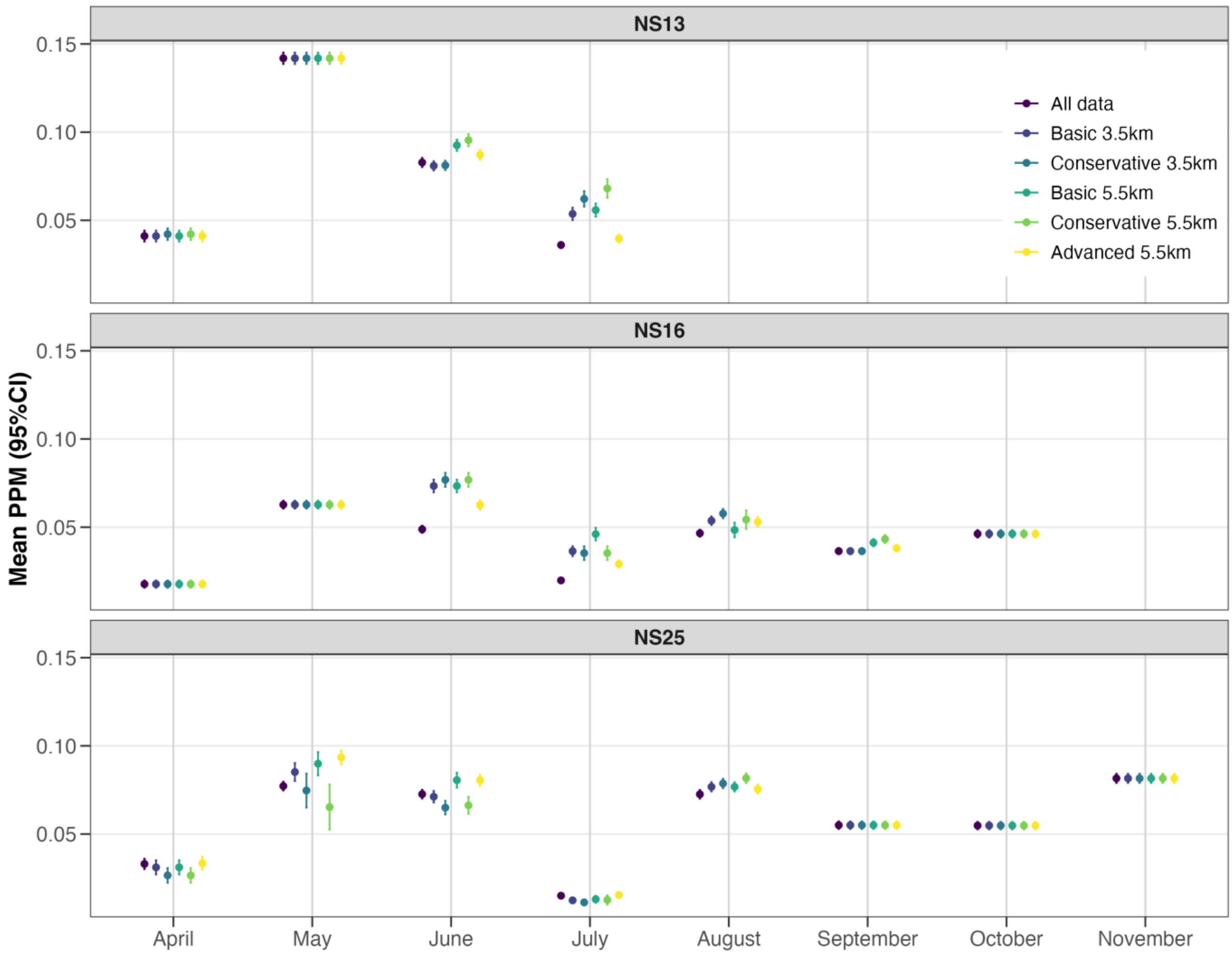


*Figure 5.1. Plot showing the mean (95% CI) probability of porpoise positive minutes (PPM) calculated for the "All data" set and the five exclusion datasets (Table 5.1) across each month and impact station (NS13, NS16 and NS25). Note that in some months the mean and 95% CI are the same across the datasets used, which means no minutes were removed as no survey ships were present within the defined exclusion criteria.*

The results (Figure 5.1) show that the change in PPM varied substantially between exclusion approaches, both within and between stations and months. Specifically, no systematic changes in PPM were detected when using the "Basic" and "More conservative" approaches as the mean PPM was higher than the mean PPM in the "all dataset" in some months and stations (e.g. August in NS25) but, in other months and stations, the mean PPM was lower than in the "All dataset" (e.g. April and July NS 25). Both the basic and more conservative approaches remove significant amounts of data (24 hours and 48 hours respectively), in the event of survey activities, regardless of whether it concerns a single vessel pass or continuous activity over 24 hours in the vicinity of the station. It therefore stands to reason, that these exclusion approaches remove data that are affected by ship presence in varying degrees. It therefore also makes sense that some cases would exclude data with high PPM and thereby resulting in lower PPM for the excluded data set. Other cases where high survey activity periods were excluded might lead to a higher PPM. The only exclusion approach that provided systematic changes in PPM was the "Advanced" approach as the mean PPM was consistently (i.e. in all months and stations with minutes removed) higher than the mean PPM in the "All dataset".

Despite that the advanced approach appears to be the best way to correct the data, this approach may not fully capture the effect of USBL signals on harbour porpoise presence, because the used waiting time is calculated from USBL signal to first harbour porpoise event, which is a lot shorter than the actual waiting time between individual harbour porpoise encounters that occurs when consecutive USBL pulses are recorded. Further, even with the advanced approach of correcting the baseline data, it should be kept in mind that the dataset was impacted by noise from other acoustic equipment types than from USBL systems (regardless of source) per se.

# 6. Conclusion

Based on the assumption that a 3.5 km impact range could be considered the impact range based on the harbour porpoise behavioural reaction threshold of $\mathrm{L_{p,rms,125ms,VHF}} = 103\ dB\ re.1\mu Pa$, survey vessel presence overlap within a 3.5 km range of each of the 42 PAM stations was documented on a daily basis. For this basic approach, a total of 668 days in 2023 were marked as affected due to survey vessel presence within 3.5 km (Table 4.1), ranging from zero days affected at 18 PAM stations, to 67 days affected for PAM station NS24. In the more conservative approach, where in addition to the survey presence day, the following day was also counted, 953 days in 2023 were marked as affected.

Detailed analysis of USBL occurrences within the six F-POD + ST station recordings, and survey vessel presence, was used to establish a connection between the recorded USBL signals' sound pressure levels (SPL) $L_{p,rms,125ms,VHF}$, and the distance to nearby survey vessels. Curve fitting was used to determine the intersection between the USBL signal SPL and the harbour porpoise behaviour criterion $\mathrm{L_{p,rms,125ms,VHF}} = 103\ dB\ re.1\mu Pa$, resulting in distances from ~1 km to ~5.5 km. The analysis revealed that the variation in observed impact ranges was not linked to different USBL systems, as variations were observed for the same survey vessel on different days. It could not be concluded whether the impact range variations were due to human interaction with the USBL operational parameters, or autonomous USBL system behaviour. It is therefore concluded that actual impact ranges from the use of USBL systems, cannot be generally defined.

A negative correlation was observed between underwater noise from geophysical survey USBL signals and the presence of harbour porpoises. A negative correlation was also observed between underwater noise from unknown sources of USBL signals and the presence of harbour porpoises. It is concluded that all USBL signals, regardless of source, have a negative impact on harbour porpoise presence both inside (impact stations) and outside (control stations) the survey area.

In answer to the main objective of this study, it is concluded that the baseline data collected for harbour porpoises in the North Sea I survey area are not unbiased baseline data during the presence of geophysical survey vessels. Approaches for correction of the baseline data, using data exclusion based on geophysical survey vessel presence were examined to address this.

Five different data exclusion approaches that could potentially be used to correct the North Sea I baseline data were explored in terms of how they affected PPM. Removing minutes from the data using criteria in the two basic and more conservative approaches produced random or inconsistent changes to PPM, with the mean PPM either increasing or decreasing across stations and months compared to the original dataset "All data". Such inconsistencies in the change in PPM over time and space suggests the basic and more conservative approaches are likely unsuitable to correct the data and get closer to baseline values. These random patterns are likely caused by the large number of minutes removed (Table 5.1) based on the criteria of the basic and more conservative approaches and thereby also loss of minutes where no harbour porpoises were present (i.e. true 0 counts) but also PPM that were unaffected by the presence of survey ships. The advanced exclusion approach, which is based on analyses of porpoise waiting time (USBL-HP), was the only approach where the change in PPM was systematic and consistently higher than in the original dataset "All data". This consistency suggests that the advanced approach could potentially be suitable to correct the North Sea I data to get closer to baseline values. Moreover, out of the five approaches tested, the advanced approach also has the smallest amount of data loss with 18.3% of minutes removed out of all minutes in the dataset "All data" collected at the impact stations (Table 5.1). This is valuable as it means that a larger proportion of the dataset can be considered baseline unaffected by the geophysical surveys.

However, it is important to interpret the results of the exclusion exercise with caution because it is based on survey vessel presence within defined distance buffers only and does not consider whether USBL signals were emitted. Moreover, the presence of other ships not part of the survey but potentially emitting USBL signals were also not included in this exercise, yet USBL signals from these ships, as well as other emitted noise from various sources, do impact harbour porpoise echolocation activity, as highlighted in this report. The suggested approach for correcting data impacted by geophysical surveys may, with all the uncertainties listed throughout the report, be used to correct the 2023 dataset from the North Sea I survey area. The approach can however not be directly applied in other areas or to other species without site specific studies. The approach can also be used to correct 2024 data from the same area, provided that tracks of the geotechnical surveys active there are available.

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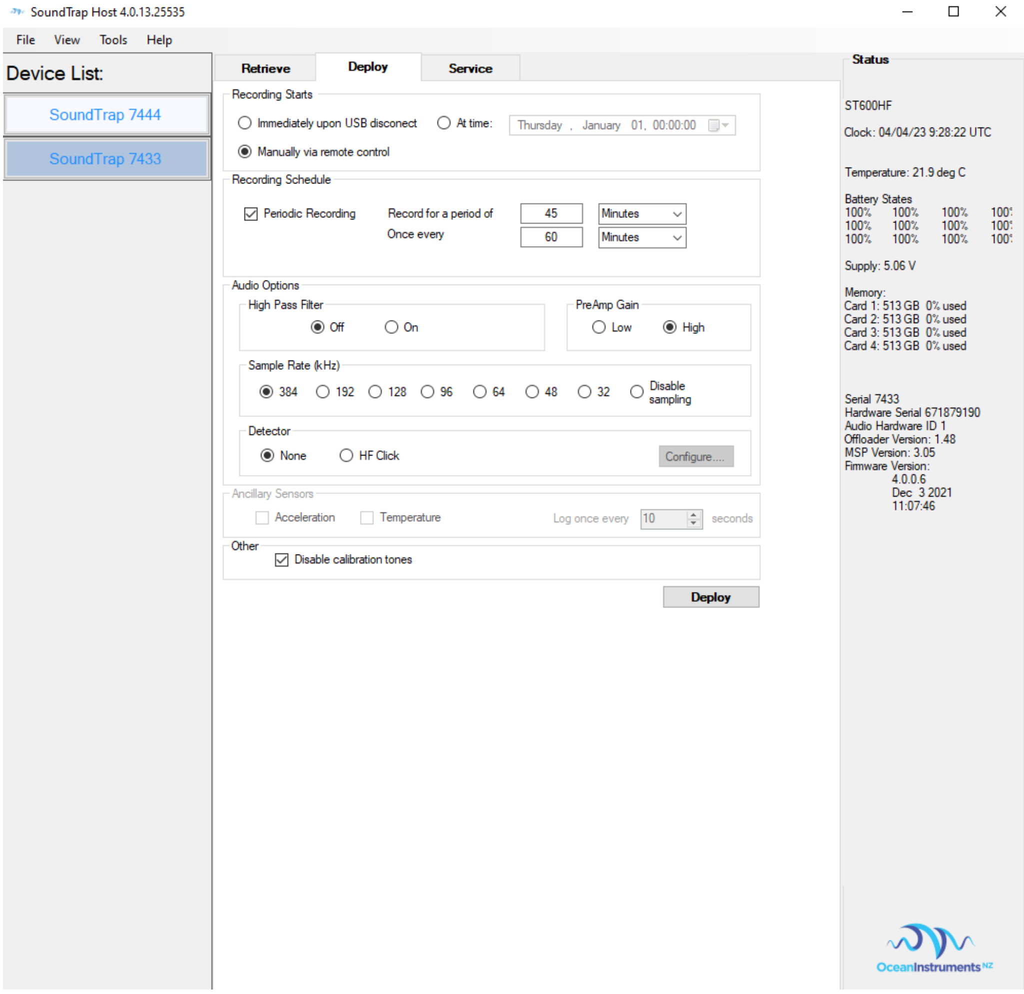
# Appendix 1

## PAM metadata and calibration

*Figure A1. 1. Example of set up file from SoundTrap Host, audio data download and decompression software accompanying each SoundTrap unit. Notice duty cycle, pre-amp, gain, and sample rate.*




All ST600HF were pistonphone calibrated prior to deployment (see North Sea I report on first year results of baseline here), unless they were brand new in which case the factory calibration ('Ocean Instruments) was used to calculate clip level. A 250 Hz pistonphone was used for the calibration. The calibration microphone was produced by G.R.A.S, and the settings were as follows:

Calibration microphone ID: 245958

Sensitivity VPa=0.012.

Sensitivity dB=-158.4163751.

A custom printed coupler sealed with an o-ring was used.

*Table A 1: Metadata for the included PAM data. Cal Notes column denotes if the ST600HF being deployed was brand new, and therefore the clip level used in the calibration came from the manufacturer (Ocean Instruments). Clip level was calculated via pistonphone for all subsequent deployments.*

| Station | Deployment | FPOD ID | SoundTrap ID | Sampling frequency (kHz) | Pre-amplifier gain (dB) | Duty cycle (minutes per hour) | Sample rate, kHz | Time for reset of clock (UTC) | Recording start date/time (UTC) | Cal, V | Calibrated clip level, dB re 1uPa | Cal notes | Deployment date | Deployment time (UTC) | Recovery date | Recovery time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NS02 | A | 6959 | 7433 | 384 | H | 45/60 | 384 | 04-04-2023 09:28:22 | 05-04-2023 10:06:00 | | 176,3 | Ocean Instruments | 18-04-2023 | 08:45 | 05-08-2023 | 15:42 |
| NS06 | A | 6995 | 7606 | 384 | H | 45/60 | 384 | 05-04-2023 11:53:08 | 05-04-2023 10:15:00 | 0,723 | 174,65 | | 21-04-2023 | 05:23 | 02-08-2023 | 10:45 |
| NS13 | A | 6987 | 7444 | 384 | H | 45/60 | 384 | 04-04-2023 09:30:11 | 05-04-2023 11:52:00 | | 175,7 | Ocean Instruments | 19-04-2023 | 18:15 | 02-08-2023 | 08:33 |
| NS14 | A | 6997 | 7605 | 384 | H | 45/60 | 384 | 05-04-2023 11:54:22 | 05-04-2023 11:59:00 | 0,744 | 173,7 | | 21-04-2023 | 07:58 | 02-08-2023 | 13:20 |
| NS16 | A | 6982 | 7435 | 384 | H | 45/60 | 384 | 04-04-2023 14:33:38 | 05-04-2023 10:21:00 | | 176,4 | Ocean Instruments | 19-04-2023 | 10:14 | 06-08-2023 | 11:21 |
| NS25 | A | 6990 | 7443 | 384 | H | 45/60 | 384 | 05-04-2023 07:45:28 | 05-04-2023 11:43:00 | | 175,9 | Ocean Instruments | 20-04-2023 | 09:36 | 06-08-2023 | 14:09 |
| NS02 | B | 6997 | 7775 | 384 | H | 45/60 | 384 | 26-07-2023 09:40:20 | 26-07-2023 11:15:00 | 0.774 | 175,07 | | 02-08-2023 | 11:01 | 02-12-2023 | 09:39 |
| NS06 | B | 6943 | 7763 | 384 | H | 45/60 | 384 | 26-07-2023 09:11:16 | 26-07-2023 11:31:00 | 0.717 | 174,78 | | 05-08-2023 | 15:50 | 08-01-2024 | 11:05 |
| NS13 | B | 6944 | 7772 | 384 | H | 45/60 | 384 | 26-07-2023 09:19:13 | 26-07-2023 11:58:00 | 0.741 | 175,28 | | 06-08-2023 | 08:59 | na | na |
| NS14 | B | 6940 | 7768 | 384 | H | 45/60 | 384 | 26-07-2023 09:49:38 | 26-07-2023 10:00:00 | 0.762 | 174,62 | | 06-08-2023 | 11:28 | 02-12-2023 | 10:58 |
| NS16 | B | 6954 | 7771 | 384 | H | 45/60 | 384 | 26-07-2023 08:55:32 | 26-07-2023 09:43:00 | 0.770 | 173,94 | | 06-08-2023 | 14:17 | 01-12-2023 | 07:33 |
| NS25 | B | 6980 | 7773 | 384 | H | 45/60 | 384 | 26-07-2023 09:59:16 | 26-07-2023 10:57:00 | 0.737 | 175,45 | | 02-08-2023 | 09:09 | 29-11-2023 | 14:44 |

