Assessing the impact of offshore wind construction: Harbour porpoises behaviorally react to playbacks of vibropiling noise

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WOZEP DUTCH GOVERNMENTAL OFFSHORE WIND ECOLOGICAL PROGRAMME


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BIOLOGY
Marine Biological Research Center

Harbour Porpoises: Freja, Saga and Eskild

Outreach and Scientific Research

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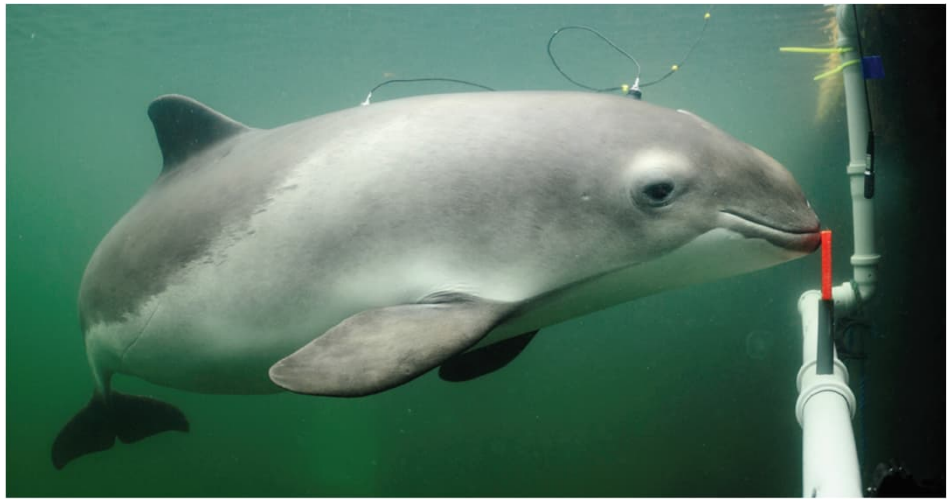
Photo: Solvin Zankl

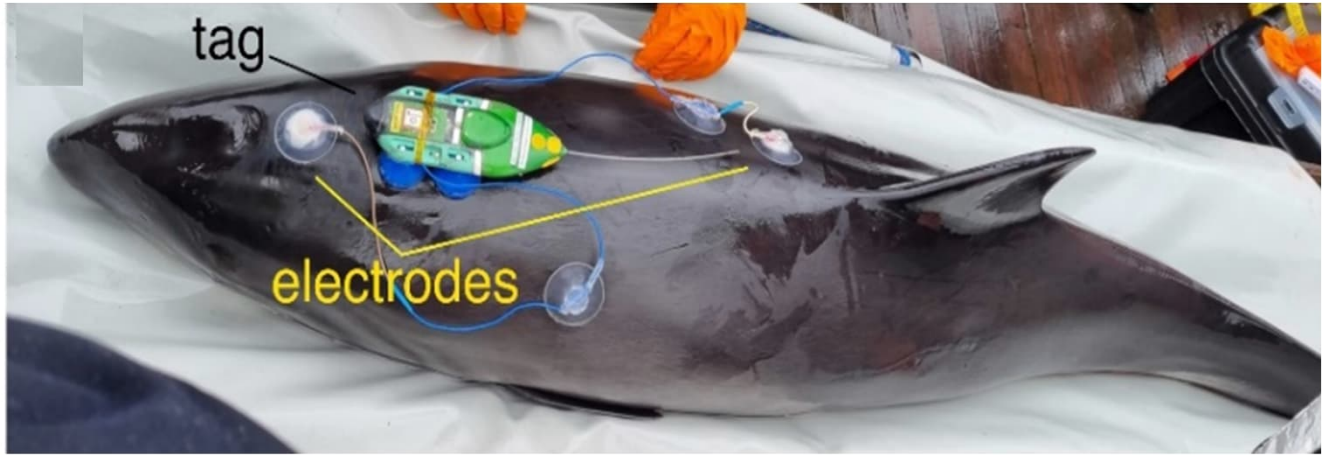
Effects of noise on porpoises



Hearing studies, including TTS

E.g.,
Lucke et al. 2009
Linnenschmidt et al. 2012
Schaffeld et al. 2016
Beedholm et al. 2026

Field playback with drones and PAM
(Brennecke et al 2022, Hao et al. 2024, Kindt-Karsen et al. 2024)



Hearing measurements of wild animals
(Smith et al. in prep.)

Offshore wind farm installation

Pile driving, challenges

Very noisy
Effects on porpoises at large ranges
Expensive mitigation

Could *vibropiling* offer an interesting alternative to pile driving?

Project:

Vibro piling effects on harbour porpoise

2025-2026

Behavioural thresholds of porpoises in captivity (playback)

