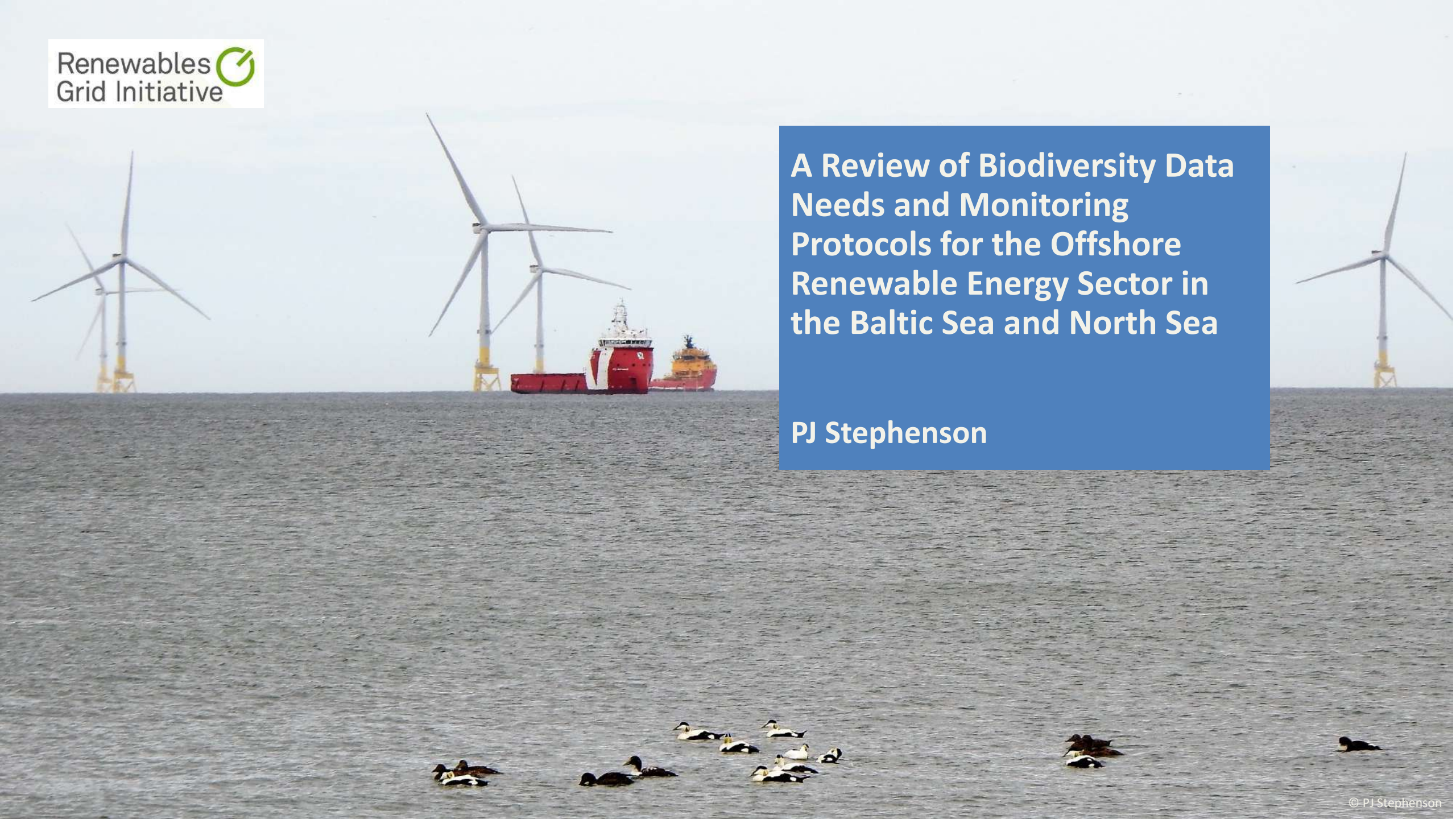
Renewables Grid Initiative

# A Review of Biodiversity Data Needs and Monitoring Protocols for the Offshore Renewable Energy Sector in the Baltic Sea and North Sea

PJ Stephenson



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IUCN

THE BIODIVERSITY CONSULTANCY

# Mitigating biodiversity impacts associated with solar and wind energy development

Guidelines for project developers

IUCN GLOBAL BUSINESS AND BIODIVERSITY PROGRAMME

BirdLife INTERNATIONAL Partnership for nature and people

FAUNA & FLORA INTERNATIONAL

The Nature Conservancy

WCS

# The challenge

In order to choose and apply relevant mitigation measures, it is essential:

- to identify and monitor potential environmental pressures and impacts
- to monitor the marine fauna and flora affected.

However, many actors are not always clear of the best monitoring methods to use.



# The aim of the review

**Purpose**: to conduct a review of biodiversity data needs in the offshore wind energy sector using the Baltic Sea and North Sea as case studies.

**Aim**: to identify monitoring priorities and assess data collection methods and protocols to make recommendations for a more standardised approach across the sector, in the focal seas and beyond

Focused on OWE infrastructure and the associated submarine power cables
Excluded onshore infrastructure (e.g. substations) and other onshore and offshore electricity generation sources.