# Appendix 2

## Survey vessel presence

*Table A2. 1: Presence of survey vessels within 3.5 km of each PAMstation, where a "1" indicates a North Sea I survey vessel with active USBL, a "0" indicates a North Sea survey vessel without active USBL system, and an "Ext" indicates survey vessels not linked to the North Sea I project. Only the "1"s count towards the exclusion days.*

| DATE | NS1 | NS2 | NS3 | NS4 | NS5 | NS6 | NS7 | NS8 | NS9 | NS10 | NS11 | NS12 | NS13 | NS14 | NS15 | NS16 | NS17 | NS18 | NS19 | NS20 | NS21 | NS22 | NS24 | NS25 | NS27 | NS28 | NS29 | NS30 | NS31 | NS32 | NS33 | NS34 | NS35 | HR3_1 | HR3_2 | HR3_3/NS23 | HR3_4 | HR3_5 | HR3_6 | T2 | T3/NS26 | T4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023-04-04 | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-04-05 | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-04-06 | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-04-07 | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-04-08 | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-04-09 | | | | 1 | | | | | | | | | | | | | | | | | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-04-10 | | | | | | | | 1 | | | | | | | | | | | | | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-04-11 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-04-12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-04-13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-04-14 | | | | 1 | | | | 1 | 1 | | 1 | | | | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| 2023-04-15 | | | | | | | | 1 | 1 | | 1 | 1 | 1 | | | 1 | 1 | 1 | | | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-04-16 | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | | 1 | 1 | | | | 1 | | | | | | | | | | | | | | |
| 2023-04-17 | | | | | | | | 1 | | | 1 | 1 | | | | 1 | | | | 1 | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-04-18 | | | | | | | | | 1 | | | | 1 | | | | 1 | 1 | | | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-04-19 | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | |
| 2023-04-20 | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-04-21 | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-04-22 | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-04-23 | | | | | | | | | | | | | | | | | 1 | 1 | 1 | | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-04-24 | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | 1 | | | | | | | | | | | | | 1 | | | | | |
| 2023-04-25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-04-26 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-04-27 | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | 1 | 1 | | | | |
| 2023-04-28 | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-04-29 | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-04-30 | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | | | | | | | | | | | | | | | | | | |
| **SUM** | **0** | **0** | **0** | **2** | **0** | **0** | **0** | **5** | **3** | **0** | **4** | **3** | **3** | **0** | **0** | **2** | **3** | **3** | **3** | **3** | **14** | **0** | **15** | **8** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **3** | **1** | **0** | **0** | **0** | **0** |
| **ADDED DAYS AFTER** | | | | **2** | | | | **4** | **2** | | **3** | **3** | **2** | | | **2** | **3** | **3** | **3** | **2** | **3** | | **4** | **3** | | | | **1** | | | | | | | | | **3** | **1** | | | | |
| **TOTAL DAYS EXCLUDED** | **0** | **0** | **0** | **4** | **0** | **0** | **0** | **9** | **5** | **0** | **7** | **6** | **5** | **0** | **0** | **4** | **6** | **6** | **6** | **5** | **17** | **0** | **19** | **11** | **0** | **0** | **0** | **2** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **6** | **2** | **0** | **0** | **0** | **0** |
| DATE | NS1 | NS2 | NS3 | NS4 | NS5 | NS6 | NS7 | NS8 | NS9 | NS10 | NS11 | NS12 | NS13 | NS14 | NS15 | NS16 | NS17 | NS18 | NS19 | NS20 | NS21 | NS22 | NS24 | NS25 | NS27 | NS28 | NS29 | NS30 | NS31 | NS32 | NS33 | NS34 | NS35 | HR3_1 | HR3_2 | HR3_3/NS23 | HR3_4 | HR3_5 | HR3_6 | T2 | T3/NS26 | T4 |
| 2023-05-01 | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | | | | | | | | | | | | | | | |
| 2023-05-02 | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-05-03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-05-04 | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-05-05 | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |
| 2023-05-06 | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |
| 2023-05-07 | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-05-08 | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | 1 | 1 | | | | |
| 2023-05-09 | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-05-10 | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-05-11 | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-05-12 | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-05-13 | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-05-14 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-05-15 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-05-16 | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | 1 | 1 | | | | |
| 2023-05-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-05-18 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | 1 | | | | | | | | | | | | | 1 | 1 | | | | |
| 2023-05-19 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-05-20 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-05-21 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-05-22 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | 1 | | | | | | | | | | | | | 1 | 1 | | | | |
| 2023-05-23 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | | |
| 2023-05-24 | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | 1 | 1 | | | | |
| 2023-05-25 | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | 1 | 1 | | | | | | | | | | | | | | |
| 2023-05-26 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | 1 | | | 1 | | | | | | | | | | | | | | | |
| 2023-05-27 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-05-28 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | 1 | | | 1 | | | | | | | | | | | | | | | |
| 2023-05-29 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | |
| 2023-05-30 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | 1 | | | 1 | | | | | | | | | | | | | | | |
| 2023-05-31 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | 1 | | | 1 | | | | | | | | | | 1 | 1 | | | | |
| **SUM** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **12** | **17** | **0** | **13** | **23** | **0** | **0** | **8** | **2** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **7** | **7** | **0** | **0** | **0** | **0** |
| **ADDED DAYS AFTER** | | | | | | | | | | | | | | | | | | | | **3** | **4** | | **5** | **6** | | | **4** | **2** | | | | | | | | | **4** | **4** | | | | |
| **TOTAL DAYS EXCLUDED** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **15** | **21** | **0** | **18** | **29** | **0** | **0** | **12** | **4** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **11** | **11** | **0** | **0** | **0** | **0** |

| DATE | NS1 | NS2 | NS3 | NS4 | NS5 | NS6 | NS7 | NS8 | NS9 | NS10 | NS11 | NS12 | NS13 | NS14 | NS15 | NS16 | NS17 | NS18 | NS19 | NS20 | NS21 | NS22 | NS24 | NS25 | NS27 | NS28 | NS29 | NS30 | NS31 | NS32 | NS33 | NS34 | NS35 | HR3_1 | HR3_2 | HR3_3/NS23 | HR3_4 | HR3_5 | HR3_6 | T2 | T3/NS26 | T4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023-06-01 | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |
| 2023-06-02 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | 1 | | | 1 | | | | | | | | | | 1 | 1 | | | | |
| 2023-06-03 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-06-04 | | | | | | | | | | | 1 | | | | | | | | 1 | 1 | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-06-05 | | | | | | | | | | | | | | | | | | | 1 | 1 | | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-06-06 | | | | | | | | | | | | | | | | | | 1 | | 1 | 1 | | 1 | 1 | | | 1 | | | | | | | | | | | | | | | |
| 2023-06-07 | | | | | | | | | | | | | | | | | | 1 | | 1 | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-06-08 | | | | 1 | | | | 1 | | | | | | | | 1 | | | | 1 | | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-06-09 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-06-10 | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-06-11 | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-06-12 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-06-13 | | | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-06-14 | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | 1 | 1 | | | | |
| 2023-06-15 | | | | | | | | | | | | | | | | 1 | 1 | | 1 | 1 | 1 | | 1 | | | | | | | | | | | | | | 1 | 1 | | | | |
| 2023-06-16 | | | | | | | | | | | | | | | | 1 | 1 | | 1 | 1 | | | 1 | | | | | | | | | | | | | | 1 | | | | | |
| 2023-06-17 | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| 2023-06-18 | | | | | | | | | | | | 1 | | | | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| 2023-06-19 | | | | | | | | | | | 1 | 1 | | | | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-06-20 | | | | 1 | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| 2023-06-21 | | | | | | | | 1 | | | | 1 | | | | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-06-22 | | | | | | | | 1 | | | 1 | | | | | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-06-23 | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| 2023-06-24 | | | | | | | | 1 | | | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | | 1 | | | | | | | | | | | | | | | |
| 2023-06-25 | | | | | | | | 1 | | | | | | | | 1 | 1 | 1 | 1 | 1 | | | 1 | | | | 1 | | | | | | | | | | | | | | | |
| 2023-06-26 | | | | | 1 | | | 1 | | | | | | | 1 | 1 | | 1 | 1 | 1 | | | | | | | | | | | | | | | | | 1 | 1 | | | | |
| 2023-06-27 | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-06-28 | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | | | | | | | | | | | 1 | 1 | | | | |
| 2023-06-29 | | | | | | | | | | | | | 1 | | | 1 | 1 | 1 | 1 | | | | | 1 | | | | 1 | | | | | | | | | | | | | | |
| 2023-06-30 | | | | 1 | | | | | | | | | | | | 1 | 1 | 1 | 1 | | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| **SUM** | **0** | **0** | **0** | **3** | **1** | **0** | **0** | **6** | **0** | **0** | **3** | **3** | **1** | **0** | **2** | **16** | **14** | **15** | **18** | **25** | **11** | **0** | **21** | **13** | **0** | **1** | **5** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **6** | **5** | **0** | **0** | **0** | **0** |
| **ADDED DAYS AFTER** | | | | **2** | **1** | | | **3** | | | **3** | **2** | **1** | | **2** | **2** | **1** | **2** | **1** | **4** | **7** | | **6** | **6** | | **1** | **3** | **1** | | | | | | | | | **5** | **5** | | | | |
| **TOTAL DAYS EXCLUDED** | **0** | **0** | **0** | **5** | **2** | **0** | **0** | **9** | **0** | **0** | **6** | **5** | **2** | **0** | **4** | **18** | **15** | **17** | **19** | **29** | **18** | **0** | **27** | **19** | **0** | **2** | **8** | **2** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **11** | **10** | **0** | **0** | **0** | **0** |

| DATE | NS1 | NS2 | NS3 | NS4 | NS5 | NS6 | NS7 | NS8 | NS9 | NS10 | NS11 | NS12 | NS13 | NS14 | NS15 | NS16 | NS17 | NS18 | NS19 | NS20 | NS21 | NS22 | NS24 | NS25 | NS27 | NS28 | NS29 | NS30 | NS31 | NS32 | NS33 | NS34 | NS35 | HR3_1 | HR3_2 | HR3_3/NS23 | HR3_4 | HR3_5 | HR3_6 | T2 | T3/NS26 | T4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023-07-01 | | | | 1 | | | | 1 | | | 1 | | 0 | | 1 | 1 | | | 1 | | 1 | | | | | 1 | | | | | | | | | 1 | | 1 | 1 | 1 | | | |
| 2023-07-02 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-07-03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-07-04 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-07-05 | | | | | | | | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| 2023-07-06 | | | | 1 | | | | | | | 1 | | | | | | 1 | 1 | | 1 | | | 1 | 1 | | | | | | | | | | | 1 | | 1 | 1 | 1 | | | |
| 2023-07-07 | | | | | | | | | | | | | 1 | | | 1 | 1 | 1 | 1 | 1 | 1 | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-07-08 | | | | | | | | | | | | | 1 | | | 1 | 1 | 1 | 1 | 1 | | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-07-09 | | | | | | | | | | | | | 1 | | | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | | 1 | | | | | | | | | | | | | | | | |
| 2023-07-10 | | | | | | | | | | | | | 1 | | | 1 | 1 | 1 | 1 | | | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-07-11 | | | | | | | | | | | | 1 | 1 | | | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-07-12 | | | | | | | | | | | 1 | | | | 1 | | 1 | | | | | | 1 | 1 | | | | | | | | | | | 1 | | 1 | 1 | | | | |
| 2023-07-13 | | | | | | | | 1 | | | 1 | | 1 | | 1 | 1 | 1 | | 1 | | | | 1 | 1 | | | | | | | | | | | 1 | | 1 | 1 | | | | |
| 2023-07-14 | | | | | | | | 1 | | | | | 1 | | | 1 | 1 | 1 | 1 | 1 | | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-07-15 | | | | | | | | 1 | | | 1 | | 1 | | | 1 | 1 | | 1 | | | | 1 | 1 | | 1 | | | | | | | | | 1 | | | 1 | 1 | | | |
| 2023-07-16 | | | | | | | | | | | | | | | 1 | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-07-17 | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-07-18 | | | | | | | | 1 | | | | 1 | 1 | | 1 | 1 | 1 | 1 | | | | | | | | | 1 | | | | | | | | 1 | | | | | | | |
| 2023-07-19 | | | | | | | | 1 | | | | | 1 | | | 1 | 1 | 1 | 1 | | | | | 1 | | | | | | | | | | | | | | | | | | |
| 2023-07-20 | | | | | | | | 1 | | | 1 | 1 | 1 | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |
| 2023-07-21 | | | | | 1 | | | 1 | | | | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | | 1 | | 1 | 1 | | 1 | | | | | | | | | | | | 1 | 1 | | | |
| 2023-07-22 | | | | | | | | 1 | | | | | 1 | | | 1 | 1 | 1 | 1 | | | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-07-23 | | | | | | | | 1 | | | | | 1 | | | 1 | 1 | 1 | 1 | | | | 1 | 1 | | | | | | | | | | | | | 1 | 1 | | | | |
| 2023-07-24 | | | | | | | | 1 | | | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | | | | 1 | | | | | | | | | | | | 1 | | 1 | 1 | | | | |
| 2023-07-25 | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 2023-07-26 | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-07-27 | | | | | | | | 1 | | | 1 | 1 | 1 | | 1 | 1 | | | | | | | 1 | 1 | | | | | | | | | | | 1 | | 1 | 1 | | | | |
| 2023-07-28 | | | | | | | | 1 | | | | 1 | 1 | | | 1 | | | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-07-29 | | | | | | | | 1 | | | | | 1 | | | 1 | | | | | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-07-30 | | | | | | | | 1 | | | 1 | | 1 | | | 1 | | | | | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-07-31 | | | | | | | | 1 | | | | | 1 | | | | 1 | | 1 | | 1 | | 1 | | | | | | | | | | | | | | | | | | | |
| **SUM** | **0** | **0** | **0** | **2** | **1** | **0** | **0** | **17** | **0** | **0** | **10** | **8** | **20** | **0** | **8** | **19** | **17** | **13** | **17** | **7** | **6** | **0** | **16** | **16** | **0** | **4** | **2** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **9** | **0** | **7** | **9** | **4** | **0** | **0** | **0** |
| **ADDED DAYS AFTER** | | | | **2** | **1** | | | **3** | | | **8** | **5** | **3** | | **7** | **6** | **4** | **5** | **6** | **3** | **3** | | **5** | **4** | | **4** | **2** | | | | | | | | **7** | | **5** | **7** | **4** | | | |
| **TOTAL DAYS EXCLUDED** | **0** | **0** | **0** | **4** | **2** | **0** | **0** | **20** | **0** | **0** | **18** | **13** | **23** | **0** | **15** | **25** | **21** | **18** | **23** | **10** | **9** | **0** | **21** | **20** | **0** | **8** | **4** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **16** | **0** | **12** | **16** | **8** | **0** | **0** | **0** |