TTS thresholds

Calculated PTS thresholds

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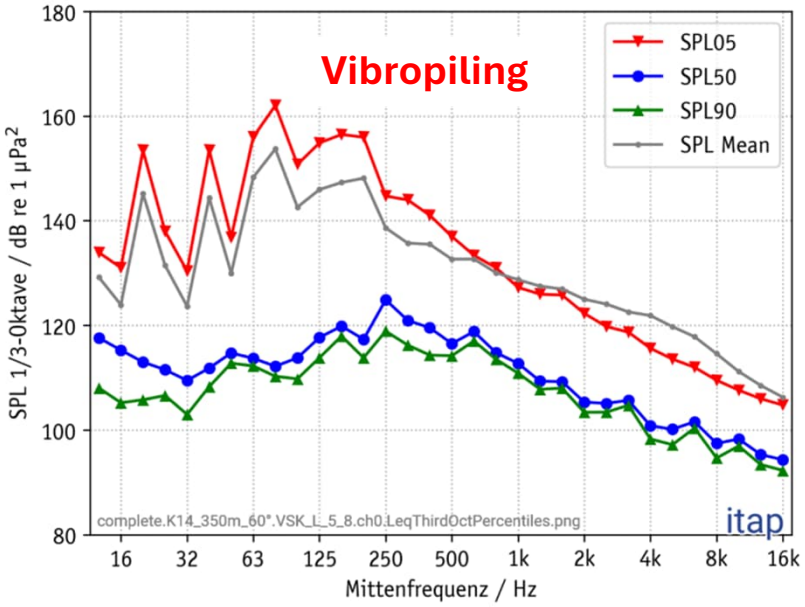
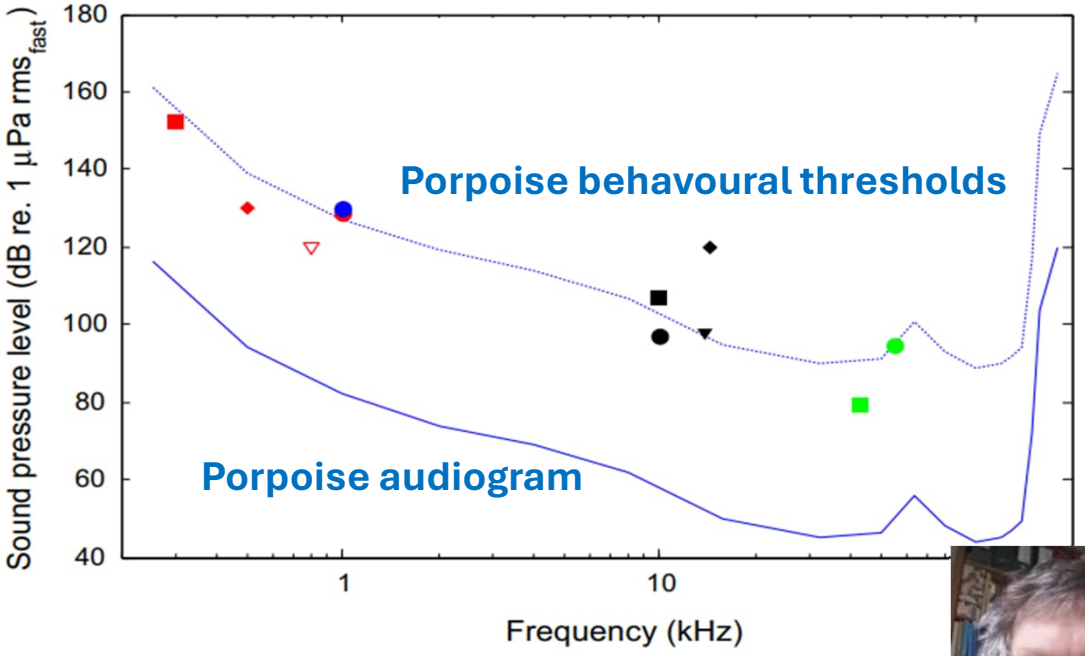
Vibropiling signals are difficult to reproduce

Signals obtained from VISSKA (RWE, ITAP et al.) and SIMPLE III (TNO et al.)



Bellman et al. 2024



From Tougaard et al. 2015, with data from Ron Kastelein (SEAMARCO)

