PURE WIND: Effekter av støy fra havvindparker på plankton og sjøpattedyr (seler og niser)



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PURE WIND Partners

- Norway: NTNU
- Spain: PLOCAN, ULPGC
- Italy: CNR, UNIGE
- Belgium: RBINS
- Germany: BSH, TiHO
- Poland: Gdynia Maritime U
- Ireland: UCC, GDG

NTNU

PLOCAN Plataforma Oceánica de Canarias

ULPGC Universidad de Las Palmas de Gran Canaria

Consiglio Nazionale delle Ricerche

BSH Bundesamt für Seeschifffahrt und Hydrographie

Stiftung Tierärztliche Hochschule Hannover

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UCC Coláiste na hOllscoile Corcaigh University College Cork, Ireland

Maritime Institute Gdynia Maritime University

GDG Gavin & Doherty Geosolutions

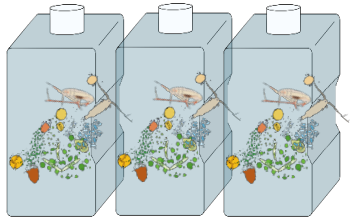
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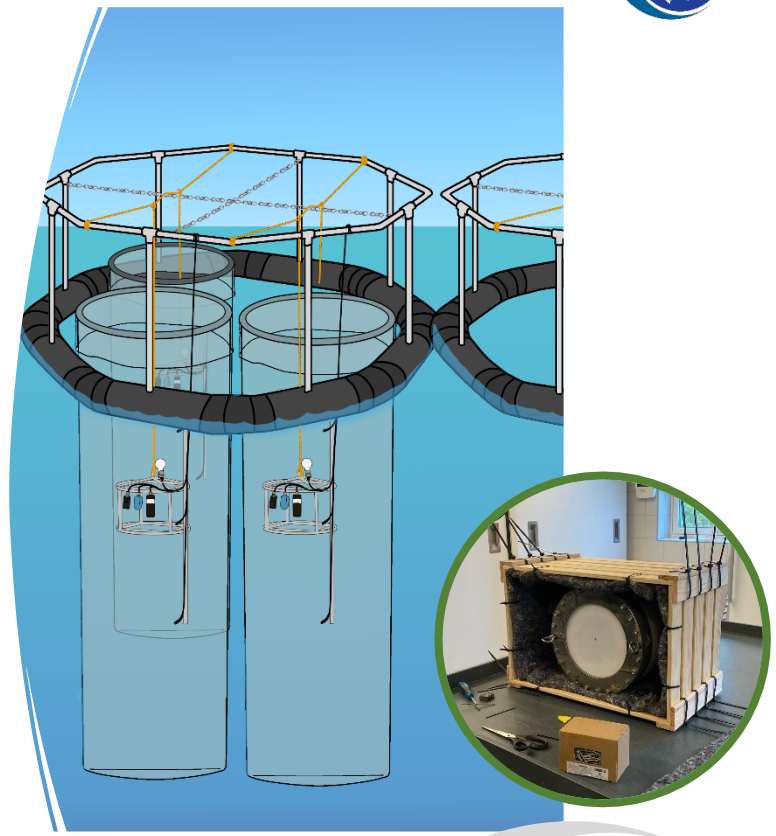
PURE WIND objectives

- **1. Describe sound fields** around fixed and floating offshore wind farms (OWF) and identify sensitive soundscapes across basins
- **2. Develop tools for integration of numerical models** for OWF noise production & propagation to facilitate assessment of planned OWF expansion
- **3. Identify impacts** from operational OWF **on marine ecosystems**, including plankton and marine mammals
- **4. Synthesize knowledge and best practices** from fixed offshore wind and translate for application in the development of floating OWF
- 5. Broadly **share results** with policy and management community & scientific and general public. **Train next generation** of scientists to work on these problems.

Plankton experiments

- 24 h microcosms with high, medium and control exposure (2023)
- 3 mesocosms exposed to the **noise treatment (SPL ~ 105 dB_{rms})** (2024)
- 3 mesocosm **control (SPL ~ 80-90 dB_{rms})**
- 18 days of noise exposure