| DATE | NS1 | NS2 | NS3 | NS4 | NS5 | NS6 | NS7 | NS8 | NS9 | NS10 | NS11 | NS12 | NS13 | NS14 | NS15 | NS16 | NS17 | NS18 | NS19 | NS20 | NS21 | NS22 | NS24 | NS25 | NS27 | NS28 | NS29 | NS30 | NS31 | NS32 | NS33 | NS34 | NS35 | HR3_1 | HR3_2 | HR3_3/NS23 | HR3_4 | HR3_5 | HR3_6 | T2 | T3/NS26 | T4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023-08-01 | | | | | | | | 1 | | | | | 1 | | | | | | | | 0 | | 0 | | | | | | | | | | | | | | | | | | | |
| 2023-08-02 | | | | | | | | 1 | | | | 1 | 1 | | | | | | | | 0 | | 0 | | | | | | | | | | | | | | | | | | | |
| 2023-08-03 | | | | | | | | 1 | | | | 1 | 1 | | 1 | 1 | | | | | 0 | | 0 | | | | | | | | | | | | 1 | | | | | | | |
| 2023-08-04 | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | 0 | 0 | | | | |
| 2023-08-05 | | | | | | | | 1 | | | | 1 | 1 | | 1 | 1 | | | | | 0 | | 0 | | | | | | | | | | | | 1 | | 0 | 0 | | | | |
| 2023-08-06 | | | | | | | | 1 | | | | 1 | 1 | | 1 | | | | | | 0 | | 0 | | | | | | | | | | | | | | 0 | 0 | | | | |
| 2023-08-07 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 2023-08-08 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-08-09 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-08-10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-08-11 | 1 | | | | | | | | | | | 1 | 1 | | 1 | | | | | 0 | 0 | | 0 | | | | | | | | | | | | | | 0 | 0 | | | | |
| 2023-08-12 | | | | | | | | | | | | 1 | 1 | | | | 1 | | | 0 | 0 | | | | | | | | | | | | | | | | | | | | | |
| 2023-08-13 | | | | | | | | | 1 | | | | | | | | 1 | 1 | 1 | 0 | 0 | | 0 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-08-14 | | | | | | | | | | | | | | | | | 1 | | 1 | 0 | 0 | | 0 | 1 | | | | | | | | | | | | | | | | | | |
| 2023-08-15 | | | | | | | | | | | | | | | | | 1 | | 1 | 0 | 0 | | 0 | 0 | | | | | | | | | | | | | 0 | 0 | | | | |
| 2023-08-16 | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-08-17 | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 0 | 1 | | | | | | | | | | | | | | 0 | | | | | | | |
| 2023-08-18 | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | |
| 2023-08-19 | | | | | | | | | | | | | | | | | 1 | | | 0 | 1 | | | | | | | | | | | | | | | | | | | | | |
| 2023-08-20 | | | | | | | | | | | | | | | | | 1 | | 1 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | |
| 2023-08-21 | | | | | | | | 1 | | | | | | | | | 1 | | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | |
| 2023-08-22 | | | | | | | | 1 | | | 1 | 1 | | | | 1 | 1 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | |
| 2023-08-23 | | | | | | | | | | | 1 | 1 | | | | 1 | | 0 | 0 | 0 | | | 1 | | | | | | | | | | | | | | 1 | 1 | | | | |
| 2023-08-24 | | | | | | | | | | | 1 | 1 | 1 | | | | | 0 | 1 | 0 | | | 1 | | | | | | | | | | | | | | | | | | | |
| 2023-08-25 | | | | | | | | | | | 1 | 1 | | | 0 | 1 | | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-08-26 | | | | | | | | | | | | 1 | | | | 1 | 0 | 0 | 0 | | | | 0 | 0 | | | | | | | | | | | | | | | | | | |
| 2023-08-27 | | | | | | | | | | | | 1 | | | | | 0 | 0 | 0 | | | | | 0 | | | | | | | | | | | | | | | | | | |
| 2023-08-28 | | | | | | | | | | | | 1 | | | | | 0 | 0 | 0 | | 0 | | | | | | | | | | | | | | | | | | | | | |
| 2023-08-29 | | | | | | | | | | | | 1 | | | | | 0 | 0 | 0 | | | | 0 | | | | | | | | | | | | | | | | | | | |
| 2023-08-30 | | | | | | | | | | | | 1 | | | | | 1 | | 0 | | | | 0 | | | | | | | | | | | | | | | | | | | |
| 2023-08-31 | | | | | | | | | 0 | | 0 | 1 | 1 | | | | 1 | | | | | | 0 | | | | | | | | | | | | | | | | | | | |
| **SUM** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **7** | **1** | **0** | **4** | **16** | **9** | **0** | **4** | **7** | **13** | **3** | **7** | **0** | **3** | **0** | **2** | **2** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **3** | **0** | **1** | **1** | **0** | **0** | **0** | **0** |
| **ADDED DAYS AFTER** | **1** | | | | | | | **3** | **1** | | **1** | **3** | **4** | | **3** | **3** | **1** | **2** | **4** | | **2** | | **1** | **1** | | | | | | | | | | | **3** | | **1** | **1** | | | | |
| **TOTAL DAYS EXCLUDED** | **2** | **0** | **0** | **0** | **0** | **0** | **0** | **10** | **2** | **0** | **5** | **19** | **13** | **0** | **7** | **10** | **14** | **5** | **11** | **0** | **5** | **0** | **3** | **3** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **6** | **0** | **2** | **2** | **0** | **0** | **0** | **0** |

| DATE | NS1 | NS2 | NS3 | NS4 | NS5 | NS6 | NS7 | NS8 | NS9 | NS10 | NS11 | NS12 | NS13 | NS14 | NS15 | NS16 | NS17 | NS18 | NS19 | NS20 | NS21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023-09-01 | | | | | | | | 0 | | | | 1 | 1 | | | | | | | 0 | |
| 2023-09-02 | | | | | | | | 0 | | | | 1 | 1 | | | | 1 | | 0 | | |
| 2023-09-03 | | | | | | | | | | | | 1 | 1 | | Ext | | 1 | | 0 | Ext | |
| 2023-09-04 | | | | | | | | | | | | 1 | 1 | | Ext | | 1 | | | Ext | 1 |
| 2023-09-05 | | | | | | | | | 0 | | | 1 | 1 | | | | 0 | 1 | | 1 | 1 |
| 2023-09-06 | | | | | | | | 0 | 0 | | | | | | | | | | 1 | | 0 |
| 2023-09-07 | | | | | | | | 1 | | | 1 | 0 | 0 | | 1 | | 0 | | 0 | | |
| 2023-09-08 | | | | | | | | | | | | 0 | 0 | | | | 0 | | 1 | 1 | |
| 2023-09-09 | | | | | | | | | | | | 0 | 0 | | 0 | 0 | | 1 | 1 | 1 | |
| 2023-09-10 | | | | | | | | 0 | | | | 1 | 0 | | | | | | 1 | | |
| 2023-09-11 | | | | | | | | | | | | 1 | 0 | | | | | 0 | | | 0 |
| 2023-09-12 | | | | | | | | 1 | | | | | 0 | | | | | | | | 0 |
| 2023-09-13 | | | | | | | | | | | | | | | | | | | | | |
| 2023-09-14 | | | | | | | | | | | | 1 | 1 | | | | | | | | |
| 2023-09-15 | | | | | | | | | 0 | | 0 | | | | | | | | | | |
| 2023-09-16 | | | | | | | | | 0 | | 0 | | | | | | 1 | 1 | 1 | | |
| 2023-09-17 | | | | | | | | | 0 | | 0 | | | | | | | | | | |
| 2023-09-18 | | | | | | | | | | | | | | | | | | | Ext | Ext | |
| 2023-09-19 | | | | | | | | | | | | | | | | | | | | | |
| 2023-09-20 | | | | | | | | | | | | | | | | | | | | | |
| 2023-09-21 | | | | | | | | | | | 0 | | | | | | | | | | |
| 2023-09-22 | | | | | | | | | | | 0 | 0 | | | | | | | | | |
| 2023-09-23 | | | | | | | | | | | 0 | 0 | | | | | | | | | |
| 2023-09-24 | | | | | | | | | | | | 0 | | | | | | | | | |
| 2023-09-25 | | | | | | | | | | | | | | | Ext | Ext | | | | | |
| 2023-09-26 | | | | | | | | | | | 0 | 0 | | | Ext | Ext | | | | Ext | Ext |
| 2023-09-27 | | | | | | | | | | | | | 0 | | Ext | 0 | | | | | |
| 2023-09-28 | | | | | | | | | 0 | | | | 0 | | | | | | | | |
| 2023-09-29 | | | | | | | | | | | | | | | | | | | | | |
| 2023-09-30 | | | | | | | | | | | | | | | Ext | | | | | Ext | |
| **SUM** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **2** | **0** | **0** | **1** | **8** | **6** | **0** | **1** | **0** | **4** | **3** | **5** | **3** | **2** |
| **ADDED DAYS AFTER** | | | | | | | | **2** | | | **1** | **3** | **2** | | **1** | | **2** | **3** | **3** | **2** | **1** |
| **TOTAL DAYS EXCLUDED** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **4** | **0** | **0** | **2** | **11** | **8** | **0** | **2** | **0** | **6** | **6** | **8** | **5** | **3** |

| DATE | NS22 | NS24 | NS25 | NS27 | NS28 | NS29 | NS30 | NS31 | NS32 | NS33 | NS34 | NS35 | HR3_1 | HR3_2 | HR3_3/NS23 | HR3_4 | HR3_5 | HR3_6 | T2 | T3/NS26 | T4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023-09-01 | | | | | | | | | | | | | | | | | | | | | |
| 2023-09-02 | | | | | | | | | | | | | | | | | | | | | |
| 2023-09-03 | | | | | | 0 | | | | | | | | | | | | | | | |
| 2023-09-04 | Ext | | | | | | | | | | | | | | | | | | Ext | Ext | Ext |
| 2023-09-05 | | | 0 | | | 0 | | | | | | | | | | | | | | Ext | Ext |
| 2023-09-06 | | 0 | | | 0 | | 0 | | | | | | | | | 0 | 0 | 0 | | | |
| 2023-09-07 | | | | | | | | | | | | | | 1 | | | | | | Ext | Ext |
| 2023-09-08 | | | | | | 1 | | | | | | | | | | | | | | Ext | Ext |
| 2023-09-09 | | | | | | | | | | | | | | | | | | | | Ext | Ext |
| 2023-09-10 | | | | | | | | | | | | | | | | | | | | Ext | Ext |
| 2023-09-11 | | | | | | | | | | | | | | | | | | | | Ext | Ext |
| 2023-09-12 | | 0 | 0 | | | | | | | | | | | | | 0 | 0 | | | Ext | Ext |
| 2023-09-13 | | | | | | | | | | | | | | | | | | | | Ext | Ext |
| 2023-09-14 | | | | | | | | | | | | | | | | | | | | Ext | Ext |
| 2023-09-15 | | | | | | | | | | | | | | 0 | | | | | | Ext | Ext |
| 2023-09-16 | | | | | | | | | | | | | | | | | | | | Ext | Ext |
| 2023-09-17 | | | | | | | | | | | | | | | | | | | | Ext | Ext |
| 2023-09-18 | | | | | | | | | | | | | | 0 | | | | | | Ext | Ext |
| 2023-09-19 | | | | | | | | | | | | | | | | | | | | | |
| 2023-09-20 | | | | | | | | | | | | | | | | | | | | | |
| 2023-09-21 | | | | | | | | | | | | | | 0 | | | | | | Ext | Ext |
| 2023-09-22 | | | | | | | | | | | | | | | | | | | | Ext | Ext |
| 2023-09-23 | | | | | | | | | | | | | | | | | | | | | Ext |
| 2023-09-24 | Ext | 0 | | | | | | | | | | | | | | | | | | | Ext |
| 2023-09-25 | | 0 | | | | | | | | | | | | | | | | | Ext | Ext | Ext |
| 2023-09-26 | | | | | | | | | | | | | | | | | | | | Ext | Ext |
| 2023-09-27 | | | | | | | | | | | | | | | | | | | | | Ext |
| 2023-09-28 | Ext | | | | | | | | | | | | | 0 | | | | | Ext | Ext | Ext |
| 2023-09-29 | | | | | | | | Ext | | | | | | | | | | | | | Ext |
| 2023-09-30 | Ext | | | | | | | | | | | | | | | | | | | | Ext |
| **SUM** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **ADDED DAYS AFTER** | | | | | | **1** | | | | | | | | **1** | | | | | | | |
| **TOTAL DAYS EXCLUDED** | **0** | **0** | **0** | **0** | **0** | **2** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **2** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |

| DATE | NS1 | NS2 | NS3 | NS4 | NS5 | NS6 | NS7 | NS8 | NS9 | NS10 | NS11 | NS12 | NS13 | NS14 | NS15 | NS16 | NS17 | NS18 | NS19 | NS20 | NS21 | NS22 | NS24 | NS25 | NS27 | NS28 | NS29 | NS30 | NS31 | NS32 | NS33 | NS34 | NS35 | HR3_1 | HR3_2 | HR3_3/NS23 | HR3_4 | HR3_5 | HR3_6 | T2 | T3/NS26 | T4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023-10-01 | | | | | | | | | | | | | | | | | | | | | Ext | | | | | | | | Ext | | | | | | 0 | | | | | | Ext | Ext |
| 2023-10-02 | | | | | | | | | | | 0 | 0 | 0 | | | 0 | | | | | | | | | | | | | Ext | | | | | | | | | | | | Ext | Ext |
| 2023-10-03 | | | | | | | | | | | | | 0 | | | 0 | 0 | | | | | | | | | | | | | | | | | | 0 | | | | | | Ext | |
| 2023-10-04 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-10-05 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-10-06 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-10-07 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-10-08 | | | | | | | | | | | | | 0 | | | | | | | | | | | | | | | | Ext | | | | | | 0 | | | | | | | Ext |
| 2023-10-09 | | | | | | | | | | | | 0 | 0 | | | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | Ext |
| 2023-10-10 | | | | | | | | | | | | | 0 | | | 0 | | | | | | | | | | | | | | | | | | | 0 | | | | | | | Ext |
| 2023-10-11 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-10-12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-10-13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-10-14 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-10-15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-10-16 | | | | | | | | | | | | | | | | | | | | | | Ext | | | | | | | | | | | | | | | | | | Ext | | Ext |
| 2023-10-17 | | | | | | | | | | | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | 0 | | | | | | | Ext |
| 2023-10-18 | | | | | | | | | | | 0 | 0 | | | Ext | Ext | | | | | | | | | | | | | Ext | | | | | | 0 | | | | | | Ext | Ext |
| 2023-10-19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-10-20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-10-21 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-10-22 | | | | | | | | | | | | | | | Ext | Ext | | | | Ext | | | | | | | | | | | | | | | | | | | | Ext | Ext | Ext |
| 2023-10-23 | | | | | | | | | | | | 0 | 0 | | | 0 | | | | | | Ext | | | | | | | | | | | | | 0 | | | | | Ext | Ext | Ext |
| 2023-10-24 | | | | | | | | | | | | | 0 | | Ext | 0 | | | | Ext | | Ext | | | | | | | | | | | | | 0 | | | | | Ext | Ext | Ext |
| 2023-10-25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2023-10-26 | | | | | | | | | | | | | 0 | | Ext | Ext | | | | | Ext | | | | | | | | | | | | | | 0 | | | | | Ext | Ext | Ext |
| 2023-10-27 | | | | | | | | | | | | | 0 | | | 0 | | | | | | | | | | | | | | | | | | | 0 | | | | | | | Ext |
| 2023-10-28 | | | | | | | | | | | | | | | | | | | | | | Ext | | | | | | | | | | | | | | | | | | | | Ext |
| 2023-10-29 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Ext | | | | | | | | | | | | Ext | Ext |
| 2023-10-30 | | | | | | | | | | | | | | | | | | Ext | | | | Ext | | | | | | | | | | | | | | | | | | | Ext | Ext |
| 2023-10-31 | | | | | | | | | | | | | | | | 0 | | | | | | Ext | | | | | | | | | | | | | 0 | | | | | Ext | Ext | Ext |
| **SUM** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **ADDED DAYS AFTER** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **TOTAL DAYS EXCLUDED** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |

| DATE | NS1 | NS2 | NS3 | NS4 | NS5 | NS6 | NS7 | NS8 | NS9 | NS10 | NS11 | NS12 | NS13 | NS14 | NS15 | NS16 | NS17 | NS18 | NS19 | NS20 | NS21 | NS22 | NS24 | NS25 | NS27 | NS28 | NS29 | NS30 | NS31 | NS32 | NS33 | NS34 | NS35 | HR3_1 | HR3_2 | HR3_3/NS23 | HR3_4 | HR3_5 | HR3_6 | T2 | T3/NS26 | T4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023-11-01 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  | Ext |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  | Ext |  | Ext |
| 2023-11-02 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2023-11-03 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2023-11-04 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2023-11-05 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  | Ext |
| 2023-11-06 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Ext | Ext |
| 2023-11-07 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  | Ext | Ext |
| 2023-11-08 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Ext | Ext | Ext |
| 2023-11-09 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Ext |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  | Ext | Ext | Ext |
| 2023-11-10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Ext |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Ext | Ext | Ext |
| 2023-11-11 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Ext | Ext |
| 2023-11-12 |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  | 0 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Ext |
| 2023-11-13 |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  | Ext |
| 2023-11-14 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Ext |
| 2023-11-15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Ext |  | Ext |
| 2023-11-16 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Ext |
| **SUM** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **ADDED DAYS AFTER** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **TOTAL DAYS EXCLUDED** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |

*Table A2. 2: Percentage of days per month per station, where at least one survey vessel has passed within the 3.5 km radius. The results are visualized through a colour scale, with red colours indicating a high percentage, and green a low percentage. Empty fields indicate months where no survey activity took place.*

| FPOD (+ST) station | Percentage of days pr. month with active surveys (with USBL) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | jan-23 | feb-23 | mar-23 | apr-23 | maj-23 | jun-23 | jul-23 | aug-23 | sep-23 | okt-23 | nov-23 | dec-23 |
| NS1 | - | - | - | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 0% | - |
| NS2 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS3 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS4 | - | - | - | 7% | 0% | 10% | 6% | 0% | 0% | 0% | 0% | - |
| NS5 | - | - | - | 0% | 0% | 3% | 3% | 0% | 0% | 0% | 0% | - |
| NS6 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS7 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS8 | - | - | - | 17% | 0% | 20% | 55% | 23% | 7% | 0% | 0% | - |
| NS9 | - | - | - | 10% | 0% | 0% | 0% | 3% | 0% | 0% | 0% | - |
| NS10 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS11 | - | - | - | 13% | 0% | 10% | 32% | 13% | 3% | 0% | 0% | - |
| NS12 | - | - | - | 10% | 0% | 10% | 26% | 52% | 27% | 0% | 0% | - |
| NS13 | - | - | - | 10% | 0% | 3% | 65% | 29% | 20% | 0% | 0% | - |
| NS14 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS15 | - | - | - | 0% | 0% | 7% | 26% | 13% | 3% | 0% | 0% | - |
| NS16 | - | - | - | 7% | 0% | 53% | 61% | 23% | 0% | 0% | 0% | - |
| NS17 | - | - | - | 10% | 0% | 47% | 55% | 42% | 13% | 0% | 0% | - |
| NS18 | - | - | - | 10% | 0% | 50% | 42% | 10% | 10% | 0% | 0% | - |
| NS19 | - | - | - | 10% | 0% | 60% | 55% | 23% | 17% | 0% | 0% | - |
| NS20 | - | - | - | 10% | 39% | 83% | 23% | 0% | 10% | 0% | 0% | - |
| NS21 | - | - | - | 47% | 55% | 37% | 19% | 10% | 7% | 0% | 0% | - |
| NS22 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS24 | - | - | - | 50% | 42% | 70% | 52% | 6% | 0% | 0% | 0% | - |
| NS25 | - | - | - | 27% | 74% | 43% | 52% | 6% | 0% | 0% | 0% | - |
| NS27 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS28 | - | - | - | 0% | 0% | 3% | 13% | 0% | 0% | 0% | 0% | - |
| NS29 | - | - | - | 0% | 26% | 17% | 6% | 0% | 3% | 0% | 0% | - |
| NS30 | - | - | - | 3% | 6% | 3% | 0% | 0% | 0% | 0% | 0% | - |
| NS31 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS32 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS33 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS34 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS35 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| HR3_1 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| HR3_2 | - | - | - | 0% | 0% | 0% | 29% | 10% | 3% | 0% | 0% | - |
| HR3_3/NS23 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| HR3_4 | - | - | - | 10% | 23% | 20% | 23% | 3% | 0% | 0% | 0% | - |
| HR3_5 | - | - | - | 3% | 23% | 17% | 29% | 3% | 0% | 0% | 0% | - |
| HR3_6 | - | - | - | 0% | 0% | 0% | 13% | 0% | 0% | 0% | 0% | - |
| T2 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| T3/NS26 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| T4 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |

*Table A2. 3: Cautious approach. Percentage of days per month per station, where at least one survey vessel has passed within the 3.5 km radius for the cautious approach, where an extra day following a survey presence, is included. The results are visualized through a colour scale, with red colours indicating a high percentage, and green a low percentage. Empty fields indicate months where no survey activity took place.*

| FPOD (+ST) | Percentage of days pr. month with active surveys (with USBL), Cautious approach | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| station | jan-23 | feb-23 | mar-23 | apr-23 | maj-23 | jun-23 | jul-23 | aug-23 | sep-23 | okt-23 | nov-23 | dec-23 |
| NS1 | - | - | - | 0% | 0% | 0% | 0% | 6% | 0% | 0% | 0% | - |
| NS2 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS3 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS4 | - | - | - | 13% | 0% | 17% | 13% | 0% | 0% | 0% | 0% | - |
| NS5 | - | - | - | 0% | 0% | 7% | 6% | 0% | 0% | 0% | 0% | - |
| NS6 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS7 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS8 | - | - | - | 30% | 0% | 30% | 65% | 32% | 13% | 0% | 0% | - |
| NS9 | - | - | - | 17% | 0% | 0% | 0% | 6% | 0% | 0% | 0% | - |
| NS10 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS11 | - | - | - | 23% | 0% | 20% | 58% | 16% | 7% | 0% | 0% | - |
| NS12 | - | - | - | 20% | 0% | 17% | 42% | 61% | 37% | 0% | 0% | - |
| NS13 | - | - | - | 17% | 0% | 7% | 74% | 42% | 27% | 0% | 0% | - |
| NS14 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS15 | - | - | - | 0% | 0% | 13% | 48% | 23% | 7% | 0% | 0% | - |
| NS16 | - | - | - | 13% | 0% | 60% | 81% | 32% | 0% | 0% | 0% | - |
| NS17 | - | - | - | 20% | 0% | 50% | 68% | 45% | 20% | 0% | 0% | - |
| NS18 | - | - | - | 20% | 0% | 57% | 58% | 16% | 20% | 0% | 0% | - |
| NS19 | - | - | - | 20% | 0% | 63% | 74% | 35% | 27% | 0% | 0% | - |
| NS20 | - | - | - | 17% | 48% | 97% | 32% | 0% | 17% | 0% | 0% | - |
| NS21 | - | - | - | 57% | 68% | 60% | 29% | 16% | 10% | 0% | 0% | - |
| NS22 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS24 | - | - | - | 63% | 58% | 90% | 68% | 10% | 0% | 0% | 0% | - |
| NS25 | - | - | - | 37% | 94% | 63% | 61% | 10% | 0% | 0% | 0% | - |
| NS27 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS28 | - | - | - | 0% | 0% | 7% | 26% | 0% | 0% | 0% | 0% | - |
| NS29 | - | - | - | 0% | 39% | 27% | 13% | 0% | 7% | 0% | 0% | - |
| NS30 | - | - | - | 7% | 13% | 7% | 0% | 0% | 0% | 0% | 0% | - |
| NS31 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS32 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS33 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS34 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| NS35 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| HR3_1 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| HR3_2 | - | - | - | 0% | 0% | 0% | 52% | 19% | 7% | 0% | 0% | - |
| HR3_3/NS23 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| HR3_4 | - | - | - | 20% | 35% | 37% | 39% | 6% | 0% | 0% | 0% | - |
| HR3_5 | - | - | - | 7% | 35% | 33% | 52% | 6% | 0% | 0% | 0% | - |
| HR3_6 | - | - | - | 0% | 0% | 0% | 26% | 0% | 0% | 0% | 0% | - |
| T2 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| T3/NS26 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |
| T4 | - | - | - | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | - |

# Appendix 3

## Daily USBL detection minutes

*Table A3. 1: Minutes with USBL from geophysical survey vessels or other sources.*

| STATION | NS2 | | | NS6 | | | NS13 | | | NS14 | | | NS16 | | | NS25 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** |
| 2023-04-17 | | | | | | | | | | | | | | | | | | |
| 2023-04-18 | | | | | | | | | | | | | | | | | | |
| 2023-04-19 | **RECORDING STARTED** | | | | | | | | | | | | | | | | | |
| 2023-04-20 | | | | | | | **RECORDING STARTED** | | | | | | **RECORDING STARTED** | | | | | |
| 2023-04-21 | | | | | | | | | | | | | | | | **RECORDING STARTED** | | |
| 2023-04-22 | | | | **RECORDING STARTED** | | | | | | **RECORDING STARTED** | | | | | | | | |
| 2023-04-23 | | | | | | | | | | | | | | | | | | |
| 2023-04-24 | | | | | | | | | | | | | | | | | 45 | 45 |
| 2023-04-25 | | | | | | | | | | | | | | | | | | |
| 2023-04-26 | | | | | | | | | | | | | | | | | | |
| 2023-04-27 | | | | | | | | | | | | | | | | 2 | 80 | 82 |
| 2023-04-28 | | | | | | | | | | | | | | | | 6 | 256 | 262 |
| 2023-04-29 | | | | | | | | | | | | | | | | 2 | 193 | 195 |
| 2023-04-30 | | | | | | | | | | | | | | | | 2 | 194 | 196 |
| **SUM** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **12** | **768** | **780** |

| STATION | NS2 | | | NS6 | | | NS13 | | | NS14 | | | NS16 | | | NS25 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** |
| 2023-05-01 | | | | | | | | | | | | | | | | 3 | 107 | 110 |
| 2023-05-02 | | | | | | | | | | | | | | | | | | |
| 2023-05-03 | | | | | | | 16 | | 16 | | | | | | | 41 | 26 | 67 |
| 2023-05-04 | | | | | | | | | | | | | | | | 20 | 132 | 152 |
| 2023-05-05 | | | | | | | | | | | | | | | | 2 | 4 | 6 |
| 2023-05-06 | | | | | | | | | | 51 | | 51 | | | | 3 | 23 | 26 |
| 2023-05-07 | | | | | | | | | | | | | | | | 26 | 176 | 202 |
| 2023-05-08 | | | | | | | | | | 21 | | 21 | | | | 18 | 302 | 320 |
| 2023-05-09 | | | | | | | | | | 16 | | 16 | | | | 1 | 29 | 30 |
| 2023-05-10 | 5 | | 5 | | | | | | | 14 | | 14 | 8 | | 8 | | 139 | 139 |
| 2023-05-11 | | | | | | | | | | | | | | | | 4 | 137 | 141 |
| 2023-05-12 | | | | | | | | | | 4 | | 4 | 1 | | 1 | 14 | 149 | 163 |
| 2023-05-13 | | | | | | | | | | | | | | | | 11 | 183 | 194 |
| 2023-05-14 | | | | | | | | | | | | | | | | 2 | 106 | 108 |
| 2023-05-15 | | | | | | | | | | | | | | | | 1 | 100 | 101 |
| 2023-05-16 | | | | | | | | | | | | | | | | | | |
| 2023-05-17 | | | | | | | | | | | | | | | | | | |
| 2023-05-18 | | | | | | | | | | 7 | | 7 | | | | 5 | 193 | 198 |
| 2023-05-19 | | | | | | | | | | | | | | | | 5 | 213 | 218 |
| 2023-05-20 | | | | | | | | | | | | | | | | 5 | 174 | 179 |
| 2023-05-21 | | | | | | | | | | | | | | | | | 175 | 175 |
| 2023-05-22 | 22 | | 22 | | | | | | | 9 | | 9 | 42 | | 42 | 9 | 154 | 163 |
| 2023-05-23 | | | | | | | | | | | | | | | | | | |
| 2023-05-24 | | | | | | | | | | 20 | | 20 | | | | 3 | 74 | 77 |
| 2023-05-25 | | | | | | | | | | | | | | | | | 28 | 28 |
| 2023-05-26 | | | | | | | | | | 7 | | 7 | | | | | 73 | 73 |
| 2023-05-27 | 5 | | 5 | | | | | | | | | | | | | 1 | 161 | 162 |
| 2023-05-28 | | | | | | | 7 | | 7 | 54 | | 54 | | | | 2 | 199 | 201 |
| 2023-05-29 | | | | | | | | | | | | | | | | **RECORDING ENDED** | | |
| 2023-05-30 | | | | | | | | | | 98 | | 98 | | | | 39 days recorded | | |
| 2023-05-31 | | | | | | | | | | | | | | | | | | |
| **SUM** | **32** | **0** | **32** | **0** | **0** | **0** | **23** | **0** | **23** | **301** | **0** | **301** | **51** | **0** | **51** | **176** | **3057** | **3233** |

| STATION | NS2 | | | NS6 | | | NS13 | | | NS14 | | | NS16 | | | NS25 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** |
| 2023-06-01 | | | | | | | | | | | | | | | | | | |
| 2023-06-02 | | | | | | | | | | 134 | | 134 | | | | | | |
| 2023-06-03 | | | | | | | | | | 112 | | 112 | 90 | | 90 | | | |
| 2023-06-04 | | | | | | | | | | 71 | | 71 | 38 | | 38 | | | |
| 2023-06-05 | | | | | | | | | | 29 | | 29 | 5 | | 5 | | | |
| 2023-06-06 | | | | | | | | | | 15 | | 15 | | | | | | |
| 2023-06-07 | | | | | | | | | | 52 | | 52 | | | | | | |
| 2023-06-08 | 37 | | 37 | | | | | | | | | | 54 | 82 | 136 | | | |
| 2023-06-09 | | | | | | | | | | 189 | | 189 | | | | | | |
| 2023-06-10 | 4 | | 4 | | | | | | | 100 | | 100 | | | | | | |
| 2023-06-11 | | | | | | | 32 | | 32 | 311 | | 311 | | | | | | |
| 2023-06-12 | 6 | | 6 | | | | | | | 478 | | 478 | | | | | | |
| 2023-06-13 | 5 | | 5 | | | | | | | 196 | | 196 | 42 | | 42 | | | |
| 2023-06-14 | 29 | | 29 | | | | | | | 65 | | 65 | | | | | | |
| 2023-06-15 | 6 | | 6 | | | | | | | 72 | | 72 | 3 | 35 | 38 | | | |
| 2023-06-16 | 86 | | 86 | | | | | | | 8 | | 8 | 3 | 146 | 149 | | | |
| 2023-06-17 | 17 | | 17 | | | | | | | | | | 1 | 144 | 145 | | | |
| 2023-06-18 | | | | | | | | | | | | | 138 | 166 | 304 | | | |
| 2023-06-19 | 13 | | 13 | | | | | | | 145 | | 145 | 3 | 144 | 147 | | | |
| 2023-06-20 | 5 | | 5 | | | | | | | | | | 4 | 178 | 182 | | | |
| 2023-06-21 | 15 | | 15 | | | | | | | 105 | | 105 | 4 | 90 | 94 | | | |
| 2023-06-22 | | | | | | | 20 | | 20 | | | | 7 | 168 | 175 | | | |
| 2023-06-23 | 22 | | 22 | | | | | | | | | | 10 | 180 | 190 | | | |
| 2023-06-24 | 29 | | 29 | | | | | | | 75 | | 75 | 2 | 143 | 145 | | | |
| 2023-06-25 | | | | | | | | | | | | | | 58 | 58 | | | |
| 2023-06-26 | | | | | | | | | | | | | | 43 | 43 | | | |
| 2023-06-27 | | | | | | | | | | | | | | | | | | |
| 2023-06-28 | | | | | | | | | | 3 | | 3 | | 48 | 48 | | | |
| 2023-06-29 | | | | | | | | | | 23 | | 23 | | 48 | 48 | | | |
| 2023-06-30 | | | | | | | | | | 10 | | 10 | 3 | 63 | 66 | | | |
| **SUM** | **274** | **0** | **274** | **0** | **0** | **0** | **52** | **0** | **52** | **2193** | **0** | **2193** | **407** | **1736** | **2143** | **0** | **0** | **0** |

| STATION | NS2 | | | NS6 | | | NS13 | | | NS14 | | | NS16 | | | NS25 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** |
| 2023-07-01 | | | | | | | | | | | | | | 64 | 64 | | | |
| 2023-07-02 | | | | **RECORDING ENDED** | | | | | | 129 | | 129 | | | | | | |
| 2023-07-03 | | | | 72 days recorded | | | | | | | | | | | | | | |
| 2023-07-04 | | | | | | | | | | 73 | | 73 | | | | | | |
| 2023-07-05 | | | | | | | | | | 95 | | 95 | | | | | | |
| 2023-07-06 | **RECORDING ENDED** | | | | | | | | | 65 | | 65 | **RECORDING ENDED** | | | | | |
| 2023-07-07 | 79 days recorded | | | | | | 1 | 26 | 27 | 75 | | 75 | 78 days recorded | | | | | |
| 2023-07-08 | | | | | | | | | | | | | | | | | | |
| 2023-07-09 | | | | | | | | 3 | 3 | 61 | | 61 | | | | | | |
| 2023-07-10 | | | | | | | | | | 1 | | 1 | | | | | | |
| 2023-07-11 | | | | | | | | | | 17 | | 17 | | | | | | |
| 2023-07-12 | | | | | | | | | | 68 | | 68 | | | | | | |
| 2023-07-13 | | | | | | | 35 | 1 | 36 | | | | | | | | | |
| 2023-07-14 | | | | | | | | | | | | | | | | | | |
| 2023-07-15 | | | | | | | | | | 55 | | 55 | | | | | | |
| 2023-07-16 | | | | | | | | | | | | | | | | | | |
| 2023-07-17 | | | | | | | | | | | | | | | | | | |
| 2023-07-18 | | | | | | | **RECORDING ENDED** | | | 26 | | 26 | | | | | | |
| 2023-07-19 | | | | | | | 90 days recorded | | | 12 | | 12 | | | | | | |
| 2023-07-20 | | | | | | | | | | | | | | | | | | |
| 2023-07-21 | | | | | | | | | | | | | | | | | | |
| 2023-07-22 | | | | | | | | | | | | | | | | | | |
| 2023-07-23 | | | | | | | | | | | | | | | | | | |
| 2023-07-24 | | | | | | | | | | | | | | | | | | |
| 2023-07-25 | | | | | | | | | | | | | | | | | | |
| 2023-07-26 | | | | | | | | | | | | | | | | **RECORDING STARTED** | | |
| 2023-07-27 | | | | | | | | | | | | | | | | | | |
| 2023-07-28 | | | | | | | | | | | | | | | | | | |
| 2023-07-29 | | | | | | | | | | | | | | | | | | |
| 2023-07-30 | | | | | | | | | | **RECORDING ENDED** | | | | | | | | |
| 2023-07-31 | | | | | | | | | | 100 days recorded | | | | | | | | |
| **SUM** | **0** | **0** | **0** | **0** | **0** | **0** | **36** | **30** | **66** | **677** | **0** | **677** | **0** | **64** | **64** | **0** | **0** | **0** |

