On understanding the environmental effects of subsea cable electromagnetic fields (EMFs)

Andrew B Gill PhD FRSB

Centre for Environment
Fisheries & Aquaculture
Science

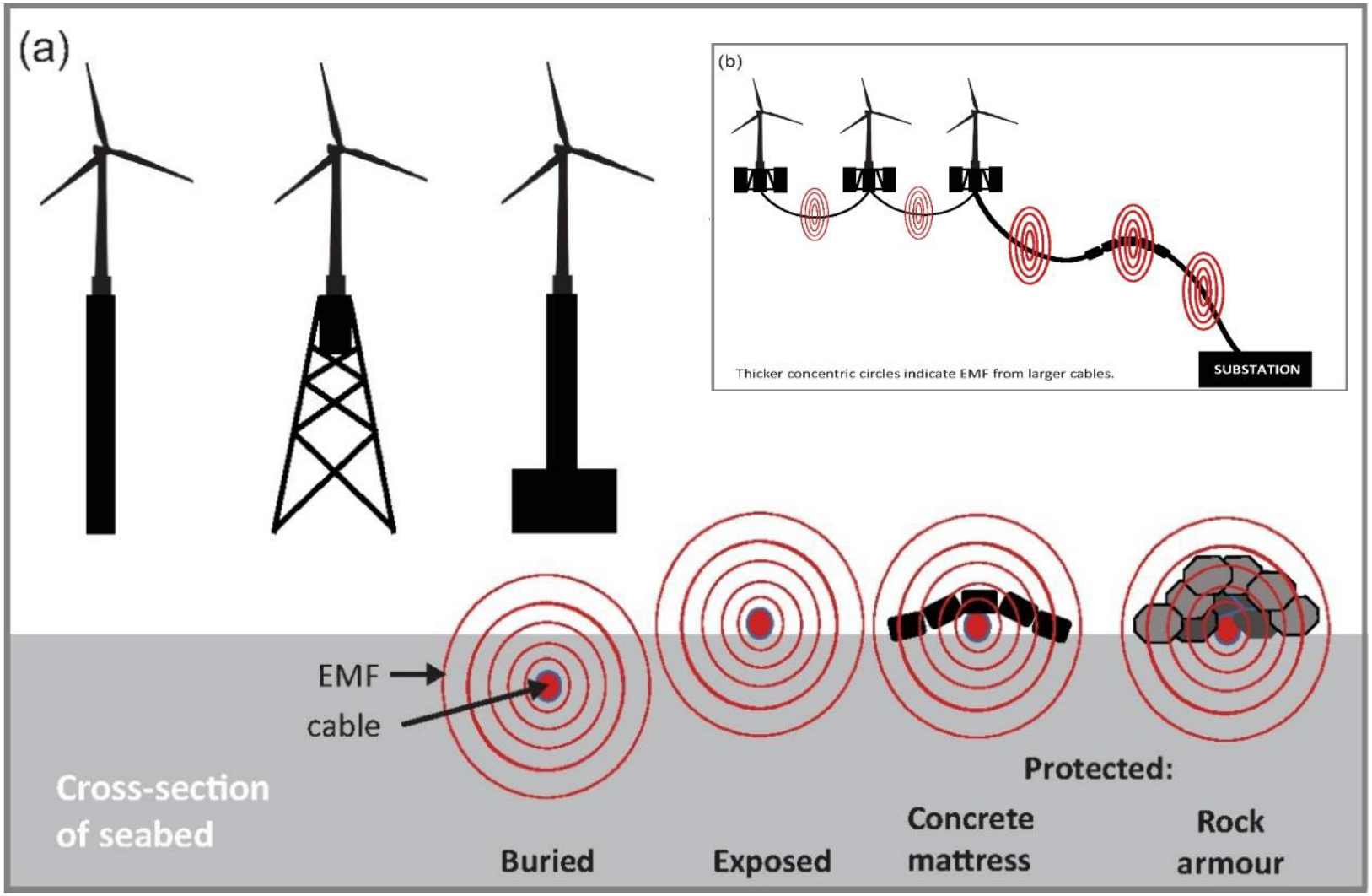
Cefas

Subsea power cables introduce EMFs

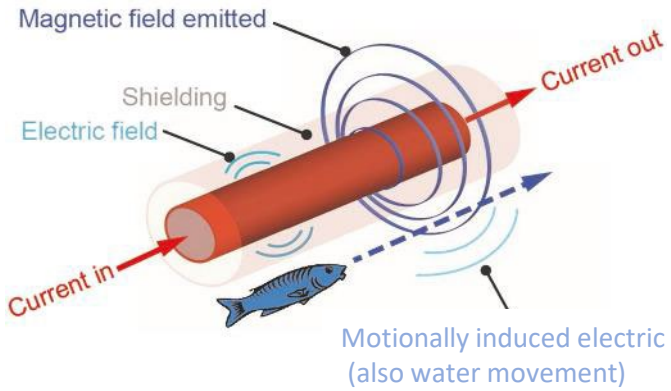
. . . in the marine environment

- AC cables
- DC cables

- Electromagnetic fields;
  - Electric field is contained
  - Magnetic field is emitted
  - Induced electric field (AC)
  - Motionally induced electric field

