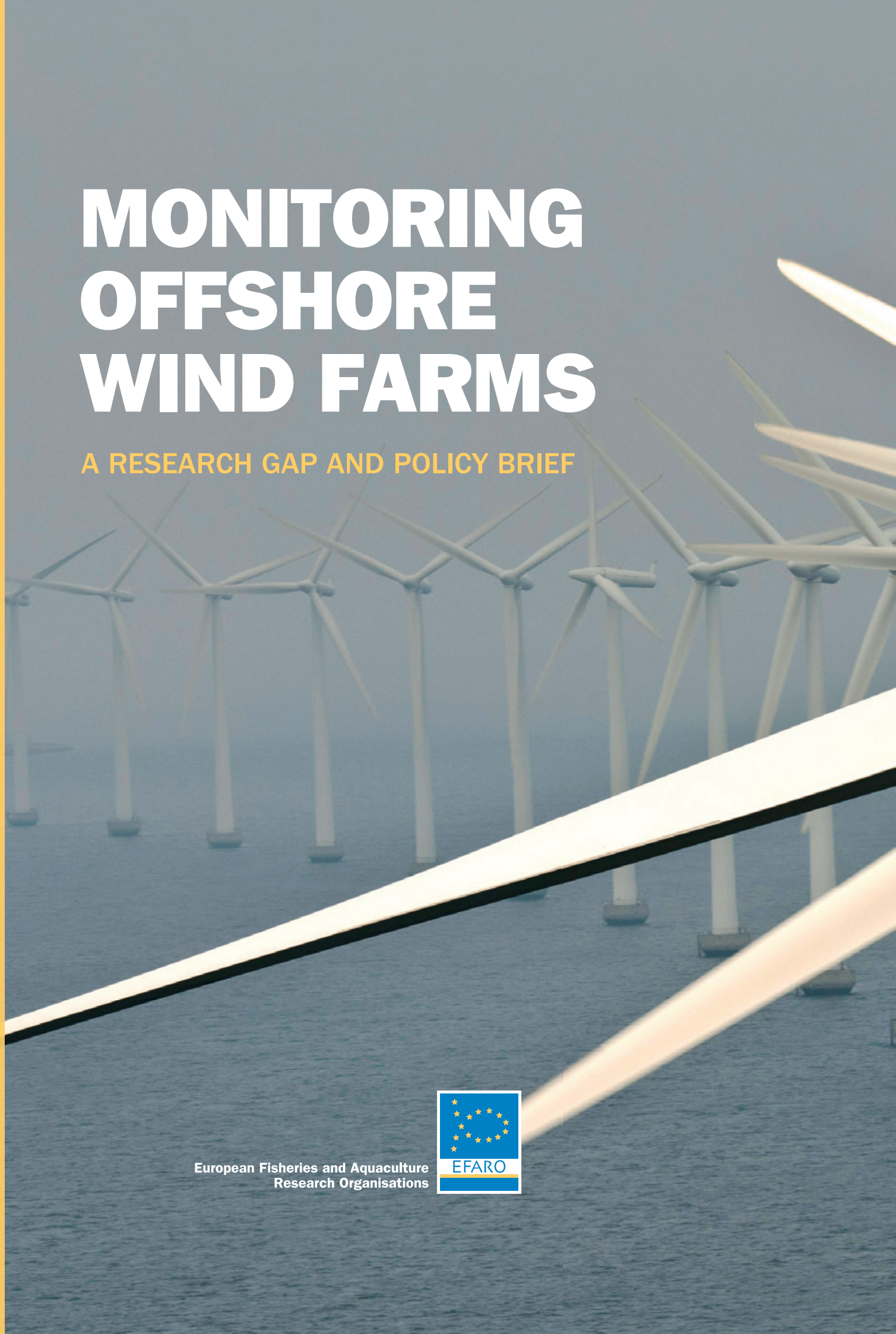
MONITORING OFFSHORE WIND FARMS

A RESEARCH GAP AND POLICY BRIEF



European Fisheries and Aquaculture Research Organisations

EFARO

Introduction

The space for fisheries and aquaculture in European waters has been severely reduced over recent decades (e.g. due to implementation of Marine Protected areas, off-shore oil and gas production platforms and pipelines and shipping). In particular, the scale of development of Offshore Wind Farms (OWFs) has and will coincide with existing fishing grounds and potentially have an impact on fisheries resources and the marine ecosystem. However, this impact on the ecosystem is not yet fully understood, since monitoring is often focused on certain species groups or on species of conservation interest as such missing out on ecosystem-wide impacts.

EFARO established a dedicated Expert Working Group in 2022 to address this issue, resulting in this discussion paper. The analysis is based on literature review, expert knowledge and experiences of the participating experts in their respective countries. In addition, a webinar was organised by EFARO in April 2023 during which the findings and the way forward were discussed. The webinar was attended by some 75 participants ranging from sector representatives, Regional Advisory Councils, National and EU managers and policy makers, NGOs and representatives from research institutes.

EFARO would like to express its gratitude to the members of the Expert Working Group, Andrew Gill of CEFAS, Annelies De Backer of ILVO, Daniel Oesterwind of Thünen Institute, Guðni Guðbergsson of MFRI, Josien Steenbergen of WMR, and Luca Bolognini of CNR for their effort and input. And EFARO's secretariat, Sarah Smith and Luc van Hoof, for organising the process and editing the output of the group.

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The issue

The development of OWFs is at different stages across Europe, with for example already quite a long history at the North Sea for example in Denmark, and early beginnings in the Mediterranean for example in Italy. But the outlook is one of significant increase: the installed offshore wind capacity in the EU was 14.6 GW in 2021 and is set to increase by at least 25 times by 2030, using the vast potential of the 5 EU sea basins[1].