| STATION | NS2 | | | NS6 | | | NS13 | | | NS14 | | | NS16 | | | NS25 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** |
| 2023-08-01 | | | | | | | | | | | | | | | | | | |
| 2023-08-02 | | | | **RECORDING STARTED** | | | | | | **RECORDING STARTED** | | | | | | | | |
| 2023-08-03 | | | | | | | | | | | | | | | | | | |
| 2023-08-04 | | | | | | | | | | | | | | | | | | |
| 2023-08-05 | **RECORDING STARTED** | | | | | | | | | 5 | | 5 | | | | | | |
| 2023-08-06 | | | | | | | | | | 13 | | 13 | **RECORDING STARTED** | | | | | |
| 2023-08-07 | | | | | | | | | | | | | | | | 13 | | 13 |
| 2023-08-08 | | | | | | | | | | | | | | | | 17 | | 17 |
| 2023-08-09 | | | | | | | | | | | | | | | | | | |
| 2023-08-10 | 34 | | 34 | 20 | | 20 | | | | 98 | | 98 | | | | | | |
| 2023-08-11 | 85 | | 85 | 92 | | 92 | | | | | | | | | | | | |
| 2023-08-12 | | | | | | | | | | | | | | | | 211 | | 211 |
| 2023-08-13 | | | | | | | | | | 38 | | 38 | | | | 285 | 255 | 540 |
| 2023-08-14 | | | | | | | | | | 14 | | 14 | | | | 11 | 474 | 485 |
| 2023-08-15 | 7 | | 7 | | | | | | | | | | | | | | | |
| 2023-08-16 | 135 | | 135 | 48 | | 48 | | | | 45 | | 45 | | | | | | |
| 2023-08-17 | 33 | | 33 | 97 | | 97 | | | | 106 | | 106 | | | | | | |
| 2023-08-18 | 11 | | 11 | 427 | | 427 | | | | 89 | | 89 | | | | | | |
| 2023-08-19 | 57 | | 57 | 85 | | 85 | | | | 8 | | 8 | | | | 96 | | 96 |
| 2023-08-20 | 134 | | 134 | 1 | | 1 | | | | 38 | | 38 | 126 | 2 | 128 | 68 | | 68 |
| 2023-08-21 | 21 | | 21 | 50 | | 50 | | | | 51 | | 51 | 13 | 26 | 39 | | | |
| 2023-08-22 | 46 | | 46 | 23 | | 23 | | | | 94 | | 94 | | 3 | 3 | | | |
| 2023-08-23 | 45 | | 45 | 26 | | 26 | | | | 42 | | 42 | 15 | 25 | 40 | | | |
| 2023-08-24 | | | | 1 | | 1 | | | | | | | 13 | | 13 | 63 | | 63 |
| 2023-08-25 | | | | | | | | | | | | | 8 | 257 | 265 | | | |
| 2023-08-26 | | | | | | | | | | | | | 2 | 477 | 479 | | 5 | 5 |
| 2023-08-27 | | | | | | | | | | | | | 47 | 2 | 49 | 62 | 121 | 183 |
| 2023-08-28 | | | | | | | | | | | | | | | | 11 | 8 | 19 |
| 2023-08-29 | 104 | | 104 | | | | | | | | | | 85 | | 85 | | | |
| 2023-08-30 | 33 | | 33 | 5 | | 5 | | | | 1 | | 1 | | | | | | |
| 2023-08-31 | | | | 96 | | 96 | | | | | | | 90 | | 90 | 16 | | 16 |
| **SUM** | **745** | **0** | **745** | **971** | **0** | **971** | **0** | **0** | **0** | **642** | **0** | **642** | **399** | **792** | **1191** | **853** | **863** | **1716** |

| STATION | NS2 | | | NS6 | | | NS13 | | | NS14 | | | NS16 | | | NS25 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** |
| 2023-09-01 | | | | 90 | | 90 | | | | 12 | | 12 | | | | | | |
| 2023-09-02 | | | | 43 | | 43 | | | | 36 | | 36 | | | | | | |
| 2023-09-03 | | | | 60 | | 60 | | | | 10 | | 10 | 5 | | 5 | | | |
| 2023-09-04 | | | | | | | | | | | | | 6 | | 6 | | | |
| 2023-09-05 | | | | | | | | | | 32 | | 32 | 15 | | 15 | 89 | | 89 |
| 2023-09-06 | | | | 40 | | 40 | | | | | | | 8 | 9 | 17 | | | |
| 2023-09-07 | 28 | | 28 | | | | | | | 45 | | 45 | | | | | | |
| 2023-09-08 | 43 | | 43 | | | | | | | 53 | | 53 | | | | | | |
| 2023-09-09 | 67 | | 67 | | | | | | | 20 | | 20 | | 101 | 101 | | | |
| 2023-09-10 | | | | | | | | | | | | | | | | | | |
| 2023-09-11 | 52 | | 52 | | | | | | | | | | | | | 4 | | 4 |
| 2023-09-12 | 45 | | 45 | | | | | | | | | | | | | 116 | | 116 |
| 2023-09-13 | | | | | | | | | | | | | 12 | | 12 | | | |
| 2023-09-14 | | | | | | | | | | | | | 14 | | 14 | | | |
| 2023-09-15 | | | | | | | | | | | | | | | | | | |
| 2023-09-16 | | | | | | | | | | | | | 3 | 17 | 20 | | | |
| 2023-09-17 | 44 | | 44 | | | | | | | | | | | | | | | |
| 2023-09-18 | | | | | | | | | | 3 | | 3 | | | | | | |
| 2023-09-19 | 65 | | 65 | | | | | | | | | | 4 | | 4 | | | |
| 2023-09-20 | | | | | | | | | | | | | | | | | | |
| 2023-09-21 | | | | | | | | | | 32 | | 32 | | | | | | |
| 2023-09-22 | 58 | | 58 | | | | | | | 38 | | 38 | | | | 370 | | 370 |
| 2023-09-23 | | | | 47 | | 47 | | | | | | | | | | 2 | | 2 |
| 2023-09-24 | | | | | | | | | | | | | | | | | | |
| 2023-09-25 | | | | | | | | | | | | | | | | | | |
| 2023-09-26 | | | | | | | | | | | | | | | | 104 | | 104 |
| 2023-09-27 | | | | | | | | | | | | | | | | | | |
| 2023-09-28 | | | | | | | | | | | | | | | | | | |
| 2023-09-29 | | | | | | | | | | | | | | | | | | |
| 2023-09-30 | | | | | | | | | | | | | 41 | | 41 | | | |
| **SUM** | **402** | **0** | **402** | **280** | **0** | **280** | **0** | **0** | **0** | **281** | **0** | **281** | **108** | **127** | **235** | **685** | **0** | **685** |

| STATION | NS2 | | | NS6 | | | NS13 | | | NS14 | | | NS16 | | | NS25 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** | Unknown | Survey | **Total** |
| 2023-10-01 | 74 | | 74 | | | | | | | | | | 35 | 6 | 41 | 97 | | 97 |
| 2023-10-02 | 78 | | 78 | | | | | | | | | | 52 | 47 | 99 | | | |
| 2023-10-03 | 22 | | 22 | | | | | | | | | | 51 | | 51 | | | |
| 2023-10-04 | | | | | | | | | | | | | | | | | | |
| 2023-10-05 | | | | | | | | | | | | | | | | | | |
| 2023-10-06 | | | | | | | | | | | | | | | | | | |
| 2023-10-07 | | | | | | | | | | | | | | | | | | |
| 2023-10-08 | | | | | | | | | | | | | | | | | | |
| 2023-10-09 | | | | | | | | | | | | | | | | | | |
| 2023-10-10 | | | | | | | | | | | | | 2 | | 2 | | | |
| 2023-10-11 | | | | | | | | | | 8 | | 8 | | | | | | |
| 2023-10-12 | | | | | | | | | | | | | 51 | | 51 | | | |
| 2023-10-13 | | | | | | | | | | | | | 30 | | 30 | | | |
| 2023-10-14 | | | | | | | | | | | | | | | | | | |
| 2023-10-15 | | | | | | | | | | | | | | | | | | |
| 2023-10-16 | | | | | | | | | | | | | 115 | | 115 | | | |
| 2023-10-17 | | | | | | | | | | | | | 8 | | 8 | | | |
| 2023-10-18 | 4 | | 4 | | | | | | | | | | 22 | | 22 | 89 | | 89 |
| 2023-10-19 | | | | | | | | | | | | | 443 | | 443 | | | |
| 2023-10-20 | | | | | | | | | | | | | 412 | | 412 | | | |
| 2023-10-21 | | | | | | | | | | | | | 42 | | 42 | | | |
| 2023-10-22 | | | | | | | | | | | | | | | | | | |
| 2023-10-23 | | | | | | | | | | 102 | | 102 | | | | 100 | | 100 |
| 2023-10-24 | **RECORDING ENDED** | | | | | | | | | | | | | | | **RECORDING ENDED** | | |
| 2023-10-25 | 81 days recordings | | | | | | | | | | | | | | | 91 days recorded | | |
| 2023-10-26 | | | | | | | | | | | | | **RECORDING ENDED** | | | | | |
| 2023-10-27 | | | | | | | | | | | | | 82 days recorded | | | | | |
| 2023-10-28 | | | | | | | | | | | | | | | | | | |
| 2023-10-29 | | | | | | | | | | | | | | | | | | |
| 2023-10-30 | | | | | | | | | | | | | | | | | | |
| 2023-10-31 | | | | | | | | | | **RECORDING ENDED** | | | | | | | | |
| **SUM** | **178** | **0** | **178** | **0** | **0** | **0** | **0** | **0** | **0** | **110** | **0** | **110** | **1263** | **53** | **1316** | **286** | **0** | **286** |
| 2023-11-01 | | | | **RECORDING ENDED** | | | | | | 90 days recorded | | | | | | | | |
| 2023-11-02 | | | | 92 days recorded | | | | | | | | | | | | | | |

# Appendix 4

## Unknown vessel identification – test cases

## Vessel pass 1: 12-08-2023, station NS25, USBL detections from 12:57 UTC – 13:41 UTC.

| timestamp | ST_active | N | SPL_VHF_I | SPL_VHF_I | SPL_VHF_I | ship | Line ID | Date | Time | | Class | MMSI no | Lat | Lon | Dist (km) | Id | Station | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12-08-2023 12:57 | 1 | 21 | 99.7 | 95.8 | 102.6 | 0 | 7303163 | 12-08-2023 | 12:57:03 | Class | A | 219014851 | 56.10014 | 7.719303 | 3.153 | 4323 | NS25_S | |
| 12-08-2023 12:58 | 1 | 23 | 99.3 | 95.7 | 104.5 | 0 | 7313234 | 12-08-2023 | 12:58:03 | Class | A | 219014851 | 56.10091 | 7.718652 | 3.198 | 4335 | NS25_S | |
| 12-08-2023 12:59 | 1 | 27 | 99.6 | 95.7 | 104.8 | 0 | 7323323 | 12-08-2023 | 12:59:03 | Class | A | 219014851 | 56.10169 | 7.71798 | 3.244 | 4346 | NS25_S | |
| 12-08-2023 13:00 | 1 | 25 | 101.8 | 96.4 | 108 | 0 | 7333512 | 12-08-2023 | 13:00:03 | Class | A | 219014851 | 56.10247 | 7.717315 | 3.290 | 4358 | NS25_S | |
| 12-08-2023 13:01 | 1 | 22 | 101.5 | 96.1 | 106.8 | 0 | 7343882 | 12-08-2023 | 13:01:03 | Class | A | 219014851 | 56.10323 | 7.716643 | 3.334 | 4370 | NS25_S | |
| 12-08-2023 13:02 | 1 | 27 | 102.6 | 96.5 | 107.7 | 0 | 7354157 | 12-08-2023 | 13:02:03 | Class | A | 219014851 | 56.104 | 7.71597 | 3.378 | 4382 | NS25_S | |
| 12-08-2023 13:03 | 1 | 29 | 103.4 | 95.5 | 108.3 | 0 | 7364369 | 12-08-2023 | 13:03:03 | Class | A | 219014851 | 56.10479 | 7.715293 | 3.425 | 4394 | NS25_S | |
| 12-08-2023 13:04 | 1 | 22 | 104.7 | 101.6 | 108.8 | 0 | 7374468 | 12-08-2023 | 13:04:03 | Class | A | 219014851 | 56.10554 | 7.714615 | 3.466 | 4406 | NS25_S | |
| 12-08-2023 13:05 | 1 | 23 | 105.1 | 93.7 | 110.2 | 0 | 7384578 | 12-08-2023 | 13:05:02 | Class | A | 219014851 | 56.1063 | 7.713858 | 3.505 | 4418 | NS25_S | |
| 12-08-2023 13:06 | 1 | 33 | 105.4 | 93.7 | 114.8 | 0 | 7394752 | 12-08-2023 | 13:06:02 | Class | A | 219014851 | 56.10703 | 7.713105 | 3.540 | 4430 | NS25_S | |
| 12-08-2023 13:07 | 1 | 33 | 106.8 | 93.1 | 114.4 | 0 | 7404807 | 12-08-2023 | 13:07:02 | Class | A | 219014851 | 56.10781 | 7.712255 | 3.574 | 4443 | NS25_S | |
| 12-08-2023 13:08 | 1 | 34 | 108.8 | 93.5 | 117.9 | 0 | 7414865 | 12-08-2023 | 13:08:02 | Class | A | 219014851 | 56.10853 | 7.711388 | 3.602 | 4454 | NS25_S | No correlation |
| 12-08-2023 13:09 | 1 | 36 | 108.4 | 92.8 | 118 | 0 | 7424989 | 12-08-2023 | 13:09:02 | Class | A | 219014851 | 56.10928 | 7.710495 | 3.631 | 4461 | NS25_S | |
| 12-08-2023 13:10 | 1 | 48 | 105.6 | 92.5 | 119.4 | 0 | 7435198 | 12-08-2023 | 13:10:02 | Class | A | 219014851 | 56.11003 | 7.709575 | 3.657 | 4467 | NS25_S | |
| 12-08-2023 13:11 | 1 | 34 | 111.4 | 92.8 | 120.6 | 0 | 7445235 | 12-08-2023 | 13:11:02 | Class | A | 219014851 | 56.11075 | 7.708643 | 3.680 | 4473 | NS25_S | |
| 12-08-2023 13:12 | 1 | 35 | 112.7 | 93.1 | 121.5 | 0 | 7455284 | 12-08-2023 | 13:12:02 | Class | A | 219014851 | 56.1115 | 7.707698 | 3.706 | 4479 | NS25_S | |
| 12-08-2023 13:13 | 1 | 52 | 107.2 | 92.6 | 123.4 | 0 | 7465443 | 12-08-2023 | 13:13:03 | Class | A | 219014851 | 56.11223 | 7.706758 | 3.730 | 4485 | NS25_S | |
| 12-08-2023 13:14 | 1 | 58 | 107.2 | 92.5 | 126.9 | 0 | 7475363 | 12-08-2023 | 13:14:03 | Class | A | 219014851 | 56.11291 | 7.705842 | 3.749 | 4491 | NS25_S | |
| 12-08-2023 13:15 | 1 | 52 | 110.3 | 92.7 | 130.6 | 0 | 7485294 | 12-08-2023 | 13:15:03 | Class | A | 219014851 | 56.11366 | 7.704865 | 3.773 | 4498 | NS25_S | |
| 12-08-2023 13:16 | 1 | 28 | 124 | 95.7 | 130.4 | 0 | 7495345 | 12-08-2023 | 13:16:03 | Class | A | 219014851 | 56.11438 | 7.703942 | 3.797 | 4504 | NS25_S | |
| 12-08-2023 13:17 | 1 | 37 | 119.1 | 97.3 | 132.2 | 0 | 7505382 | 12-08-2023 | 13:17:03 | Class | A | 219014851 | 56.11511 | 7.703007 | 3.821 | 4510 | NS25_S | |
| 12-08-2023 13:18 | 1 | 44 | 116 | 98.1 | 133.1 | 0 | 7515435 | 12-08-2023 | 13:18:03 | Class | A | 219014851 | 56.11583 | 7.702083 | 3.844 | 4516 | NS25_S | |
| 12-08-2023 13:19 | 1 | 28 | 123 | 98.7 | 133.4 | 0 | 7525429 | 12-08-2023 | 13:19:02 | Class | A | 219015362 | 56.09608 | 7.751447 | 4.667 | 4528 | NS25_S | Insufficient data |
| 12-08-2023 13:20 | 1 | 28 | 129.6 | 96.9 | 134.8 | 0 | 7535080 | 12-08-2023 | 13:20:00 | Class | A | 219015362 | 56.0944 | 7.749212 | 4.343 | 4551 | NS25_S | |
| 12-08-2023 13:21 | 1 | 17 | 129.9 | 10.3 | 135.7 | 0 | 7545657 | 12-08-2023 | 13:21:03 | Class | A | 219014851 | 56.11798 | 7.699298 | 4.209 | 4572 | NS25_S | |
| 12-08-2023 13:22 | 1 | 39 | 121.2 | 98.7 | 135.1 | 0 | 7555674 | 12-08-2023 | 13:22:03 | Class | A | 219014851 | 56.11872 | 7.698387 | 4.346 | 4584 | NS25_S | |
| 12-08-2023 13:23 | 1 | 32 | 125.1 | 96.4 | 138.1 | 0 | 7565734 | 12-08-2023 | 13:23:03 | Class | A | 219014851 | 56.11944 | 7.697443 | 4.484 | 4595 | NS25_S | |
| 12-08-2023 13:24 | 1 | 42 | 119.7 | 95.8 | 141.6 | 0 | 7575606 | 12-08-2023 | 13:24:03 | Class | A | 219014851 | 56.12015 | 7.696493 | 4.621 | 4607 | NS25_S | No correlation |
| 12-08-2023 13:25 | 1 | 23 | 135.6 | 98.8 | 140.7 | 0 | 7585373 | 12-08-2023 | 13:25:03 | Class | A | 219014851 | 56.12081 | 7.695533 | 4.753 | 4619 | NS25_S | |
| 12-08-2023 13:26 | 1 | 26 | 137.4 | 98.2 | 145.6 | 0 | 7595271 | 12-08-2023 | 13:26:03 | Class | A | 219014851 | 56.12151 | 7.694518 | 4.892 | 4629 | NS25_S | |
| 12-08-2023 13:27 | 1 | 37 | 125.5 | 96.1 | 144.4 | 0 | 7605506 | 12-08-2023 | 13:27:04 | Class | A | 219015362 | 56.07928 | 7.742797 | 2.749 | 4640 | NS25_S | |
| 12-08-2023 13:28 | 1 | 39 | 128.4 | 95.3 | 146.2 | 0 | 7616876 | 12-08-2023 | 13:28:12 | Class | A | 219015362 | 56.07681 | 7.74184 | 2.966 | 4645 | NS25_S | |
| 12-08-2023 13:29 | 1 | 29 | 134.3 | 9.6 | 147.1 | 0 | 7626730 | 12-08-2023 | 13:29:12 | Class | A | 219015362 | 56.07466 | 7.740977 | 3.152 | 4650 | NS25_S | |
| 12-08-2023 13:30 | 1 | 37 | 119.5 | 95.6 | 145.7 | 0 | 7636564 | 12-08-2023 | 13:30:12 | Class | A | 219015362 | 56.07248 | 7.740357 | 3.356 | 4656 | NS25_S | |
| 12-08-2023 13:31 | 1 | 30 | 131.2 | 95.9 | 141.5 | 0 | 7646400 | 12-08-2023 | 13:31:12 | Class | A | 219015362 | 56.07033 | 7.739527 | 3.545 | 4665 | NS25_S | |
| 12-08-2023 13:32 | 1 | 30 | 132 | 96.1 | 142.8 | 0 | 7656331 | 12-08-2023 | 13:32:14 | Class | A | 219015362 | 56.06813 | 7.738743 | 3.741 | 4673 | NS25_S | |
| 12-08-2023 13:33 | 1 | 56 | 113.1 | 92.3 | 142.3 | 0 | 7666199 | 12-08-2023 | 13:33:14 | Class | A | 219015362 | 56.06596 | 7.737923 | 3.932 | 4679 | NS25_S | |
| 12-08-2023 13:34 | 1 | 109 | 104.5 | 91.9 | 141 | 0 | 7676068 | 12-08-2023 | 13:34:14 | Class | A | 219015362 | 56.06383 | 7.737067 | 4.116 | 4686 | NS25_S | Good correlation |
| 12-08-2023 13:35 | 1 | 104 | 103.4 | 91.7 | 134.4 | 0 | 7684331 | 12-08-2023 | 13:35:04 | Class | A | 219015362 | 56.06202 | 7.736367 | 4.274 | 4693 | NS25_S | |
| 12-08-2023 13:36 | 1 | 116 | 102.4 | 91.7 | 134.9 | 0 | 7694170 | 12-08-2023 | 13:36:04 | Class | A | 219015362 | 56.05987 | 7.735433 | 4.456 | 4701 | NS25_S | |
| 12-08-2023 13:37 | 1 | 109 | 101.9 | 91.9 | 133 | 0 | 7703424 | 12-08-2023 | 13:37:00 | Class | A | 219015362 | 56.05804 | 7.73371 | 4.554 | 4718 | NS25_S | |
| 12-08-2023 13:38 | 1 | 114 | 100.1 | 92.1 | 126.2 | 0 | 7713693 | 12-08-2023 | 13:38:03 | Class | A | 219015362 | 56.05625 | 7.730985 | 4.586 | 4730 | NS25_S | |
| 12-08-2023 13:39 | 1 | 28 | 116.7 | 92.9 | 124 | 0 | 7725220 | 12-08-2023 | 13:39:14 | Class | A | 219015362 | 56.05377 | 7.729918 | 4.797 | 4754 | NS25_S | |
| 12-08-2023 13:40 | 1 | 26 | 118.1 | 114.3 | 121.2 | 0 | 7733272 | 12-08-2023 | 13:40:03 | Class | A | 219015362 | 56.05202 | 7.729232 | 4.950 | 4766 | NS25_S | |