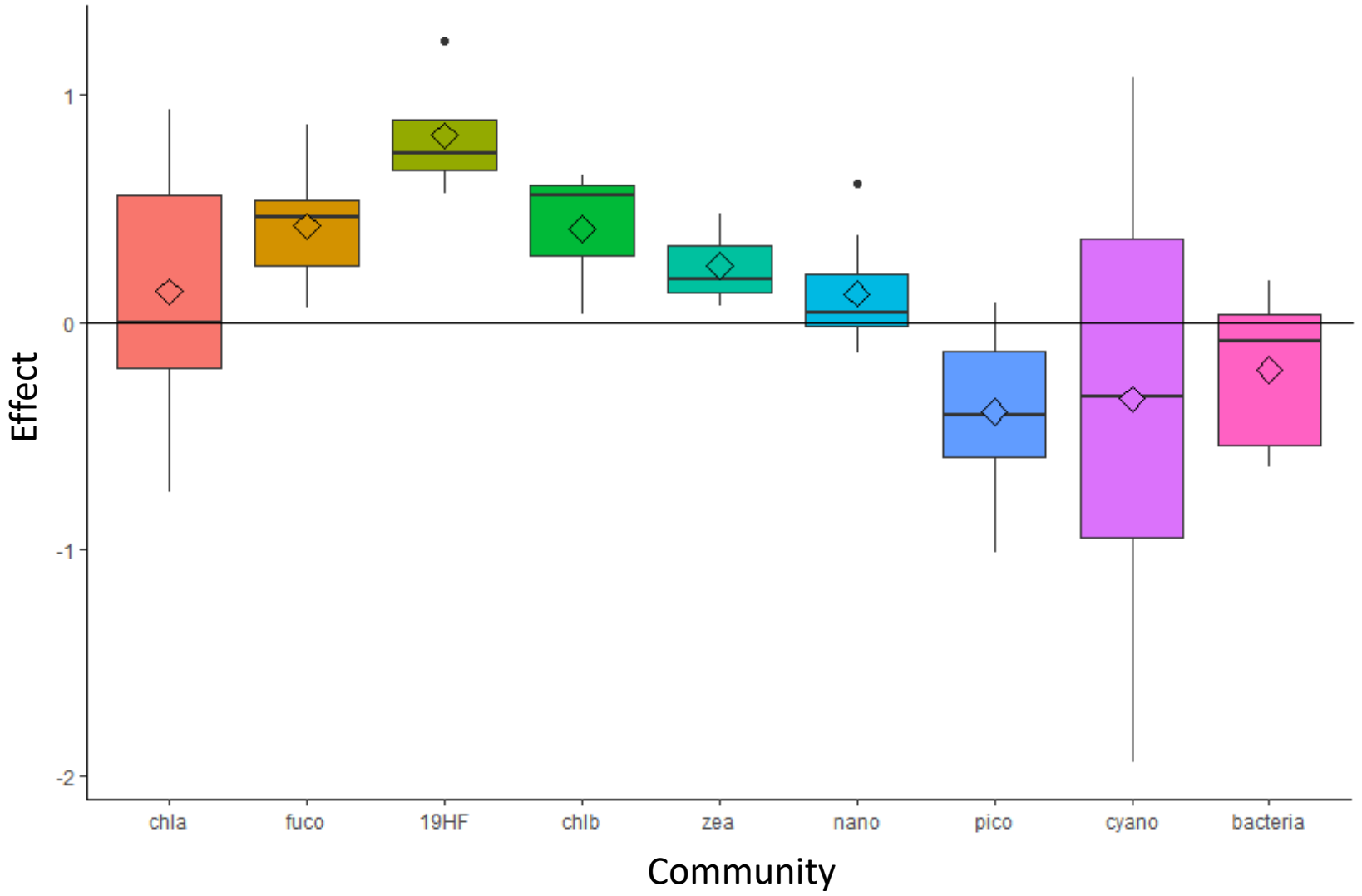


Sampling:

- Phytoplankton and zooplankton communities
- Nutrients
- Physical-chemical variables
- Growth and grazing rates



