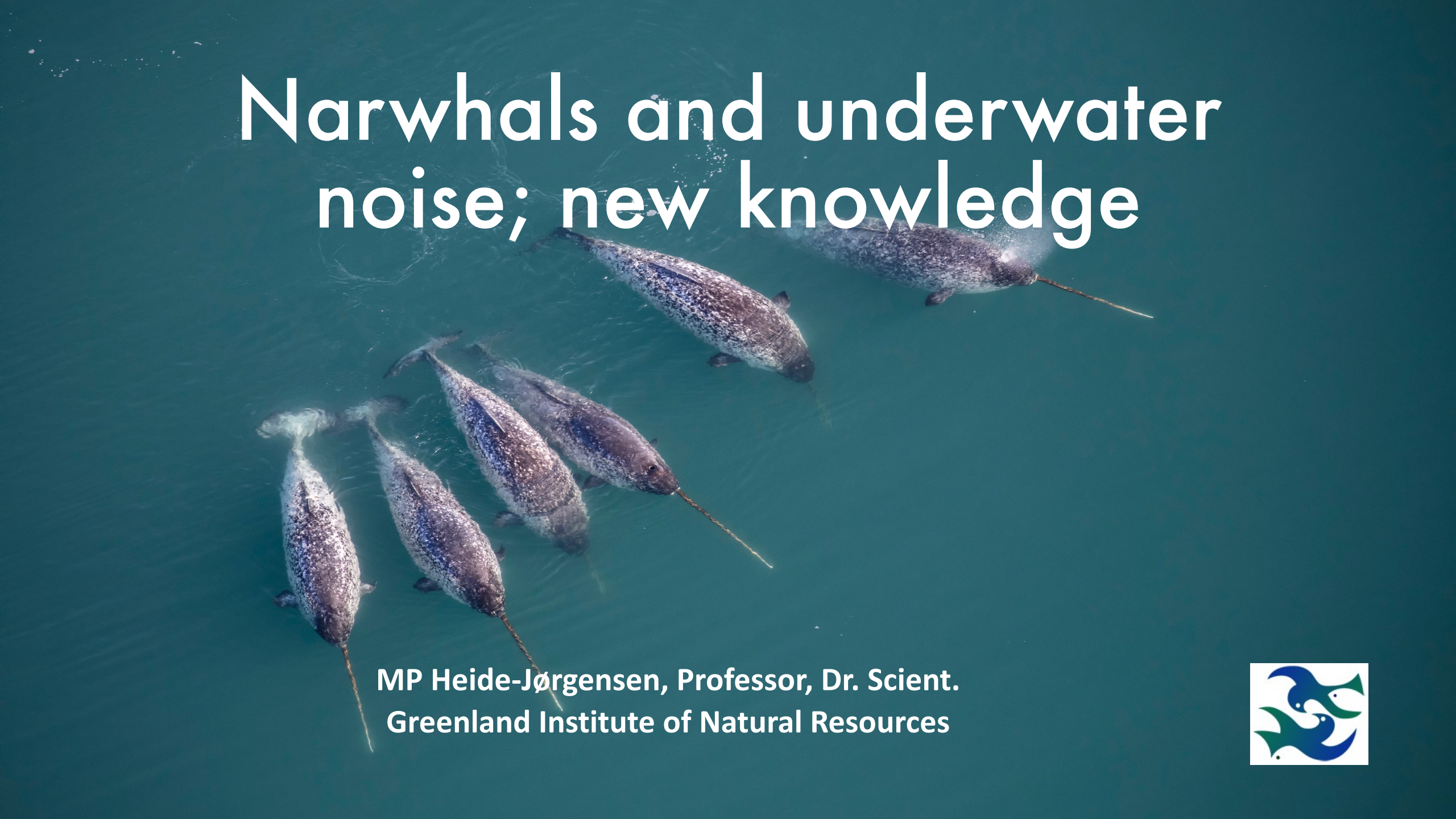
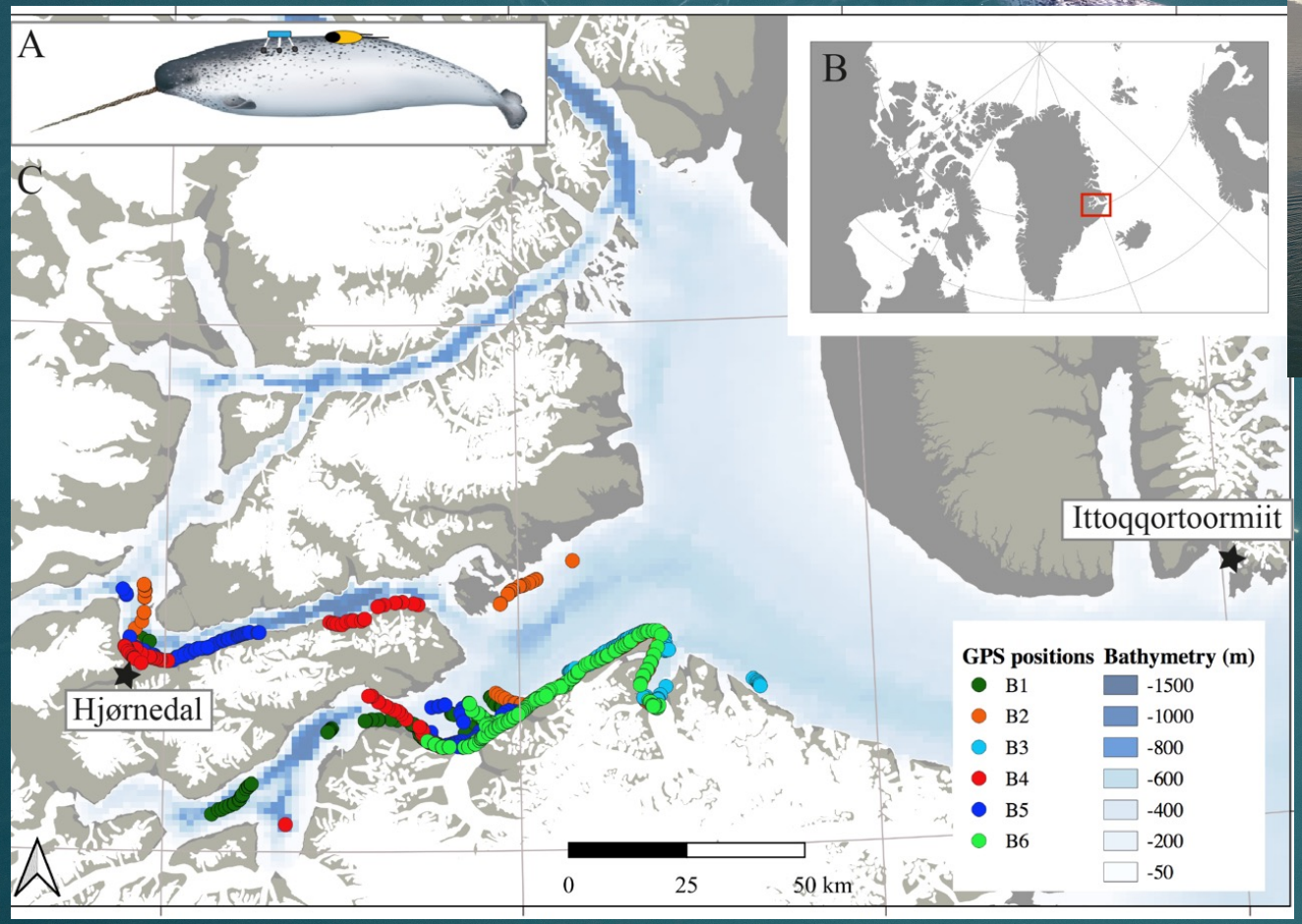
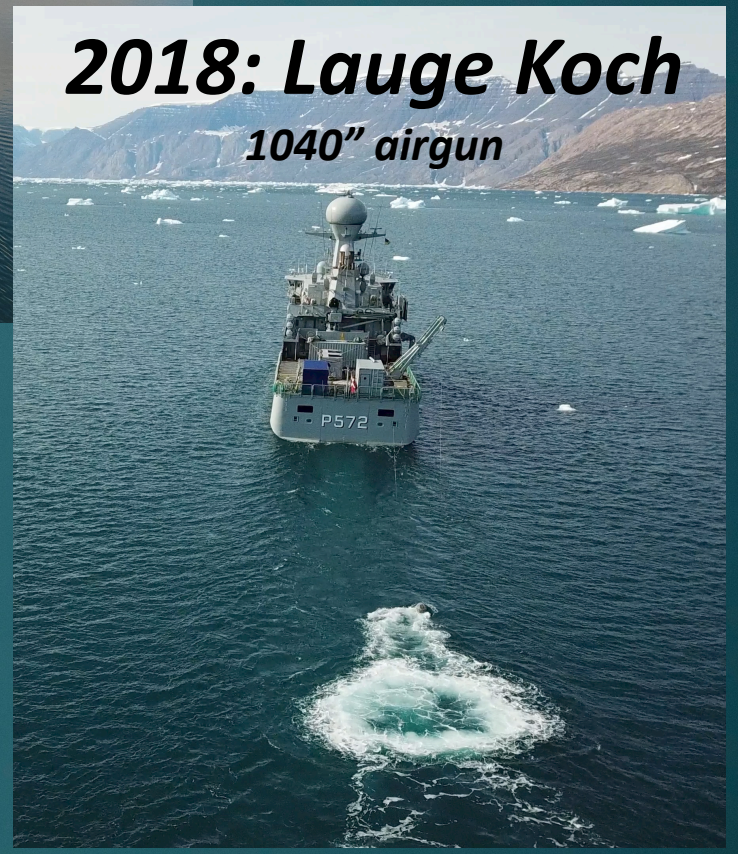
Narwhals and underwater noise; new knowledge