## Vessel pass 2: 12-08-2023, station NS25, USBL detections from 14:57 UTC – 15:41 UTC.

| timestamp | ST_active | N | SPL_VHF_n | SPL_VHF_n | SPL_VHF_n | ship |
|---|---|---|---|---|---|---|
| 12-08-2023 14:57 | 1 | 85 | 98.4 | 91.1 | 116.6 | 0 |
| 12-08-2023 14:58 | 1 | 88 | 9.9 | 91.3 | 11.9 | 0 |
| 12-08-2023 14:59 | 1 | 92 | 99.2 | 91.3 | 120.2 | 0 |
| 12-08-2023 15:00 | 1 | 95 | 100.2 | 91.5 | 12.3 | 0 |
| 12-08-2023 15:01 | 1 | 92 | 100.7 | 91.3 | 126.1 | 0 |
| 12-08-2023 15:02 | 1 | 104 | 10 | 91.4 | 128.1 | 0 |
| 12-08-2023 15:03 | 1 | 89 | 101.3 | 91.6 | 125.5 | 0 |
| 12-08-2023 15:04 | 1 | 100 | 102.5 | 91.5 | 132.1 | 0 |
| 12-08-2023 15:05 | 1 | 104 | 10.2 | 91.4 | 132.3 | 0 |
| 12-08-2023 15:06 | 1 | 106 | 101.5 | 91.6 | 131.3 | 0 |
| 12-08-2023 15:07 | 1 | 89 | 103.2 | 91.2 | 13.1 | 0 |
| 12-08-2023 15:08 | 1 | 102 | 102.1 | 91.4 | 131.1 | 0 |
| 12-08-2023 15:09 | 1 | 94 | 102.1 | 91.1 | 129.7 | 0 |
| 12-08-2023 15:10 | 1 | 83 | 103.3 | 91.3 | 13 | 0 |
| 12-08-2023 15:11 | 1 | 105 | 100.5 | 90.7 | 12.9 | 0 |
| 12-08-2023 15:12 | 1 | 95 | 101.5 | 91.3 | 128.3 | 0 |
| 12-08-2023 15:13 | 1 | 108 | 100.3 | 91.3 | 127.2 | 0 |
| 12-08-2023 15:14 | 1 | 94 | 101.6 | 91.4 | 127.8 | 0 |
| 12-08-2023 15:15 | 1 | 94 | 101.7 | 91.2 | 126.9 | 0 |
| 12-08-2023 15:16 | 1 | 106 | 101.4 | 91.2 | 129.8 | 0 |
| 12-08-2023 15:17 | 1 | 92 | 10.2 | 91.1 | 128.3 | 0 |
| 12-08-2023 15:18 | 1 | 95 | 102.1 | 91.3 | 129.4 | 0 |
| 12-08-2023 15:19 | 1 | 110 | 101.6 | 91.5 | 130.2 | 0 |
| 12-08-2023 15:20 | 1 | 94 | 102.5 | 91.6 | 130.2 | 0 |
| 12-08-2023 15:21 | 1 | 107 | 101.5 | 91.8 | 134.3 | 0 |
| 12-08-2023 15:22 | 1 | 83 | 104.8 | 91.5 | 132.1 | 0 |
| 12-08-2023 15:23 | 1 | 87 | 102.8 | 91.2 | 129.8 | 0 |
| 12-08-2023 15:24 | 1 | 77 | 105.5 | 91.3 | 134.2 | 0 |
| 12-08-2023 15:25 | 1 | 75 | 105.8 | 91.5 | 133.8 | 0 |
| 12-08-2023 15:26 | 1 | 73 | 105.4 | 91.4 | 132.6 | 0 |
| 12-08-2023 15:27 | 1 | 76 | 10.5 | 91.6 | 131.7 | 0 |
| 12-08-2023 15:28 | 1 | 86 | 102.7 | 91.4 | 129.8 | 0 |
| 12-08-2023 15:29 | 1 | 89 | 102.5 | 91.4 | 129.9 | 0 |
| 12-08-2023 15:30 | 1 | 88 | 10.3 | 91.5 | 130.5 | 0 |
| 12-08-2023 15:31 | 1 | 95 | 102.2 | 91.5 | 131.4 | 0 |
| 12-08-2023 15:32 | 1 | 76 | 104.1 | 91.3 | 128.8 | 0 |
| 12-08-2023 15:33 | 1 | 92 | 102.1 | 91.4 | 129.1 | 0 |
| 12-08-2023 15:34 | 1 | 85 | 103.7 | 91.3 | 131.3 | 0 |
| 12-08-2023 15:35 | 1 | 86 | 102.8 | 91.3 | 129.9 | 0 |
| 12-08-2023 15:36 | 1 | 64 | 10.5 | 91.6 | 12.8 | 0 |
| 12-08-2023 15:37 | 1 | 93 | 102.7 | 90.9 | 129.6 | 0 |
| 12-08-2023 15:38 | 1 | 99 | 101.2 | 91.2 | 129.1 | 0 |
| 12-08-2023 15:39 | 1 | 94 | 100.9 | 91.2 | 127.8 | 0 |
| 12-08-2023 15:40 | 1 | 122 | 99.4 | 91.5 | 128.9 | 0 |
| 12-08-2023 15:41 | 1 | 79 | 101.5 | 91.4 | 12.8 | 0 |

Vessel pass 3: 19-08-2023, station NS25, USBL detections from 17:57 UTC – 18:41 UTC.

| timestamp | ST_active | N | SPL_VHF_mean | SPL_VHF_min | SPL_VHF_max | ship | Line ID | Date | Time | Class | MMSI no | Lat | Lon | Dist (km) | Id | Station | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19-08-2023 17:57 | 1 | 22 | 101.6 | 95.5 | 105.3 | 0 | | | | | | | | | | | |
| 19-08-2023 17:58 | 1 | 28 | 106.7 | 100.4 | 112.5 | 0 | | | | | | | | | | | |
| 19-08-2023 17:59 | 1 | 26 | 112.4 | 106.1 | 116.9 | 0 | | | | | | | | | | | |
| 19-08-2023 18:00 | 1 | 28 | 110.7 | 95.3 | 11.6 | 0 | | | | | | | | | | | |
| 19-08-2023 18:01 | 1 | 27 | 111.5 | 106.7 | 115.7 | 0 | | | | | | | | | | | |
| 19-08-2023 18:02 | 1 | 28 | 114 | 94.6 | 118.1 | 0 | | | | | | | | | | | |
| 19-08-2023 18:03 | 1 | 26 | 111.2 | 107.4 | 114.7 | 0 | | | | | | | | | | | |
| 19-08-2023 18:04 | 1 | 28 | 110.4 | 92.4 | 116.4 | 0 | | | | | | | | | | | |
| 19-08-2023 18:05 | 1 | 28 | 114 | 91.2 | 118.4 | 0 | | | | | | | | | | | |
| 19-08-2023 18:06 | 1 | 31 | 111.6 | 91.9 | 119.1 | 0 | | | | | | | | | | | |
| 19-08-2023 18:07 | 1 | 33 | 110.9 | 90.9 | 119.1 | 0 | | | | | | | | | | | |
| 19-08-2023 18:08 | 1 | 30 | 108.9 | 91.3 | 115.3 | 0 | | | | | | | | | | | |
| 19-08-2023 18:09 | 1 | 31 | 110.9 | 90.6 | 118.1 | 0 | | | | | | | | | | | |
| 19-08-2023 18:10 | 1 | 40 | 108.1 | 91.6 | 119.5 | 0 | | | | | | | | | | | |
| 19-08-2023 18:11 | 1 | 41 | 108 | 9.1 | 120.8 | 0 | | | | | | | | | | | |
| 19-08-2023 18:12 | 1 | 35 | 111.6 | 91.5 | 12.4 | 0 | | | | | | | | | | | |
| 19-08-2023 18:13 | 1 | 44 | 107.9 | 9.1 | 123.4 | 0 | | | | | | | | | | | |
| 19-08-2023 18:14 | 1 | 48 | 106.1 | 90.8 | 123.1 | 0 | | | | | | | | | | | |
| 19-08-2023 18:15 | 1 | 57 | 105.6 | 90.6 | 123.3 | 0 | | | | | | | | | | | |
| 19-08-2023 18:16 | 1 | 57 | 105.1 | 90.7 | 124.6 | 0 | | | | | | | | | | | |
| 19-08-2023 18:17 | 1 | 64 | 104.2 | 90.9 | 127.1 | 0 | | | | | | | | | | | |
| 19-08-2023 18:18 | 1 | 71 | 102.6 | 90.9 | 123.8 | 0 | | | | | | | | | | | |
| 19-08-2023 18:19 | 1 | 79 | 101.7 | 90.5 | 124.8 | 0 | | | | | | | | | | | |
| 19-08-2023 18:20 | 1 | 78 | 103.4 | 90.8 | 130.4 | 0 | | | | | | | | | | | |
| 19-08-2023 18:21 | 1 | 87 | 102.7 | 90.3 | 13 | 0 | | | | | | | | | | | |
| 19-08-2023 18:22 | 1 | 107 | 100.7 | 90.5 | 130.5 | 0 | | | | | | | | | | | |
| 19-08-2023 18:23 | 1 | 114 | 100.4 | 90.7 | 132.5 | 0 | | | | | | | | | | | |
| 19-08-2023 18:24 | 1 | 113 | 100.2 | 90.7 | 132.9 | 0 | 9764721 | 19-08-2023 | 18:24:07 | Class A | 219010989 | 56.109283 | 7.7327 | 4.988 | 4192 | NS25_S | |
| 19-08-2023 18:25 | 1 | 124 | 99.9 | 90.1 | 133.2 | 0 | 9772856 | 19-08-2023 | 18:25:07 | Class A | 219010989 | 56.108567 | 7.729823 | 4.732 | 4198 | NS25_S | |
| 19-08-2023 18:26 | 1 | 145 | 98.7 | 90.7 | 131.3 | 0 | 9781012 | 19-08-2023 | 18:26:07 | Class A | 219010989 | 56.107842 | 7.726932 | 4.475 | 4204 | NS25_S | |
| 19-08-2023 18:27 | 1 | 133 | 99.1 | 90.5 | 130 | 0 | 9789307 | 19-08-2023 | 18:27:07 | Class A | 219010989 | 56.107117 | 7.72404 | 4.218 | 4210 | NS25_S | |
| 19-08-2023 18:28 | 1 | 131 | 99.2 | 90.8 | 129.6 | 0 | 9797456 | 19-08-2023 | 18:28:07 | Class A | 219010989 | 56.106383 | 7.721135 | 3.959 | 4215 | NS25_S | |
| 19-08-2023 18:29 | 1 | 148 | 99 | 90.6 | 132.3 | 0 | 9805524 | 19-08-2023 | 18:29:06 | Class A | 219010989 | 56.105657 | 7.718268 | 3.703 | 4220 | NS25_S | |
| 19-08-2023 18:30 | 1 | 150 | 99 | 90.8 | 134.5 | 0 | 9813609 | 19-08-2023 | 18:30:06 | Class A | 219010989 | 56.104915 | 7.715398 | 3.445 | 4224 | NS25_S | |
| 19-08-2023 18:31 | 1 | 149 | 99 | 90.9 | 134.6 | 0 | 9821629 | 19-08-2023 | 18:31:06 | Class A | 219010989 | 56.104172 | 7.712493 | 3.185 | 4229 | NS25_S | |
| 19-08-2023 18:32 | 1 | 153 | 99 | 90.8 | 134.8 | 0 | 9829635 | 19-08-2023 | 18:32:06 | Class A | 219010989 | 56.103438 | 7.709617 | 2.928 | 4233 | NS25_S | Good correlation |
| 19-08-2023 18:33 | 1 | 140 | 100.2 | 90.9 | 136.5 | 0 | 9837693 | 19-08-2023 | 18:33:06 | Class A | 219010989 | 56.102713 | 7.706748 | 2.672 | 4239 | NS25_S | |
| 19-08-2023 18:34 | 1 | 155 | 99.2 | 90.9 | 139.5 | 0 | 9845667 | 19-08-2023 | 18:34:06 | Class A | 219010989 | 56.10199 | 7.703935 | 2.420 | 4245 | NS25_S | |
| 19-08-2023 18:35 | 1 | 149 | 99.6 | 90.8 | 136.9 | 0 | 9853812 | 19-08-2023 | 18:35:06 | Class A | 219010989 | 56.101275 | 7.701047 | 2.246 | 4249 | NS25_S | |
| 19-08-2023 18:36 | 1 | 144 | 100.3 | 90.1 | 136.2 | 0 | 9861818 | 19-08-2023 | 18:36:05 | Class A | 219010989 | 56.100615 | 7.698332 | 2.338 | 4254 | NS25_S | |
| 19-08-2023 18:37 | 1 | 151 | 99.5 | 90.8 | 136.7 | 0 | 9872575 | 19-08-2023 | 18:37:26 | Class A | 219010989 | 56.099623 | 7.694378 | 2.470 | 4259 | NS25_S | |
| 19-08-2023 18:38 | 1 | 136 | 100 | 9.1 | 137.5 | 0 | 9878978 | 19-08-2023 | 18:38:15 | Class A | 219010989 | 56.099028 | 7.692023 | 2.547 | 4263 | NS25_S | |
| 19-08-2023 18:39 | 1 | 140 | 100.1 | 90.8 | 137.1 | 0 | 9886966 | 19-08-2023 | 18:39:15 | Class A | 219010989 | 56.098313 | 7.689127 | 2.645 | 4269 | NS25_S | |
| 19-08-2023 18:40 | 1 | 151 | 100.1 | 91.1 | 136.6 | 0 | 9895061 | 19-08-2023 | 18:40:16 | Class A | 219010989 | 56.097593 | 7.686202 | 2.744 | 4274 | NS25_S | |
| 19-08-2023 18:41 | 1 | 119 | 100.1 | 91.1 | 137.4 | 0 | 9903030 | 19-08-2023 | 18:41:16 | Class A | 219010989 | 56.096913 | 7.683403 | 2.839 | 4281 | NS25_S | |