Varied effects on growth across plankton communities



Chlorophyll *a*

Fucoxanthin

19'HF

Chlorophyll *b*

Zeaxanthin

Nanoplankton

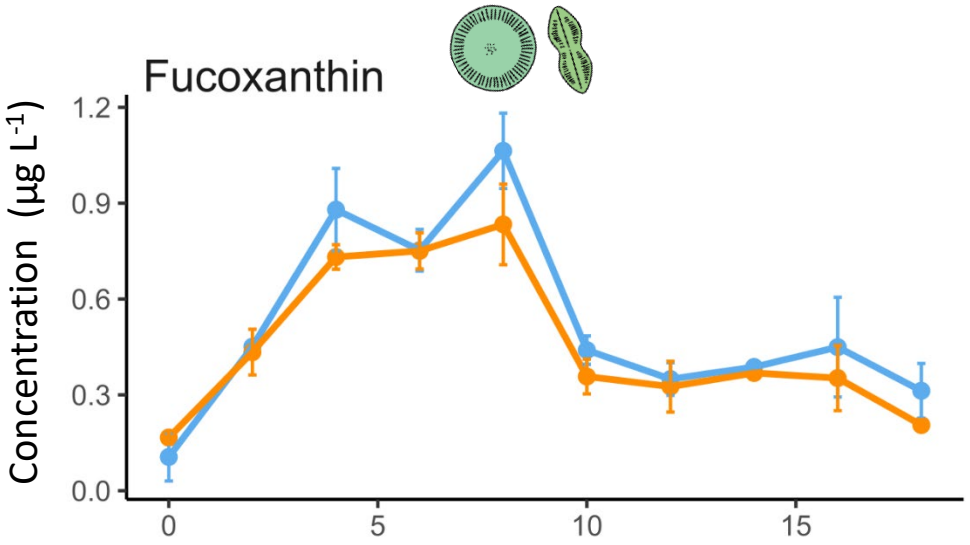
Picoplankton

Cyanobacteria

Bacteria

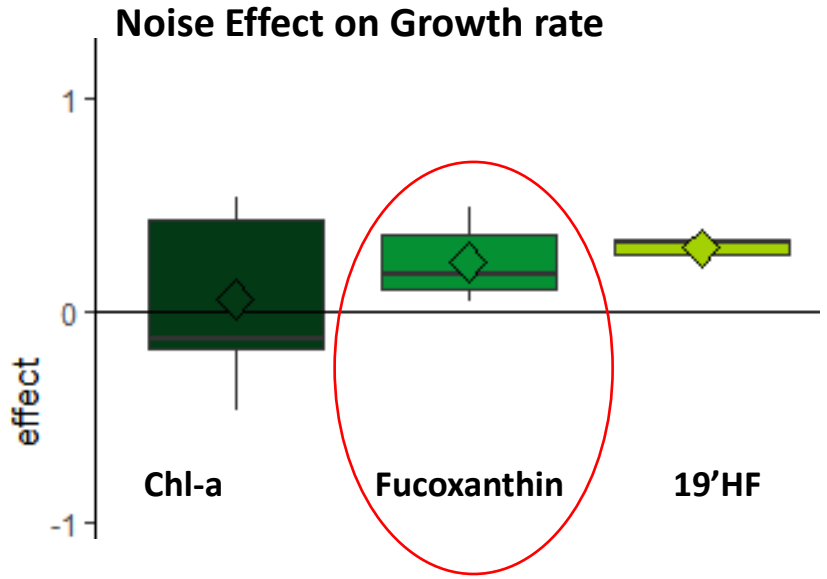
Noise effect on diatoms

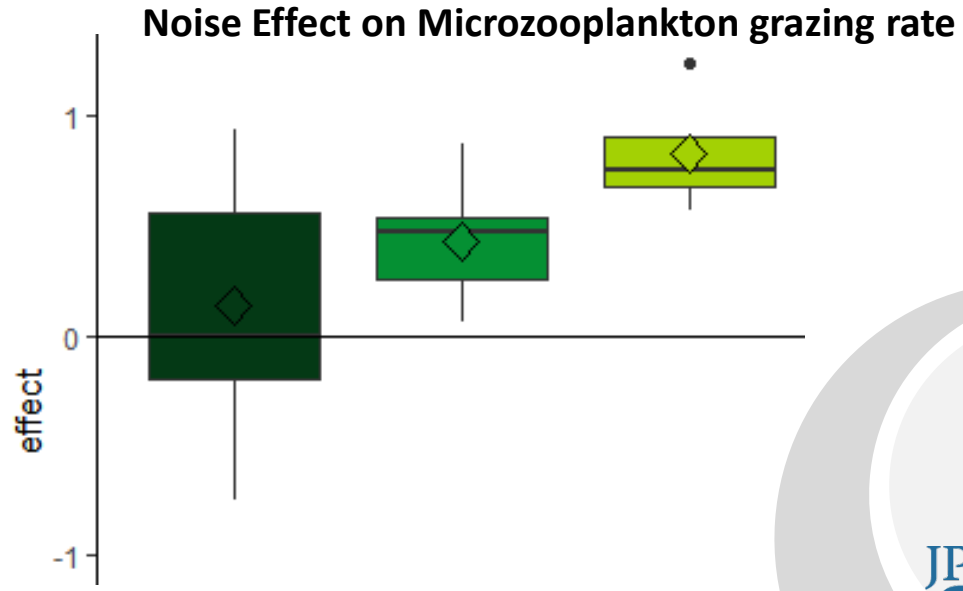
Control
Noise Treatment



Overall negative effect on diatom concentration

- Increase in diatom growth rates, but…
- Increase in microzooplankton grazing rates on diatoms