There are already quite some potential environmental impacts of OWFs known. For example, the noise produced during the construction phase has a negative impact on marine mammals. Depending on the wind park design, the pylons and surrounding scour protection layer provide a hard substrate, beneficial for, for example crabs and lobsters. And several studies indicate that turbines can increase fish populations by acting as artificial reefs. Yet the rotors constitute a danger to birds and bats and the pylons can have an impact on the stratification of the water column and ocean currents.

Although we know that some of these effects may occur locally, the actual impact of wind farms on population level as well as the wider marine ecosystem, is as yet not fully understood. Present monitoring and impact studies are implemented only at the scale of single structures/systems, preventing an overall assessment of the cumulative impacts of all activities (e.g. OWFs, other production platforms, mariculture) at a regional/sea basin scale. In addition, it is noted that the monitoring of OWFs that currently is taking place is not harmonised across Europe. This renders findings between different places to be incomparable and makes it hard to perform a holistic analysis. Therefore, it needs to be determined which monitoring methods should and could take place to assess these wider ecosystem effects.

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Monitoring practices

If we look at the current state of OWF monitoring in Europe, we note that the construction and operational phase of OWFs is monitored through country specific environmental monitoring programmes. Discussions on the monitoring of the decommissioning phase is still in its infancy. In Table 1, a summary is presented of monitoring practices in Belgium, Italy, England and Wales, Germany, the Netherlands and Scotland; the countries represented by the experts in the group.

Table 1: Summary of monitoring practices in Belgium, Italy, England and Wales, Germany, the Netherlands and Scotland.

