European Marine Energy Centre

Environmental Monitoring at EMEC

Marine Renewables and our Natural Heritage

SNH, *Sharing Good Practice*,

Stirling, 5th Nov 2009

Jennifer Norris

Research & Consents Manager

Purpose of this Event

Aims to create greater understanding of

1. Environmental obligations
2. Current environmental best practice for offshore renewable developments
3. Technical constraints to monitoring of devices

1 Environmental Obligations

- Regulatory perspective
  - Close liaison with regulators and key advisors about obligations of developers testing at EMEC
  - EMEC Monitoring Advisory Group (MAG)
    - established 2008, funded by SNH, meets regularly
    - regulators + expert advisors (+ developers)
- Working towards a Monitoring Strategy
  - to advise and assist developers in respect of monitoring methods for use at EMEC

Prioritising Development of Methods

- Concerns over many environmental unknowns, some more important than others for EMEC (due to site sensitivities)
- Prioritisation of concerns – method development
  - what urgently needs to be monitored, but has no agreed best methods for doing so?
  - UK regulatory concensus on relative importance of issues specific to wave and tidal energy devices

Monitoring Matrix

Receptor of interaction(1)	Nature of interaction(1)	Priority(1)	Tidal Site Sensitivity & Magnitude(2)	EMEC Project	Wave Site Sensitivity & Magnitude (3)	EMEC Project
Wildlife, particularly marine mammals and birds, but including a few other species such as basking sharks	Collision with devices, particularly tidal turbines.	H	M	3.2 Sonar System	L	3.2 Sonar System
	Alteration to wildlife behaviour. For example, reduction in access to feeding areas (mammals and birds), avoidance arising from "barrier effects" of arrays of devices in restricted waters.	H	M	3.1 Wildlife Observations	L	4.1 Camera Observations, 4.2 Wildlife Observations
	Underwater noise - operation	M	M	3.4 Acoustic Characterisation	L	4.3 Acoustic Characterisation
Seabed, habitats and species	Physical disturbance of the seabed	M	L	3.3 ROV Analysis	L	3.3 ROV Analysis
	Alterations to benthic faunal communities through changes in flow or wave exposure.	M	L	3.3 ROV Analysis	L	3.3 ROV Analysis
Navigation	Surface vessels, merchant shipping, fishing vessels, naval vessels	H	M	Ongoing consultation. Detailed study requires funding.	M	Ongoing consultation. Detailed study requires funding.
	Submarine navigation	H	L	-	L	-
Commercial fisheries	Limitation of access of fishers to actual or potential fishing grounds	H	L	4.5 Fisheries Project. Requires funding.	M	4.5 Fisheries Project. Requires funding.
Aesthetic impact	Visual impact of objects on or above the sea surface	M	L	Ongoing local consultation	M	4.6 Local Residents Group
	Impact on marine (underwater) landscape	M	L	Detailed study requires funding	L	Detailed study requires funding

Table 1: EMEC Impact Matrix

(1) Selected from Appendix 1 – Potential Impacts from Marine Renewables

(2) Selected from Appendix 2 – Fall of Warness Environmental Sensitivities

(3) Selected from Appendix 3 – Billia Croo Environmental Sensitivities

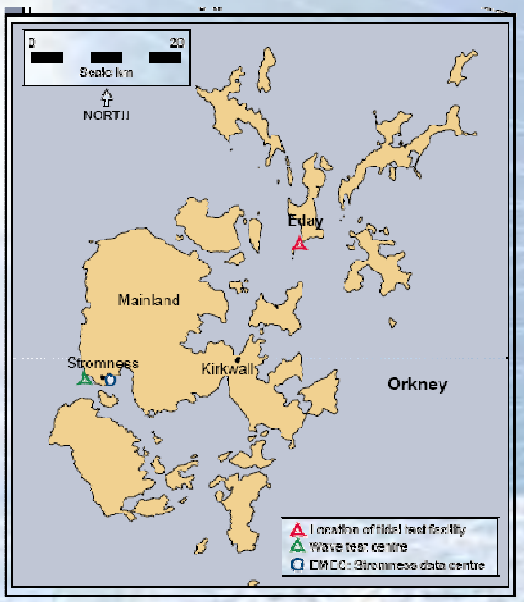
Why develop strategies for EMEC sites?