# Process

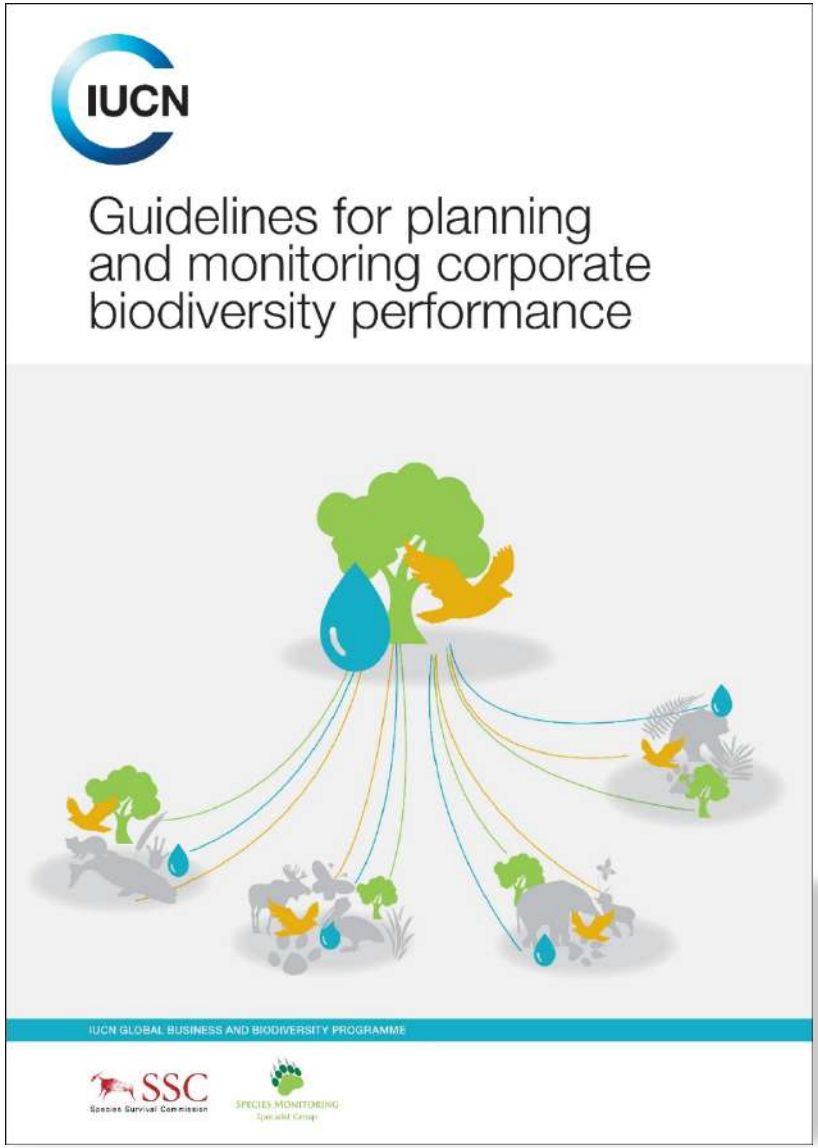
April-June 2021:

- Rapid narrative review of peer-reviewed and grey literature, as well as strategies and policies
- Informal interviews with thematic experts
- Participation in a BirdLife International webinar on monitoring seabirds

Assessed methods and priorities based on criteria such as:

- accuracy
- reliability
- feasibility of use and wider adoption
- appropriateness
- the value of the information generated for planning and decision-making.

# Approach




IUCN Guidelines:
monitoring should focus on indicators that are directly relevant to the goals and biodiversity priorities defined by assessing a company's environmental impacts.

# Approach

Therefore, I identified:

1. the main pressures and impacts placed on biodiversity by OWE and associated grids
2. the main species and habitats affected
3. the relevant indicators
4. the monitoring methods and protocols used and those most relevant across the sector.

The report is structured by taxa (marine birds & bats; marine mammals; fish & seabed communities)