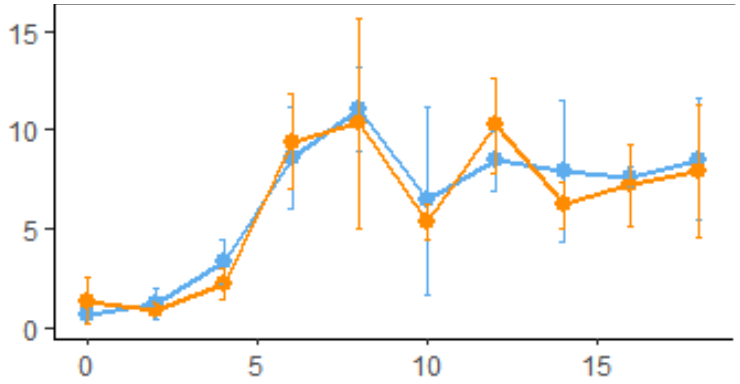




Noise effect on copepods

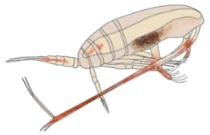
Control
Noise Treatment

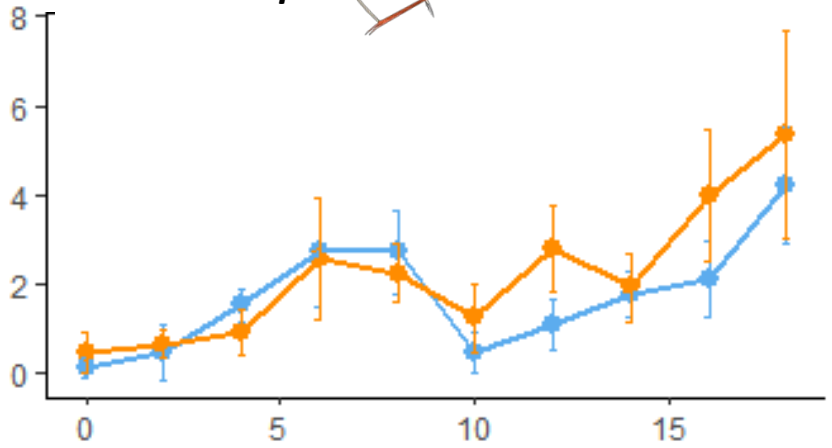
Copepods total



Abundance (individuals L^{-1})

Calanoida sp.

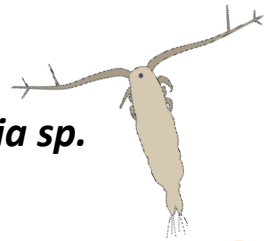


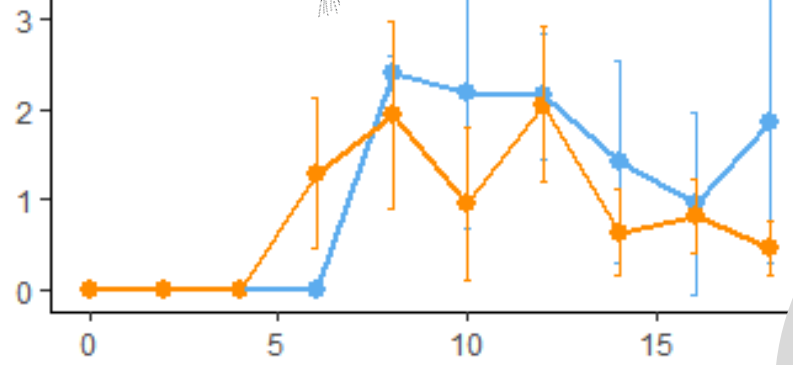


Species-specific effects on copepods

- Higher abundance of *Calanoida sp.*
- Lower abundance of *Acartia sp.*

Acartia sp.