- Developers need to address the same range of environmental sensitivities
- Developers seeking advice on methods
- Using consistent methods / protocols for data collection and analysis
  - Facilitates comparison of impacts of different devices deployed within the same environment (intra-site comparison – different devices)
  - Potentially facilitates inter-site comparison (same device) if methods applicable elsewhere

2. Current environmental best practice for offshore renewable developments

Land-based visual observations

- Tidal test site
- Wave test site



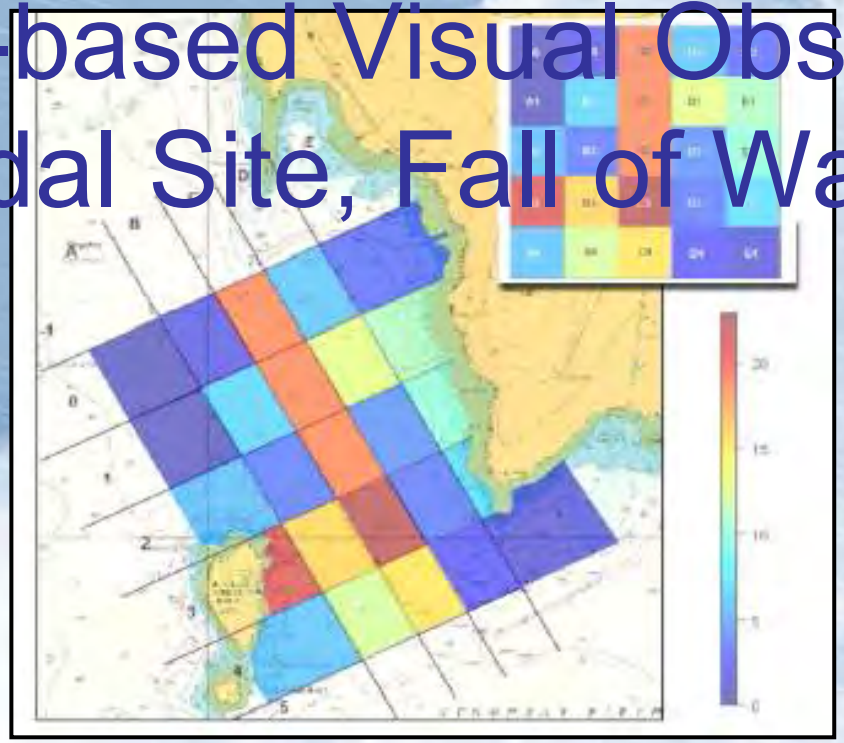
Land-based Visual Observations Tidal Site, Fall of Warness

- Established July 2005, ongoing (£££!)
- Method developed by SMRU Ltd
- Land-based observer
- Recording to pre-defined grid

Observations Method (Tidal Site)

- Area scanned by telescope from elevated vantage point, for hour-long periods, in 4-hour watches
- Sampling over range of tidal states, times of day & conditions
- Sightings identified & recorded to species level
- Location on the imposed grid recorded (grid cell)
- Physical variables (tidal state, wind direction & strength, precipitation, cloud cover, glare etc) recorded
- Approx 1,000 hours of observations per year
- SMRU Ltd – expert statistical modelling of the data to identify patterns of distribution (& any changes due to device presence)
- Species distribution can be presented visually by colour-coded groupings …

Land-based Visual Observations Tidal Site, Fall of Warness



Seals
Common seal
Grey seal
Unidentified seal
Cetaceans
Harbour porpoise
Minke whale
Unidentified cetecean
White beaked dolphins
Risso's Dolphin
Orca
Other
Basking shark
Otter