Today I'll focus on key highlights and recommendations

# Main findings: pressures and impacts

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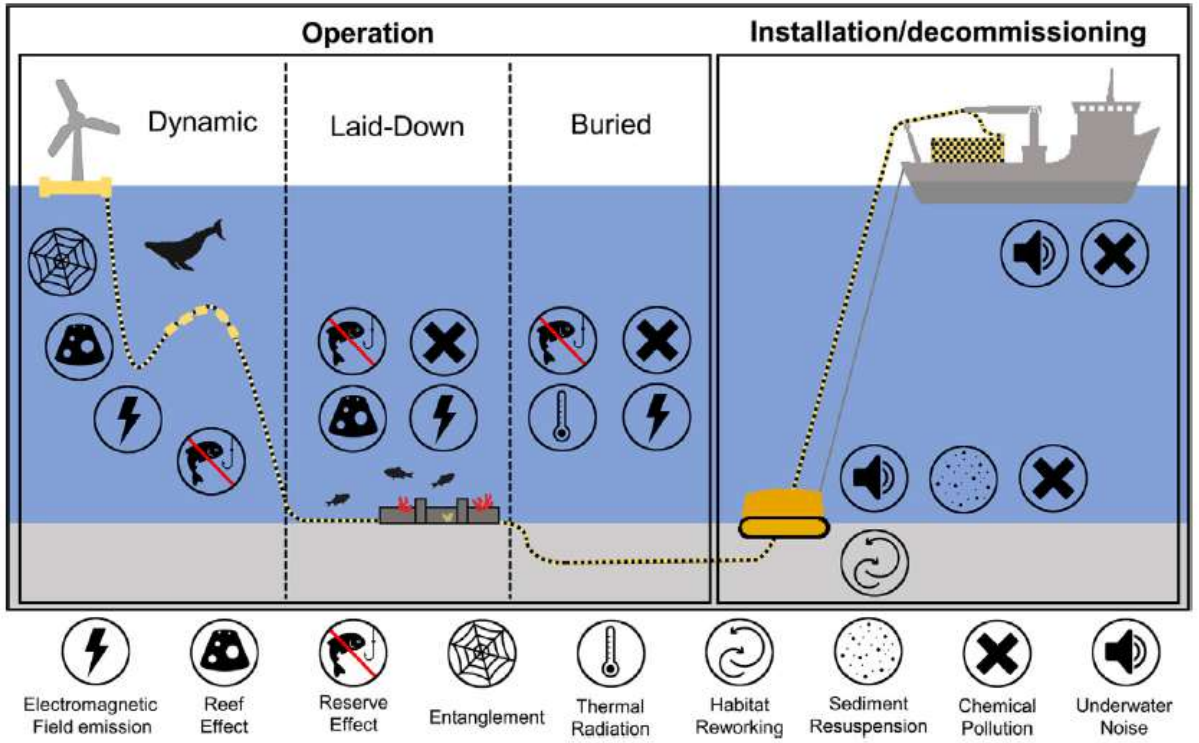
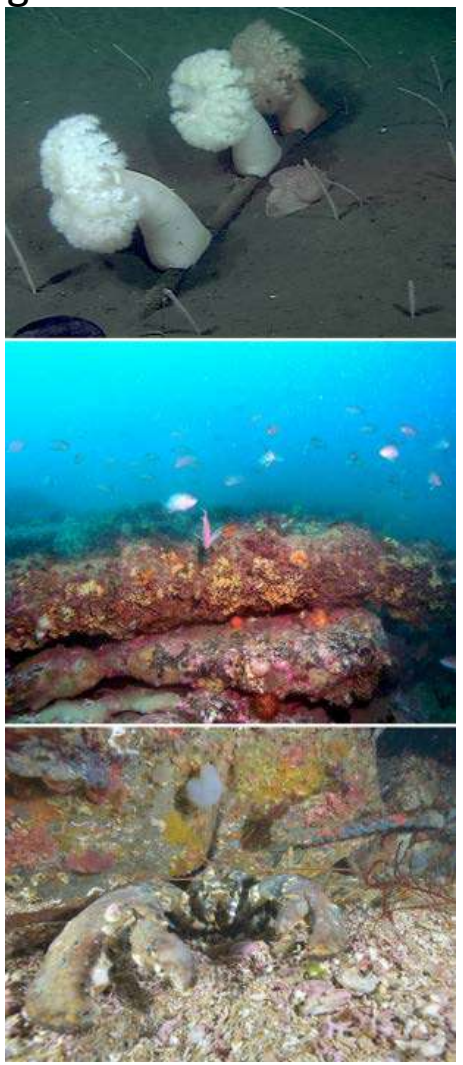
Pressures placed by OWE on biodiversity are commonly agreed
(e.g. habitat loss, collision mortality, displacement due to disturbance, barrier effects restricting movement)

Greater focus on turbines, but submarine power cables can also have impacts (including emissions of heat and electromagnetic fields)



Taormina et al. 2018. *Renewable and Sustainable Energy Reviews,* 96: 380-391.

# Main findings: pressures and impacts

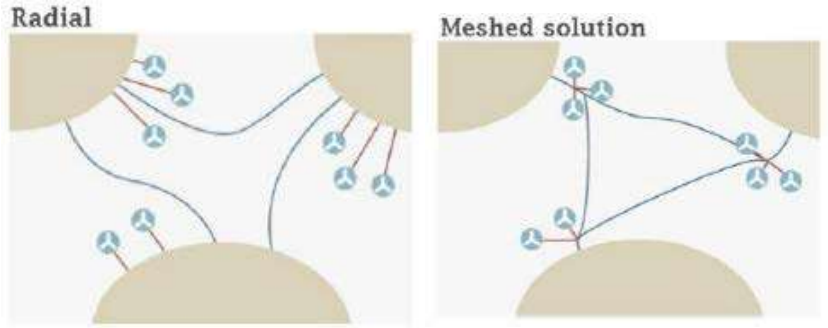
Positive impacts have also been noted
(e.g. artificial reef effects, reserve effect)

Generally OWE creates less pressure on biodiversity than other activities, (e.g. shipping, oil & gas exploitation, fishing)

Pressures vary:

- between taxa
  (e.g. mammals more impacted by noise, birds by collisions)
- between different stages of operation
  (e.g. habitat loss during construction; bird strikes during operation)
- between the design and type of technology used
  (e.g. bottom-fixed versus floating turbines; meshed versus radial grid connections).

Photos © PJ Stephenson




Cole et al 2014. Report to the EC.

# Main findings: taxa impacted

Wide diversity of marine and coastal species and habitats may be impacted.

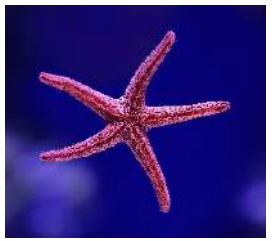
The biodiversity at most risk and in need of monitoring includes

- seals
- toothed cetaceans
- sea birds
- bats
- fish
- benthic invertebrates
- plants
- a variety of offshore and coastal habitat types.







Photos: Henrik Hansen; David Splode; PJ Stephenson; IUCN Red List

# Main findings: taxa and indicators

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Existing monitoring efforts (including research) focus primarily on marine mammals and marine birds, and more on turbines than submarine power cables

Indicators used are diverse (presence, abundance, diversity, distribution, behaviour, flight height, breeding success, etc.)
Indicators are not always clearly defined or identical, hampering comparisons and data aggregation. Or they are not measured offshore.

**Table 4B**. Marine bird Indicators adopted by Helsinki Commission and the OSPAR Commission

| Indicator | Regional indicator | Notes |
|---|---|---|
| **Marine bird abundance** | OSPAR B1 marine bird abundance | Currently not used for birds at sea |
| | HELCOM abundance of waterbirds in the breeding season | For coastal area only - not used for birds at sea |
| | HELCOM abundance of waterbirds in the wintering season | For coastal area only - not used for birds at sea |

# Main findings: methods and protocols

Numerous methods, from traditional observer-based surveys to high-tech sensors.