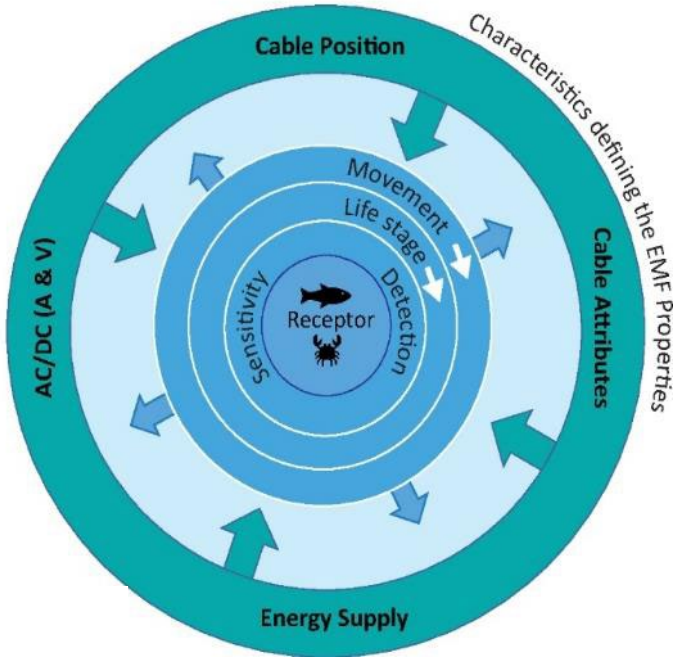


Adapted from Hutchison et al., 2020, *Oceanography*



Hutchison, Gill, Sigray, He, & King, 2021, *Renewable Energy*

Taking a fish-eye view of EMFs



Take the vantage point of the receptive species

- Take their position in space and time
- Consider how they perceive their sensory environment
- Which cues are important at that time
- Cable characteristics which influence the EMF

Adapted from Hutchison, Secor & Gill 2020, Oceanography

Offshore Wind Evidence + Change Programme

Technical workshop Electromagnetic Fields (EMFs) from subsea cables in the marine environment

- Jan 23

Thanks to colleagues:
Zoë L Hutchison, Offshore Wind Directorate, Scottish Govt
Marieke Desender, Cefas

THE CROWN ESTATE

Cefas

The Scottish Government
Riaghaltas na h-Alba

Workshop Aims & Objectives

Offshore Wind Evidence + Change Programme

Overall aim - to provide an agreed and standardised approach for estimating the poorly understood energy emission of subsea cable electromagnetic fields (EMFs) in the environment through facilitated expert agreement.

Objectives:

1. Agree fundamental aspects for calculating and modelling EMF (in 2D and 3D) associated with HVDC and HVAC subsea cables.
2. i- Determine how to account for the cable EMF interaction with the local geomagnetic field

   ii- how to account for motionally induced electric fields associated with sea water movement
3. Based on 1. and 2. - initial agreed approach(es) to modelling and measuring EMF
   - Minimum approach based on current knowledge to support licensing
   - R&D approach to improve confidence in the evidence base to support impact assessment
   - Set the approach in the context of the current knowledge and evidence needs for environmental policy and planning
   - Identification of key knowledge gaps and recommendations to improve the agreed approach in the future
   - https://www.marinedataexchange.co.uk/details/3718/summary

Offshore Wind Evidence + Change Programme

FLOWERS – Floating Offshore Wind Environmental Response to Stressors

- Sept ‘22 – Mar ‘25

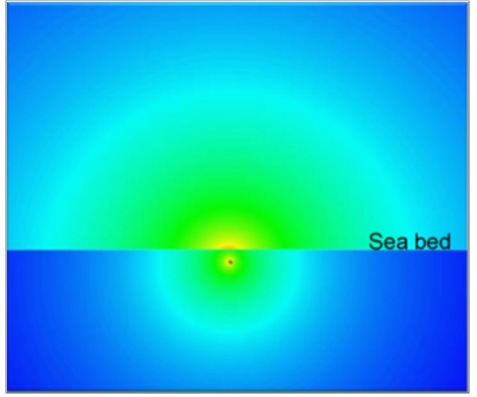
Thanks to colleagues:
Marieke Desender, Cefas
Elena Couce, Cefas
Zoë L Hutchison, Offshore Wind Directorate, Scottish Govt
Kirsty Wright, Marine Directorate, Scottish Govt