Bird species observed at Fall of Warness Tidal Site

Arctic tern
Black guillemot
Black throated Diver
Common guillemot
Common scoter
Cormorant
Diver Sp.
Eider Duck
Gannet
Goldeneye
Great Northern Diver
Kittiwake
Little Auk
Long Tailed Duck
Phalcrocorax spp
Puffin
Razorbill
Red Breasted Merganser
Red Throated Diver
Shag
Slavonian Grebe

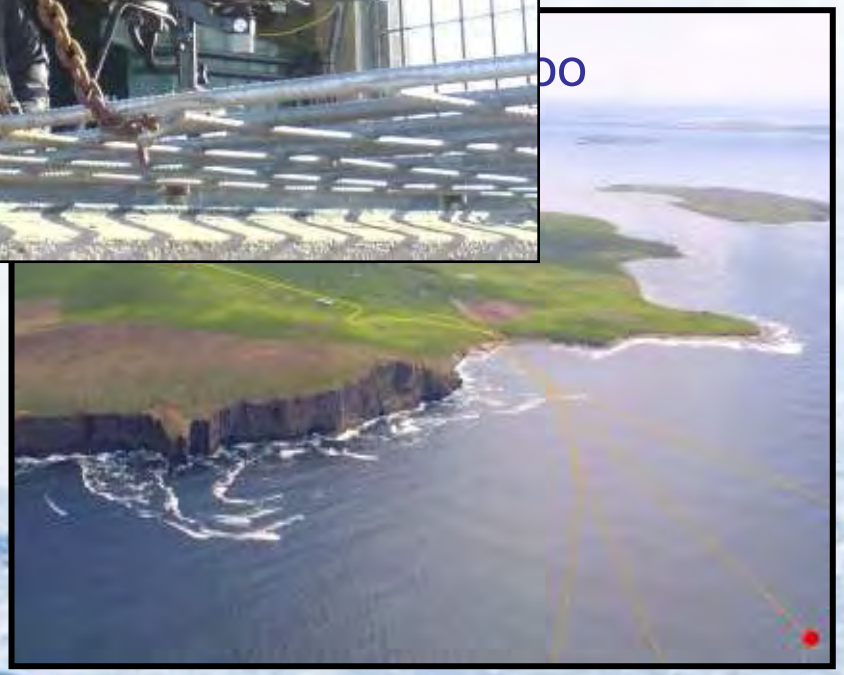
Land-based Visual Observations Wave Site, Billia Croo

- Established March 2009, ongoing (£££!)
- Method developed by SMRU Ltd
- Land-based observer
- Recording to inner, mid and outer zones

Observations Method (Wave Site)

- Area scanned using ‘big-eye’ binoculars from elevated vantage point for hour-long periods in 4-hour watches
- Sampling over range of tidal states, times of day & conditions
- Sightings identified & recorded to species level
- Location recorded using
  - Horizontal (compass) angle
  - Angle of declination
- Location of sightings needs to be calculated from 2 angles
- Record data directly to database on laptop
- Physical variables (tidal state, wind direction & strength, precipitation, cloud cover, glare etc) also recorded
- Approx 1,000 hours of observations per year
- SMRU Ltd – expert statistical modelling of the data

Land-based Visual Observations
te, Billia Croo



Seals
Common seal
Grey seal
Unidentified seal
Cetaceans
Harbour porpoise
Minke whale
Unidentified cetacean
White sided dolphins
Risso's Dolphin
Orca
Pilot whale

Bird species observed at Billia Croo Wave Site

- Arctic Skua
- Arctic Tern
- Auk Sp
- Black Guillemot
- Common Gull
- Eider
- Fulmar
- Gannet
- Great Black Backed Gull
- Great Northern Diver
- Great Skua
- Guillemot
- Greylag Goose
- Herring Gull
- Kittiwake
- Lesser Black Backed Gull
- Puffin
- Razorbill
- Red Throated Diver
- Scaup
- Shag
- Storm Petrel
- Unidentified Auk