## Grab sampling

Tuit & Wait 2020. Environmental Forensics, 21:3-4.

HELCOM 2015. Recommendations and Guidelines for Benthic Habitat Monitoring…

# Main findings: methods and protocols

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## Ship-based and aerial surveys

*Seabird at sea survey, Wee Bankie (E Scotland), summer 2003 (CJ Camphuysen)*

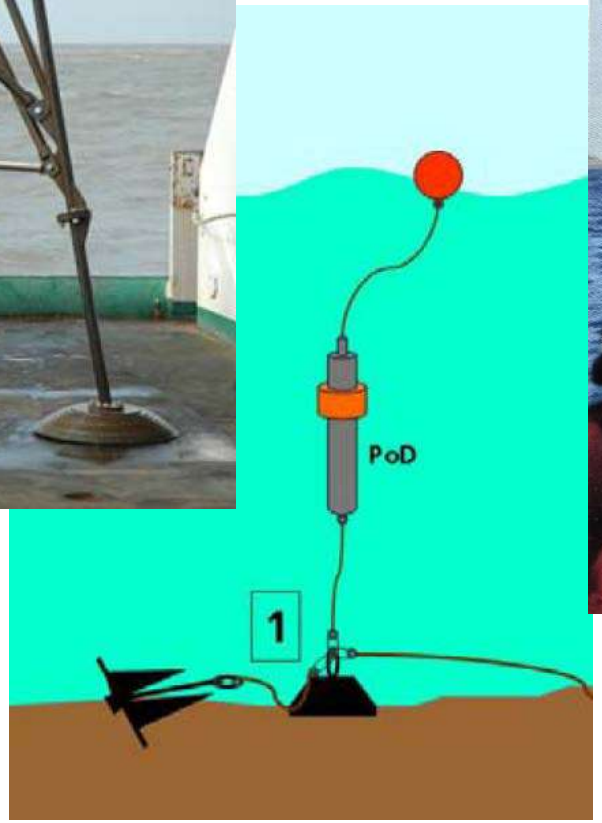
*Figure 1. Partenavia P-68 Observer aircraft. Note the plexiglass nose for pilot and front seat observer, and bubble windows on both sides of the aircraft in the rear passenger panels (see on open door to right).*

Camphuysen et al. 2004. Royal Netherlands Institute for Sea Research.

# Main findings: methods and protocols

## Passive acoustic monitoring

Image: J.Backers, MUMM





Perrow 2019. *Wildlife and Wind Farms, Conflicts and Solutions. Volume 4.* Pelagic, UK.

Haelters, J. (2009). *Royal Belgian Institute of Natural Sciences, Department MUMM, Brussels, Belgium*.

# Main findings: methods and protocols

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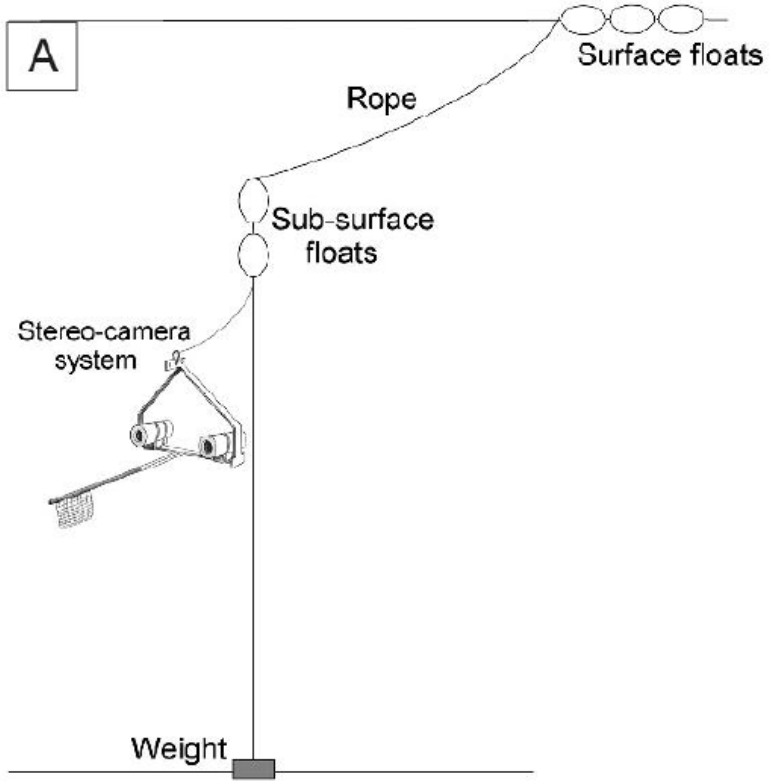
## Baited Remote Underwater Videos