Country	Belgium	Italy	England/Wales	Germany (North Sea & Baltic	The Netherlands	Scotland
Years	Since 2010	Since 2022	Since 2000	Since 2010	Since 2007	Since 2006
Area (km2)	238	0,131	2405 (UK)			2822
N turbines	399	10	2600+	1501	462	317
GW	2,26	0,03	13,8 (UK)	8,1	2,4	1,9
Years	2020-2026	2019-2049	To 2030	To 2030 (to 2035)	2023-2031	To 2030 (to 2035)
Area (km2)	285			3880		9563
N turbines (fixed; floating)			??			
GW	3,5		Upto 50GW (UK)	30 (40)		30
Coordination	Government	Private	Private (guidance from Govt)	Private (guidance from BSH)	Government (since 2016)	Private (guidance from Govt)
Funding	All OWF owners	OWF owners	Owners/asset operators			OWF owners
Monitoring length	2005 onwards	2022-2025	Pre (1-2 years); post (1-5 years)			Ongoing throughout - preconstruction, construction
Open source data	Yes	No	No (available after 5+ years)	No	Yes	No
Birds	Yes		Yes	Yes	Yes	Yes
Bats				Yes	Yes	
Marine mammals	Yes	Yes	Yes	Yes	Yes	Yes
Fish	Yes		Yes	Yes	Yes	Yes
Fisheries			Yes			Yes
Benthos	Yes		Yes	Yes	Yes	Yes
Physical	Yes		Yes		Yes	Yes
Socio-economic	Yes				Yes	Yes
Baseline	Yes		Yes	Yes		Yes
Construction	Yes		Yes	Yes	Yes	Yes
Operational	No info		Yes	Yes	Yes	Yes
Decommissioning	No info	No info	Yes	Yes		Yes

In table 2 the items on which the monitoring programmes of the different countries were analysed is presented:

Table 2: Elements of OWF monitoring	
REALISED	
Years	Since when do you have OWF in your national waters?
Area	Area occupied by existing OWF
N turbines	Total number of currently existing turbines
GW	Total capacity of current OWF
PLANNED	
Years	Time horizon for the expected future OWF
Area	Area reserved for future planned OWF (including fixed and floating devices)
N turbines	Total number of planned turbines
GW	Total capacity of planned OWF
MONITORING	
Coordination	Which party is responsible for organising and coordinating the monitoring activities: government or the private OWF companies
Funding	Which party funds the monitoring activities?
Monitoring length	Period over which the OWF is being monitored; if possible make a distinction for which fase of the OWF (construction, operation, decommissioning) the monitoring is implemented
Open source data	Are the data collected under the monitoring programme being made publicly available and when?
TOPIC	
Birds	Is bird monitoring part of the monitoring programme?
Bats	Is bat monitoring part of the monitoring programme?
Marine mammals	Is mammal monitoring (seals, dolphins, whales) part of the monitoring programme?
Fish	Is fish species monitoring (number of species, numbers per species, weight, length) part of the monitoring programme?
Fisheries	Are fisheries activities inside the OWF being monitored?
Benthos	Is benthos monitoring (number of species, weight) part of the monitoring programme?
Physical	Is the impact of the OWF on physical aspects, such as oceanographic and geophysical features being monitored?
Socio-economic	Is the impact of the OWF on other activities (e.g. fisheries, aquaculture) being monitored?
Baseline	Has there been a base line survey, T0 monitoring?
Construction	Is the monitoring programme implemented during the construction phase?
Operational	Is the monitoring programme implemented during the operations phase?
Decommissioning	Is the monitoring programme implemented during the decommissioning phase?

Based on this limited inventory, we can already observe that the situation varies widely between countries. In some countries, the government is responsible for carrying out the monitoring programme while in most countries the private OWF operators are in charge of monitoring. Related to this is that in most cases data collected by the private industry are not made publicly available and are thus scattered between different wind farm owners, where of course data collected through government programmes are made publicly available. In addition, government funded programmes tend to collect data and monitor developments over a longer time period, whereas data collection by the OWF operators is limited to the preconstruction, construction and operational phase; monitoring of the decommissioning phase is as yet not a common feature. The number of elements that are included in the monitoring programmes also varies between the countries.