## Vessel pass 4: 22-09-2023, station NS25, USBL detections from 15:57 UTC – 16:41 UTC.

| timestamp | ST_active | N | SPL_VHF_mean | SPL_VHF_min | SPL_VHF_max | ship | Line ID | Date | Time | Class | MMSI no | Lat | Lon | Dist (km) | Id | Station | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22-09-2023 15:57 | 1 | 176 | 105.3 | 93.9 | 139.8 | 0 | 7247478 | 22-09-2023 | 15:57:02 | Class A | 219244000 | 56.070977 | 7.6694 | 3.137 | 3957 | NS25_S | No correlation |
| 22-09-2023 15:58 | 1 | 141 | 106 | 93.8 | 138.5 | 0 | 7255212 | 22-09-2023 | 15:58:03 | Class A | 219244000 | 56.074385 | 7.6681 | 2.836 | 3974 | NS25_S | |
| 22-09-2023 15:59 | 1 | 168 | 103.9 | 94.1 | 140.8 | 0 | 7262650 | 22-09-2023 | 15:59:03 | Class A | 219244000 | 56.077735 | 7.6668 | 2.545 | 3985 | NS25_S | |
| 22-09-2023 16:00 | 1 | 149 | 106.4 | 93.9 | 140.2 | 0 | 7270112 | 22-09-2023 | 16:00:03 | Class A | 219244000 | 56.081105 | 7.6655 | 2.247 | 3997 | NS25_S | |
| 22-09-2023 16:01 | 1 | 135 | 108.6 | 93.8 | 142.6 | 0 | 7277593 | 22-09-2023 | 16:01:03 | Class A | 219244000 | 56.084443 | 7.6643 | 2.621 | 4009 | NS25_S | |
| 22-09-2023 16:02 | 1 | 119 | 107.7 | 93.8 | 142.4 | 0 | 7285124 | 22-09-2023 | 16:02:03 | Class A | 219244000 | 56.087805 | 7.663 | 3.075 | 4020 | NS25_S | |
| 22-09-2023 16:03 | 1 | 125 | 108.6 | 93.7 | 143.2 | 0 | 7292669 | 22-09-2023 | 16:03:03 | Class A | 219244000 | 56.091172 | 7.6617 | 3.526 | 4032 | NS25_S | |
| 22-09-2023 16:04 | 1 | 102 | 112 | 94.5 | 144.2 | 0 | 7300086 | 22-09-2023 | 16:04:02 | Class A | 219244000 | 56.094442 | 7.6605 | 3.967 | 4046 | NS25_S | |
| 22-09-2023 16:05 | 1 | 83 | 114.4 | 94.2 | 143.5 | 0 | 7307673 | 22-09-2023 | 16:05:02 | Class A | 219244000 | 56.09787 | 7.6591 | 4.428 | 4058 | NS25_S | |
| 22-09-2023 16:06 | 1 | 54 | 117.2 | 94.9 | 140.6 | 0 | 7315234 | 22-09-2023 | 16:06:02 | Class A | 219244000 | 56.101222 | 7.6579 | 4.878 | 4072 | NS25_S | |
| 22-09-2023 16:07 | 1 | 97 | 109.8 | 9.4 | 143.6 | 0 | 7323488 | 22-09-2023 | 16:07:07 | Class A | 219793000 | 56.073897 | 7.7441 | 3.426 | 4080 | NS25_S | Good correlation |
| 22-09-2023 16:08 | 1 | 105 | 110.5 | 9.4 | 145.7 | 0 | 7330709 | 22-09-2023 | 16:08:04 | Class A | 219793000 | 56.074538 | 7.7433 | 3.309 | 4087 | NS25_S | |
| 22-09-2023 16:09 | 1 | 125 | 108.6 | 93.7 | 144 | 0 | 7338648 | 22-09-2023 | 16:09:07 | Class A | 219793000 | 56.075147 | 7.7423 | 3.177 | 4097 | NS25_S | |
| 22-09-2023 16:10 | 1 | 181 | 104.5 | 93.3 | 142.4 | 0 | 7346233 | 22-09-2023 | 16:10:07 | Class A | 219793000 | 56.075705 | 7.7412 | 3.052 | 4102 | NS25_S | |
| 22-09-2023 16:11 | 1 | 172 | 105.5 | 92.9 | 143.3 | 0 | 7353079 | 22-09-2023 | 16:11:01 | Class A | 219793000 | 56.076102 | 7.7402 | 2.943 | 4117 | NS25_S | |
| 22-09-2023 16:12 | 1 | 102 | 110.5 | 92.9 | 142.9 | 0 | 7361375 | 22-09-2023 | 16:12:07 | Class A | 219793000 | 56.076482 | 7.7387 | 2.812 | 4125 | NS25_S | |
| 22-09-2023 16:13 | 1 | 72 | 114.7 | 93.2 | 145.4 | 0 | 7368173 | 22-09-2023 | 16:13:00 | Class A | 219793000 | 56.076752 | 7.7375 | 2.708 | 4134 | NS25_S | |
| 22-09-2023 16:14 | 1 | 61 | 118.6 | 95.2 | 145.3 | 0 | 7376838 | 22-09-2023 | 16:14:08 | Class A | 219793000 | 56.076798 | 7.7359 | 2.602 | 4148 | NS25_S | |
| 22-09-2023 16:15 | 1 | 33 | 126.1 | 95.5 | 147.9 | 0 | 7384514 | 22-09-2023 | 16:15:08 | Class A | 219793000 | 56.076885 | 7.7344 | 2.503 | 4154 | NS25_S | |
| 22-09-2023 16:16 | 1 | 26 | 133 | 99.1 | 143.3 | 0 | 7392239 | 22-09-2023 | 16:16:08 | Class A | 219793000 | 56.076918 | 7.733 | 2.412 | 4161 | NS25_S | |
| 22-09-2023 16:17 | 1 | 28 | 133.8 | 109.3 | 148.5 | 0 | 7399845 | 22-09-2023 | 16:17:08 | Class A | 219793000 | 56.076712 | 7.7316 | 2.352 | 4175 | NS25_S | |
| 22-09-2023 16:18 | 1 | 19 | 140 | 114.8 | 147.6 | 0 | 7407341 | 22-09-2023 | 16:18:07 | Class A | 219793000 | 56.07626 | 7.7304 | 2.329 | 4180 | NS25_S | |
| 22-09-2023 16:19 | 1 | 29 | 128.8 | 97.7 | 148.3 | 0 | 7414940 | 22-09-2023 | 16:19:07 | Class A | 219793000 | 56.07563 | 7.7294 | 2.335 | 4191 | NS25_S | |
| 22-09-2023 16:20 | 1 | 37 | 125.3 | 95.7 | 147.3 | 0 | 7422450 | 22-09-2023 | 16:20:07 | Class A | 219793000 | 56.074865 | 7.7286 | 2.375 | 4197 | NS25_S | |
| 22-09-2023 16:21 | 1 | 34 | 132.5 | 96.3 | 146.1 | 0 | 7429331 | 22-09-2023 | 16:21:01 | Class A | 219793000 | 56.074145 | 7.7282 | 2.431 | 4209 | NS25_S | |
| 22-09-2023 16:22 | 1 | 27 | 135.4 | 95.4 | 148.8 | 0 | 7437779 | 22-09-2023 | 16:22:07 | Class A | 219793000 | 56.07315 | 7.7283 | 2.542 | 4216 | NS25_S | |
| 22-09-2023 16:23 | 1 | 40 | 122.4 | 94.5 | 149.5 | 0 | 7445317 | 22-09-2023 | 16:23:07 | Class A | 219793000 | 56.072272 | 7.7287 | 2.664 | 4221 | NS25_S | |
| 22-09-2023 16:24 | 1 | 46 | 120.7 | 94.7 | 149.3 | 0 | 7452891 | 22-09-2023 | 16:24:07 | Class A | 219793000 | 56.071413 | 7.7288 | 2.771 | 4238 | NS25_S | |
| 22-09-2023 16:25 | 1 | 47 | 118.6 | 94.1 | 147.3 | 0 | 7460630 | 22-09-2023 | 16:25:08 | Class A | 219793000 | 56.070625 | 7.729 | 2.870 | 4248 | NS25_S | |
| 22-09-2023 16:26 | 1 | 62 | 114.1 | 93.2 | 146.4 | 0 | 7468183 | 22-09-2023 | 16:26:08 | Class A | 219793000 | 56.069898 | 7.7294 | 2.974 | 4260 | NS25_S | |
| 22-09-2023 16:27 | 1 | 66 | 117.6 | 92.7 | 148 | 0 | 7475713 | 22-09-2023 | 16:27:08 | Class A | 219793000 | 56.069182 | 7.73 | 3.089 | 4270 | NS25_S | |
| 22-09-2023 16:28 | 1 | 124 | 107.6 | 92.7 | 146.9 | 0 | 7485647 | 22-09-2023 | 16:28:27 | Class A | 219793000 | 56.068308 | 7.731 | 3.248 | 4283 | NS25_S | |
| 22-09-2023 16:29 | 1 | 215 | 102.3 | 91.8 | 146.9 | 0 | 7490804 | 22-09-2023 | 16:29:08 | Class A | 219793000 | 56.067877 | 7.7316 | 3.331 | 4292 | NS25_S | |
| 22-09-2023 16:30 | 1 | 260 | 100 | 91.7 | 142 | 0 | 7498301 | 22-09-2023 | 16:30:08 | Class A | 219793000 | 56.067318 | 7.7326 | 3.453 | 4305 | NS25_S | |
| 22-09-2023 16:31 | 1 | 270 | 99.1 | 91.5 | 138.2 | 0 | 7505722 | 22-09-2023 | 16:31:07 | Class A | 219793000 | 56.066817 | 7.7336 | 3.574 | 4319 | NS25_S | |
| 22-09-2023 16:32 | 1 | 233 | 100.3 | 91.3 | 139.5 | 0 | 7513292 | 22-09-2023 | 16:32:07 | Class A | 219793000 | 56.066378 | 7.7348 | 3.695 | 4336 | NS25_S | |
| 22-09-2023 16:33 | 1 | 200 | 101.5 | 91.5 | 142 | 0 | 7520830 | 22-09-2023 | 16:33:07 | Class A | 219793000 | 56.065987 | 7.736 | 3.814 | 4352 | NS25_S | |
| 22-09-2023 16:34 | 1 | 200 | 101.8 | 9.2 | 141 | 0 | 7528332 | 22-09-2023 | 16:34:07 | Class A | 219793000 | 56.065665 | 7.7373 | 3.929 | 4368 | NS25_S | |
| 22-09-2023 16:35 | 1 | 179 | 102.4 | 92.4 | 140.9 | 0 | 7535801 | 22-09-2023 | 16:35:07 | Class A | 219793000 | 56.0654 | 7.7387 | 4.041 | 4383 | NS25_S | |
| 22-09-2023 16:36 | 1 | 245 | 100.1 | 91.7 | 142.5 | 0 | 7543350 | 22-09-2023 | 16:36:07 | Class A | 219793000 | 56.06517 | 7.74 | 4.149 | 4398 | NS25_S | |
| 22-09-2023 16:37 | 1 | 229 | 100.9 | 91.5 | 142.5 | 0 | 7552149 | 22-09-2023 | 16:37:17 | Class A | 219793000 | 56.064938 | 7.7416 | 4.271 | 4417 | NS25_S | |
| 22-09-2023 16:38 | 1 | 220 | 100.9 | 92.1 | 140.3 | 0 | 7559615 | 22-09-2023 | 16:38:17 | Class A | 219793000 | 56.064688 | 7.7429 | 4.378 | 4425 | NS25_S | |
| 22-09-2023 16:39 | 1 | 248 | 99.6 | 91.3 | 137.9 | 0 | 7567220 | 22-09-2023 | 16:39:18 | Class A | 219793000 | 56.064455 | 7.7442 | 4.484 | 4430 | NS25_S | |
| 22-09-2023 16:40 | 1 | 261 | 99.4 | 91.3 | 136.4 | 0 | 7572633 | 22-09-2023 | 16:40:02 | Class A | 219793000 | 56.064278 | 7.7452 | 4.562 | 4439 | NS25_S | |
| 22-09-2023 16:41 | 1 | 167 | 100.8 | 91.4 | 135.2 | 0 | 7583336 | 22-09-2023 | 16:41:27 | Class A | 219793000 | 56.063622 | 7.7467 | 4.728 | 4448 | NS25_S | |

