

Static acoustic monitoring of harbour porpoises at the research platform FINO 3, German Bight, North Sea

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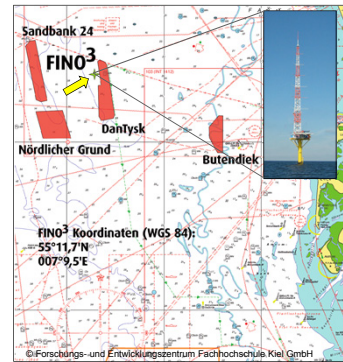
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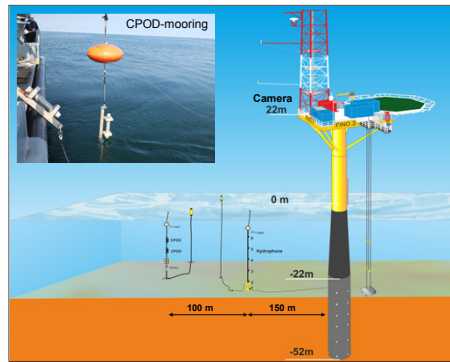
Objectives

The objective of this study as part of a larger scale project (Underwater sound measurements at FINO 3) was to investigate the presence of harbour porpoises, looking at seasonal and daily patterns, using acoustic and visual techniques. We wanted to look at and compare results of CPOD, hydrophone and visual data, furthermore look at possible changes of harbour porpoise observations caused by construction activities of an offshore-wind farm nearby the FINO 3 platform.

Methods

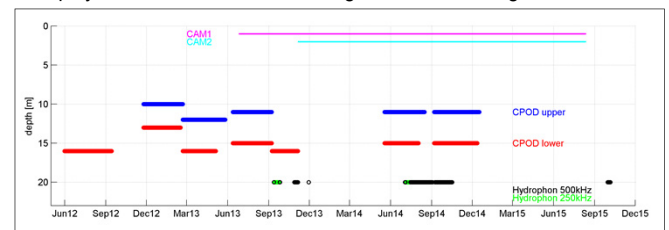


Location of FINO 3 northwest off Sylt and nearby offshore wind farms.



Scheme of the moorings for acoustic measurements. CPOD mooring (left) and hydrophone chain (right), located within about 100-200 m.

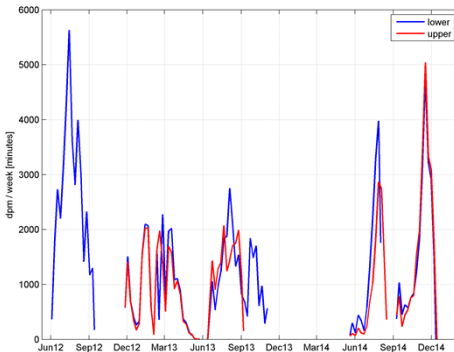
- Mooring with two Continuous Porpoise Detectors (CPOD) deployed at about 11 and 15 m to detect harbour porpoises
- Hydrophone chain for acoustic measurements temporarily up to 500 kHz
- Automated video camera system for visual detection (1 image/sec) deployed on FINO 3 in 22 m, aiming at CPOD-mooring



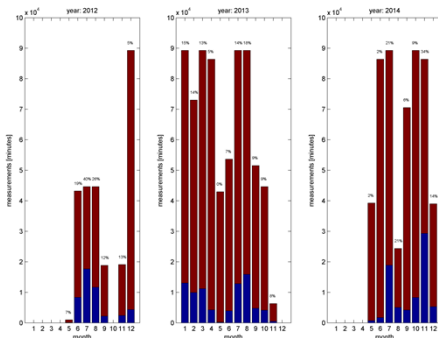
Overview of recording times of upper and lower CPOD, hydrophone with resolution ≥ 250 kHz and camera system. Interruptions due to instrument damages, loss or failure.

Results

Seasonal pattern

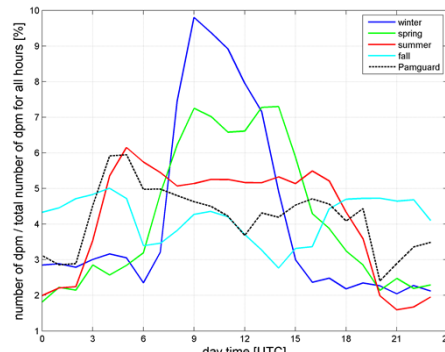


Number of detection positive minutes (dpm) of lower and upper CPOD.



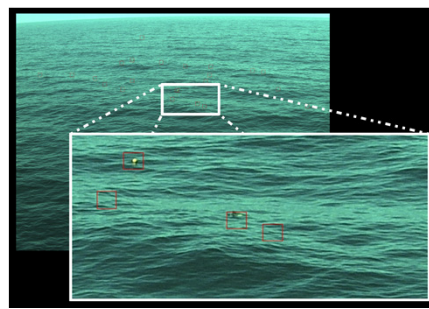
Time of all CPOD measurements (brown) and dpm (blue) for each recorded month. Percentage of dpm is listed above bar.

Diurnal pattern



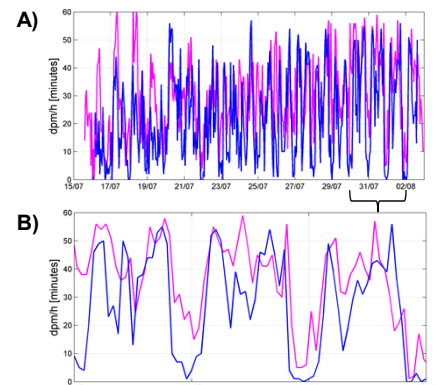
Distribution of all dpm with regard to day time for each season of the CPOD data and hydrophone data of summer 2014, analysed with Pamguard®.

Visual detection

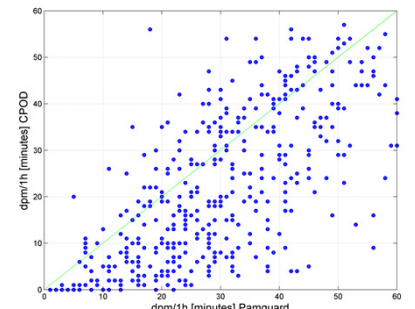


Outcome of the visual detection algorithm (FAST features) to automatically find harbour porpoises. The example shows the reduction of interesting objects from 1000 to 22 using FAST. The proper detection is shown in the enlarged detail.

CPOD / hydrophone comparison



Number of dpm/h in summer 2014 of lower CPOD (blue) and hydrophone data (light blue) analysed with Pamguard®. A) overview, B) detailed view.



Correlation between dpm of lower CPOD and hydrophone data within summer 2014.

- High rate of harbour porpoise occurrence at FINO 3. Data of upper and lower CPOD highly correlated ($r > 0.9$).
- Seasonal changes with maxima in July / August and minima in May. Additional maximum in November 2014.
- Inter-annual changes with less detections in summer 2013 during construction activities at wind farm *DanTysk*. Data too poor to affirm a direct correlation.
- Diurnal cycle with higher activities during day light hours and peaks in the morning during winter, spring and summer. Fall data are dominated by unique observations in November 2014.

- Unusual diurnal pattern confirmed by hydrophone data. This could be related to local prey and adapted feeding behaviour.
- Feasible visual detection algorithm (FAST features) was developed. Number of visual detections much lower than acoustical and highly dependent on environmental conditions (e.g. wave height).
- High resolution hydrophone data (15th July to 2nd Aug 2014) analysed with Pamguard® correlated with corresponding CPOD data ($r = 0.7$), but number of detection positive minutes even higher.