SIMPLE III signal recorded in Kerteminde habour

LL1424HP

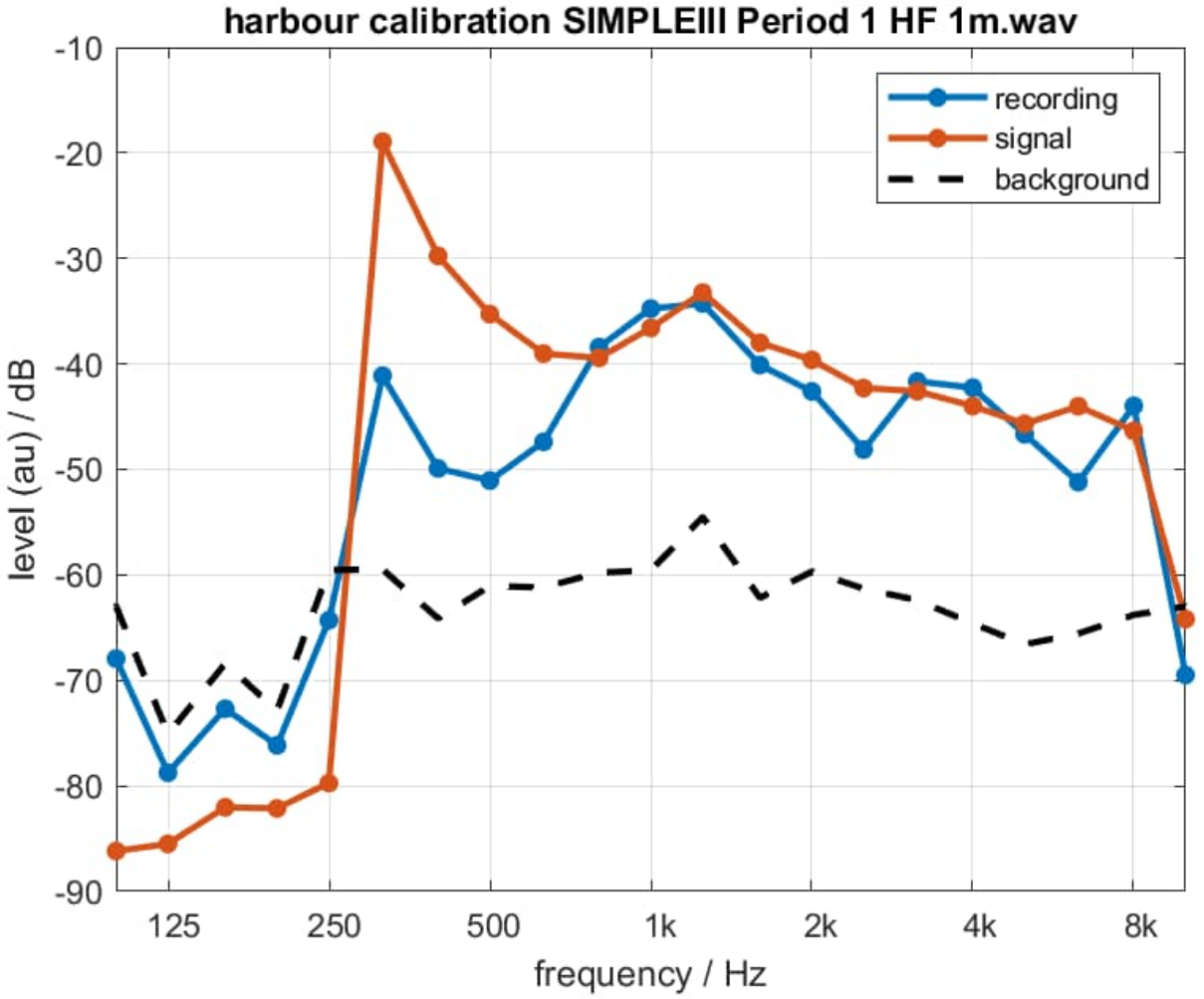