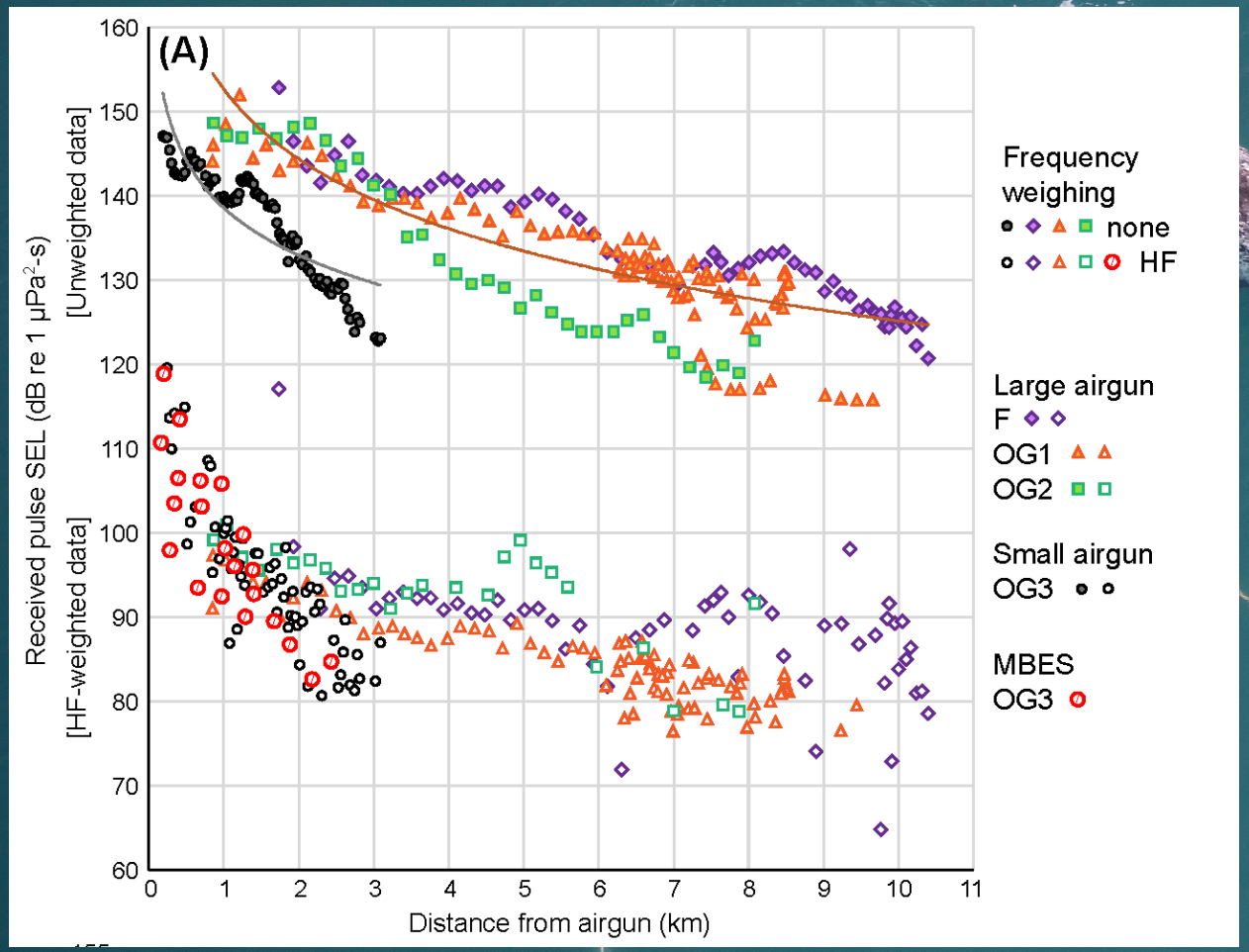
MP Heide-Jørgensen, Professor, Dr. Scient.
Greenland Institute of Natural Resources

