Novel Use of *Teledyne RESON 7128* Multibeam Sonar to Monitor Endangered Species Around Renewable Energy Sites

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Scotland’s targets by 2020*:
100% of Scotland's electricity demand from renewables
Target EU 2020: 20% of EU's energy consumption from renewables

* http://www.scotland.gov.uk/topics/marine/marineenergy

25% of the European offshore wind resource potential  
25% of Europe's tidal power  
10% of its wave power
Arrays of devices
Arrays of devices

Spatial overlap with large, marine species?
Possible interactions

1 Large-scale: Avoidance or attraction of renewable sites by marine animals?

2 Fine-scale
- Attraction vs Evasion?
- Blade interactions?
- Noise disturbance?
- Electromagnetic fields?

Collision Risk

Need for monitoring
Basking sharks, *Cetorhinus maximus*

Basking shark fisheries: >70,000 fished

IUCN: ‘Endangered’ in the Northeast Atlantic

Basking shark seasonal aggregations:
How to monitor interactions with renewables?

- Animal tagging
- Passive acoustics
- Acoustic receivers and pinger systems
- Underwater video
Advantages of Multibeam Sonar

Acoustic imaging at **high resolution**

*In situ* behavioural observations

Frequency: 200 or 400 kHz  **no auditory injury to other marine mammals**

Long range (>100m)  **wide coverage** (128° swath)

Teledyne RESON SeaBat 7128 forward-looking multibeam sonar
Challenges and Aims

1. Acoustic visualisation
2. Underwater, fine-scale tracking
3. Precise parameters on natural behaviour
4. Movement metrics for automated detection
5. Future: A monitoring tool for impact assessments
Study site

Planned renewables

West Coast of Scotland, Sea of the Hebrides, Coll & Tiree
Deployment

Sonar head (transducer and receiver)

12.5m motorized vessel FV Tarka

Front view

Side

At 50m range
>25m depth covered

Flexible pan & tilt mechanism

Dry end, real-time display

Bio-physical measurements:

multiple sensors towed for:

- fluorometer for chl \(a\)
- sea temperature
- salinty
Multibeam survey Aug 25th 2013

Relative chlorophyll a

Sharks at the sea surface

Survey
Range: max 150m to target
Vessel speed ~ 2 knots
Operated at: 400kHz

At 50m range:
- **Pulse length** per transmission = 65µs
- **Ping rate** of around 15.8 pings/s
Target tracking

Custom algorithms for shark detection and tracking

- National Instruments software LabVIEW
- Tracking uses shark position coupled with parameterisation of key target features, i.e. size, ellipse ratio, velocity:

1. Multibeam Raw Image
2. Thresholding by Intensity
3. Dilation
4. Thresholding by particle size

Algorithms written by Benjamin Williamson, University of Aberdeen
1 A possible monitoring tool allowing for integrated monitoring

Spatial distribution

Bio-physical environment

Habitat use

2 No Single Approach: Combining sonar, tagging, robots and cameras to get the full picture

3 Industry: Academia Collaboration

Our future?
Thank you!

ADVICE AND DATA COLLECTION: Beth Scott, Benjamin Williamson
TELEDYNE RESON: John Fraser, Richard Fotheringham, Adam Junner
FIELD WORK STAFF: Innes Henderson, John McCann & crew

Any suggestions? Come and find me or email: l.lieber@abdn.ac.uk