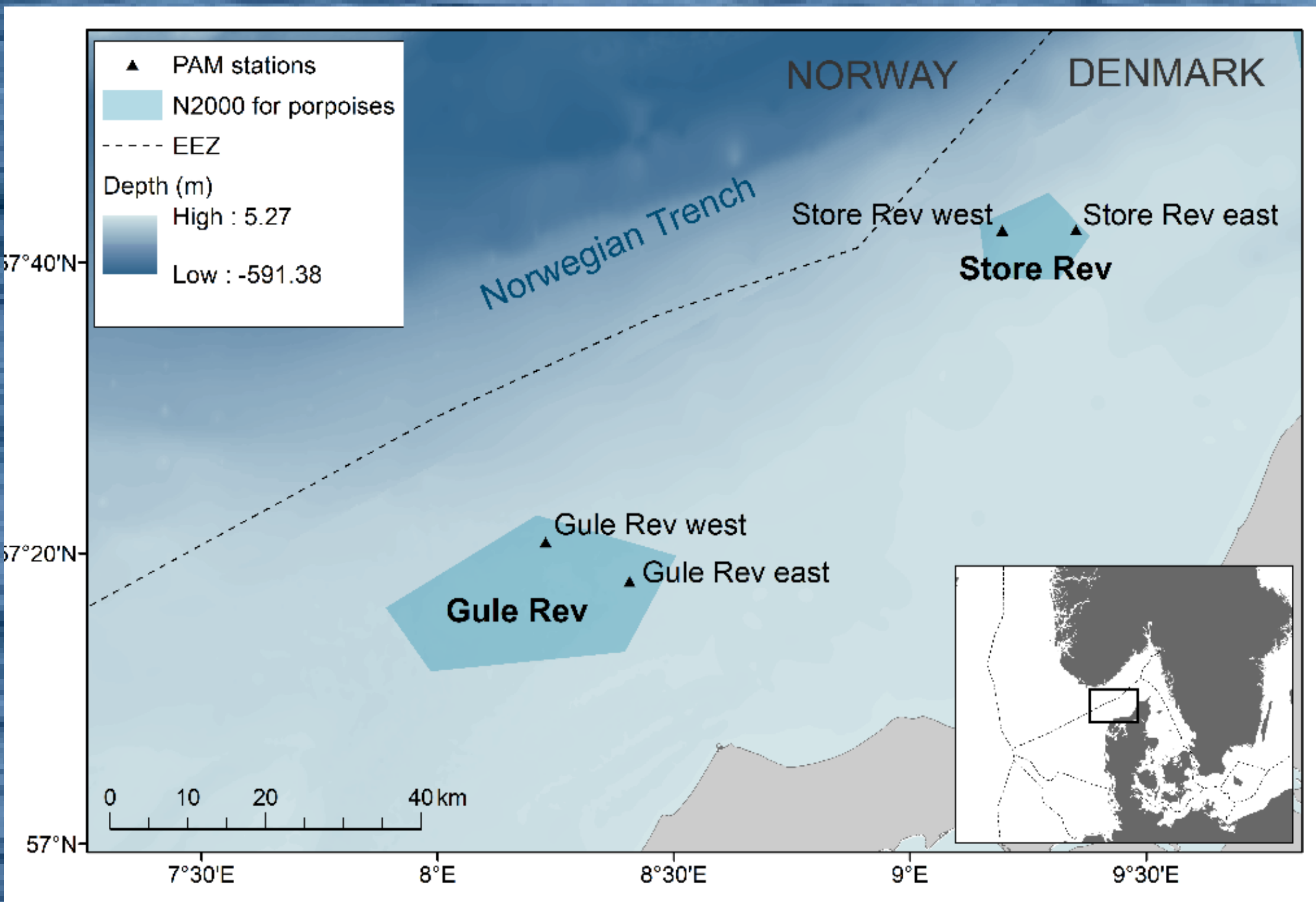


Detection and classification of delphinid vocalisations in Skagerrak waters from autonomous acoustic recorders