THE CROWN ESTATE

Cefas

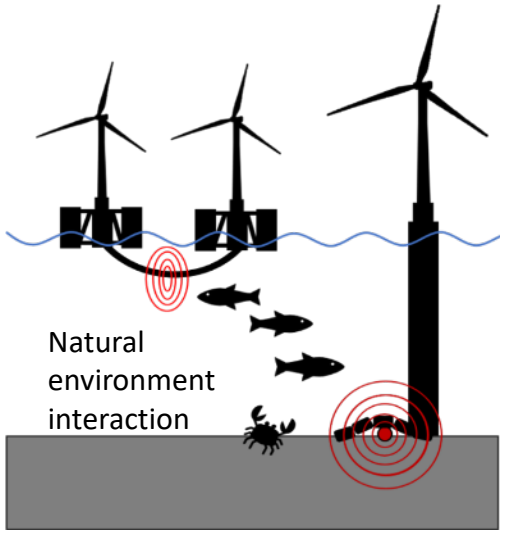
The Scottish Government
Riaghaltas na h-Alba

EMF Work Package



Aim

Method to assess encounter rate between species and EMF environment associated with dynamic cables.



Objectives

1) Define the EMF environment associated with subsea cables (both on the seabed and in the water column)

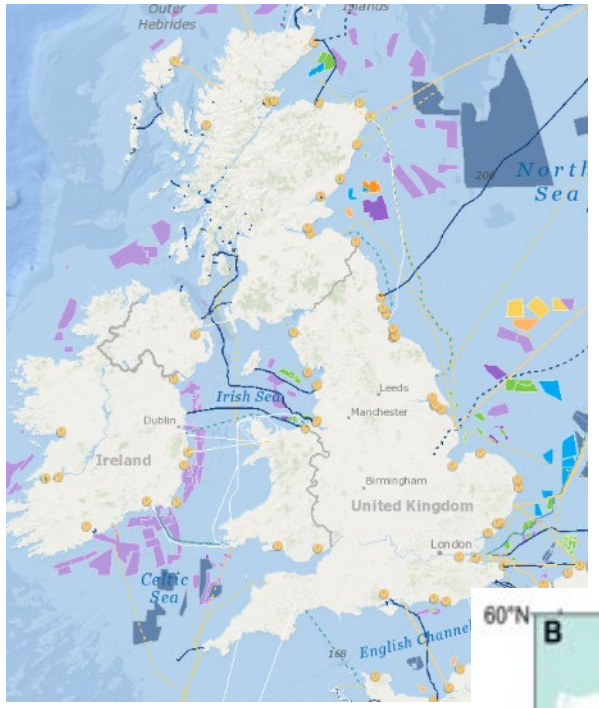
- build on simple EMF emission models (OWEC Discretionary project EMF Workshop – report)

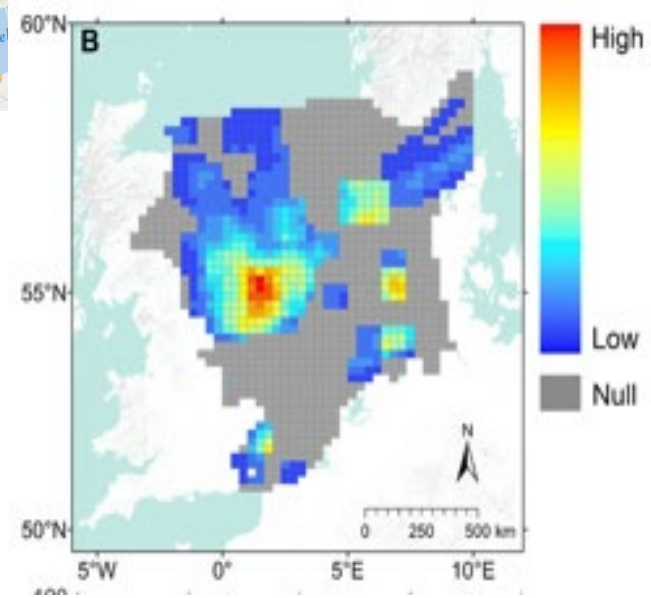
2) Verification of EMF model parameters through field data collection,

3) Estimation of the temporal and spatial overlap between selected species and cabling routes

4) Development of a version 1 method to estimate the likelihood of species encounter as a proxy to inform the potential risk of EMF to target species.

