SAVE from harmful noise

– real-time detection system of harbour porpoises before pile driving

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The noise emissions produced by pile driving during construction of offshore wind farms can physically harm harbour porpoises close to the noise source. In order to avoid potential injury to porpoises, German consenting authorities demand different measures:

1. Pile driving noise must not exceed 160 dB re 1µ Pa (SEL) within 750 m of the sound source.
2. Noise mitigation methods and acoustic deterrent devices are implemented prior to pile driving to ensure that all animals have left the area of harmful noise.
3. C-PODs are deployed in 750m to the piling in order to verify a successful deterrence.

In order to monitor harbour porpoises continuously within the potential danger zone around piling we initiated a project (SAVE) to develop and improve a wireless detection system (WDS), which is able to detect animals entering this zone.

The detection system consists of a network of autonomous buoys (WDS) deployed on moorings at a distance of 1500m around the pile-driving location. Each buoy is equipped with a broadband hydrophone, GPS and radio telemetry. The receiving and processing station is located on board a dedicated vessel. The buoys can be turned on and off remotely. PAMGUARD is used to process the raw data and to identify the clicks and click trains originated from harbour porpoises.

The efficacy of the WDS buoys was accomplished in different trials:

→ The detection rate from the WDS is compared to that recorded by the C-POD

1. Artificially generated porpoise clicks proving the detection range of the WDS

- C-POD + reference hydrophone attached to the WDS.
- At a defined distance the artificial porpoise click emits a series of five pulses [center frequency: 130kHz; click duration: 70 µs; envelope: flat or raised sine]
- Trial started with a source level at full power of 168 dB re 1µPa@1m and was repeated at reduced power (-6, -12, -18, -24,-30dB)
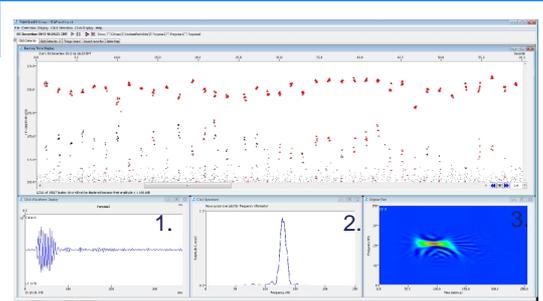
The test pulse series at full power transmission are shown as raw data analysed in PAMGUARD (upper graph).
The operator identified test pulses as they would harbour porpoise events in real-time, aided by Pamguard's automatic classifier, waveform (1.), spectrum (2.) and Wigner plot (3.) displays (lower graphs).
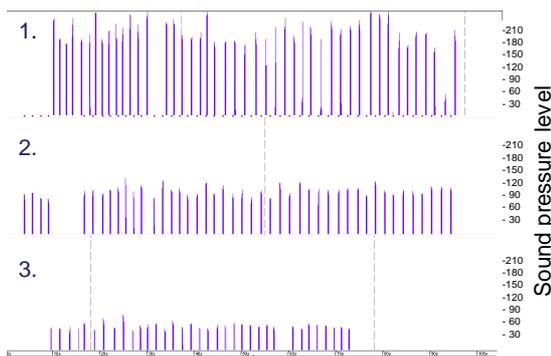
The test pulse series at full power (1.), reduced by 6dB (2.) and by 12 dB recorded by the C-POD.

→ Artificial porpoise clicks were detectable from full transmission reduced by 18dB for WDS and C-PODs: 1 WDS and C-POD also detected in -24dB, none of the devices in -30dB.

2. WDS and C-POD against visual observations from a cliff

WDS and C-POD detected porpoises swimming in a range of 150m which was visually observed and tracked. Harbour porpoises were recorded on C-PODs (click trains shown as ICI) and on WDS (shown as the same PAMGUARD aids as above).
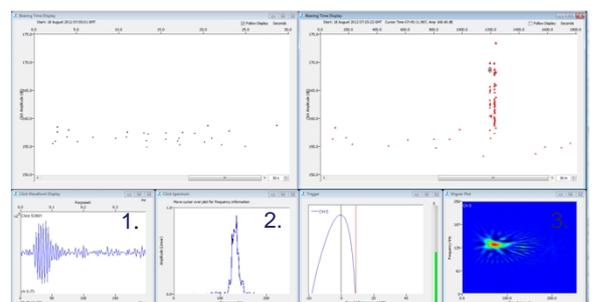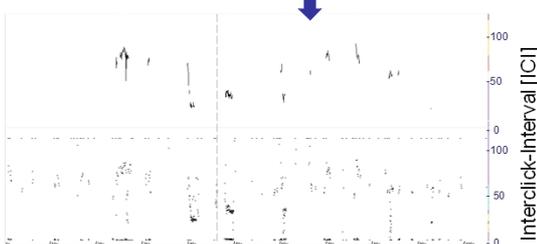
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