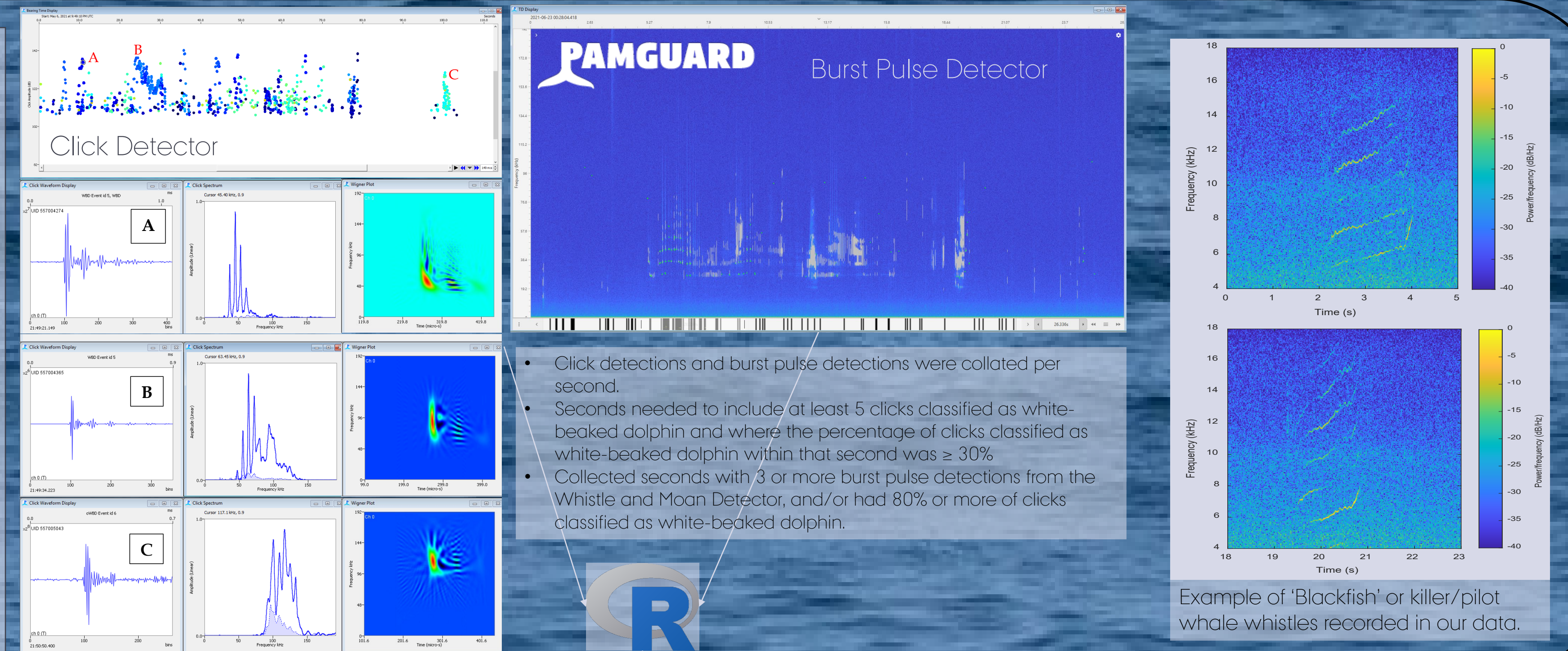
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Objective: Between May and August, 2021, 4 passive acoustic monitoring (PAM) stations were deployed on two large stone reefs in Skagerrak north of Denmark. Delphinids, such as killer whales (*Orcinus orca*), long-finned pilot whales (*Globicephala melas*), and white-beaked dolphins (*Lagenorhynchus albirostris*) have been seen in the area, but very little is understood about their general distribution and seasonal use of this region. In this pilot study, we set out to use semi-autonomous detection and classification methodologies to better understand delphinid use of the area.