Controlled dose study in the world's largest fjord system

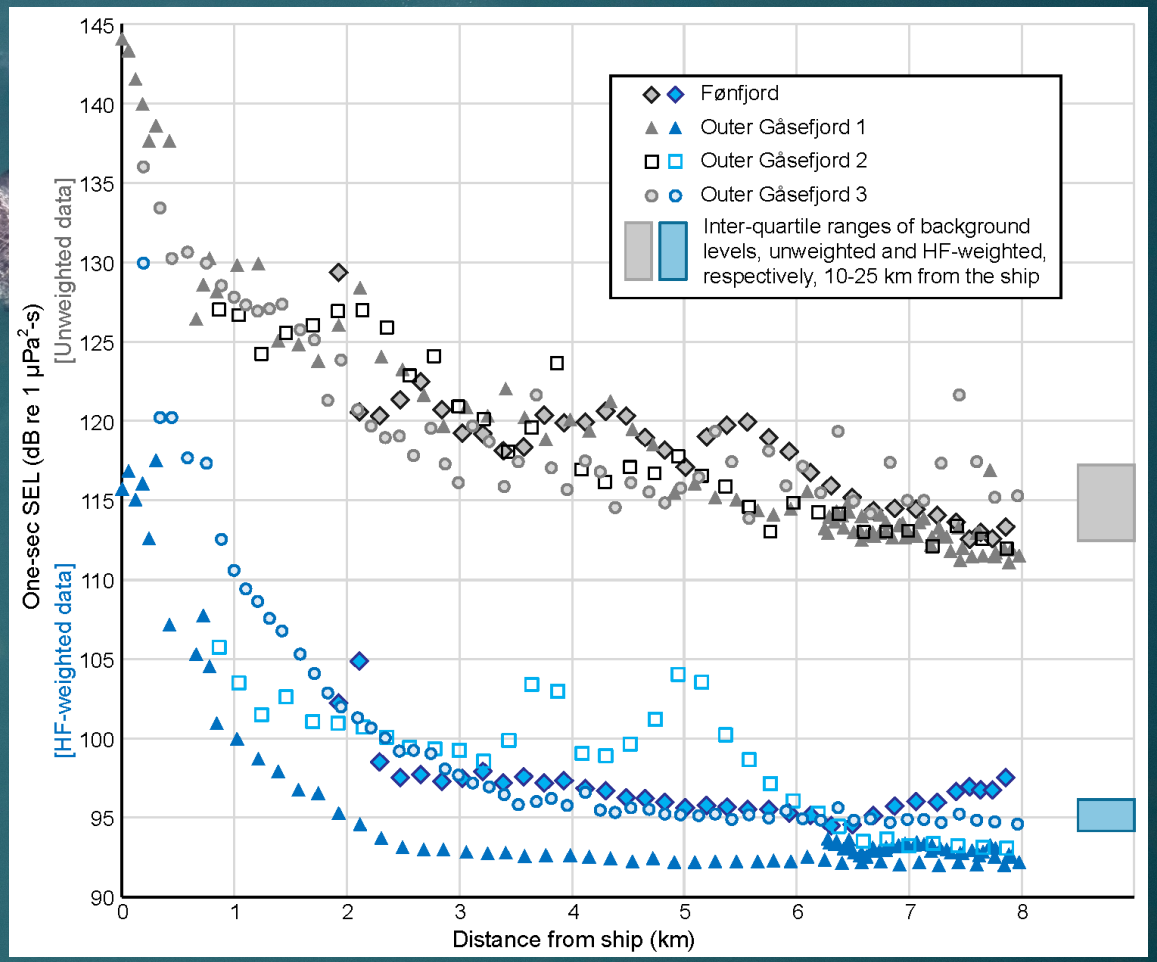




Airgun pulses



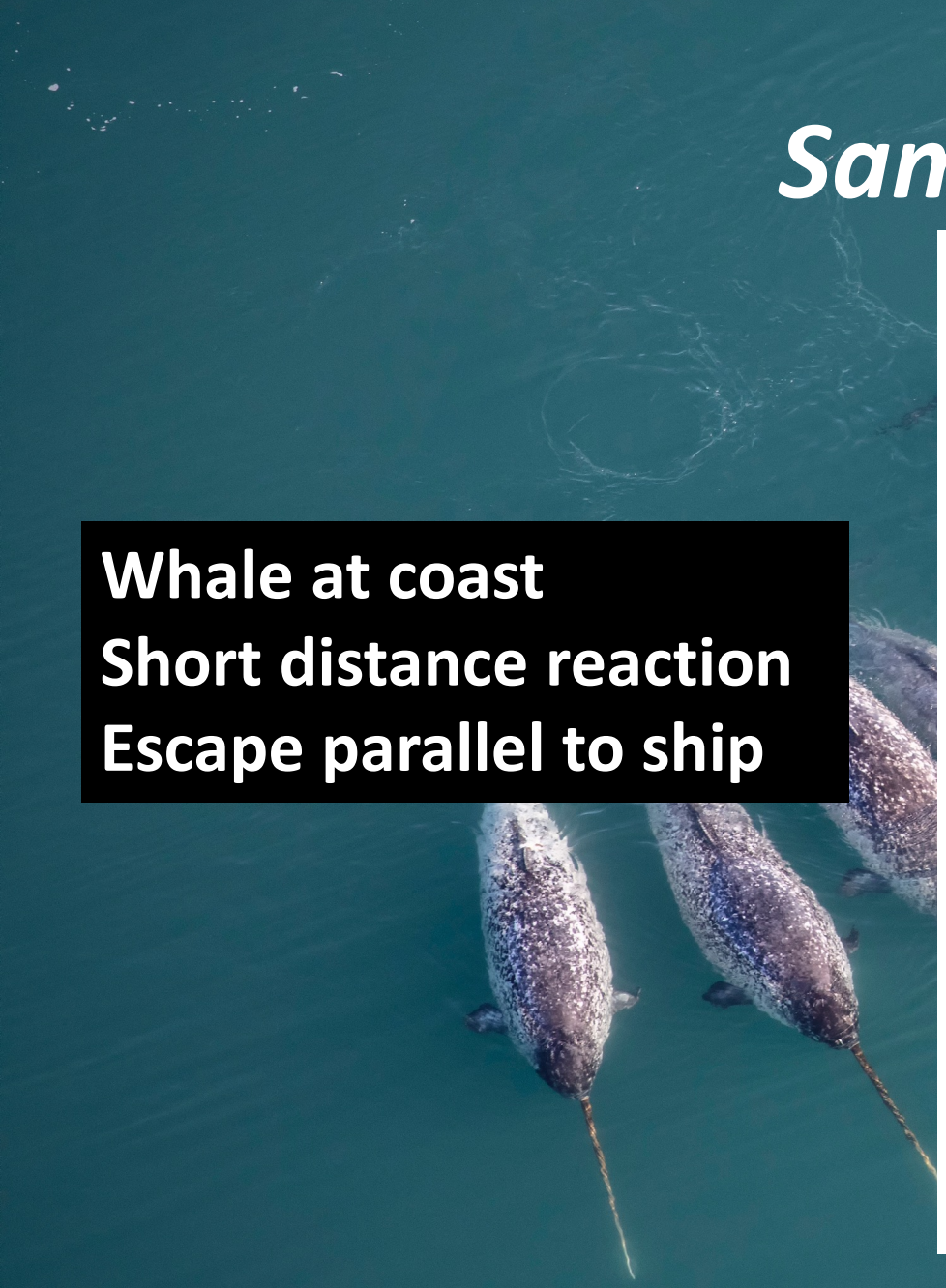
Ship generated noise

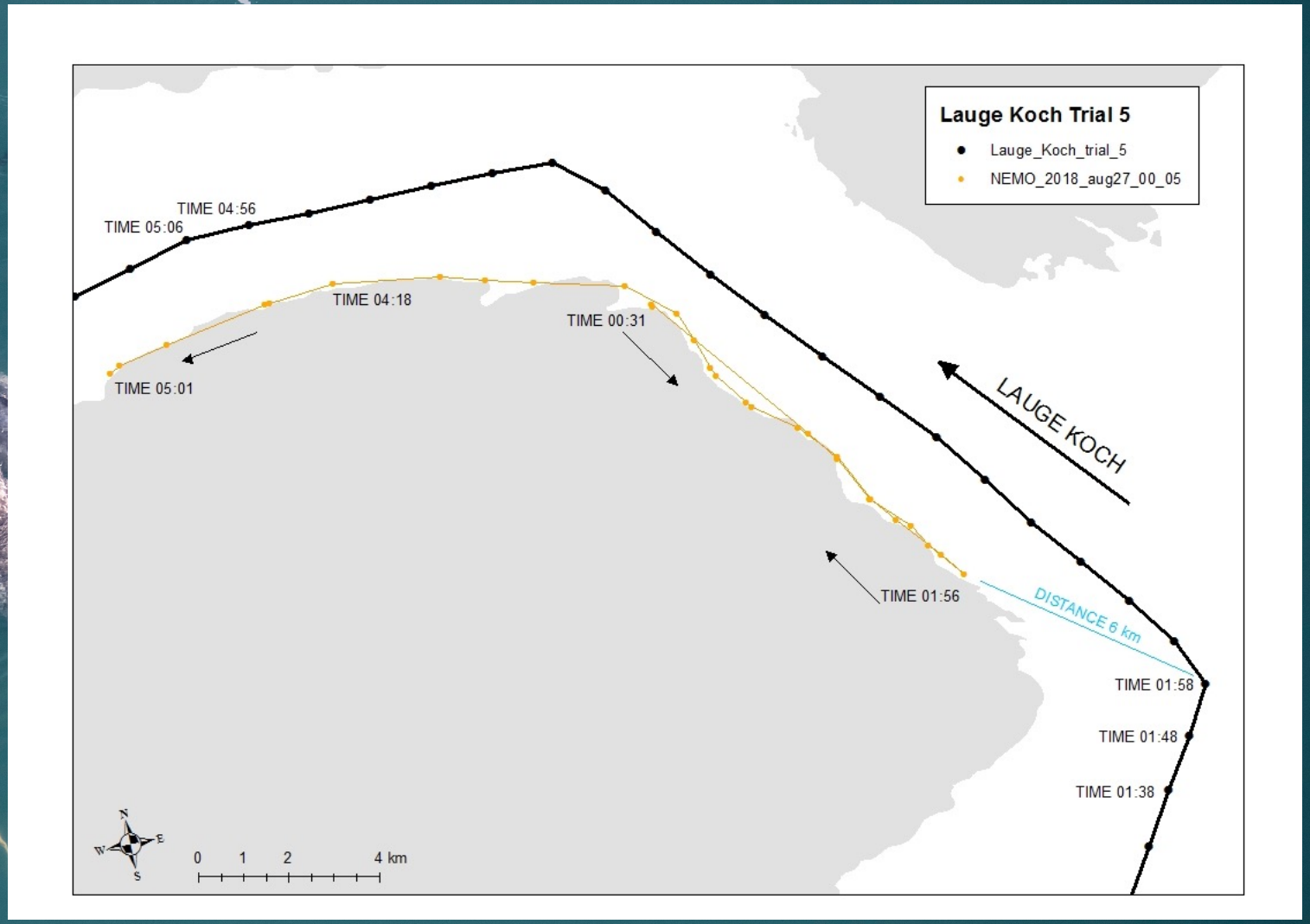


