Deutsche Umwelthilfe

The North Sea Foundation

SEAS AT RISK

WWF

Making space for nature

Recommendations for ecosystem-based multi-use

North Sea Alliance

Contents

Executive summary

The North Sea is one of the busiest seas in the world and decades of extractive human activities have led to the severe deterioration of its ecosystems. In parallel, the large-scale expansion of offshore wind, needed to mitigate climate change and its impacts, requires appropriate measures to avoid and minimise environmental impacts, ensure alignment with biodiversity objectives and support co-existence with other sustainable uses of the sea.

In this context, multi-use - the combination of different human activities at sea with different degrees of integration - is receiving increasing interest as a possible solution to address the spatial squeeze at sea. At the same time, multi-use may contribute to reducing the cumulative impacts of human activities by exploring synergies and reducing the amount of infrastructure and disturbance on marine ecosystems. However, this potential largely depends on the implementation of multi-use strategies and scientific evidence on its effectiveness is limited. In addition, barriers such as lack of knowledge on the environmental and social impact of multi-use, regulatory uncertainty and lack of specific insurance coverage are among the main obstacles for multi-use implementation.

The revision of the EU Maritime Spatial Planning (MSP) Directive and the plan to develop a definition of multi-use by the Greater North Sea Basin Initiative (GNSBI) – an intergovernmental framework on cross-border cooperation in MSP in the North Sea – provide unique opportunities to shape multi-use policies. Both initiatives must ensure that multi-use contributes to reducing the cumulative impacts of human activities on the marine environment and supports low-impact sectors.

This paper focuses on ecosystem-based multi-use with offshore wind, aquaculture and fisheries and puts forward recommendations and principles to ensure that it is only considered when it delivers environmental benefits. It also discusses the interaction between offshore wind and marine biodiversity, highlighting that nature is not simply another user of the sea, but the ecological foundation on which healthy, resilient marine ecosystems, the benefits they provide and the activities they support depend.

Based on this analysis, this paper provides the following recommendations:

Develop a harmonised definition of multi-use at EU and North Sea level, requiring it to contribute to the reduction of cumulative impacts

Common principles for multi-use must be included in the MSP Directive revision and in the GNSBI definition of multi-use. Such principles must require that multi-use is explored only when it contributes to the reduction of cumulative impacts on marine ecosystems through a more efficient use of marine space.

To this end, ecosystem-based multi-use in offshore wind farms must not create additional space for human activities at sea, but rather focus on synergies between compatible activities, facilitating the sharing of infrastructure and services to reduce disturbance and free up space for nature recovery and protection elsewhere. Any multi-use proposal should demonstrate clear environmental benefits compared to single-use development.

Require multi-use to be integrated in ecosystem-based MSP and strengthen multi-use governance at sea-basin level

The revision of the MSP Directive must require member states to consider multi-use in ecosystem-based MSPs, ensuring that it is subjected to a Strategic Environmental Assessment (SEA) and coherent with environmental targets and sectoral objectives. To reduce the spatial squeeze, activities which are not in line with EU and international strategic objectives such as oil and gas extraction must be phased out.

The upcoming GNSBI definition must promote coherence across national approaches to multi-use in the North Sea, ensuring that all countries embed multi-use in ecosystem-based MSP.

Biodiversity as the premise, not multi-use

Healthy ecosystems are the foundation of resilient seas and thriving biodiversity. In line with this, nature should not be considered a sector and a "use" of marine space, but rather as the ecological basis of any sustainable blue economy activity.

While critical to reaching climate goals, offshore wind farms are large scale industrial projects with significant environmental impacts on marine ecosystems and therefore incompatible with marine protection. As a result, offshore wind farms should not be installed in Marine Protected Areas (MPAs), Natura 2000 sites and other sensitive areas.

Restoration in offshore wind farms seeking to bring back valuable habitats must be incentivised, including through non-price criteria. However, considering the environmental impact of offshore wind farms and the knowledge and regulatory gaps concerning the decommissioning phase, restoration measures within offshore wind farms must not count towards restoration targets.

Multi-use in offshore wind farms must only be explored in combination with low-impact fisheries and low-impact aquaculture

The revision of the MSP Directive and the GNSBI definition must also require that multi-use in offshore wind farms involving fisheries and aquaculture is considered only in combination with low-impact activities, such as Low-Trophic Aquaculture (LTA) and low-impact fisheries. Destructive practices, including bottom trawling and intensive aquaculture, must not be allowed in offshore wind farms.

Require EIAs and improve monitoring and data collection to better understand the ecological and health impacts of multi-use

Each multi-use project in offshore wind farms must be subject to an Environmental Impact Assessment (EIA) in line with the EIA Directive. In addition, mandatory monitoring for multi-use projects must be required throughout the project lifecycle to improve understanding of the environmental effects of multi-use and generate data in support of future assessments and decision-making. Regional fora such as the GNSBI and OSPAR – the Convention on the Protection of the marine environment of the North-East Atlantic – must facilitate the collection, harmonisation and sharing of monitoring data and best practices across the North Sea region, helping to build a stronger evidence base for future multi-use projects.