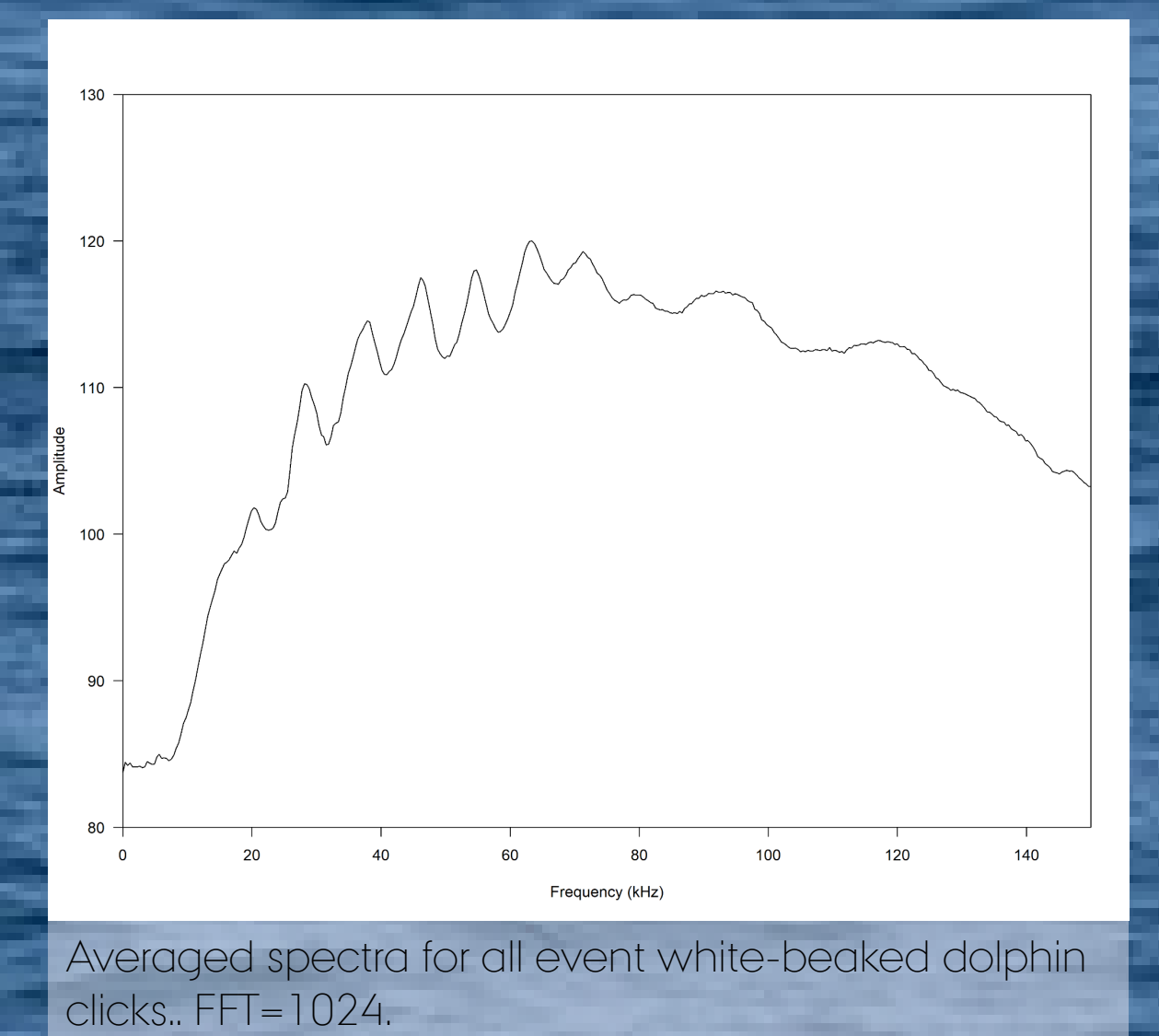