Heide-Jørgensen et al. 2021. Frontiers in Marine Science.

Sample of reaction 1

Whale at coast
Short distance reaction
Escape parallel to ship

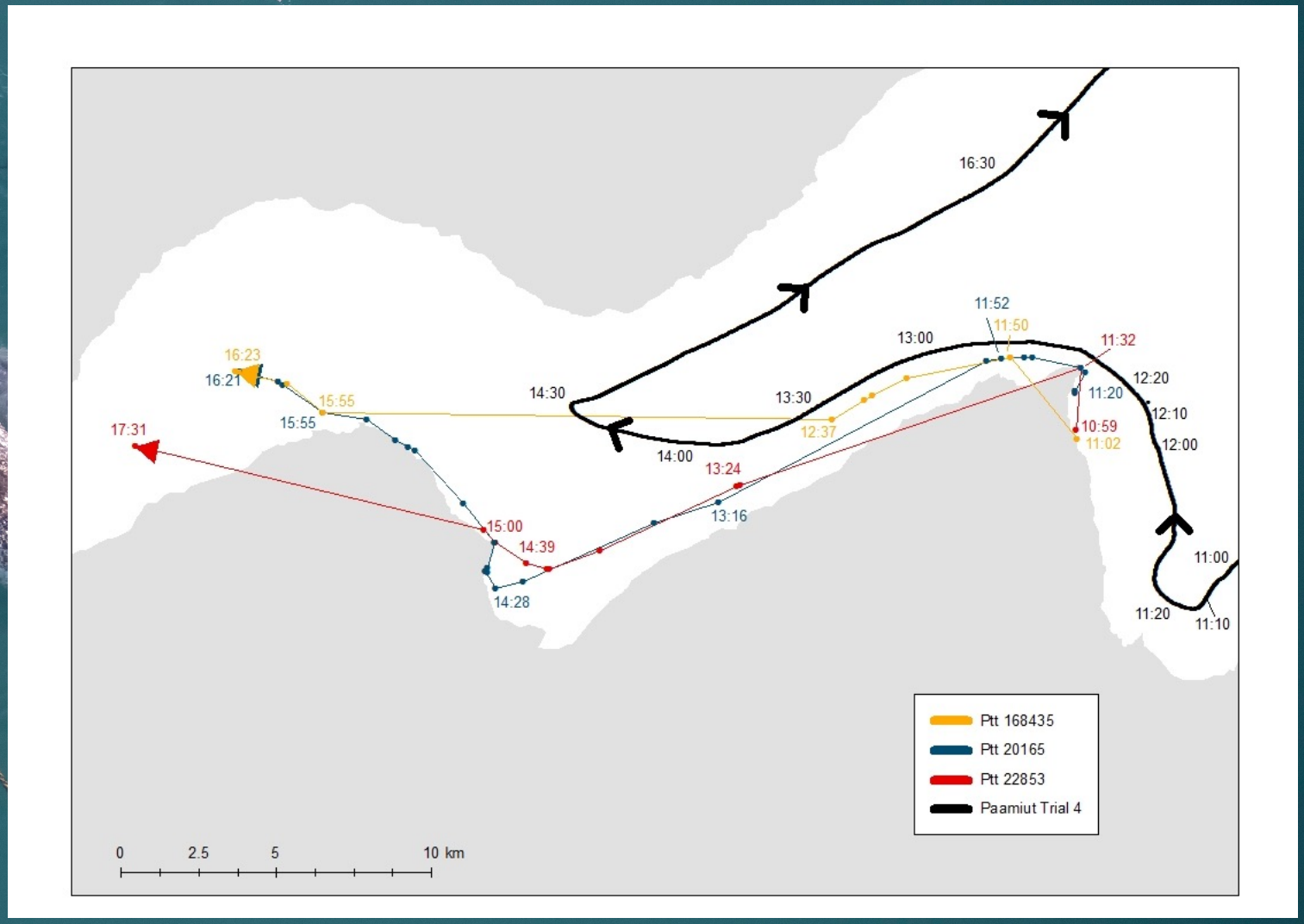




Heide-Jørgensen et al. 2021. Frontiers in Marine Science.