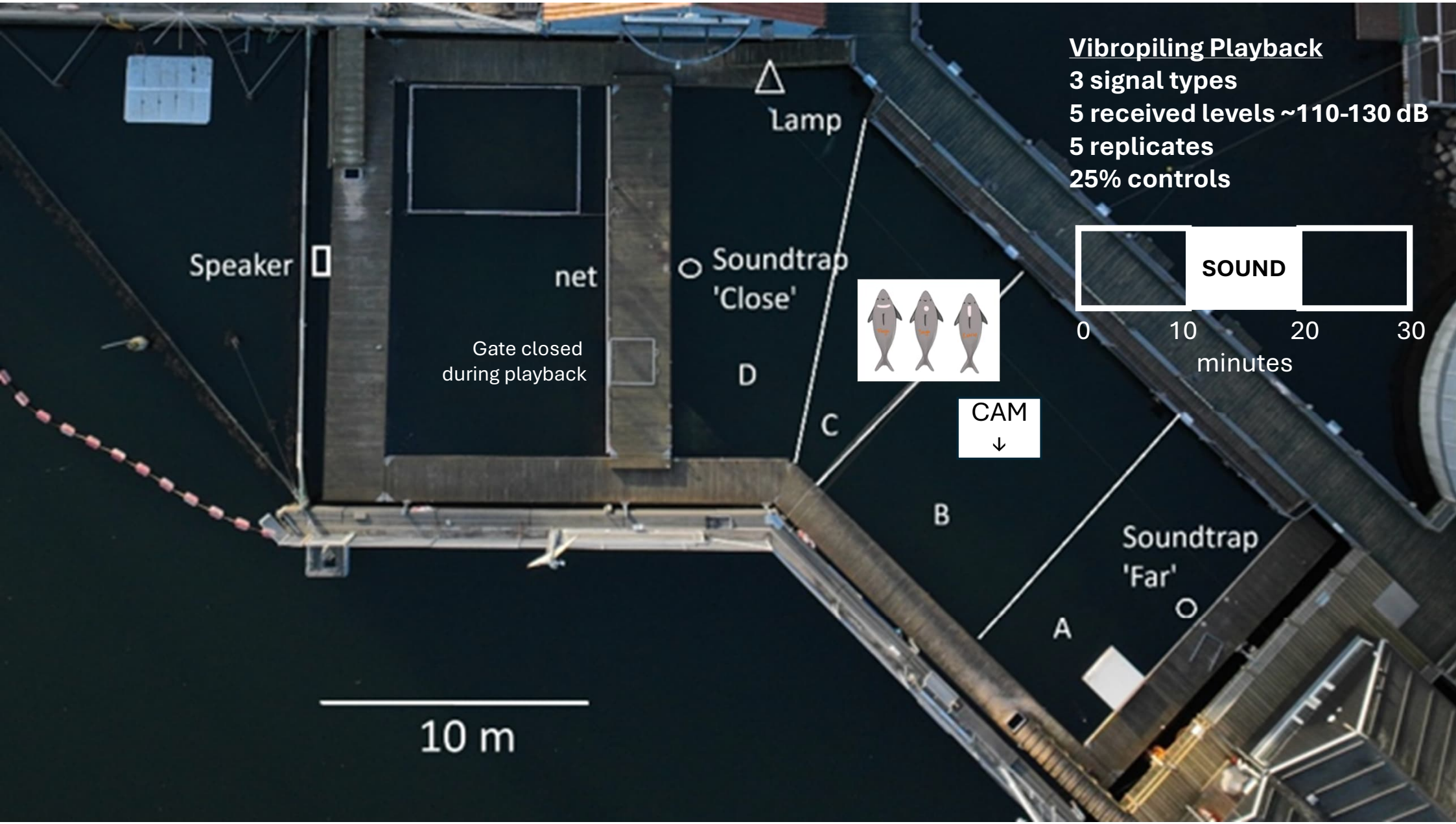
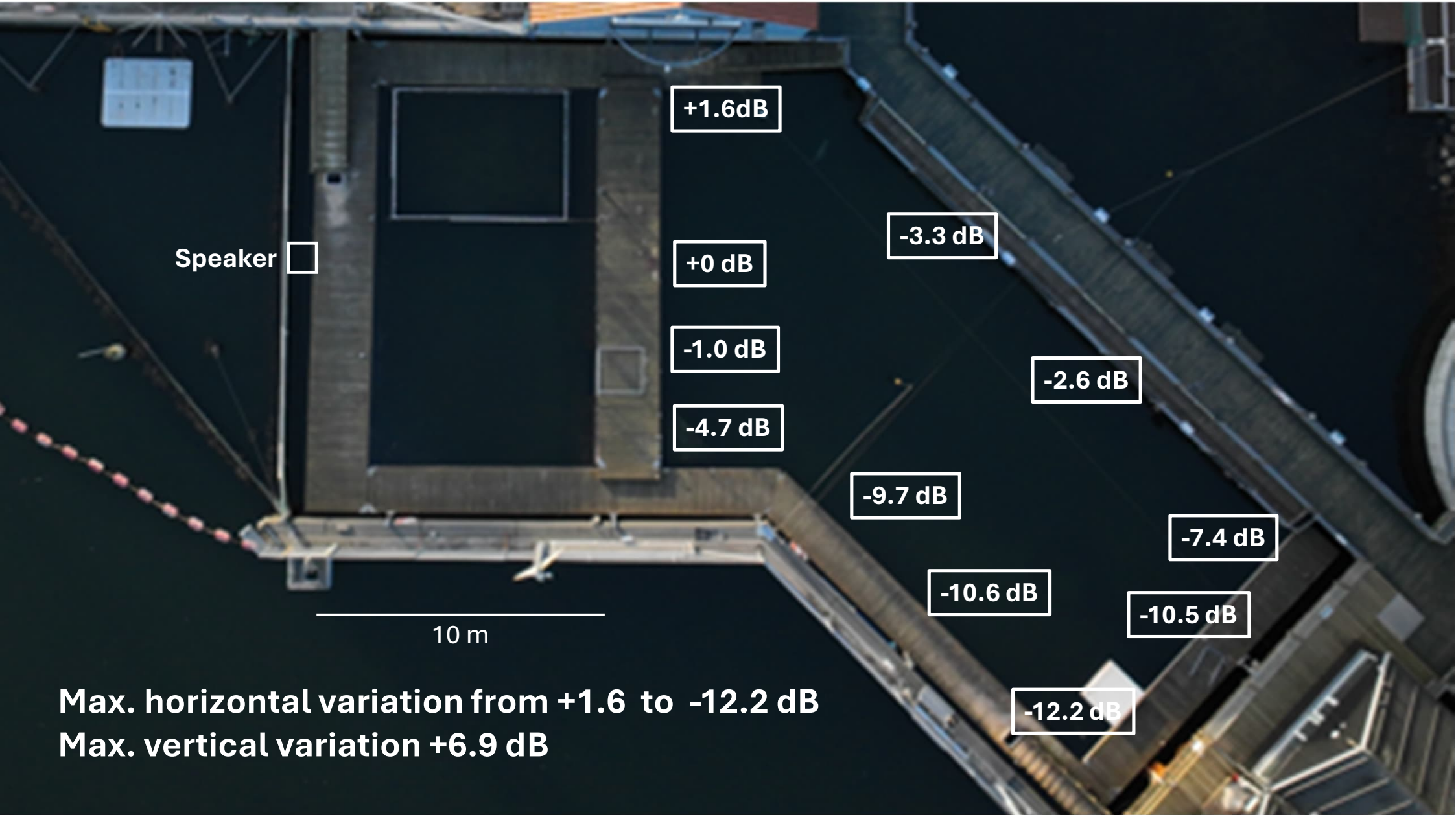
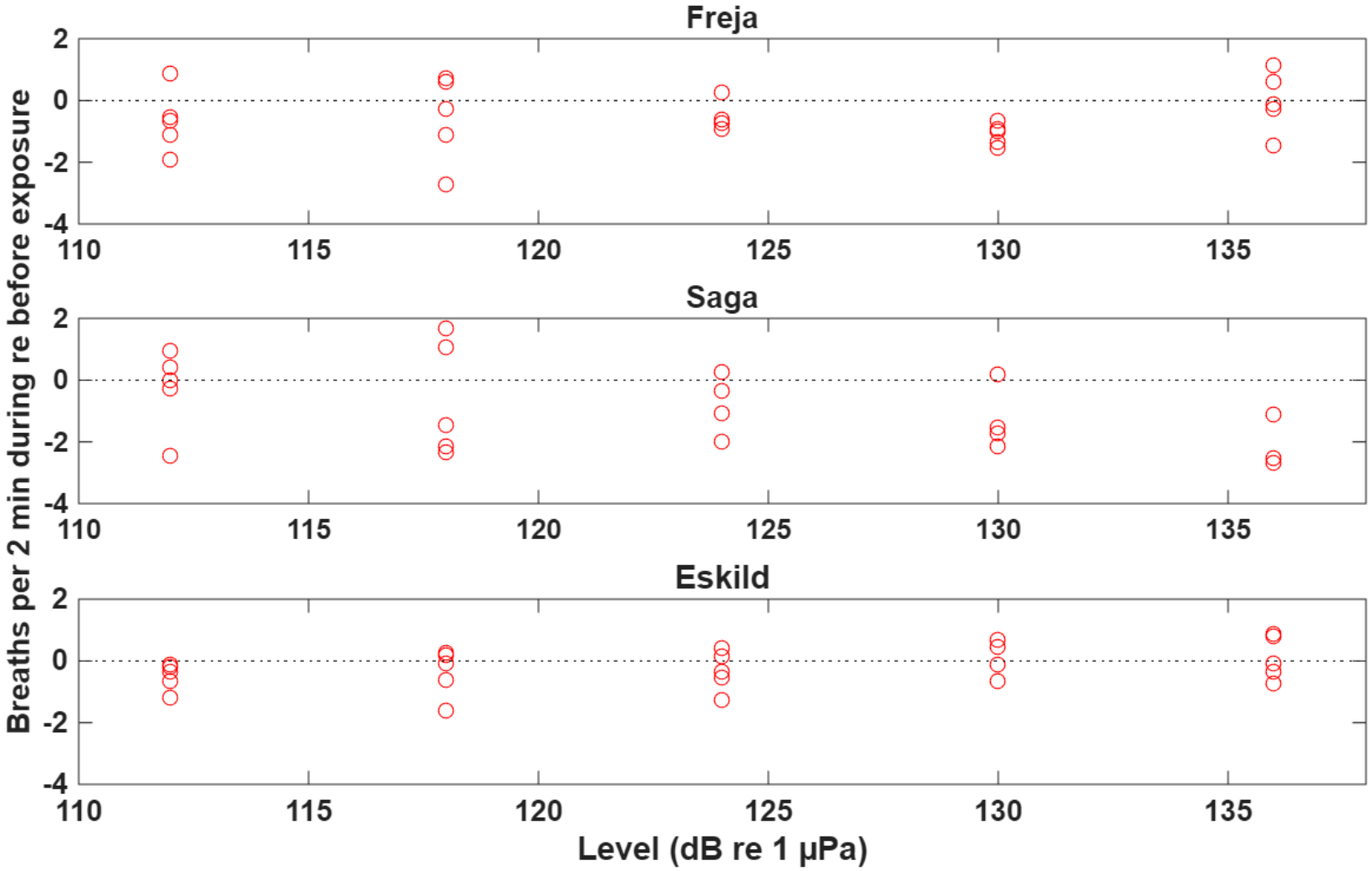