Lessons learned

If we consider the different monitoring practices currently in operation, there are a number of aspects that need to be considered. These aspects focus on environmental pressures and on the environmental receptors; the parts of the ecosystem that are affected. As the impacts of OWFs have both a spatial and a temporal component (they may occur elsewhere and at a different period in time in the ecosystem), monitoring has to be considered at the ecosystem/sea basin level. And, in order to indeed arrive at a meaningful level of analysis at the sea basin/ecosystem level, there are some data considerations to take into account.

As for the environmental receptors, the current monitoring practices focus primarily on important species from a conservation perspective, driven by environmental policies and directives such as the Birds Directive and Natura 2000. An analysis basically aligned with the Environmental Impact Assessment required for offshore activities. This excludes the monitoring of other species, and components to truly understand a wider ecosystem effect and is not consistent with an ecosystem-based approach.

Noting the spatial and temporal aspects of the impacts of OWFs and cumulative impacts on the ecosystem, especially noting the EU desire to increase OWFs 25-fold in the coming years, this rather short term and spatially limited analysis should be extended to the ecosystem level. This implies that, in order to accommodate the temporal aspect, long term data series are required. And for the spatial aspect it implies that monitoring should take place in a transboundary fashion, covering the entirety of the sea basin.

These aspects all have a bearing on the data requirements. Currently the period over which data are required to be collected, the type of data collected and the public availability of data differs widely between countries. In order to arrive at a meaningful impact assessment of the collective of all OWFs activities (and other activities) in a sea basin, it is necessary that data are collected over a substantial period of time. Hence, the monitoring not to be left to the discretion of the individual OWF operator, but related to other monitoring efforts for example as part of the EU Marine Strategy Framework Directive and Good Environmental Status indicator monitoring. Hence, OWF monitoring as a combination of standard monitoring and targeted monitoring focusing on filling specific OWF knowledge gaps.

In addition, data should be publicly available and accessible and quality of data collection and assessment has to be ensured by providing minimum guidance at the very least. Objectives of data collection, sampling protocols and procedures need to be standardised and be coordinated between countries, for example at the Regional Coordination Groups ii of the EU data collection programme. Moreover, it could be considered to introduce more innovative techniques, e.g. eDNA analysis, to arrive at a more unified monitoring approach.

Furthermore, it is important to take into account the life cycle of a species, since impacts and effects might differ between life stages and this should be done transboundary at the ecosystem space of that specific species. In addition, noting prey and predator relations, all species involved should be taken into account in a food web approach.

Research Gaps

Noting the practices of monitoring OWF impact by EU Member States and the lessons we can draw from these, there are some high level strategic research questions to be considered. These are fundamental to filling the knowledge gaps at the ecosystem level to arrive at a valid OWF impact assessment including the physical and biological changes at adequate spatial and temporal scales and including the cumulative aspects of these changes at the ecosystem level. There will be changes to physical habitats that may lead to both direct and indirect effects on ecosystem processes, structure and functions. In addition, there will be changes and responses relating to species and their habitat that will be direct or indirect. These could lead to different levels of effects on populations and wider ecosystem effects.

These lead to the following considerations concerning current gaps in knowledge:

Physical and species changes

- What are the effects (at the site and downstream) of OWF physical presence on the environment?
- What are the direct and indirect consequences of relevance to the ecosystem? (e.g. mixing and stratification; sediment dynamics)
- How do we define the level of impact that is of significance to the ecosystem?
- What is the (cumulative) effect of OWFs at the population level of target species? (e.g. fish species of commercial importance or of ecological importance, such as predators)?
- What is/are the key life stage or stages where changes to the species will most likely manifest themselves and be of relevance to the changes at the population level of the species?
- Are there artificial reef effects that lead to production of species within the OWF and being large enough to cause movement into adjacent/downstream areas?