Sample of reaction 2; continued response

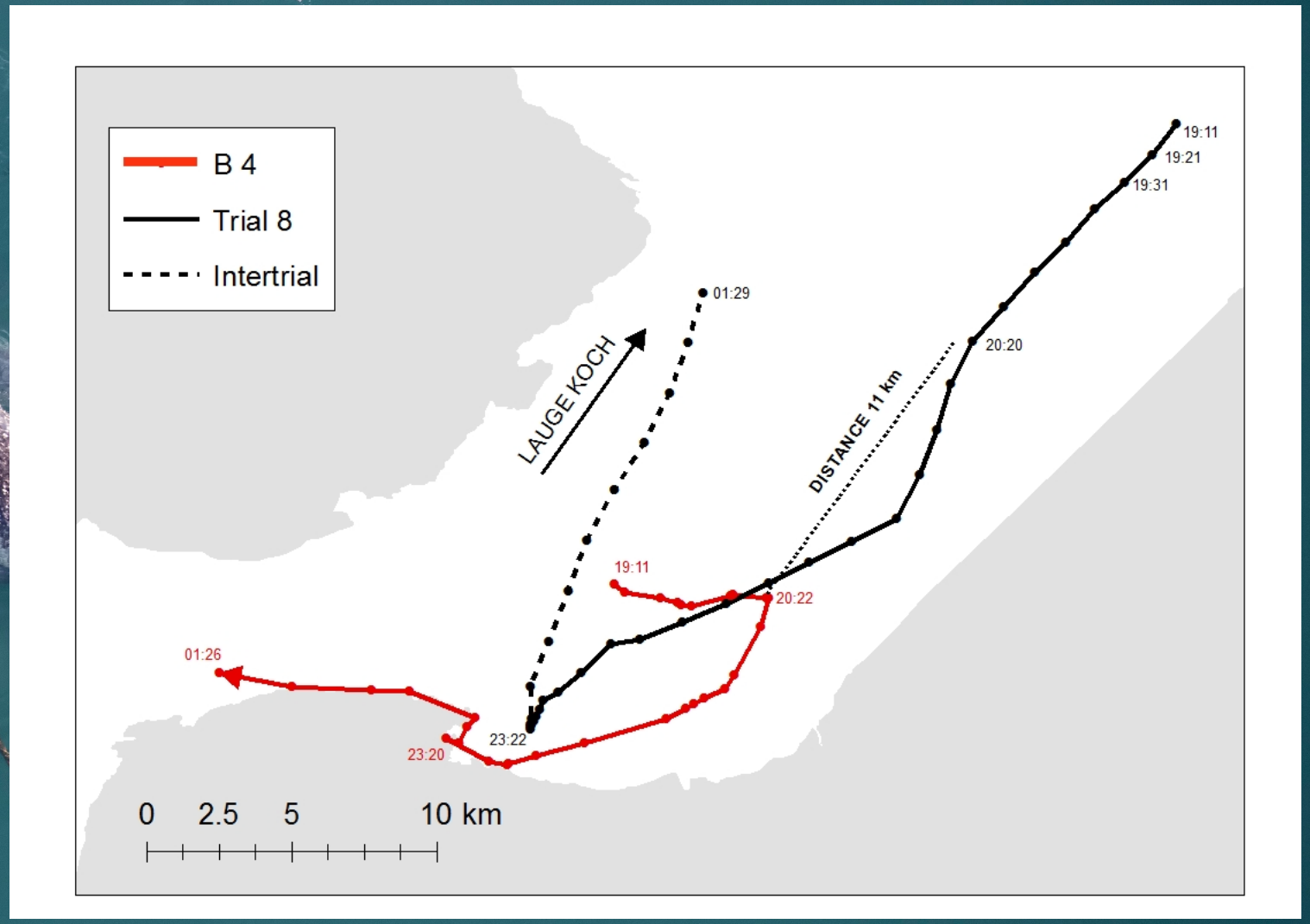
Whale at coast
Short distance reaction
Reaction without LOS
Continued reaction



Heide-Jørgensen et al. 2021. Frontiers in Marine Science.

Sample of reaction 3; offshore

Whale offshore
Long distance reaction
Moving towards shore
Continued reaction



Heide-Jørgensen et al. 2021. Frontiers in Marine Science.

Before:
- Whale off the coast
- Diving >400m
- Buzzing

Intertrial:
- No deep dives
- No buzzing

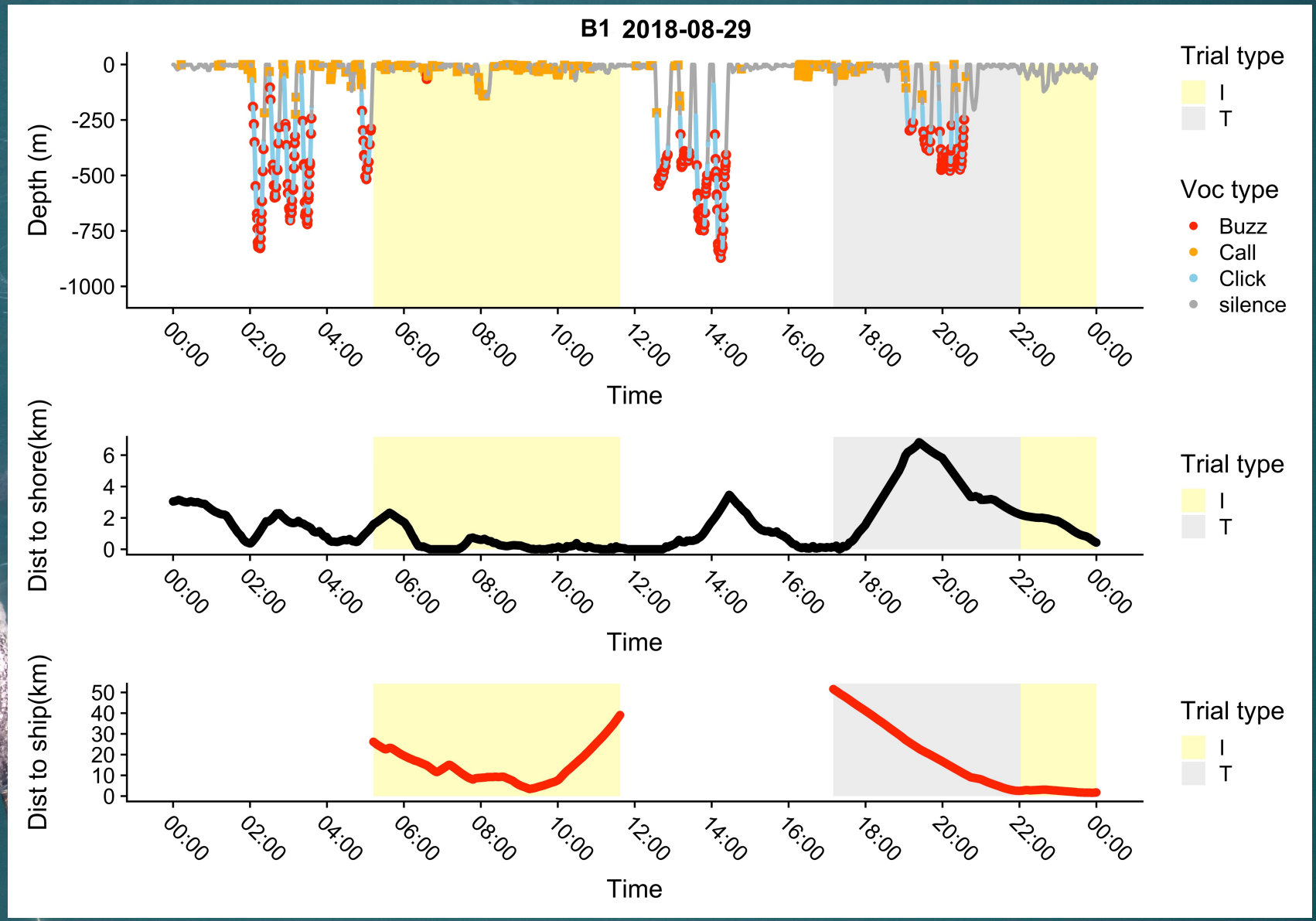
Off line of sight:
- Diving resumed
- Buzzing resumed