Figure by Christ de Jong, TNO

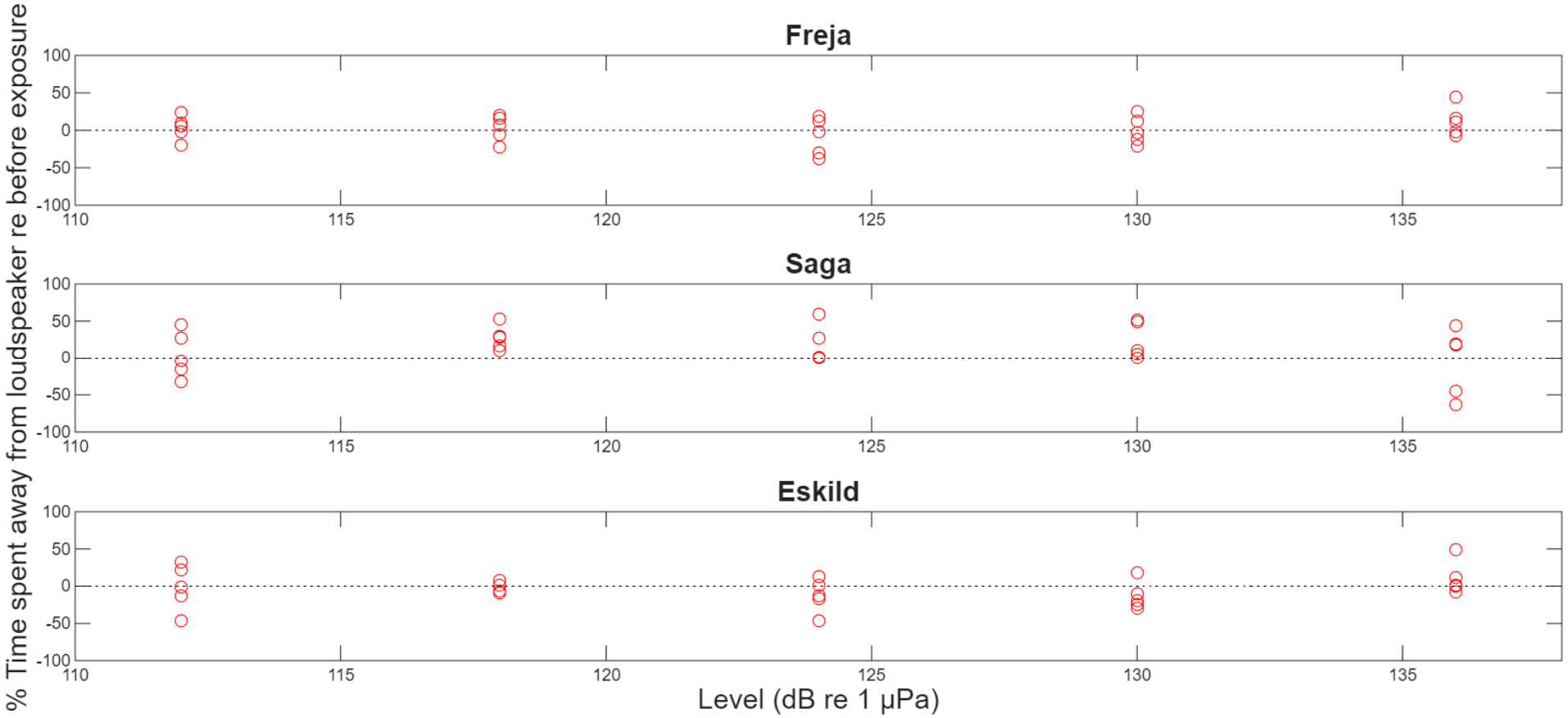

Vibropiling Playback
3 signal types
5 received levels ~110-130 dB
5 replicates
25% controls
SOUND
0
10
20
30
minutes
Lamp
Speaker
net
Soundtrap
'Close'
Gate closed
during playback
D
C
CAM
↓
B
Soundtrap
'Far'
A
10 m