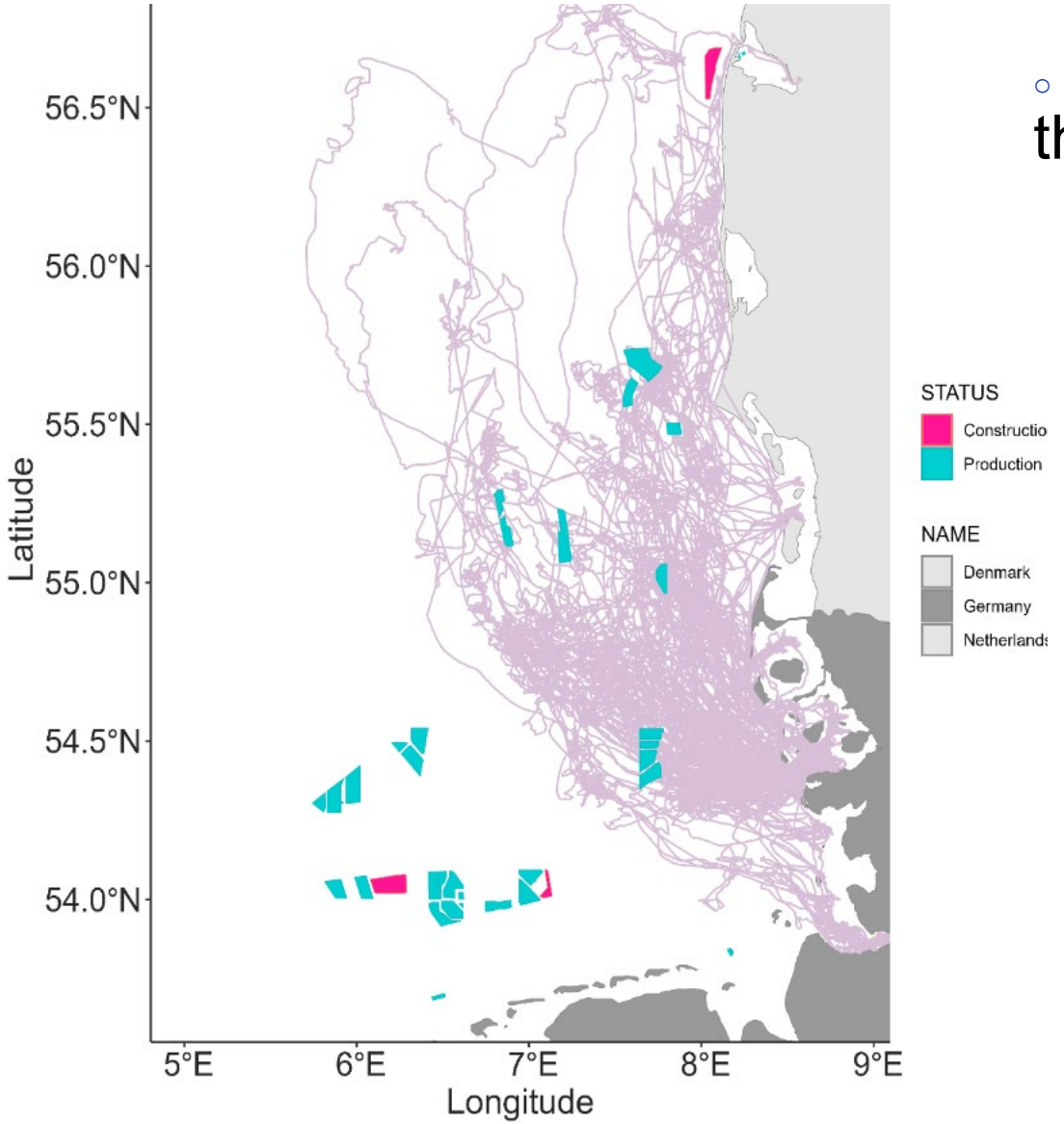




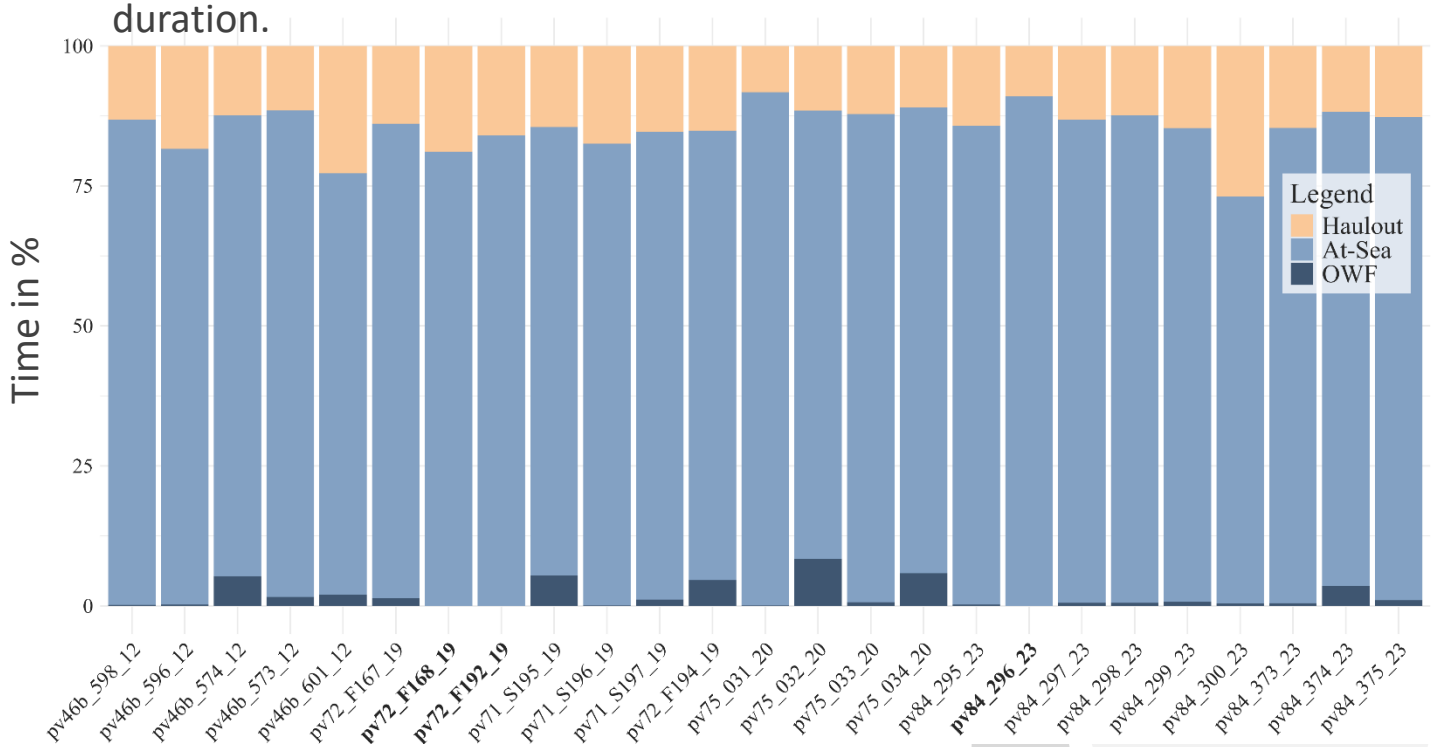
Are OWFs important habitat for seals?