Ecosystem-level

- What are the ecosystem process and functions (e.g. habitat connectivity) that are affected?
- How is primary production affected within the ecosystem that OWFs occupy?
- What is the effect on secondary and higher trophic level production and linked effects on the food web?
- What are the time and space scales on which these effects occur? (this requires transboundary, regional or sea-basin scale considerations)
- Are there downstream effects to the ecosystem of the different species making up the species community that develops within the OWFs (e.g. increased production and dispersal of early life stages)?
- Does the scale of OWFs affect the ecological carrying capacity of defined regions (e.g. Southern North Sea; Baltic sea basin; West Mediterranean)
- What are the specific impacts on the ecosystem that occur in the after-life/decommissioning phase of the OWF?

Data

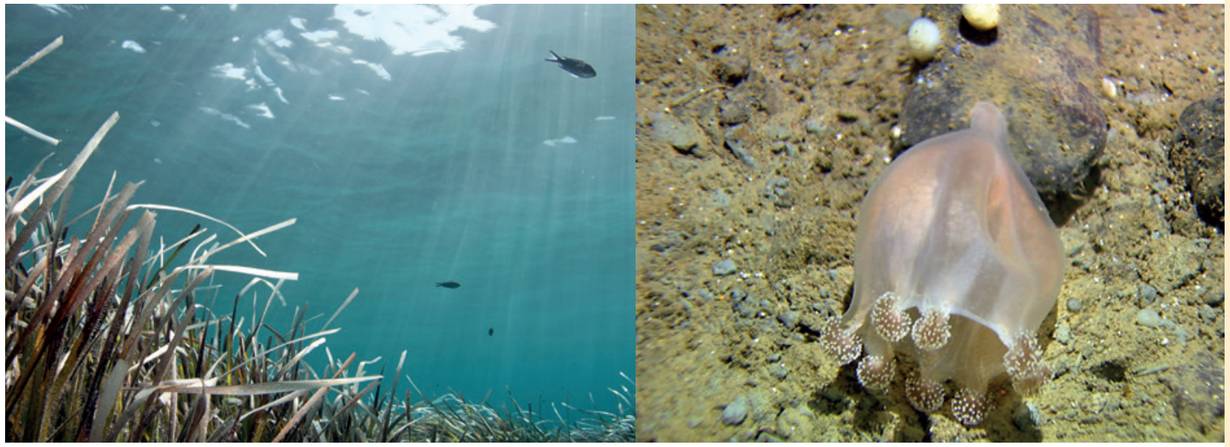
- What data/knowledge do we need to understand these ecosystem scale impacts (see the questions raised above)?
- How do we obtain the data required to answer these questions across jurisdictions?
- Which data gaps need to be filled and what are standard methods/approaches to collect the right data at the right spatial and temporal scale over the ecosystem (i.e. across a region, transboundary).

Policy Implications

Noting that Europe is seeking to increase its renewable energy production at sea through OWFs significantly, and the fact that currently the environmental effects of OWFs are not fully known and understood, there is a clear need to increase our knowledge, implement thorough impact assessments and employ proper monitoring of these ecosystem effects. Currently, EU Member States apply their own individual monitoring strategies, resulting in a myriad of monitoring programmes differing in length, spatial coverage and scope.

As there are significant spatial, temporal and cumulative aspects to the environmental impact of OWFs, there is a clear need to not only implement OWF monitoring in situ but to implement this at the sea basin level. In order to enable this level of monitoring, a transboundary coordination and alignment of monitoring requirements is necessary. A significant facet in this is that across Member States the same data and aspects are being collected and assessed in a concerted way.

In order to arrive at such a converging data collection programme the scientific fora of for example ICES and GFCM can be petitioned to develop the required monitoring protocols. Yet, it is up to the Member States to align their monitoring efforts. The EU Regional Coordinating Groups can and should play a significant role in this. In addition, this monitoring of Offshore Wind Farms can be aligned and be embedded in current monitoring programmes such as for the MSFD.



1 https://energy.ec.europa.eu/topics/renewable-energy/offshore-renewable-energy_en
2 https://datacollection.jrc.ec.europa.eu/regional-coordination

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