Seismic >50km:
- Buzzing
- Dives <500m

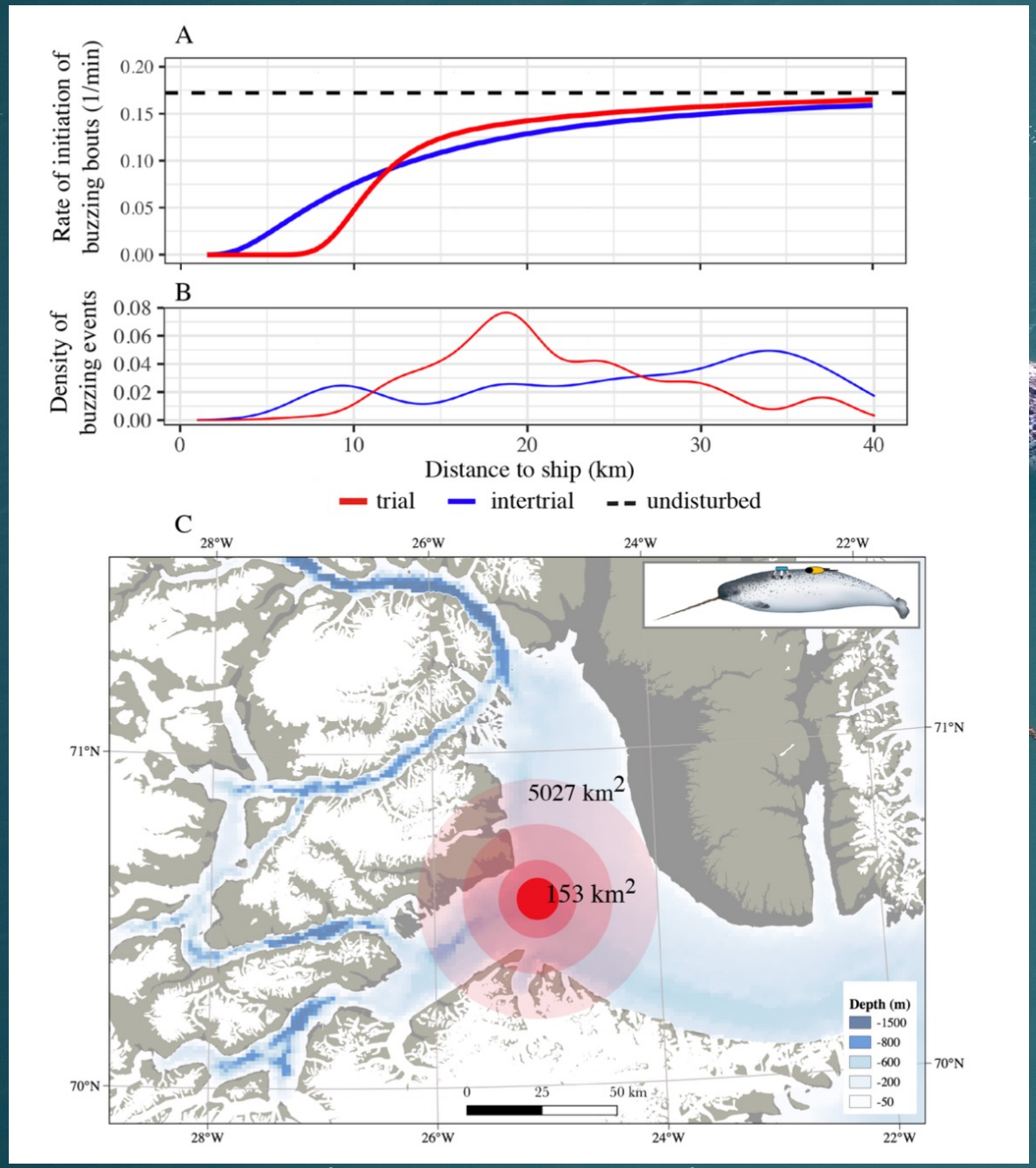
Seismic <30km:
- Towards shore

Seismic <10km:
- No buzzing
- Towards shore

Intertrial:
- No buzzing
- No deep dives
- Towards shore



Heide-Jørgensen et al. 2021. Frontiers in Marine Science. https://doi.org/10.3389/fmars.2021.658173



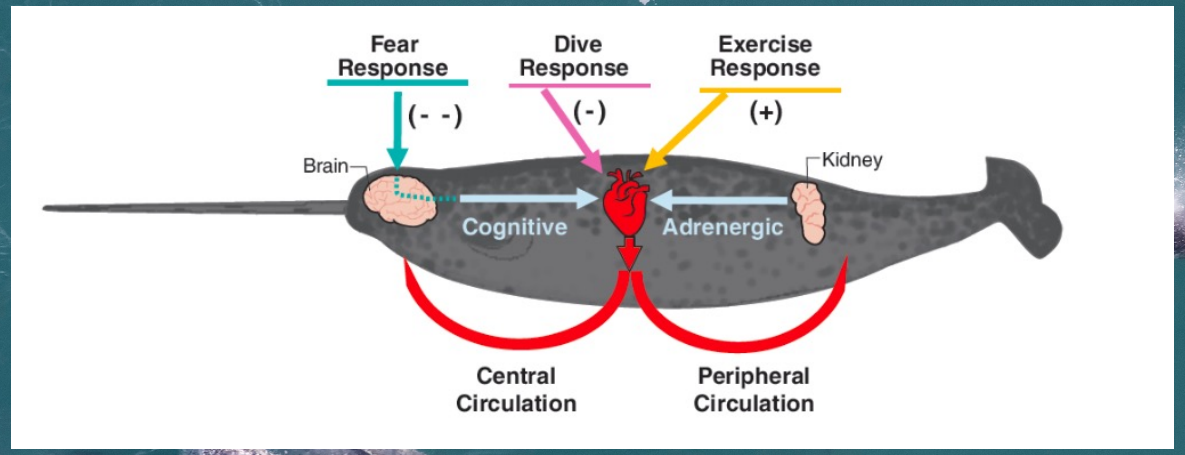
Tervo et al. In press. Science Advances

Loss of vocal activity

=

and loss of foraging

Cascade of physiological responses

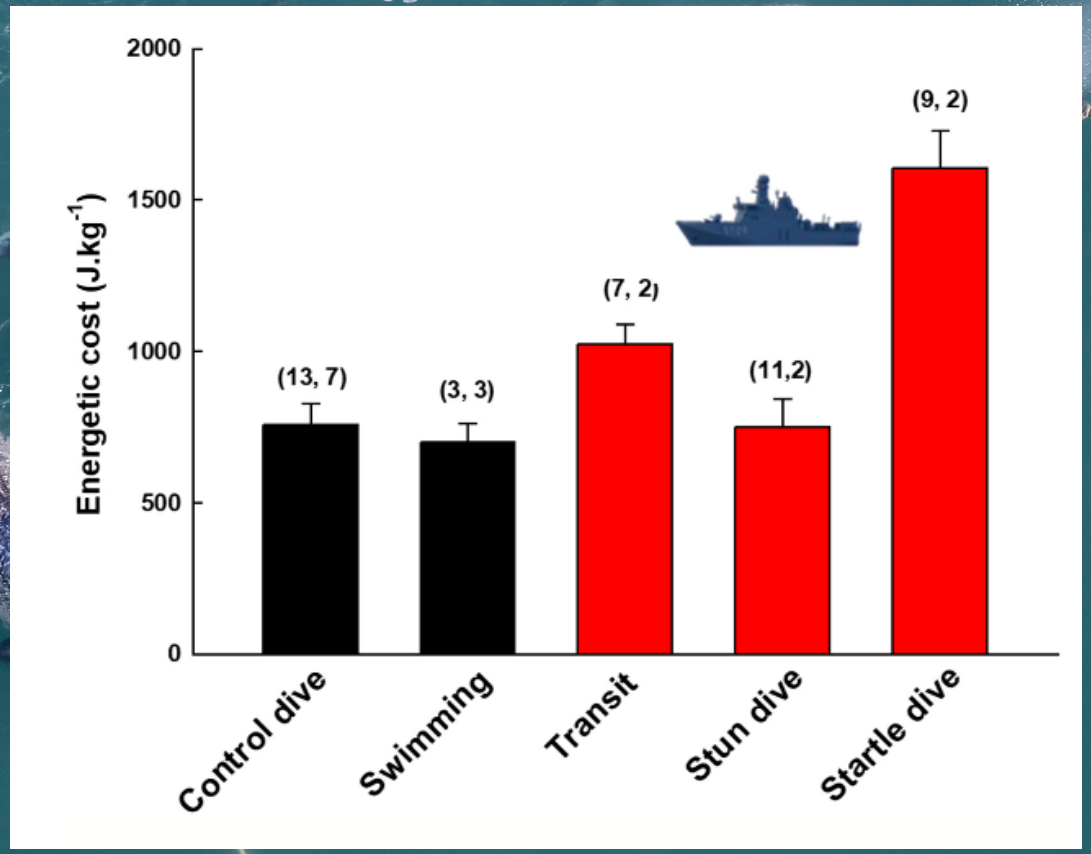


During exposure:

- **80% reduction of duration of gliding**
- **Prolonged high intensity activity with elevated stroke frequencies >40 strokes per minute**
- **Intense (< 10 bpm) bradycardia decoupled from stroking frequency**
- **Increased variability in heart rate, switching between bradycardia and tachycardia**
- **Maximum respiratory frequency 1.5 times control levels.**
- **In total a 2.2-fold increase in energetic costs while suppressing cardiac exercise response**

Williams et al. 2021.Functional Ecology.

Energetic costs of disturbance



Williams et al. 2021.Functional Ecology.

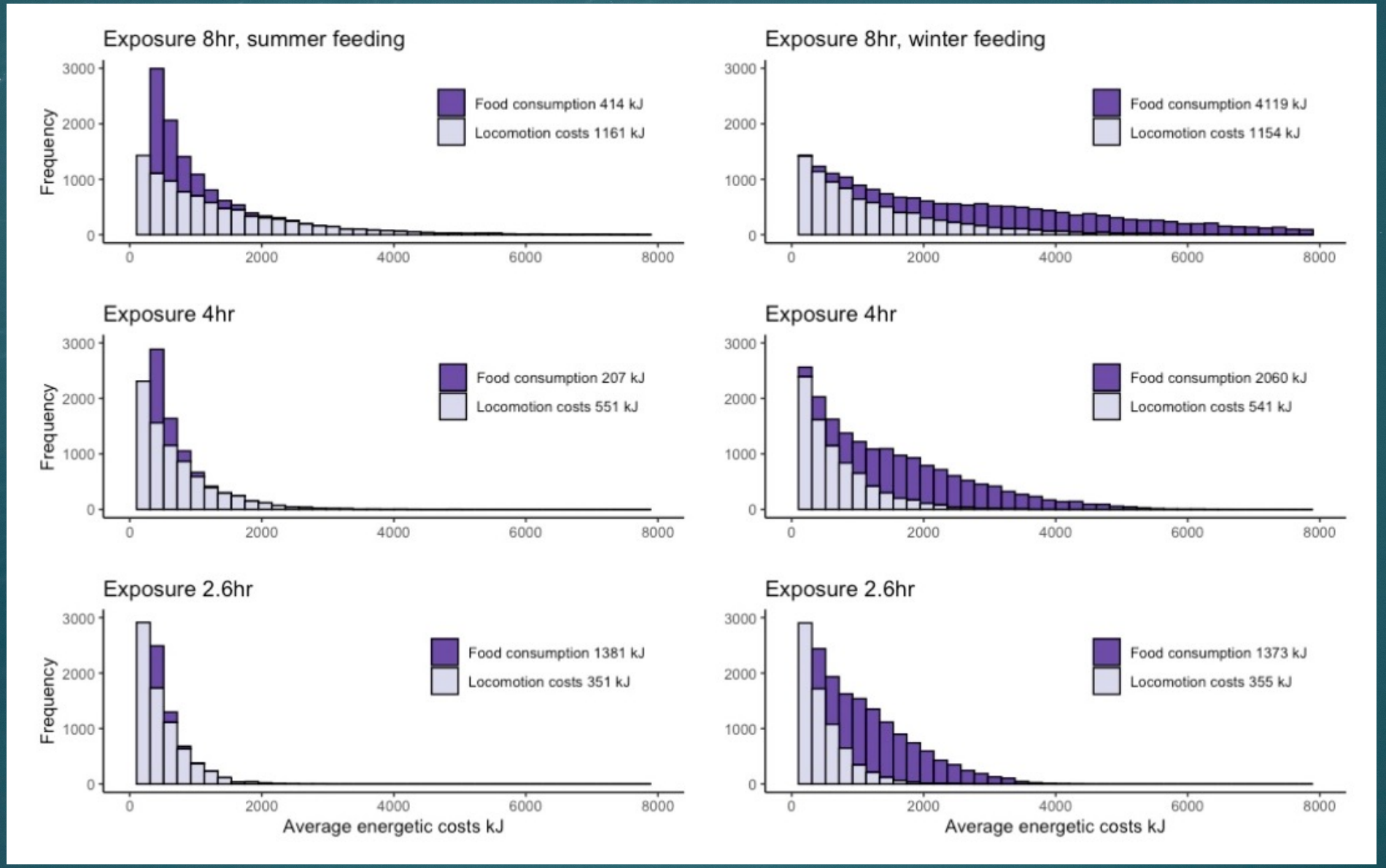
Extreme sensitivity

Effects on:

- **swimming speed**
- **distance to shore**
- **buzzing rate**
- **diving patterns**
- **cardiac performance**
- **energetics**