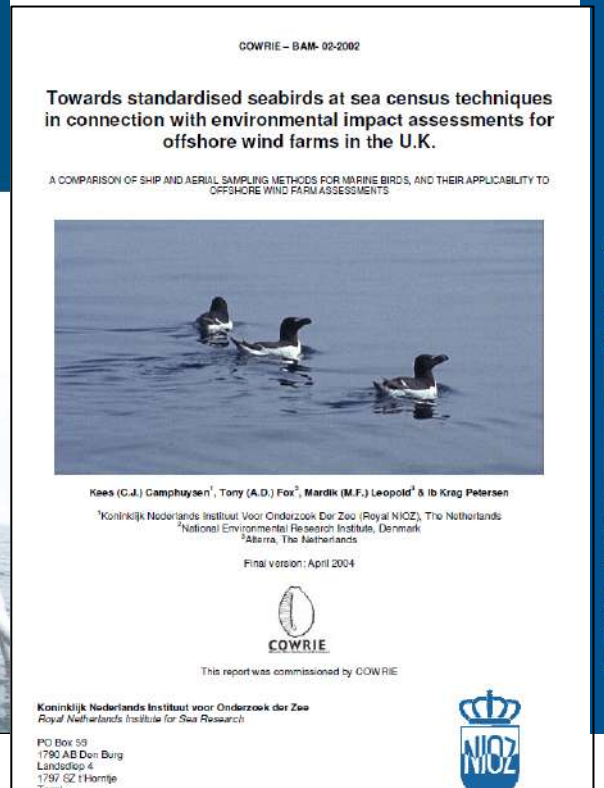

Photograph: Pelagic stereo-BRUV deployed in French Polynesia. Credits: Manu San Felix, National Geographic Society (2014).

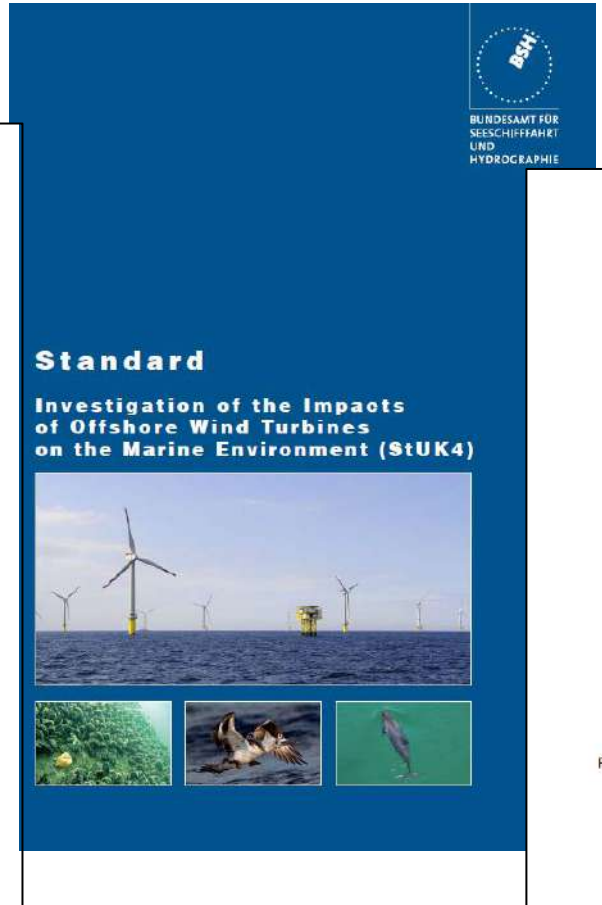
Source: Bouchet et al. 2018. Marine sampling field manual for pelagic BRUVS (Baited Remote Underwater Videos). In *Field Manuals for Marine Sampling to Monitor Australian Waters,* Przeslawski & Foster (Eds). National Environmental Science Programme. pp. 105-132.

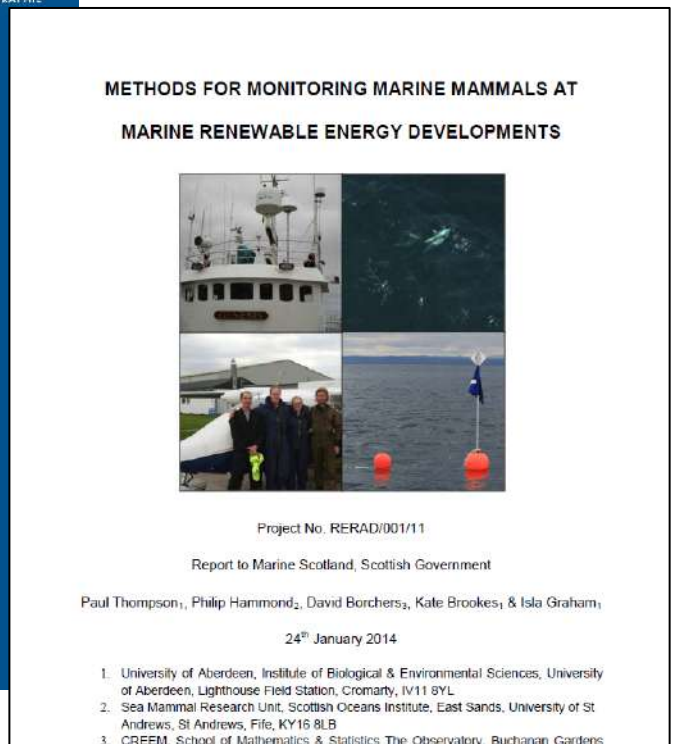
# Main findings: methods and protocols

Abundance of guidance, standards and protocols for applying methods but they are:

- inconsistent
- not always easy to find
- lack clear guidance on how to prioritise methods for a given monitoring need.