+1.6dB
Speaker
+0 dB
-3.3 dB
-1.0 dB
-2.6 dB
-4.7 dB
-9.7 dB
-7.4 dB
-10.6 dB
-10.5 dB
10 m
-12.2 dB
Max. horizontal variation from +1.6 to -12.2 dB
Max. vertical variation +6.9 dB

VISSKA Signal 1: Breathing rates



VISSKA Signal 1:
Time spent far from loudspeaker



DTAG trials (ongoing)

Sara Zera (ERASMUS MSC student),
Adam Smith and Magnus Wahlberg

SIMPLE III Signal

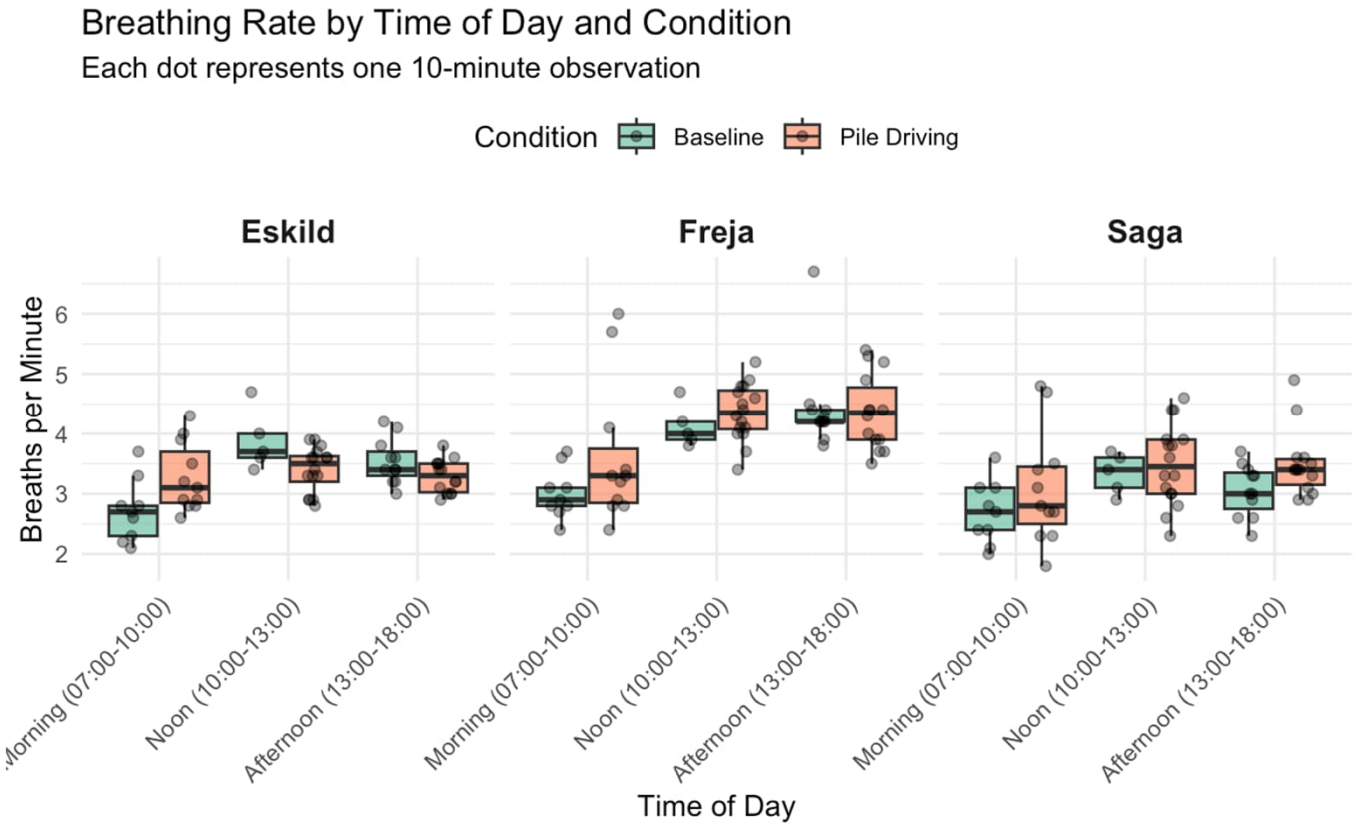
6 sessions with Freja
- 3 with highest intensity
- 3 with lowest intensity

Trials planned with Eskild and perhaps also Saga

Goal:
To obtain fined-tuned behavioural reactions that can be compared to the ‘normal’ playbacks

Piledriving close to enclouse in October, 2025

(Clara D’Autilia, ERASMUS Student)



Preliminary conclusions

Porpoises react to vibropiling at higher received levels

Response depends on individual; young female most sensitive

Porpoises also react to long-term low-frequency pulses
(generated by pile driving on land)

Road ahead

Vibropiling playbacks	April, 2026
Playback report	1st of June, 2026
TTS trials	Spring / summer, 2026
PTS calculations from TTS data	Summer, 2026
Final project report	1st of October, 2026

If there is time...

