

Novel uses of hydroacoustic methods to record fine-scale predator-prey interactions in marine habitats

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Background

- Little is known about pelagic predator-prey interactions at fine spatiotemporal scales in the marine environment. Simultaneously recording hydrodynamics, prey and predator behaviours during foraging events could answer key questions
- Hydroacoustic methods offer solutions as: **[1]** they can record the fine scale behaviours (metres and seconds) of prey and predators **[2]** they can record some subsurface hydrodynamics such as turbulence and internal waves. **[3]** their *in-situ* deployment means that they can be used alongside conventional oceanographic instruments to record other useful information (e.g. sea surface temperature, chlorophyll a, current speeds/directions) during foraging events.



James Waggitt & Benjamin Williamson

Lilian Lieber

EXAMPLE 1: Using a seabed mounted hydroacoustic setup to record seabird-fish interactions within high energy habitats



Frame being deployed

Here 2 examples of Hydroacoustic methods being used to successfully record fine-scale predator prey interactions in marine habitats are presented

EXAMPLE 2: Using a vessel mounted multibeam sonar setup to record basking shark interactions in a thermal front habitat



Instruments being deployed

EXAMPLE 1: Using a seabed mounted hydroacoustic setup to record seabird-fish interactions within high energy habitats

QUESTION: Will deep diving seabird (auk and cormorant) behaviour around wave and tidal stream turbines make them vulnerable to changes brought about by installations?

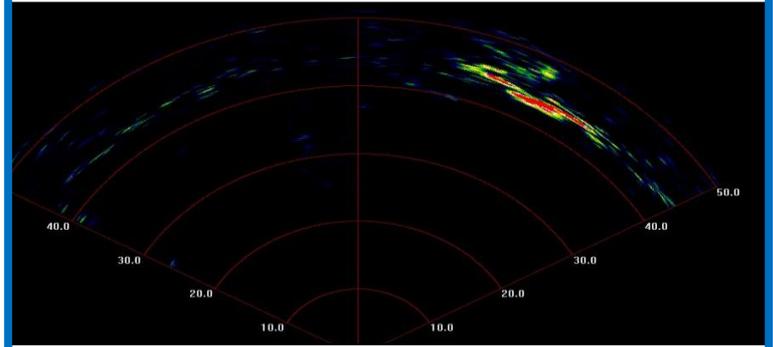
AIMS: To simultaneously record subsurface hydrodynamics, bird dive profiles and prey characteristics at turbine test sites in the Fall Of Warness and Billia Croo, Orkney, UK.

Methods

Studies were performed during July 2012 and June-August 2013. A frame containing hydroacoustics, oceanographic equipment and batteries was deployed on the seabed. An upwards facing **Imagenex multibeam sonar** (260kHz) and **Simrad EK60 echosounder** (38,120,200 kHz) recorded diving birds, prey characteristics and turbulence. An **ADV and Fluorometer** recorded currents and chlorophyll a levels respectively. During deployments an **Onshore Observer** recorded when seabirds were foraging nearby.

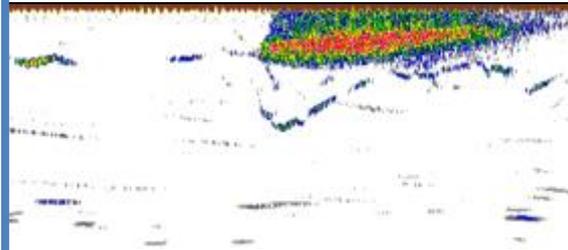


Imagenex Multibeam Sonar



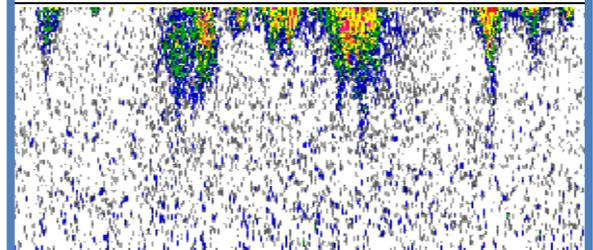
Real time recordings of Common guillemots *Uria aalge* and/or Razorbills *Alca torda* diving beneath fish shoals. It is likely that integrating information provided by multibeam sonar, echosounder and observations will be crucial in discriminating between birds, fish and turbulence. Dive profiles and fish characteristics will be analysed in relation to oceanographic parameters recorded *in-situ* or from remote sensing data (radar).