- 26 tagged harbour seals from the German Wadden Sea



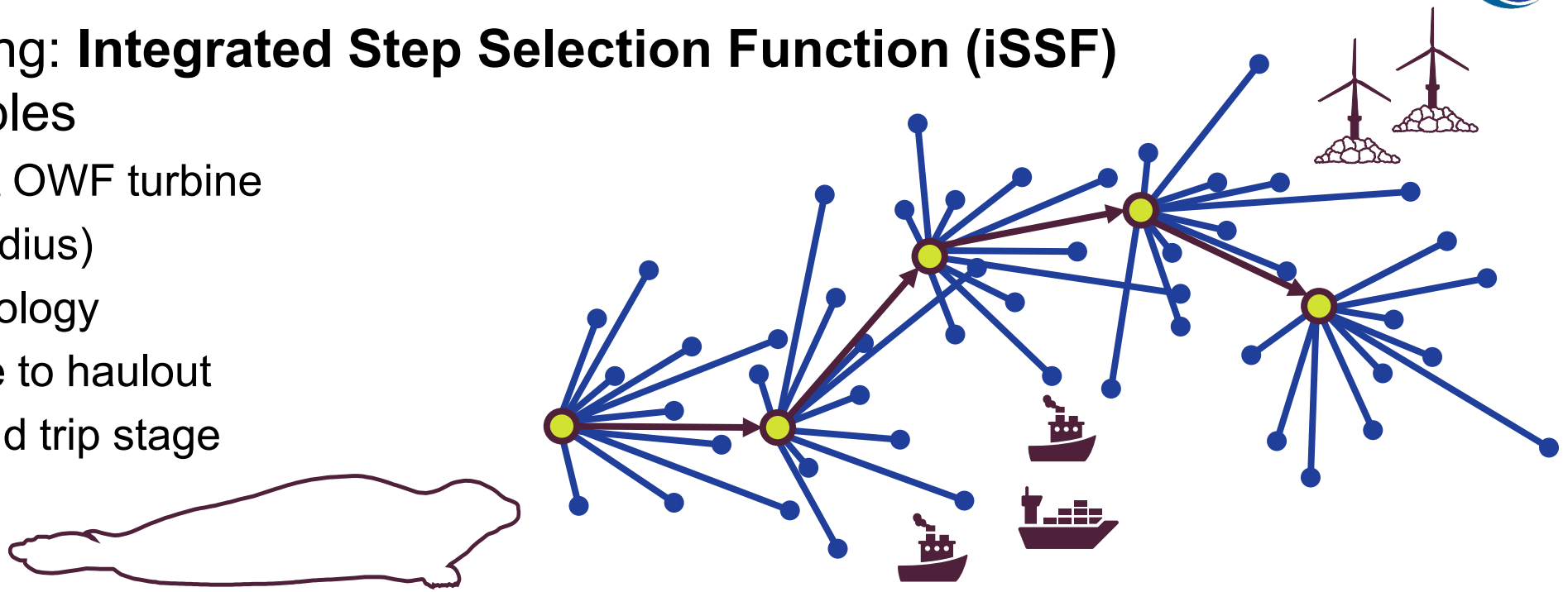
Time hauled out, at-sea and in OWFs in % of deployment duration.



What affects seal movement in OWFs?