Electroreception in porpoises

Adam Smith
Magnus Wahlberg
Mathieu Delfosse
Joanna Sarnocinska
Peter Sigray
Laia Rojano Donate
Peter Madsen
Jonas Teilmann

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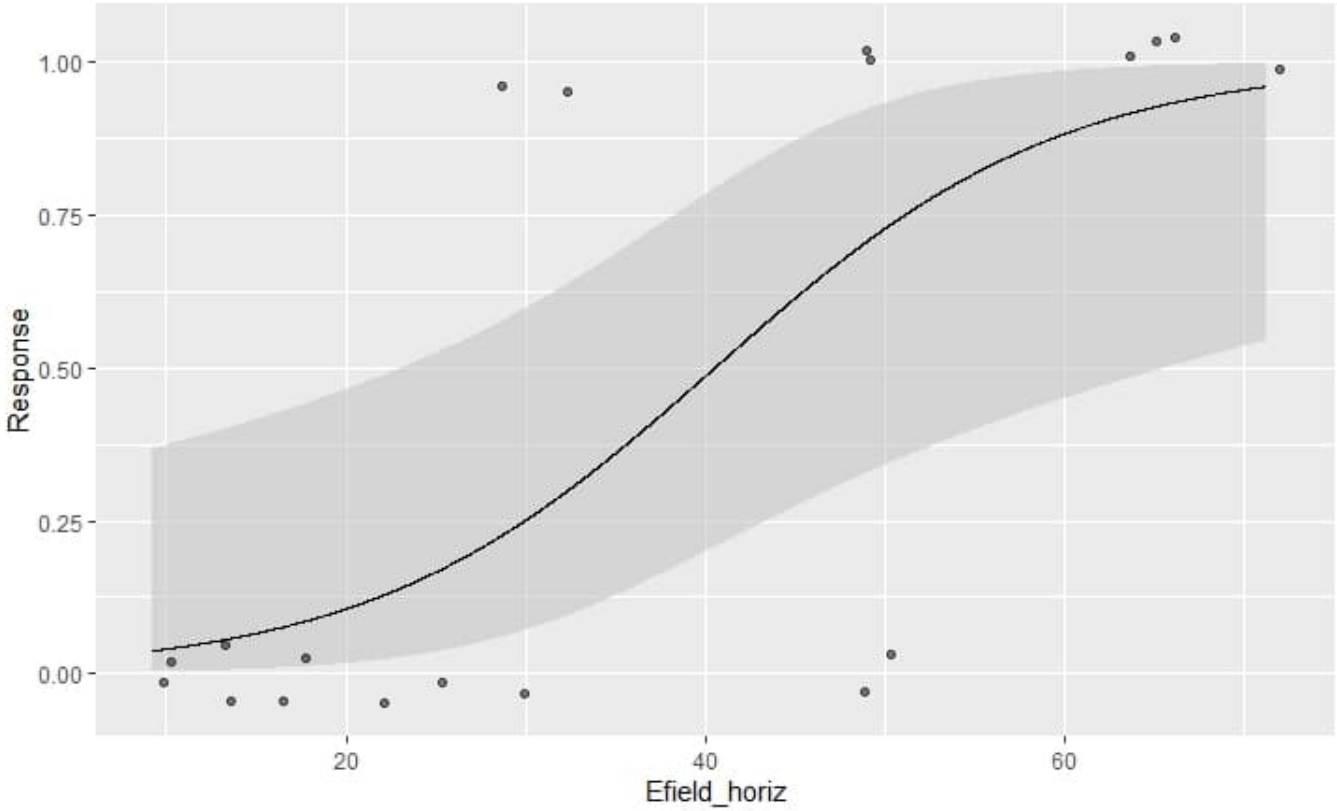
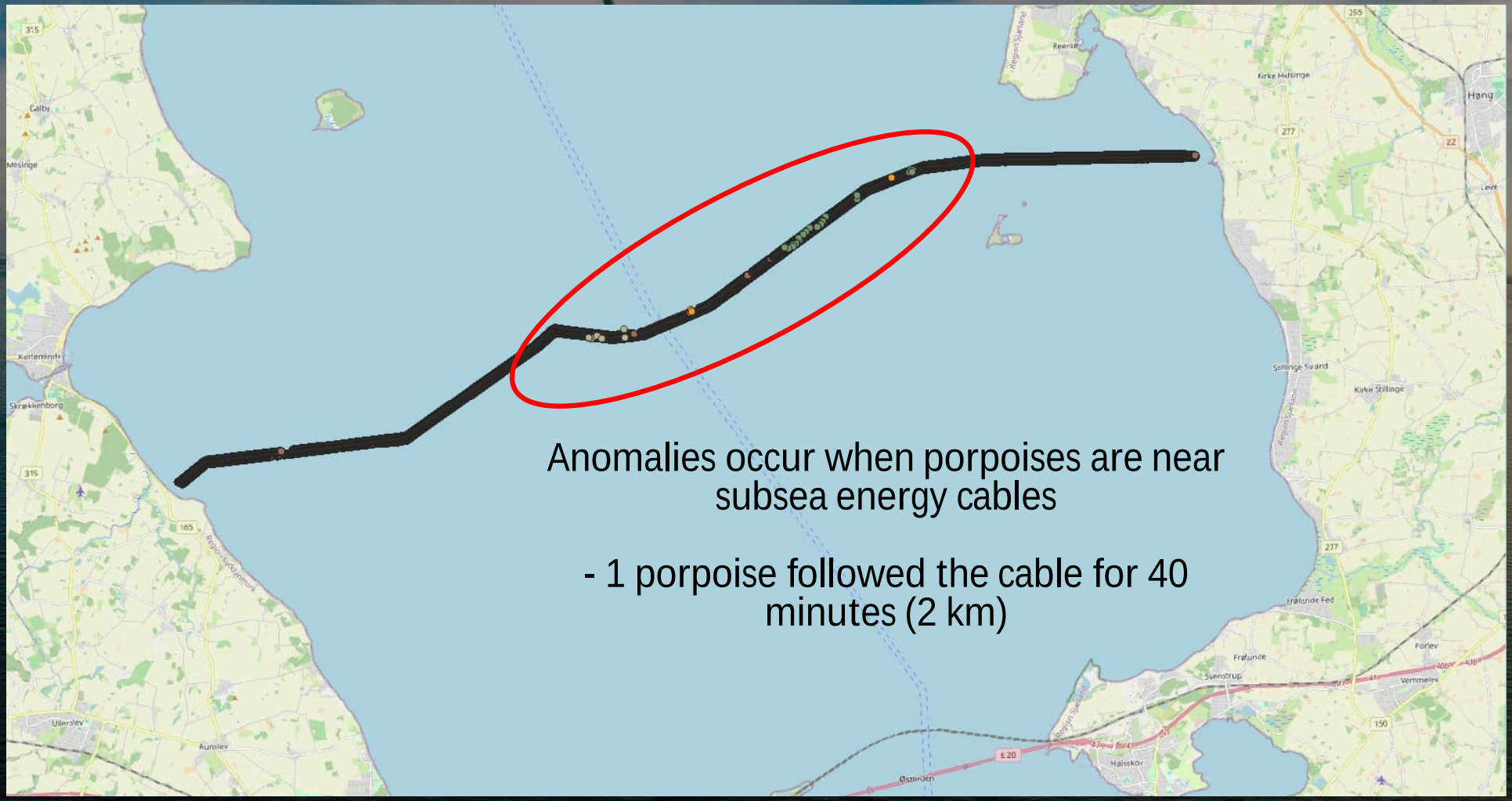
KTH VETENSKAP OCH KONST
VATTENFALL
ENERGINET
AARHUS UNIVERSITET