## Vessel pass 5: 26-09-2023, station NS25, USBL detections from 04:57 UTC – 05:41 UTC.

| timestamp | ST_active | N | SPL_VHF_mean | SPL_VHF_min | SPL_VHF_max | ship | Line ID | Date | Time | Class | MMSI no | Lat | Lon | Dist (km) | Id | Station | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26-09-2023 04:57 | 1 | 91 | 101.9 | 90.7 | 129.9 | 0 | | | | | | | | | | | |
| 26-09-2023 04:58 | 1 | 98 | 100.9 | 90.9 | 126.2 | 0 | | | | | | | | | | | |
| 26-09-2023 04:59 | 1 | 93 | 101.3 | 90.8 | 129.1 | 0 | | | | | | | | | | | |
| 26-09-2023 05:00 | 1 | 91 | 101.3 | 91.4 | 128.1 | 0 | | | | | | | | | | | |
| 26-09-2023 05:01 | 1 | 79 | 103.2 | 91.2 | 127.8 | 0 | | | | | | | | | | | |
| 26-09-2023 05:02 | 1 | 98 | 10.1 | 91.1 | 127.7 | 0 | | | | | | | | | | | |
| 26-09-2023 05:03 | 1 | 117 | 99.4 | 90.5 | 129.9 | 0 | | | | | | | | | | | |
| 26-09-2023 05:04 | 1 | 109 | 100.5 | 90.6 | 12.9 | 0 | | | | | | | | | | | |
| 26-09-2023 05:05 | 1 | 102 | 101.3 | 9.1 | 130.9 | 0 | | | | | | | | | | | |
| 26-09-2023 05:06 | 1 | 109 | 100.4 | 90.9 | 129.4 | 0 | | | | | | | | | | | |
| 26-09-2023 05:07 | 1 | 104 | 100.9 | 90.8 | 129.5 | 0 | | | | | | | | | | | |
| 26-09-2023 05:08 | 1 | 99 | 101.2 | 9.1 | 130.7 | 0 | | | | | | | | | | | |
| 26-09-2023 05:09 | 1 | 102 | 100.9 | 90.9 | 130.4 | 0 | | | | | | | | | | | |
| 26-09-2023 05:10 | 1 | 98 | 100.8 | 90.7 | 126.7 | 0 | | | | | | | | | | | |
| 26-09-2023 05:11 | 1 | 95 | 101.3 | 91.2 | 126.2 | 0 | | | | | | | | | | | |
| 26-09-2023 05:12 | 1 | 98 | 100.8 | 9.1 | 128.6 | 0 | | | | | | | | | | | |
| 26-09-2023 05:13 | 1 | 86 | 102.2 | 91.1 | 130.2 | 0 | | | | | | | | | | | |
| 26-09-2023 05:14 | 1 | 92 | 101.3 | 91.3 | 128.4 | 0 | | | | | | | | | | | |
| 26-09-2023 05:15 | 1 | 97 | 101.3 | 9.1 | 131.2 | 0 | | | | | | | | | | | |
| 26-09-2023 05:16 | 1 | 97 | 101.3 | 9.1 | 129.7 | 0 | 2386911 | 26-09-2023 | 05:16:26 | Class A | 219015362 | 56.119662 | 7.689578 | 4.989 | 506 | NS25_S | |
| 26-09-2023 05:17 | 1 | 129 | 99.5 | 90.9 | 130.3 | 0 | 2391596 | 26-09-2023 | 05:17:00 | Class A | 219015362 | 56.118658 | 7.689162 | 4.903 | 522 | NS25_S | |
| 26-09-2023 05:18 | 1 | 129 | 100.1 | 90.8 | 132.8 | 0 | 2401931 | 26-09-2023 | 05:18:13 | Class A | 219015362 | 56.116327 | 7.68888 | 4.662 | 546 | NS25_S | |
| 26-09-2023 05:19 | 1 | 136 | 99.9 | 91.1 | 136.8 | 0 | 2409514 | 26-09-2023 | 05:19:07 | Class A | 219015362 | 56.114448 | 7.688375 | 4.484 | 565 | NS25_S | |
| 26-09-2023 05:20 | 1 | 136 | 100.5 | 9.1 | 138.4 | 0 | 2417990 | 26-09-2023 | 05:20:07 | Class A | 219015362 | 56.112323 | 7.687782 | 4.284 | 581 | NS25_S | |
| 26-09-2023 05:21 | 1 | 140 | 100.2 | 91.2 | 138.2 | 0 | 2425644 | 26-09-2023 | 05:21:01 | Class A | 219015362 | 56.110425 | 7.687415 | 4.095 | 601 | NS25_S | |
| 26-09-2023 05:22 | 1 | 145 | 100.3 | 9.1 | 139.3 | 0 | 2435023 | 26-09-2023 | 05:22:07 | Class A | 219015362 | 56.108073 | 7.687627 | 3.821 | 616 | NS25_S | |
| 26-09-2023 05:23 | 1 | 150 | 100.4 | 90.9 | 140.3 | 0 | 2443542 | 26-09-2023 | 05:23:07 | Class A | 219015362 | 56.105983 | 7.688428 | 3.540 | 637 | NS25_S | |
| 26-09-2023 05:24 | 1 | 157 | 100.3 | 91.2 | 141.6 | 0 | 2451979 | 26-09-2023 | 05:24:07 | Class A | 219015362 | 56.103852 | 7.688807 | 3.280 | 646 | NS25_S | |
| 26-09-2023 05:25 | 1 | 148 | 101.3 | 91.2 | 143.1 | 0 | 2460491 | 26-09-2023 | 05:25:07 | Class A | 219015362 | 56.101713 | 7.689243 | 3.016 | 652 | NS25_S | |
| 26-09-2023 05:26 | 1 | 137 | 103.3 | 91.4 | 148.2 | 0 | 2468905 | 26-09-2023 | 05:26:07 | Class A | 219015362 | 56.099542 | 7.6897 | 2.746 | 661 | NS25_S | |
| 26-09-2023 05:27 | 1 | 131 | 103.8 | 91.4 | 151.5 | 0 | 2477464 | 26-09-2023 | 05:27:07 | Class A | 219015362 | 56.097427 | 7.690137 | 2.485 | 674 | NS25_S | |
| 26-09-2023 05:28 | 1 | 108 | 107.2 | 91.6 | 152.5 | 0 | 2486065 | 26-09-2023 | 05:28:07 | Class A | 219015362 | 56.095307 | 7.690605 | 2.221 | 687 | NS25_S | Good correlation |
| 26-09-2023 05:29 | 1 | 60 | 118.5 | 92.6 | 155 | 0 | 2494548 | 26-09-2023 | 05:29:07 | Class A | 219015362 | 56.093167 | 7.691028 | 1.957 | 699 | NS25_S | |
| 26-09-2023 05:30 | 1 | 53 | 120.5 | 92.8 | 156.6 | 0 | 2503053 | 26-09-2023 | 05:30:07 | Class A | 219015362 | 56.091015 | 7.691582 | 1.684 | 711 | NS25_S | |
| 26-09-2023 05:31 | 1 | 49 | 122.7 | 95.4 | 158.7 | 0 | 2511659 | 26-09-2023 | 05:31:07 | Class A | 219015362 | 56.088882 | 7.691955 | 1.424 | 722 | NS25_S | |
| 26-09-2023 05:32 | 1 | 46 | 121.1 | 99.1 | 159.2 | 0 | 2520146 | 26-09-2023 | 05:32:07 | Class A | 219015362 | 56.086718 | 7.692358 | 1.159 | 733 | NS25_S | |
| 26-09-2023 05:33 | 1 | 39 | 139.2 | 10.1 | 163.5 | 0 | 2528688 | 26-09-2023 | 05:33:07 | Class A | 219015362 | 56.084575 | 7.692792 | 0.895 | 746 | NS25_S | |
| 26-09-2023 05:34 | 1 | 52 | 125.1 | 102.7 | 161.4 | 0 | 2537153 | 26-09-2023 | 05:34:07 | Class A | 219015362 | 56.08243 | 7.693307 | 0.625 | 757 | NS25_S | |
| 26-09-2023 05:35 | 1 | 45 | 130.3 | 10.3 | 162 | 0 | 2545659 | 26-09-2023 | 05:35:07 | Class A | 219015362 | 56.080275 | 7.6939 | 0.606 | 767 | NS25_S | |
| 26-09-2023 05:36 | 1 | 37 | 133.5 | 104.2 | 161.4 | 0 | 2554157 | 26-09-2023 | 05:36:07 | Class A | 219015362 | 56.078167 | 7.69485 | 0.783 | 777 | NS25_S | |
| 26-09-2023 05:37 | 1 | 39 | 133.9 | 99.7 | 160.8 | 0 | 2562652 | 26-09-2023 | 05:37:07 | Class A | 219015362 | 56.076053 | 7.695747 | 0.963 | 787 | NS25_S | |
| 26-09-2023 05:38 | 1 | 35 | 13.1 | 98.9 | 155.5 | 0 | 2571047 | 26-09-2023 | 05:38:07 | Class A | 219015362 | 56.073883 | 7.69675 | 1.142 | 799 | NS25_S | |
| 26-09-2023 05:39 | 1 | 30 | 140.3 | 96.7 | 153 | 0 | 2579510 | 26-09-2023 | 05:39:07 | Class A | 219015362 | 56.071703 | 7.69777 | 1.322 | 806 | NS25_S | |
| 26-09-2023 05:40 | 1 | 39 | 121.3 | 96.3 | 153.1 | 0 | 2587907 | 26-09-2023 | 05:40:07 | Class A | 219015362 | 56.06954 | 7.698875 | 1.495 | 812 | NS25_S | |
| 26-09-2023 05:41 | 1 | 38 | 121.3 | 92.9 | 151 | 0 | 2596360 | 26-09-2023 | 05:41:07 | Class A | 219015362 | 56.06737 | 7.699895 | 1.674 | 818 | NS25_S | |

## Vessel pass 6: 18-10-2023, station NS25, USBL detections from 07:57 UTC – 08:41 UTC.

| timestamp | ST_active | N | SPL_VHF_n | SPL_VHF_n | SPL_VHF_n | ship | Line ID | Date | Time | | Cl | MMSI no | Lat | Lon | Dist (km) | Id | Station | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18-10-2023 07:57 | 1 | 265 | 98.7 | 89.9 | 142.3 | 0 | 556520 | 18-10-2023 | 07:57:06 | Class | A | 219021428 | 56.06653 | 7.733817 | 3.618 | 1432 | NS25_S | |
| 18-10-2023 07:58 | 1 | 282 | 98.4 | 90.2 | 147.8 | 0 | 3564708 | 18-10-2023 | 07:58:06 | Class | A | 219021428 | 56.0678 | 7.731268 | 3.320 | 1439 | NS25_S | |
| 18-10-2023 07:59 | 1 | 288 | 98.7 | 90.7 | 150.7 | 0 | 3572824 | 18-10-2023 | 07:59:06 | Class | A | 219021428 | 56.06909 | 7.728713 | 3.021 | 1445 | NS25_S | |
| 18-10-2023 08:00 | 1 | 292 | 98.8 | 90.5 | 150.9 | 0 | 3580927 | 18-10-2023 | 08:00:06 | Class | A | 219021428 | 56.07037 | 7.72617 | 2.723 | 1451 | NS25_S | |
| 18-10-2023 08:01 | 1 | 271 | 99.4 | 90.2 | 155 | 0 | 3589079 | 18-10-2023 | 08:01:06 | Class | A | 219021428 | 56.07165 | 7.723628 | 2.426 | 1457 | NS25_S | |
| 18-10-2023 08:02 | 1 | 241 | 100.3 | 91.1 | 155.2 | 0 | 3597257 | 18-10-2023 | 08:02:06 | Class | A | 219021428 | 56.07294 | 7.721008 | 2.123 | 1463 | NS25_S | |
| 18-10-2023 08:03 | 1 | 161 | 102.5 | 91.2 | 159.2 | 0 | 3605322 | 18-10-2023 | 08:03:06 | Class | A | 219021428 | 56.07424 | 7.718497 | 1.825 | 1468 | NS25_S | |
| 18-10-2023 08:04 | 1 | 57 | 111.5 | 92.5 | 161.9 | 0 | 3613352 | 18-10-2023 | 08:04:06 | Class | A | 219021428 | 56.07556 | 7.715892 | 1.519 | 1475 | NS25_S | |
| 18-10-2023 08:05 | 1 | 90 | 111.4 | 95.4 | 165.3 | 0 | 3621619 | 18-10-2023 | 08:05:06 | Class | A | 219021428 | 56.07685 | 7.713318 | 1.218 | 1481 | NS25_S | |
| 18-10-2023 08:06 | 1 | 90 | 114.8 | 99.1 | 168.3 | 0 | 3630087 | 18-10-2023 | 08:06:07 | Class | A | 219021428 | 56.07815 | 7.710637 | 0.910 | 1487 | NS25_S | |
| 18-10-2023 08:07 | 1 | 27 | 128.2 | 101.2 | 168.3 | 0 | 3638351 | 18-10-2023 | 08:07:07 | Class | A | 219021428 | 56.07945 | 7.70807 | 0.609 | 1493 | NS25_S | |
| 18-10-2023 08:08 | 1 | 12 | 128.5 | 104.1 | 163.5 | 0 | 3646658 | 18-10-2023 | 08:08:07 | Class | A | 219021428 | 56.08074 | 7.705587 | 0.314 | 1499 | NS25_S | |
| | | | | | | | 3654954 | 18-10-2023 | 08:09:07 | Class | A | 219021428 | 56.08177 | 7.70343 | 0.142 | 1505 | NS25_S | |
| 18-10-2023 08:10 | 1 | 3 | 134.8 | 105.5 | 157 | 0 | 3662751 | 18-10-2023 | 08:10:04 | Class | A | 219021428 | 56.08136 | 7.700817 | 0.063 | 1520 | NS25_S | |
| 18-10-2023 08:11 | 1 | 69 | 121.8 | 101.6 | 167.1 | 0 | 3671435 | 18-10-2023 | 08:11:07 | Class | A | 219021428 | 56.0793 | 7.701108 | 0.274 | 1537 | NS25_S | |
| 18-10-2023 08:12 | 1 | 91 | 114.9 | 96.6 | 165 | 0 | 3679684 | 18-10-2023 | 08:12:07 | Class | A | 219021428 | 56.07741 | 7.701488 | 0.461 | 1543 | NS25_S | |
| 18-10-2023 08:13 | 1 | 63 | 115.5 | 93.3 | 159 | 0 | 3689159 | 18-10-2023 | 08:13:17 | Class | A | 219021428 | 56.07522 | 7.701725 | 0.691 | 1549 | NS25_S | |
| 18-10-2023 08:14 | 1 | 90 | 108.6 | 91.7 | 160.6 | 0 | 3695988 | 18-10-2023 | 08:14:07 | Class | A | 219021428 | 56.07365 | 7.701808 | 0.870 | 1554 | NS25_S | |
| 18-10-2023 08:15 | 1 | 262 | 100.5 | 90.9 | 154.4 | 0 | 3704230 | 18-10-2023 | 08:15:07 | Class | A | 219021428 | 56.07176 | 7.701873 | 1.084 | 1561 | NS25_S | Good correlation |
| 18-10-2023 08:16 | 1 | 302 | 99.8 | 90.7 | 153 | 0 | 3712436 | 18-10-2023 | 08:16:07 | Class | A | 219021428 | 56.06989 | 7.701933 | 1.296 | 1575 | NS25_S | |
| 18-10-2023 08:17 | 1 | 326 | 98.5 | 90.3 | 146.2 | 0 | 3720759 | 18-10-2023 | 08:17:07 | Class | A | 219021428 | 56.06799 | 7.701875 | 1.503 | 1587 | NS25_S | |
| 18-10-2023 08:18 | 1 | 247 | 98.9 | 90.8 | 145 | 0 | 3729194 | 18-10-2023 | 08:18:07 | Class | A | 219021428 | 56.06608 | 7.701863 | 1.715 | 1599 | NS25_S | |
| 18-10-2023 08:19 | 1 | 287 | 98.5 | 90.7 | 144.2 | 0 | 3737467 | 18-10-2023 | 08:19:07 | Class | A | 219021428 | 56.06417 | 7.701815 | 1.924 | 1614 | NS25_S | |
| 18-10-2023 08:20 | 1 | 286 | 98.4 | 90.2 | 141.3 | 0 | 3745757 | 18-10-2023 | 08:20:07 | Class | A | 219021428 | 56.06224 | 7.701732 | 2.134 | 1626 | NS25_S | |
| 18-10-2023 08:21 | 1 | 292 | 98.5 | 90.1 | 141 | 0 | 3754006 | 18-10-2023 | 08:21:07 | Class | A | 219021428 | 56.06032 | 7.701728 | 2.346 | 1641 | NS25_S | |
| 18-10-2023 08:22 | 1 | 288 | 97.6 | 90.1 | 137.4 | 0 | 3762133 | 18-10-2023 | 08:22:07 | Class | A | 219021428 | 56.05841 | 7.701642 | 2.562 | 1655 | NS25_S | |
| 18-10-2023 08:23 | 1 | 244 | 98.7 | 90.2 | 138.2 | 0 | 3770318 | 18-10-2023 | 08:23:07 | Class | A | 219021428 | 56.05647 | 7.70153 | 2.786 | 1668 | NS25_S | |
| 18-10-2023 08:24 | 1 | 230 | 98.3 | 90.2 | 135.1 | 0 | 3778673 | 18-10-2023 | 08:24:07 | Class | A | 219021428 | 56.05452 | 7.701448 | 3.007 | 1679 | NS25_S | |
| 18-10-2023 08:25 | 1 | 218 | 98.5 | 9 | 133 | 0 | 3788234 | 18-10-2023 | 08:25:17 | Class | A | 219021428 | 56.05228 | 7.701335 | 3.263 | 1695 | NS25_S | |
| 18-10-2023 08:26 | 1 | 197 | 97.8 | 90.2 | 129.8 | 0 | 3796512 | 18-10-2023 | 08:26:16 | Class | A | 219021428 | 56.05035 | 7.701288 | 3.480 | 1707 | NS25_S | |
| 18-10-2023 08:27 | 1 | 182 | 98.7 | 9 | 130.3 | 0 | 3804195 | 18-10-2023 | 08:27:12 | Class | A | 219021428 | 56.04902 | 7.701228 | 3.632 | 1717 | NS25_S | |
| 18-10-2023 08:28 | 1 | 166 | 99.5 | 90.2 | 133.3 | 0 | 3812994 | 18-10-2023 | 08:28:16 | Class | A | 219021428 | 56.04644 | 7.701158 | 3.922 | 1729 | NS25_S | |
| 18-10-2023 08:29 | 1 | 123 | 99.6 | 90.2 | 132.1 | 0 | 3821239 | 18-10-2023 | 08:29:16 | Class | A | 219021428 | 56.04447 | 7.701128 | 4.143 | 1734 | NS25_S | |
| 18-10-2023 08:30 | 1 | 147 | 9.9 | 90.4 | 125.8 | 0 | 3829467 | 18-10-2023 | 08:30:16 | Class | A | 219021428 | 56.0425 | 7.701032 | 4.368 | 1739 | NS25_S | |
| 18-10-2023 08:31 | 1 | 133 | 99.5 | 89.9 | 125.9 | 0 | 3836249 | 18-10-2023 | 08:31:07 | Class | A | 219021428 | 56.04087 | 7.701008 | 4.551 | 1744 | NS25_S | |
| 18-10-2023 08:32 | 1 | 110 | 99.7 | 90.6 | 130.1 | 0 | 3844372 | 18-10-2023 | 08:32:06 | Class | A | 219021428 | 56.03891 | 7.70093 | 4.773 | 1750 | NS25_S | |
| 18-10-2023 08:33 | 1 | 113 | 99.9 | 90.1 | 122 | 0 | 3852546 | 18-10-2023 | 08:33:05 | Class | A | 219021428 | 56.03726 | 7.70089 | 4.959 | 1756 | NS25_S | |
| 18-10-2023 08:34 | 1 | 84 | 99.2 | 90.6 | 119.7 | 0 | | | | | | | | | | | | |
| 18-10-2023 08:35 | 1 | 96 | 98.6 | 90.4 | 120.1 | 0 | | | | | | | | | | | | |
| 18-10-2023 08:36 | 1 | 73 | 9.9 | 90.5 | 117.4 | 0 | | | | | | | | | | | | |
| 18-10-2023 08:37 | 1 | 35 | 98.8 | 90.1 | 118.3 | 0 | | | | | | | | | | | | |
| 18-10-2023 08:38 | 1 | 68 | 98.2 | 90.8 | 11.3 | 0 | | | | | | | | | | | | |
| 18-10-2023 08:39 | 1 | 54 | 97.7 | 90.1 | 112.5 | 0 | | | | | | | | | | | | |
| 18-10-2023 08:40 | 1 | 49 | 9.8 | 90.3 | 11 | 0 | | | | | | | | | | | | |
| 18-10-2023 08:41 | 1 | 44 | 97.6 | 90.9 | 108.4 | 0 | | | | | | | | | | | | |