Movement modeling: **Integrated Step Selection Function (iSSF)**
Explanatory variables

- Distance to closest OWF turbine
- AIS data (10 km radius)
- Seabed geomorphology
- Angle and distance to haulout
- Inbound & outbound trip stage
- Individual & trip



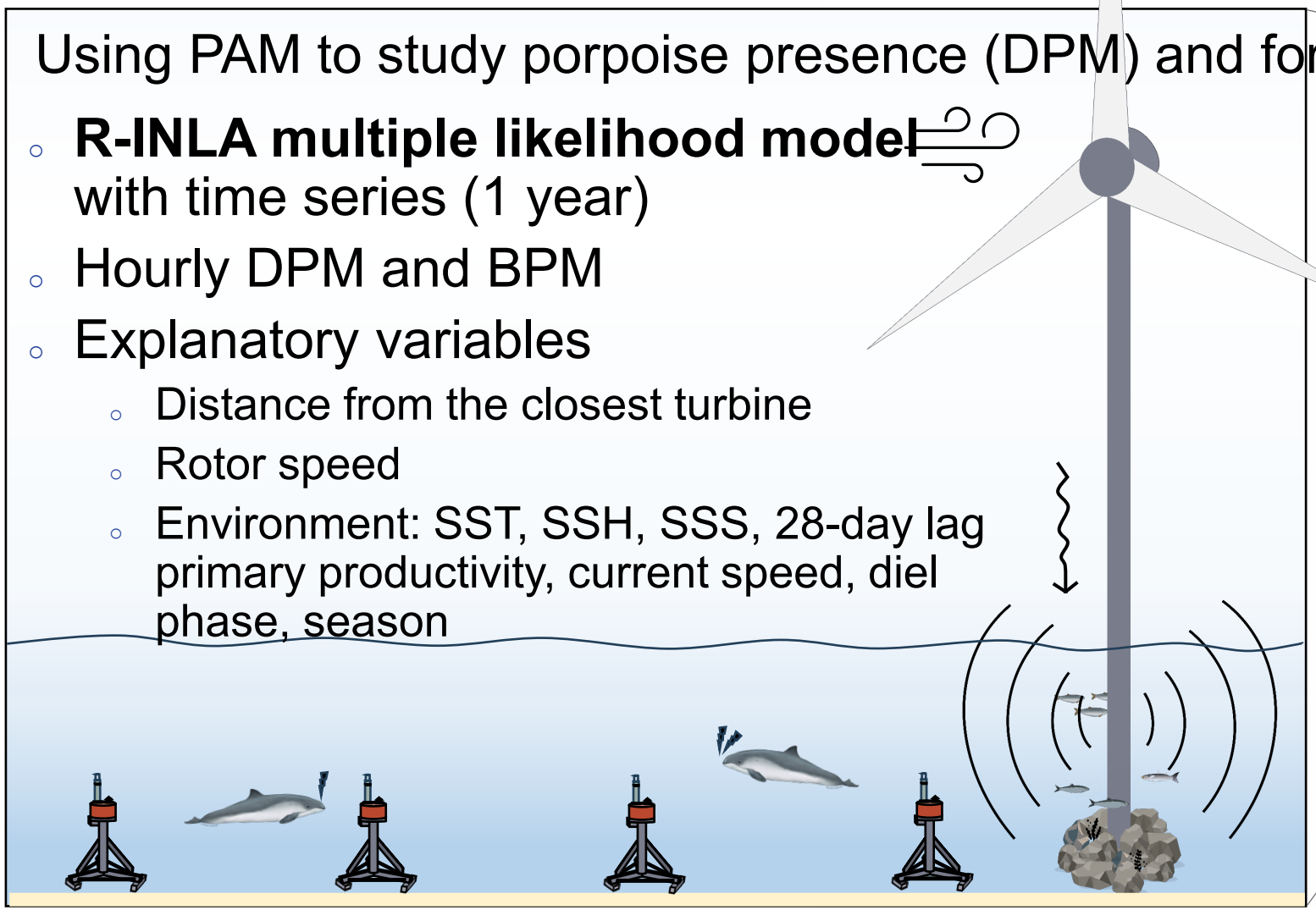
- Geomorphology significant envifornmental influence ($p = 0.015$)
- Neither distance nor angle to turbines showed a consistent significant effect ($p = 0.881$)
- Steps with >1 vessel: 16% decrease in the odds of selection ($p = 0.023$)

(Maurer et al., in prep.)