# Main findings: methods for mammals

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| Specifications | Guidance or protocols | | | |
|---|---|---|---|---|
| | Germany (BSH, 2013) | Ireland (DCCAE, 2018a,b), | Scotland (Macleod et al., 2011) | Other sources |
| Methods | Digital aerial surveys;<br>Vessel-based surveys (as a complement to bird surveys);<br>Static PAM (CPODs)<br>Recording underwater noise (using BSH protocols) | Visual aerial surveys;<br>Digital aerial surveys;<br>Vessel-based surveys;<br>Static PAM (CPODs)<br>Active PAM (towed)<br>Vantage point surveys<br>Stranding schemes (for mortality and injury)<br>Reporting of entanglements and collisions | Visual aerial surveys;<br>Digital aerial surveys (to test)<br>Vessel-based surveys;<br>Static PAM (CPODs)<br>Active PAM (towed)<br>Vantage point surveys<br>Telemetry<br>Photo-ID<br>Stranding schemes (for mortality and injury)<br>Reporting of entanglements and collisions | OSPAR for regional surveys:<br>Visual aerial surveys (using SCANs methods);<br>Vessel-based surveys using SCANs<br>Static PAM<br>Mark-recapture Photo-ID using Urian et al. (2015) methods; |

Photos © PJ Stephenson

# Main findings: methods and protocols

Threat monitoring focuses mostly on the impulsive noise generated by pile driving during construction, and bird collisions with turbines during operations.

Pollution such as oil spills and the noise from vessels, turbines and submarine power cables , as well as invasive alien species, are relatively neglected.

# Main findings: policy context

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Assessment of existing regional strategies and policies

OSPAR COMMISSION

*Protecting and conserving the North-East Atlantic and its resources*

## The North-East Atlantic Environment Strategy

Strategy of the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic 2010–2020

(OSPAR Agreement 2010-3)

### Preamble

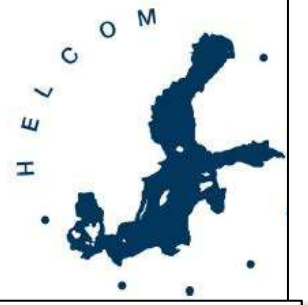
1. RECALLING the Convention for the Protection of the Marine Environment of the North-East Atlantic, 1992 ("OSPAR Convention"), and in particular Article 2.1(a) in which Contracting Parties agree to take all possible steps to prevent and eliminate pollution and to take the necessary measures to protect the maritime area against adverse effects of human activ ecosystems and, when practicable, restore n

2. BEARING IN MIND that the Ecosyster an impact on the marine environment needs order to achieve sustainable use of ecosyste

3. RECALLING Directive 2008/56/EC e Marine Environmental Policy (Marine Strate Commission will facilitate the coordinated a Directive, mindful of Contracting Parties' int objectives of the OSPAR Commission and European Union (EU) legislation, hence ensu

4. RECOGNISING that the Quality Stat number of the objectives and targets of the 2

## HELCOM Baltic Sea Action Plan




28.8.2014 EN Official Journal of the European Union L 257/135

DIRECTIVES

**DIRECTIVE 2014/89/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL**

**of 23 July 2014**

**establishing a framework for maritime spatial planning**

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

EUROPEAN COMMISSION

Brussels, 20.5.2020
COM(2020) 380 final

**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS**

**EU Biodiversity Strategy for 2030**

**Bringing nature back into our lives**

# Main findings: policy context

Regional strategies and policies suggest biodiversity monitoring around OWE and grids should factor in and prioritise:

- species and habitats listed as important by EU directives;
- regional species priorities identified in the Baltic Sea and North Sea action plans;
- actions to minimise pressures, especially noise, pollution and invasive alien species;
- the sharing of data
  - e.g. The EU Strategy to Harness Potential of Offshore Renewable 2020) promotes systematic analyses and data exchange through the Copernicus Marine Environment Monitoring Service and the European Marine Observation and Data Network (EMODnet).

EUROPEAN COMMISSION

Brussels, 19.11.2020
COM(2020) 741 final

**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS**

**An EU Strategy to harness the potential of offshore renewable energy for a climate neutral future**

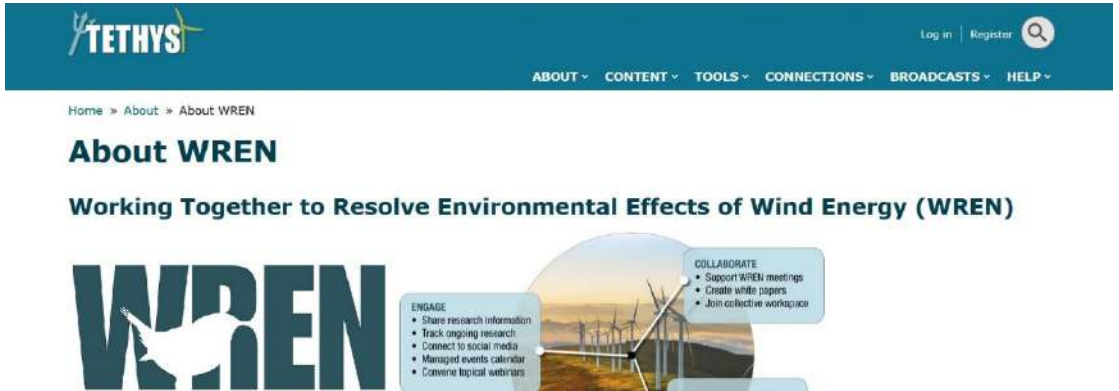
# Main findings: data use and sharing

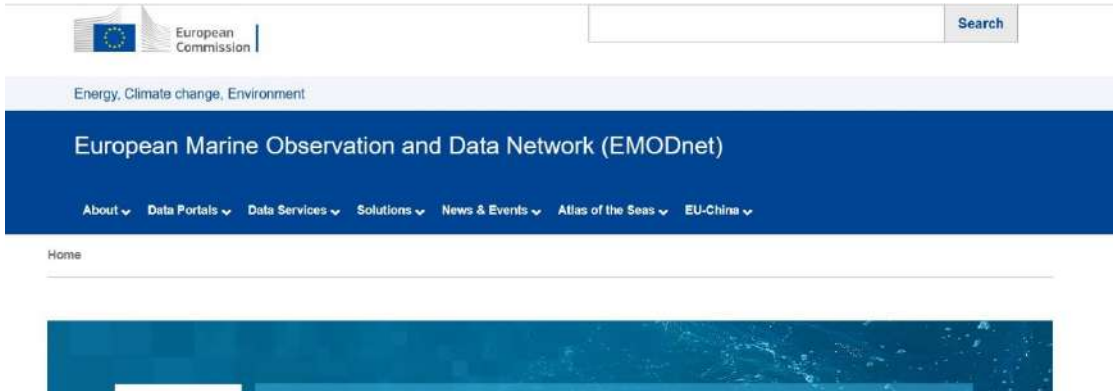
Many data collected around OWE sites and grids (e.g. for EIAs) are kept in reports, many of which are not shared or are difficult to access.

