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Listening for Bottlenose dolphins (*Tursiops truncatus*) using HydroMoths

Potential cost-effective alternatives for cetacean acoustic monitoring

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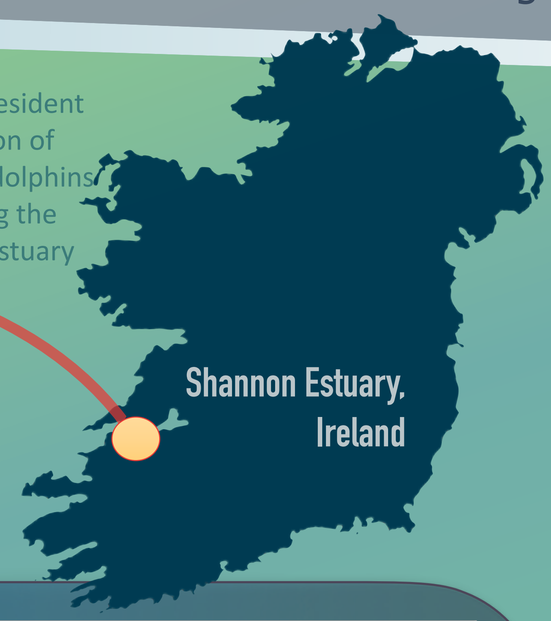
Can cost-effective hydrophones be used for cetacean monitoring?

There is a resident population of Bottlenose dolphins inhabiting the Shannon Estuary



THE SET UP

FACT BOX: HYDROMOTH

WHAT IS IT: Newly developed Hydrophone
COSTS: ~100€/UNIT
SIZE: 4x7x5cm

There is still much to learn about them, and how they can be useful for cetacean monitoring

	Sampling rate			
Recording hours of the day	48kHz	96kHz	192kHz	256kHz
00-24			1	1
00-01, 02-03, 04-05, 06-07	2	2		2
08-09, 10-11, 12-13, 14–15	2	2		2
16-17, 18-19, 20-21, 22-23	2	2		2

Table 1. Matrix showing the number of HydroMoths used with their configurations in this study

Tot: **20** units 
(**10** distributed over **2** buoys)

Duty cycles for HydroMoths with
Active recording periods: 15m sleep, 5m recording
Recording 00-24: 12m sleep, 10m recording

Paired with
Batteries: Lithium Iron Disulfide AA 1.5V
Memory card: 64GB Micro SD Card

PRELIMINARY RESULTS

from our pilot study

All sound files have not yet been processed and analyzed, but so far

What have we recorded?

Dolphin whistle ⊗ **Dolphin click** ⊗ **Echo sounder** ✓

How long time did they record?

3 days, 4 days to over 4 weeks

The hydrophones recording 00-24, with 192kHz resp 250kHz sampling rate (Table 1), recorded 3 resp 4 days, and were both **limited by memory card size**. Hydrophones with active recording hours are still recording 14 April 2023.

FACT BOX: NYQVIST-SHANNON SAMPLING THEOREM

THEORY STATES: Sampling rate must be **equal to or greater than twice** the highest frequency in the signal, to record it accurately.

Bottlenose dolphins produce high frequency sounds (whistles around 7kHz-16kHz) and clicks with peak frequencies around 40kHz-130kHz). Mysticetes produce low frequency sounds, ex Fin whales make 20Hz pulses, blue whales calls between 10Hz-40Hz. This means **sampling rate will vary depending on the target species**.

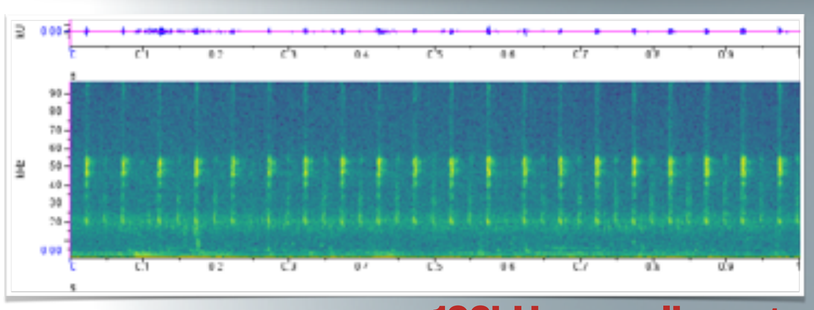
Higher sampling rate requires a lot of energy, **which affects the recording time**.

BUT: Do we really need to follow the Nyqvist-Shannon sampling theorem for monitoring purposes, if it is enough to collect presence/absence data?

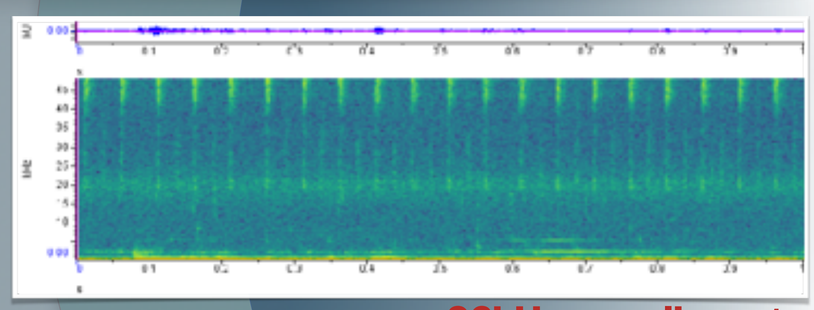
Discussion points

- Some HydroMoths are still recording after 4+ weeks, which is **promising for monitoring**
- Several sampling rates **recorded the echo sounders, indicating similar could be seen for dolphin clicks** (which may have similar peak frequencies)
- HydroMoths might be **valuable for acoustic monitoring of mysticetes**, as low sampling rate would be sufficient (= longer battery time)
- Next we will deploy in areas with greater cetacean activity to increase our chances of recording dolphins

SPECTROGRAMS - same sound, different samling rate



192kHz sampling rate



96kHz sampling rate

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