Porpoises and noise: gradient study design

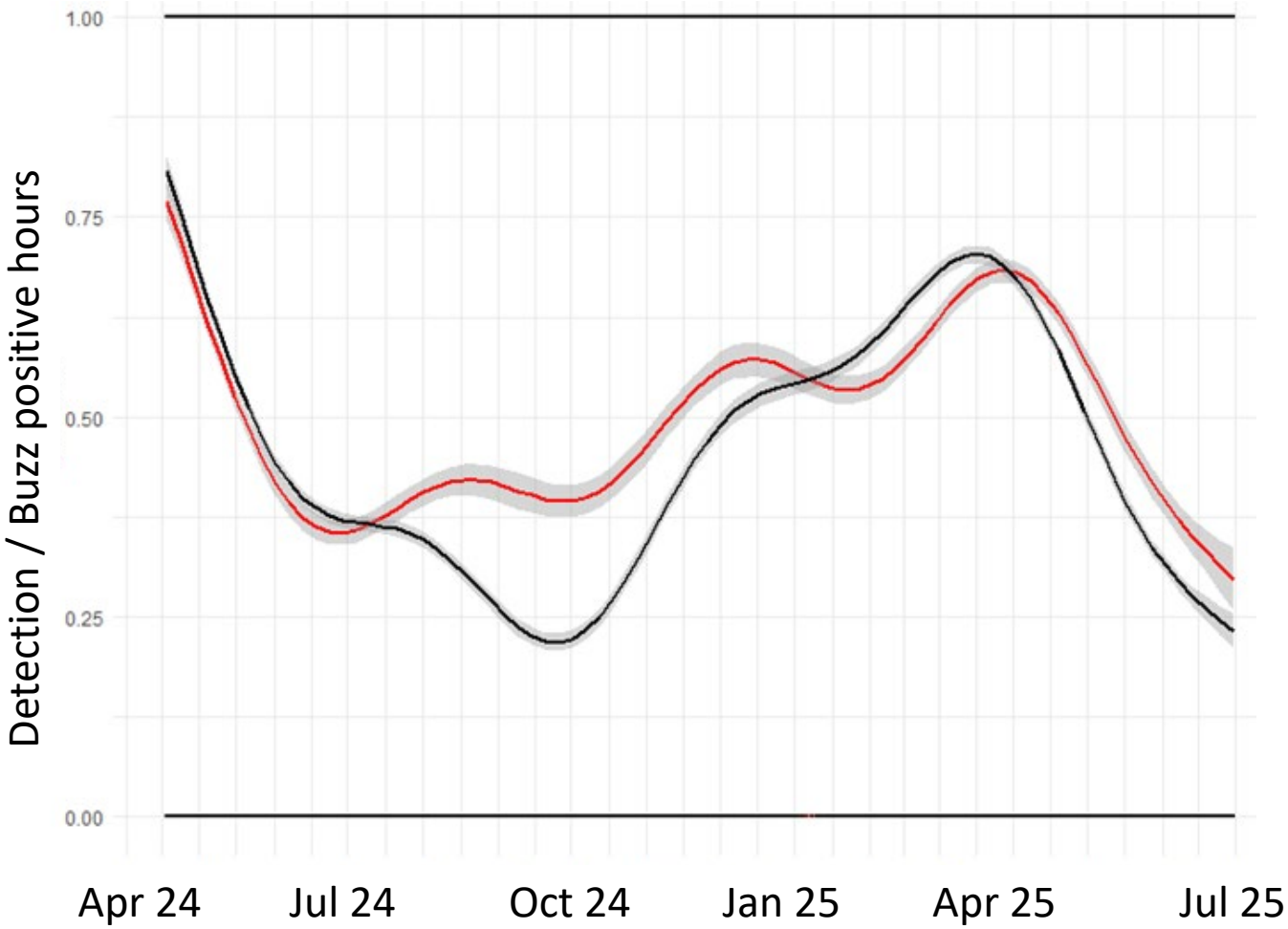
Using PAM to study porpoise presence (DPM) and foraging behaviour (BPM)

- **R-INLA multiple likelihood model** with time series (1 year)
- Hourly DPM and BPM
- Explanatory variables
  - Distance from the closest turbine
  - Rotor speed
  - Environment: SST, SSH, SSS, 28-day lag primary productivity, current speed, diel phase, season





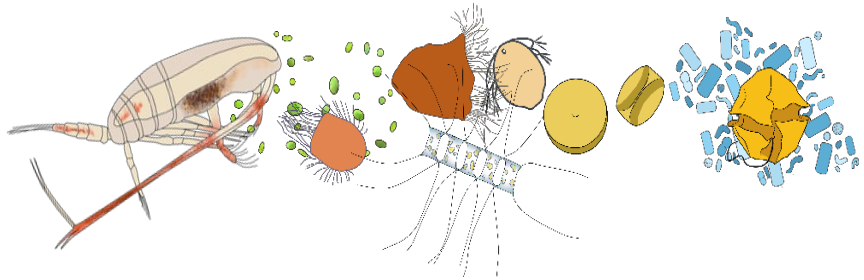
Effect of OWF noise on harbour porpoise presence and behaviour



- Seasonal porpoise presence
- No difference or higher presence around operational OWF in Belgian waters
- Foraging seemingly unaffected by operational OWF
  → cross validation still in process

So how does noise from offshore wind farms affect marine organisms?

- Responses are species- and taxon-specific
  - Increase of some plankton species, decrease of others
  - Wadden Sea seals do not seek out OWF – no reef effect detected
- Complex, cascading effects possible
- Broader spatial and temporal context also relevant
  - *E.g.* seasonality main driver of porpoise presence in Belgian North Sea
  - It's not all about turbines: boat activity also relevant







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Thank you!
Questions?