Data sharing is not systematic for marine biodiversity in general and for the OWE sector in particular.

Need to build on existing efforts such as:

- knowledge-sharing platforms (like Tethys WREN Knowledge Base and the Crown Estate's Marine Data Exchange)
- initiatives to standardise data collection formats for Europe through EurOBIS and EMODnet and link to global data sets such as OBIS and GBIF.



# Main findings: two challenges

Tuit & Wait 2020. Environmental Forensics, 21:3-4.

Kowarski et al 2020. *The Journal of the Acoustical Society of America*, 148: 1215-1230.

## Limited understanding of some impacts

- Inadequate information (still!) on the impacts of OWE on certain taxa and habitats (especially bats, marine turtles and benthic invertebrates) and the extent and scale of some impacts (e.g., how electromagnetic fields affect fish).

## Some protocols are dated

- Many monitoring methods and protocols that are best developed and most widely applied pre-date recent technological advances in remote sensing
- BUT many of the newer methods are still in their infancy and protocols have many yet to be developed or widely tested.

# Recommendations

Need a more integrated, multi-species, multi-method approach to biodiversity monitoring in the sector

- that monitors the same indicators
- that allows flexibility in the choice of methods but encourages the use of those methods in a more standardised way.

This will facilitate comparisons between sites, data aggregation and sharing across regions, the study of cumulative impacts, and more informed results-based decision-making.

# Recommendation 1: Adopt common core indicators

Use of common core indicators across sites will facilitate comparisons and data aggregation (as used for monitoring the Convention on Biological Diversity and the Sustainable Development Goals)

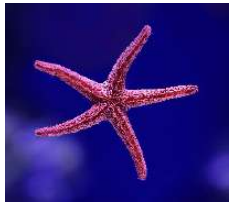
Key state indicators include area of occurrence (i.e., distribution; habitat cover) and species diversity and (relative) abundance for

- seals and toothed cetaceans
- sea birds
- bats
- fish
- benthic invertebrates
- plants








Threats to target species:

- bird and bat collisions with turbines
- anthropogenic noise levels
- invasive alien species.

Photos: Henrik Hansen; David Splode; PJ Stephenson; IUCN Red List

# Recommendation 2: Use harmonised monitoring methods & standardised protocols in integrated systems.

If a small selection of methods can be applied consistently to measure common indicators across sites, this set of “minimum requirements” will help facilitate protocol harmonisation and data aggregation.

Photos © PJ Stephenson

# Recommendation 2: Use harmonised monitoring methods

Favoured methods are:

- digital aerial surveys (birds, marine mammals)
- static passive acoustic monitoring (PAM) (bats, marine mammals; noise)
- ★ grab sampling (habitats, benthic invertebrates)
- video (drop-down/ROV/AUV) (habitats, benthic species, invasive alien species)
- ★ fyke-net sampling (fish)

Complemented where necessary or when more feasible by:

- vessel-based surveys (including for habitat use)
- towed PAM (marine mammals)
- telemetry to study habitat use (birds, marine mammals, large fish)
- scuba diving observation surveys (all taxa)
- ★ baited remote underwater video (fish)
- ★ acoustic mapping (seabed habitats)

# Recommendation 2: Use harmonised monitoring methods

Need to explore options to integrate surveys

- As happens for marine mammals and birds in  European Seabirds at Sea surveys

© PJ Stephenson

JNCC

JNCC Report No. 663

Volunteer Seabirds At Sea Survey Methods

Lewis, M. & Dunn, T.E.

August 2020



ISSN 0963-8091

# Recommendation 3: Adopt a set of key monitoring principles and approaches

- Choose methods based on indicators and monitoring questions and follow established, standardised protocols
- Define the appropriate scope and appropriate spatial and temporal scale
- Engage key stakeholders in the design and implementation of monitoring plans
- Design fit-for-purpose monitoring programmes
- Collate data in standard formats to facilitate data sharing.

# Recommendation 3: Adopt a set of key monitoring principles and approaches

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***Define the appropriate scope and spatial and temporal scale***

Most protocols suggest monitoring biodiversity through planning (scoping, pre- and post- consent), construction, operation and decommissioning
(with a few exceptions e.g. noise levels or bird collisions not during planning)

Frequency varies but it is better to have powerful, well designed surveys than monthly surveys.

Spatial scope tends to include a suitable buffer zone, but guidance is needed for a more standard interpretation of buffer zone.

Cumulative impact assessment frameworks need to be developed further to show how multiple OWFs can impact species and add to other anthropogenic pressures.