EMF Field work and analysis relating to species encounter rate





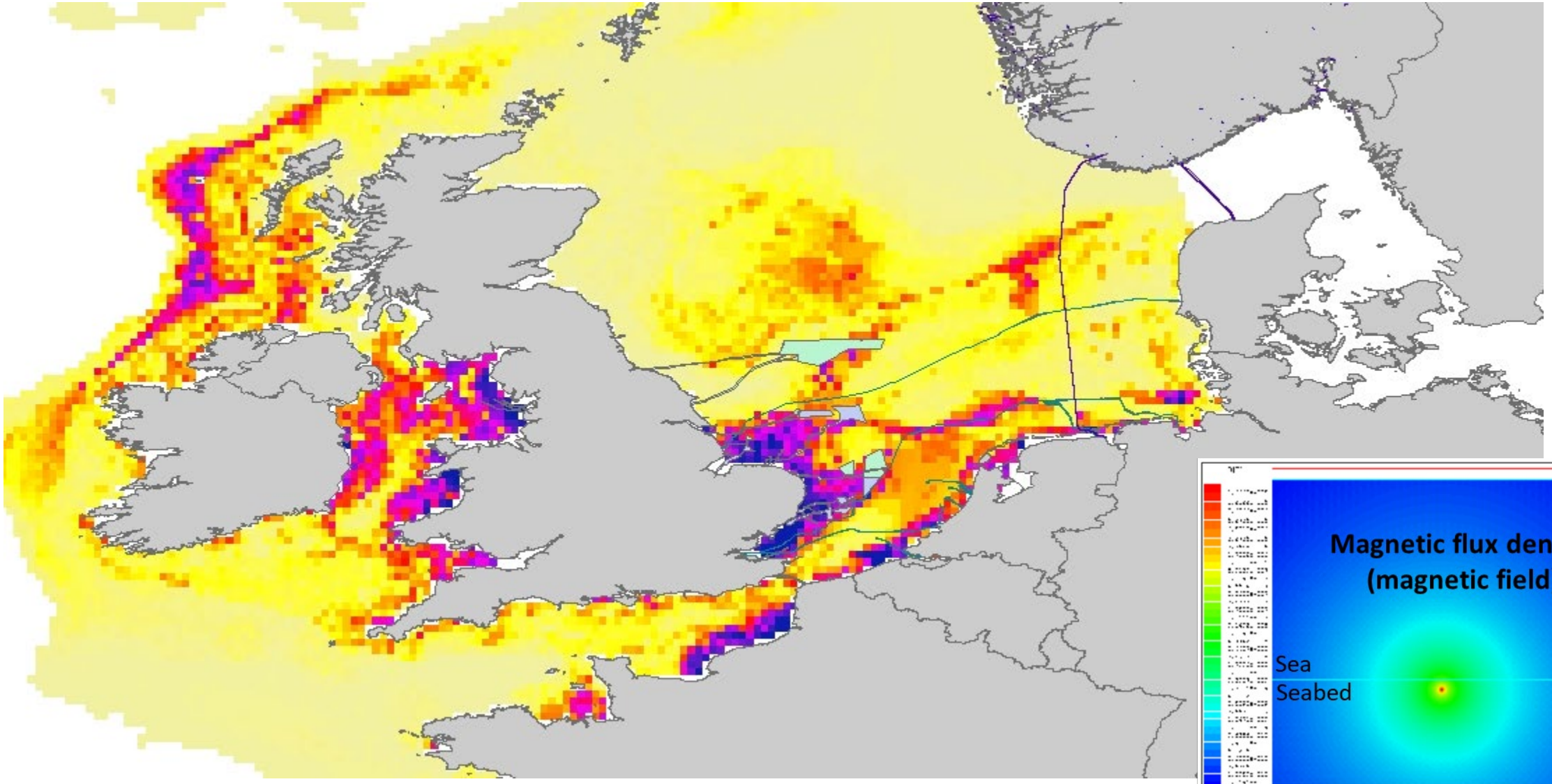
EMF Field work (2024)

- Planned series of surveys with magnetometers at operational cables (working with the transmission operators)
- Different geographic locations around the country (N,E,W,S)
  - AC and DC cables
- Post-field work use cable characteristics to model the EMF
  - Compare cable model with measurement

Species distribution (ongoing)

- Encounter rate between species and EMF emitted by dynamic cables
- Select species with data of distribution in areas we have measured and modelled the cables
  - Cefas species occurrence and distribution models (2D)
- Produce first stage method to assess of likelihood of encounter of species w.r.t. to cable EMF

(Draft example) Likelihood of overlap between Thornback Ray *(Raja clavata)* occurrence and selected subsea cable routes



Thank you for listening

Follow @CefasGovUK

Visit cefas.co.uk

Subscribe to our newsletters

Happy to talk and further details:
andrew.gill@cefas.gov.uk

Together we are working for
a sustainable blue future

Centre for Environment Fisheries & Aquaculture Science

Cefas