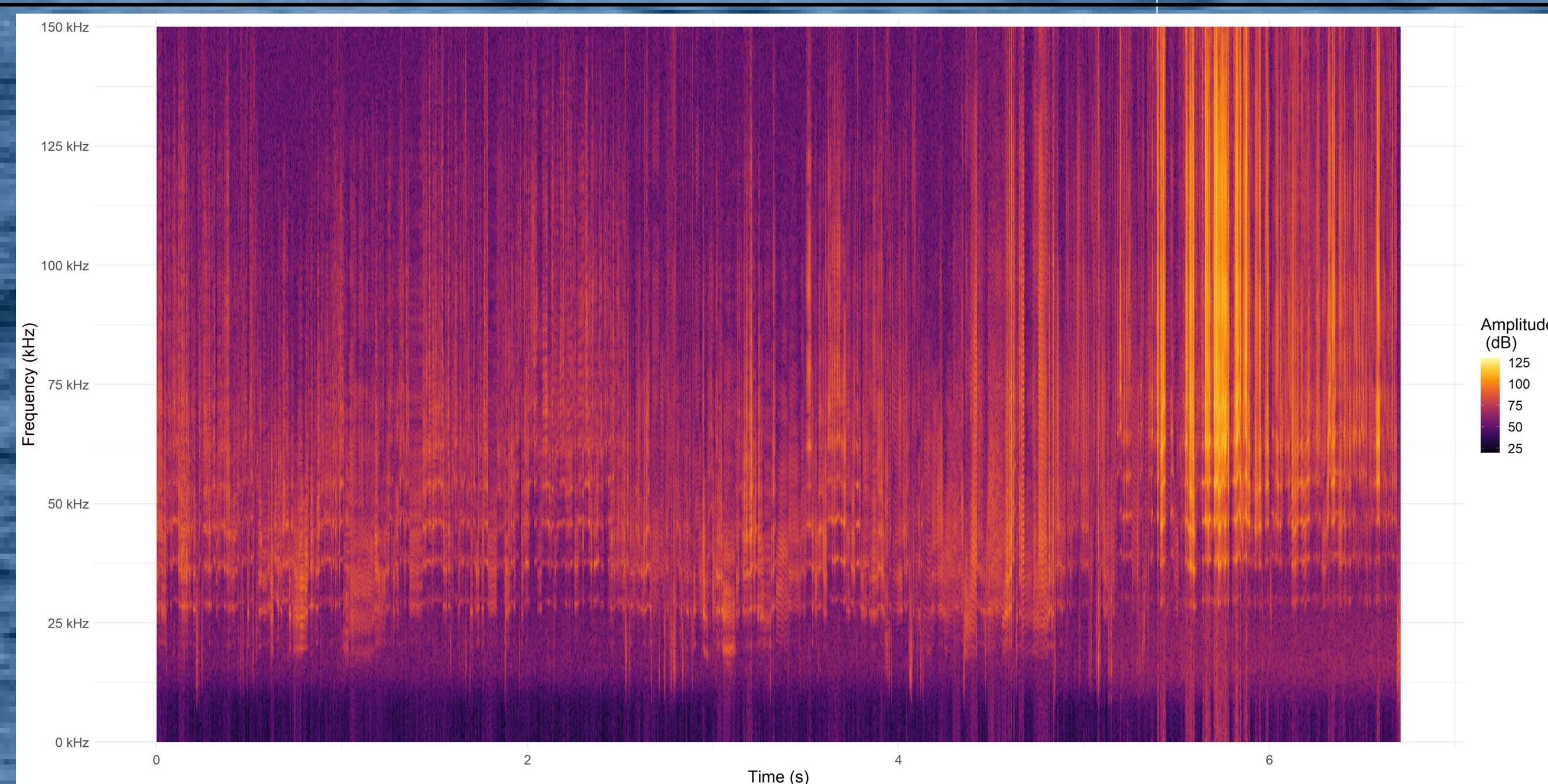
Methods:

- Deployment: 4 ST600 (Ocean Instruments) were bottom mounted in Skagerrak recording 30 minutes per hour at a sample rate of 384 kHz.
- Automated Detection: Using PAMGuard, three routines of signal processing tools were employed.
 - For large delphinids (killer and pilot whales), the Whistle & Moan detector was used to find longer tonal events typical of dolphin whistles.
 - For white-beaked dolphins, two detectors were used and the results were collated. Only 20-30% of each station were analyzed for white-beaked dolphins.
 - The Basic Click Classifier in the Click Detector was employed to find echolocation.
 - The Whistle & Moan Detector was used to locate burst pulses, or shorter tonal events.
- Results for large delphinids were reviewed manually by a trained analyst.
- Results for white-beaked dolphins were further processed in R to remove false detections. These results were manually reviewed by a trained analyst.
- Descriptive statistics of were extracted from high amplitude white-beaked dolphin clicks in R (n=257) with a bandpass filter between 10-150 kHz to reflect the flat frequency response.



Results and Conclusions:

- A total of **5 killer/pilot whale events**, which were more common in the late spring, early summer.
- **9 white-beaked dolphin events** were confirmed in the subset of data examined. White-beaked dolphins did overlap in time with blackfish, but were more common in the spring months.
- In the strongest clicks collected, descriptive statistics include (mean [Q1-Q3]):
 - **Duration:** 2.1 [1.6-2.5] ms
 - **10 dB Bandwidth:** 9.6 [2.1 - 13.5] kHz
 - **Center Frequency @ 10 dB:** 42.4 [36.4 - 46.5] kHz
 - **Q Value @ 10 dB:** 12.1 [2.9 - 19.3]
 - **RMS Bandwidth:** 28 [26-29] kHz
- Rather than a stable peak frequency, a clear banding pattern emerges with peak frequency ranges. A larger dataset is required to test:
 - A) The stability of these bands.
 - B) If these bands can be used to create an autonomous white-beaked dolphin click/burst pulse classifier.
- This is an ongoing study. Presently, the complete dataset is being analyzed for white-beak dolphin events to
 - A) Better define habitat use trends.
 - B) Generate a larger dataset of white-beaked dolphin clicks.



Station	Classification	Date	Start time (UTC + 2)	Duration
Gule Rev East	Killer/pilot whale	31 May 2021	19.29.42	30m
Store Rev West	Killer/pilot whale	20 Jun 2021	19.25.54	30m
Store Rev East	Killer/pilot whale	2 Jul 2021	05.56.13	30m
Store Rev West	Killer/pilot whale	2 Jul 2021	06.26.02	30m
Store Rev East	Killer/pilot whale	2 Jul 2021	08.00.10	1h

Station	Classification	Date	Start time (UTC + 2)	Duration
Gule Rev East	White-beaked dolphin	4 May 2021	20.51.57	1m10s
Store Rev West	White-beaked dolphin	5 May 2021	12.34.17	4m17s
Store Rev West	White-beaked dolphin	6 May 2021	00.44.33	8m54s
Store Rev West	White-beaked dolphin	6 May 2021	16.44.35	2m22s
Store Rev West	White-beaked dolphin	6 May 2021	18.42.10	2m35s
Store Rev West	White-beaked dolphin	6 May 2021	21.25.28	29m58s
Store Rev East	White-beaked dolphin	10 May 2021	09.06.28	12s
Gule Rev East	White-beaked dolphin	23 Jun 2021	00.23.07	24m2s
Gule Rev East	White-beaked dolphin	25 Jun 2021	02.23.51	27m5s



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Let's talk! Email me at: emilytgriffiths@ecos.au.dk



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Read our report!
Griffiths, Emily T., et al. "Acoustic detections of odontocetes in Skagerrak" and no.: Scientific Report from DCE-Danish Centre for Environment and Energy 539 (2023).