Electroreception startle responses

(Smith et al. in prep)



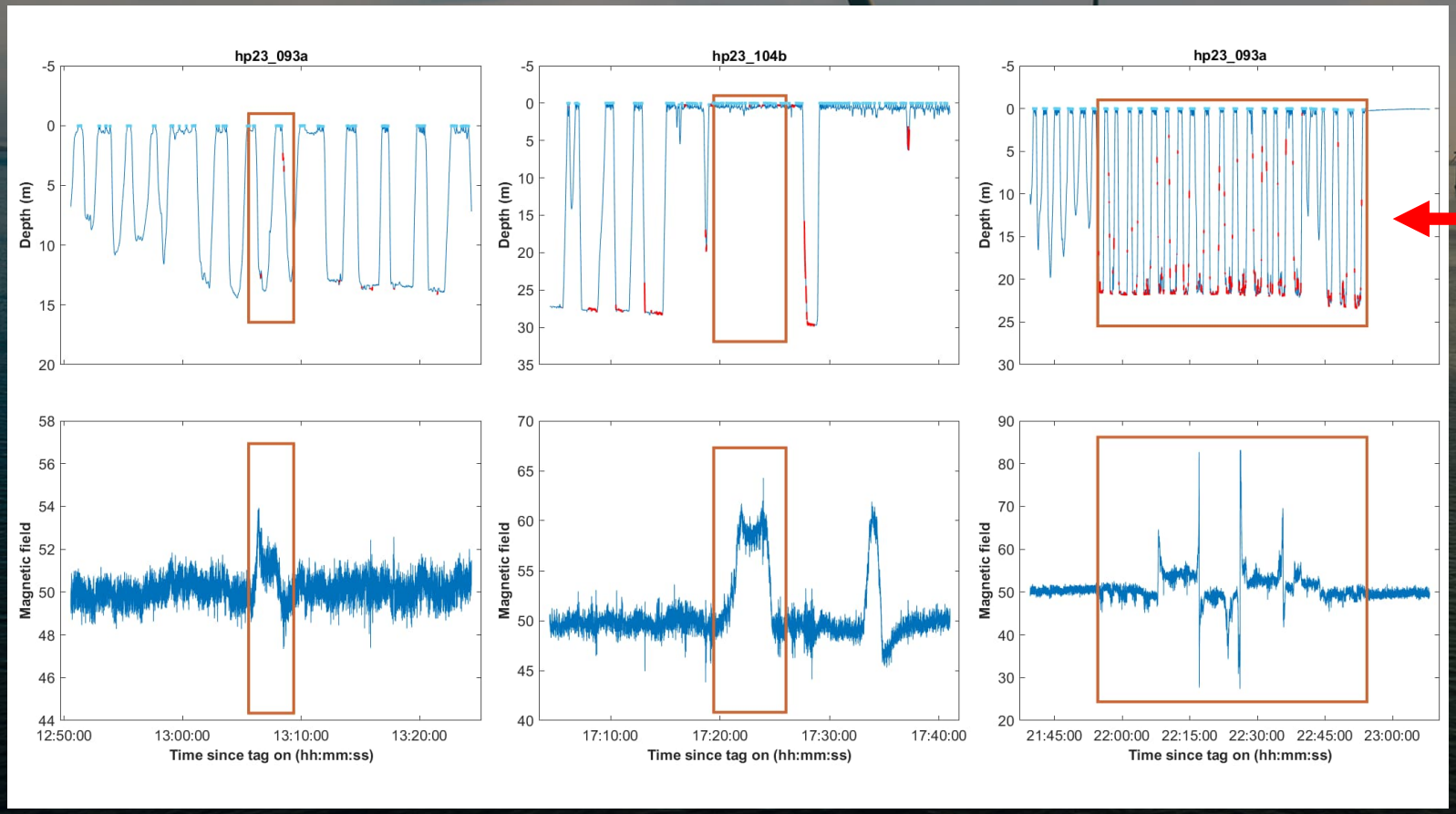
EMF Project Phase 1 (2024)



EMF Project Phase 1: 2024

Porpoises exhibit variable behavior around the cable

No foraging pattern | Foraging cessation? | Buffet



Following food?
Following cables?
- visually?
- EMF sensing?