# Recommendation 3: Adopt a set of key monitoring principles and approaches

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***Design fit-for-purpose monitoring programmes***

Follow best practices for ensuring robust sampling design and statistical power by using, for example,

- Appropriate and consistent sampling methods (e.g. distance sampling and DISTANCE software)
- Power analyses to determine how much data is sufficient
- Corrections for observer bias and availability bias by verifying detection probability
- Counterfactuals to demonstrate or infer cause and effect
  - e.g. Before-after control-impact (BACI) design or a Before-After-Gradient (BAG design)

# Recommendation 3: Adopt a set of key monitoring principles and approaches

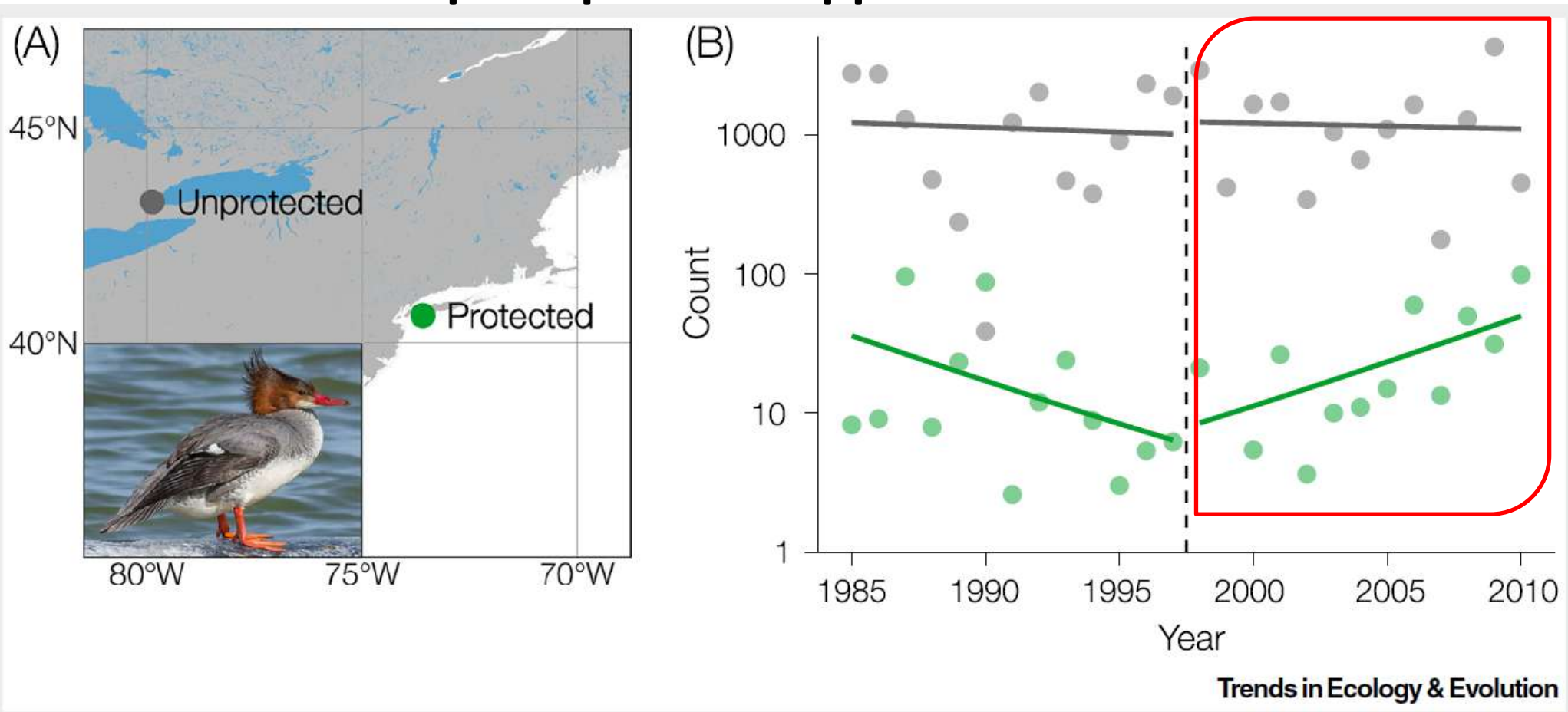


Figure I. Common Merganser (*Mergus merganser*) Case Study Site Locations and Count Data (A) Map Showing Protected (light green) and unprotected (grey) sites where merganser (*Mergus merganser*) have been monitored in the North East USA (Photo: Frank Schulenburg/Wikimedia Commons/CC BY-SA 3.0) (B) Merganser counts, with lines showing modelled trend; vertical broken line shows the year of protected area designation.

Wauchope et al 2021 *Trends in Ecology & Evolution,* 36: 193-205.

# Recommendation 4: Conduct research to improve monitoring focus and effectiveness.

Priority research topics include:

- Enhancing our knowledge of impacts, such as
  - adverse effects on bats and marine turtles
  - impacts of electromagnetic fields and pollution such as oil spills from vessels
- The potential for new tools to enhance monitoring, especially
  - environmental DNA for assessing species presence/diversity
  - baited remote underwater video for fish and crustaceans
  - light traps for benthic invertebrates
  - acoustic soundscapes for fish and crustaceans
  - multi-sensor arrays for bird and bat collision risk.

# Recommendation 5: Enhance regional and sectoral collaboration

There is a huge body of work and research to build on, but enhancing monitoring will require a greater level of sectoral and regional collaboration and data sharing.

Key stakeholders need to be engaged in defining the way forward, including companies, governments, regional bodies, academia, civil society

Existing sectoral/regional initiatives could help harmonise monitoring, such as:

- Offshore Coalition for Energy and Nature
- Joint OSPAR/HELCOM/ICES Working Group on Seabirds (JWGBIRD)
- ICES Working Group on Marine Mammal Ecology (WGMME).

Lessons could be learned from other Europe-wide monitoring schemes (e.g. contaminants, radioactivity, sea temperature) and from outside Europe.

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