3. Technical Constraints to Monitoring of Devices

- The reality and practicalities of land-based visual observations

Vantage points are exposed

Lookout posts (tidal site)…

Lookout posts (wave site)…

Some practical issues with land-based visual observations

- Weather can limit observation periods!
- Glare can be a problem, esp. when sun is low
- Lack of physical points of reference with radial (non-grid) observations
- Permission needed for observation lookout posts (needed in harsh environments)
- Direct data recording in cold environments can be a problem (gloves, numb fingers…)
- Using big-eyes can be a problem (permanent position for tripod, and the need to be precisely vertical)

More practical issues with land-based visual observations

- Vantage points – suitable, available, accessible
  - Can be too high (fog, wind speed …)
- Lower optical quality of big-eyes (cf telescope)
- Using two sighting devices (eg binos / scope) can waste time & increase 'effort' (affects stats)
- Sweeps can take much longer than expected
  - Weather conditions, numbers of animals
- Direct data entry can be problem
  - Rest times should be rest times (not data entry times)
  - Need to rest eyes, warm up etc

Wider Use of Methods

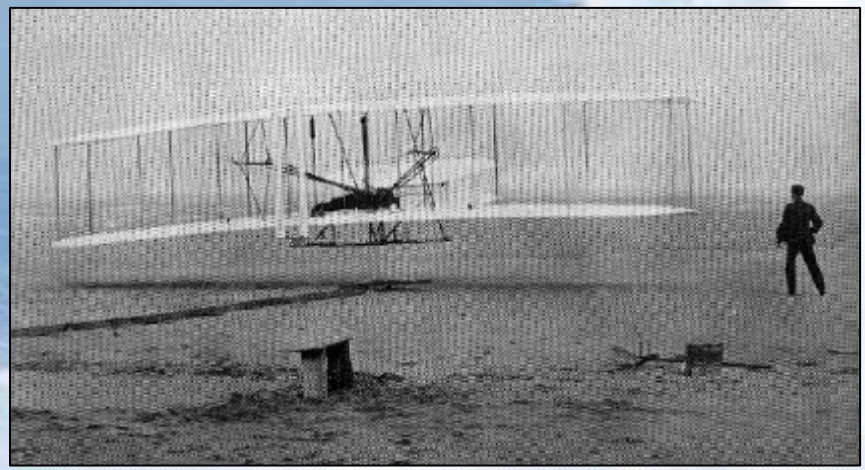
- Using standard approaches to data collection methods and analytical frameworks will benefit
  - developers (methods recognised and supported)
  - regulators (consistent advice, where appropriate)
  - policy makers (comparability of information on different devices)
- Need to test standard methods
- Need to exercise caution in applying ‘generic’ methods to different sites
  - detailed methods will rarely be truly generic
  - general approaches may be generic
  - ensure responsible ‘tweaking’ and analysis

Standards and Protocols

Some ongoing work in this area includes:

- UK work on standards for marine energy industries
  - EMEC facilitating production of Environmental Standard, one of 13 standards feeding into BSI and beyond
  - outputs to feed into international standards as they develop
- European pre-normative standards (Equimar)
  - EMEC one of many partners
  - look to ensure best use of all related work, and to avoid duplication of effort
  - working to improve on outputs wherever possible
- Scottish Gov't (SNH env. monitoring protocols; EIA survey; and EIA/AA/consenting Guide; etc.)

Where are we now?



1903

2006

There's a long way to go

A hard disk drive back
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05
np
ve
d

- The HDD weighed over a ton and stored 5 MB of data.

2009

Buffalo's DriveStation external hard drives with up to 1TB of storage

EMEC ORKNEY

Thank you for listening

www.emec.org.uk

Jenny.Norris@emec.org.uk