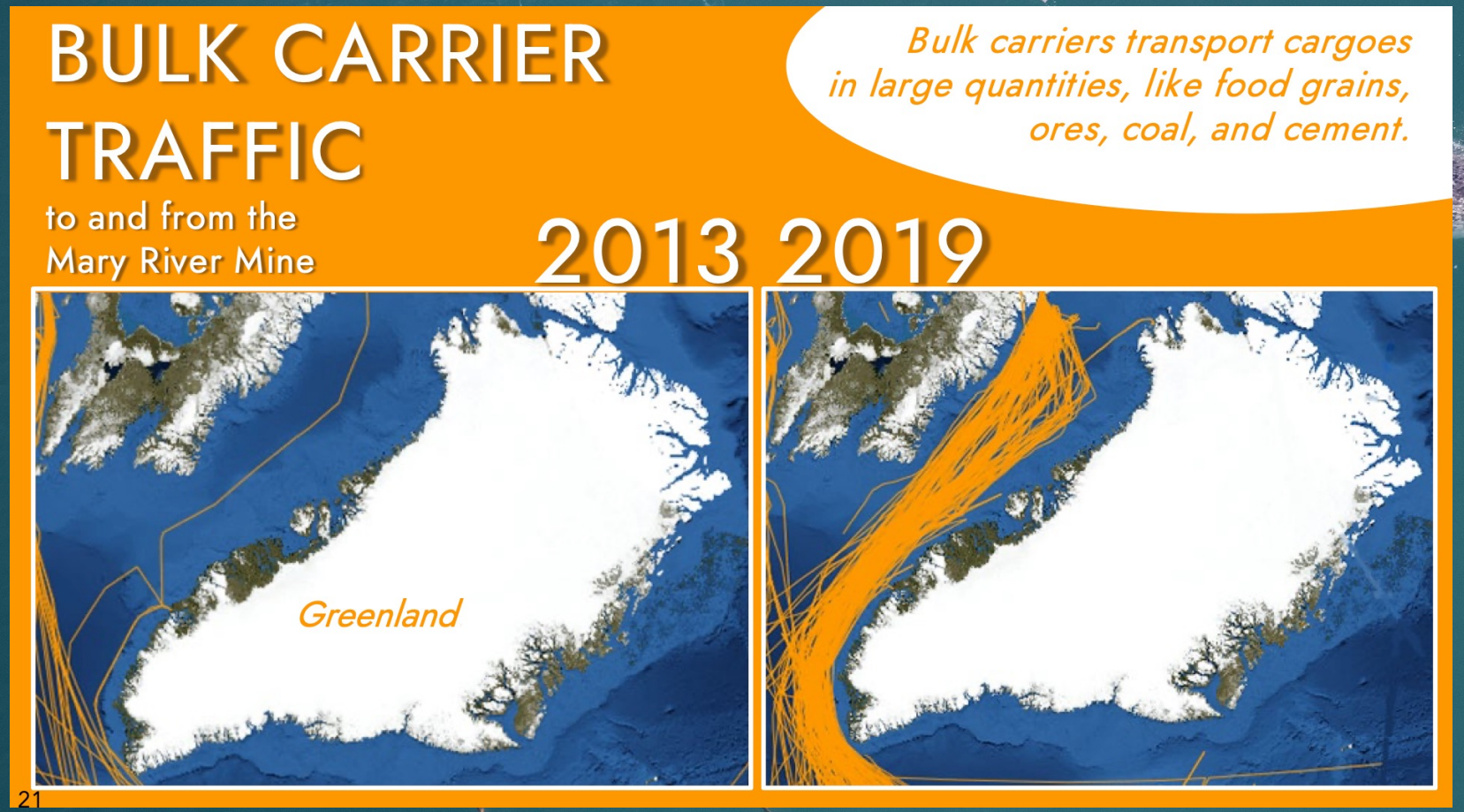
Reactions are context specific
Source of disturbance appears less important
Habituation could not be detected
Individual sensitivity can be extrapolated to population level

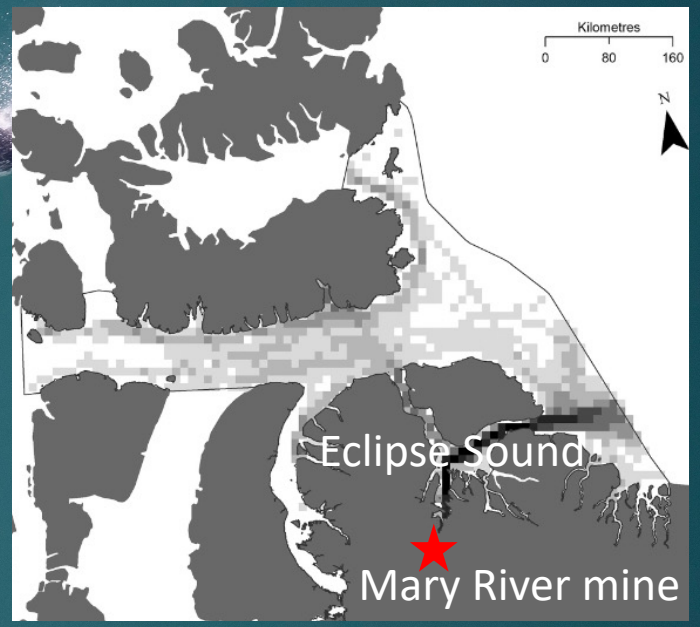
Energetic costs per ship passage



Heide-Jørgensen et al. 2022. NAMMCO Meeting.

The Mary River Project: a real-world experiment



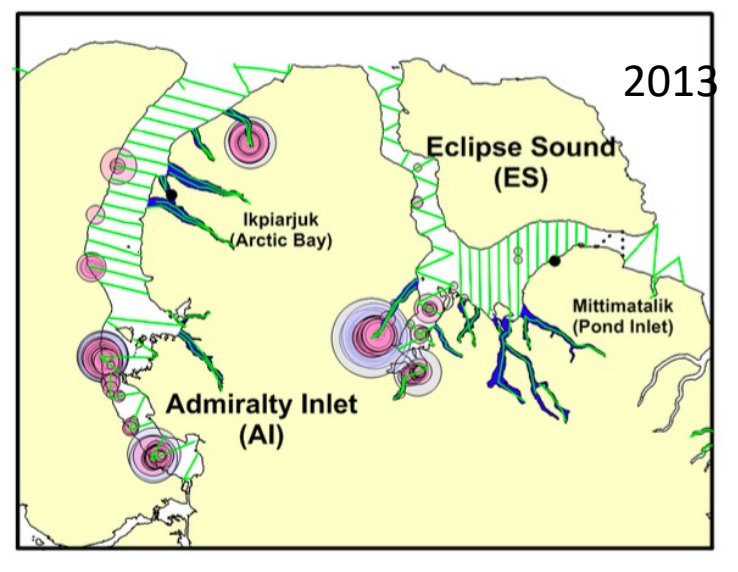


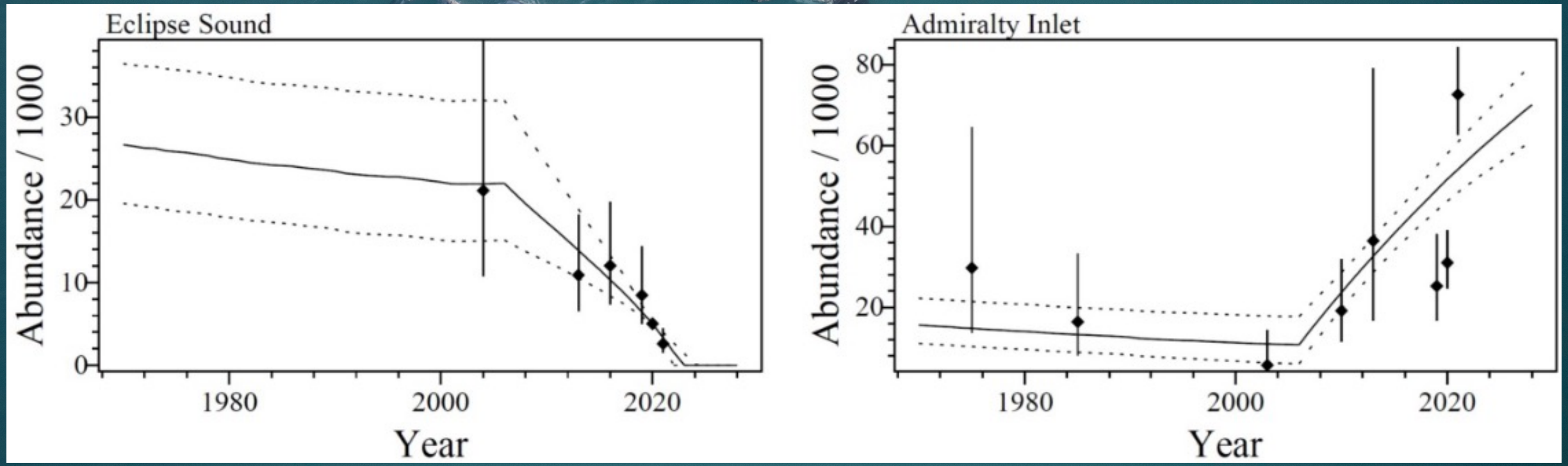
3.5 million tonnes iron ore per year

188 one-way transits of project-related ships occurred during July-October 2020, with icebreakers used early and late in the season.

Kochanowicz 2021. Marine Policy

An unprecedented shift in abundance





Available from NAMMCO
https://nammco.no/