EK60 Echosounder

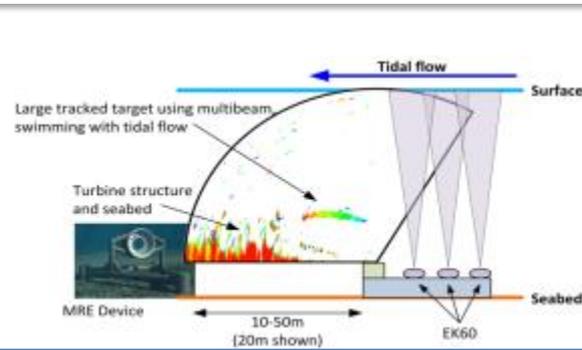


Common guillemots *Uria aalge* and/or Razorbills *Alca torda* with fish at Billia Croo, Stromness, Orkneys

EK60 Echosounder



Intense subsurface turbulence around a tidal stream turbine at the Fall Of Warness, Eday, Orkneys.



EXAMPLE 2: Using a vessel-mounted multibeam sonar to record basking shark interactions in a thermal front habitat

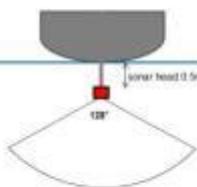
QUESTION: Basking shark aggregations occur in proximity to proposed marine renewable sites off the Scottish West Coast. Will changes in physical conditions brought about by the presence of devices impact basking shark habitat use?

AIMS: To simultaneously measure shark behaviour and oceanographic variables near the islands of Coll and Tiree, Scotland, UK. .

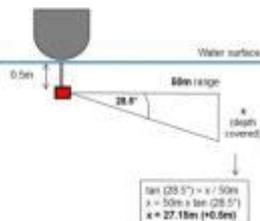
Methods

A pilot study was performed during August 2012. The *Tarka* vessel was used to locate and follow basking sharks within areas of interest. When basking sharks were located a forward facing **Reson Seabat 7128** multibeam sonar (400Khz) was deployed. A **temperature logger** recorded sea surface temperatures. Future studies will include additional oceanographic instruments.

1) Horizontal beam width (front view)

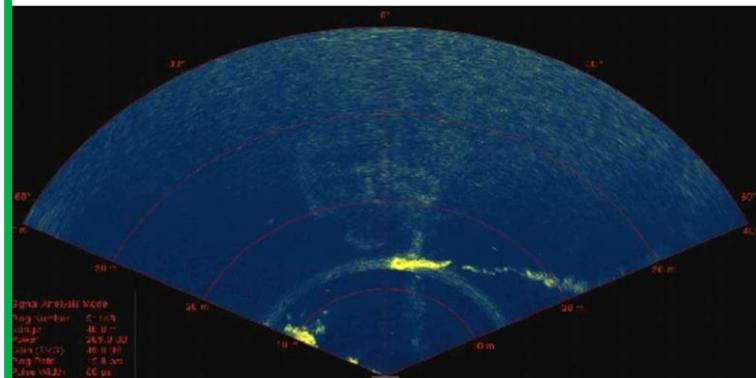


2) Vertical beam width (side view)



Picture sourced from BBC

Reson Seabat 7128



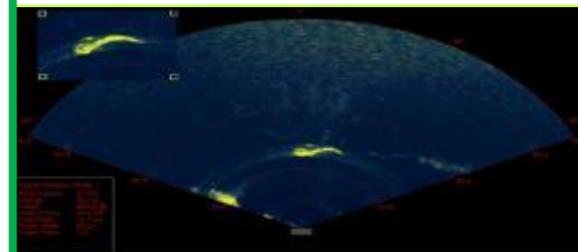
Real-time recordings of basking sharks foraging upon zooplankton. After manual detection and validation, it is hoped that individuals will be tracked automatically therefore providing information on their fine-scale movements in time and space. Behaviour will be analysed in relation to oceanographic parameters recorded *in-situ* or from remote sensing data (satellite).

Observations



A basking shark aggregation site near the islands of Coll and Tiree, Scotland, UK.

Reson Seabat 7128



Screen grab from the Seabat 7128 video output showing a basking shark ~12m from the boat