Improve dialogue and stakeholder participation in planning and project-level processes

Multi-use has the potential to reduce conflicts between compatible marine users by preserving or creating space for low impact activities at sea. However, realising this potential depends on the effective implementation of the public participation requirements of the MSP, SEA and EIA Directives. The revision of the MSP Directive provides an opportunity to strengthen public participation provisions, requiring stakeholders and coastal communities to be involved from the outset and ensuring their early, meaningful and continuous engagement throughout both planning and project-level processes.

Such engagement must be supported by transparent information sharing, participatory decision-making and the co-design of multi-use solutions with affected sectors and local communities. Mechanisms to ensure that local communities and stakeholders benefit from multi-use developments should also be explored.

Increase EU funding for research and monitoring on the cumulative effects of multi-use at sea

Significant knowledge gaps remain regarding the environmental, social and economic impacts of combining offshore wind farms with other maritime activities, such as low impact fisheries and aquaculture. The next Multiannual Financial Framework (MFF), notably through Horizon Europe and related funding instruments, should provide dedicated support for long-term, independent research, monitoring and data collection on the cumulative impacts of multi-use, including effects on biodiversity, fisheries, aquaculture, ecosystem functioning and coastal communities.

Abbreviations

EIA – Environmental Impact Assessment

LTA - Low-Trophic Aquaculture

MSFD – Marine Strategy Framework Directive

MPAs – Marine Protected Areas

MSP – Maritime Spatial Planning

OSPAR - The Convention on the Protection of the marine environment of the North-East Atlantic

SEA – Strategic Environmental Assessment

Design created by @IrisMaertens

Background and context

Introduction

The North Sea is among the busiest seas in the world, hosting activities such as shipping, fishing, offshore oil and gas drilling and - more recently - offshore wind. Decades of extractive human activities have led to the severe deterioration of marine ecosystems and, historically, human activities have taken priority over ocean health. As highlighted by OSPAR 2023 Quality Status Report[i] declining biodiversity and continued habitat degradation are observed in many parts of the OSPAR maritime area and additional measures are required to change the trajectory to one of nature recovery.

In parallel, offshore wind capacity is set to expand exponentially in the North Sea, providing an important contribution to the achievement of EU and international climate targets and helping to mitigate the impacts of climate change on marine biodiversity. In 2022, with the Ostend Declaration[ii] countries on the North Sea agreed to installing up to 300 GW of offshore wind in the sea basin by 2050. The commitment was confirmed with the Hamburg Declaration in January 2026[iii] and would mean installing almost ten times the total installed capacity in EU waters in 2025.[iv] Such large-scale expansion requires appropriate measures at planning and project level to avoid and minimise environmental impacts and ensure co-existence with other sustainable uses of the sea.

In this context, the concept of multi-use - which can take different forms, from the sharing of space by multiple uses in a specific area to their overlap through the sharing of infrastructure and services - is gaining attention as an option to support the reduction of cumulative impacts of human activities on marine ecosystems while addressing the spatial squeeze in European waters. However, real-life examples of multi-use remain rare and clear definitions, rules and guidelines are needed to ensure that it is considered only when it relieves pressure on marine ecosystems.

With this policy brief, the North Sea Alliance takes stock of multi-use in the North Sea and provides concrete policy recommendations to shape sustainable multi-use that contributes to the reduction of cumulative impacts on marine ecosystems while supporting the sustainable expansion of offshore wind.

The definition of multi-use

Different types of multi-use are theoretically possible based on the type of activities involved and the degree of integration. Several multi-use definitions have been developed, underscoring the need for a common terminology and common language to advance the conversation on multi-use[v]

The following overview aims to provide a set of

useful concepts to provide background to our policy recommendations.

A broader definition of multi-use suggests that it is the "joint use of resources in close geographic proximity by either a single user or multiple users. It is an umbrella term that covers a multitude of use combinations in the marine realm and represents a radical change from the concept of exclusive resource rights to the inclusive sharing of resources and space by one or more users"[vi].

In this sense, multi-use encompasses different levels of integration between activities at sea, ranging from the sharing of space by multiple uses in a given area to the overlap of uses in space and or time and requiring the coordination and sharing of activities for example through the creation of shared services, infrastructure and costs[vii]. Table 1 provides a categorisation of multi-use types based on their level of connectivity. The categories are identified based on four dimensions: (1) spatial – considering whether activities share space – this dimension is always present and inherent to the nature of multi-use, (2) temporal – considering whether activities occur in the same timeframe; (3) provisioning – considering whether activities share services and processes and (4) functional – considering whether they share infrastructure.

Type	Dimensions				Description	Examples
	Spatial	Temporal	Provisioning	Functional		
Type 1: Multi-purpose/multi-functional	✓	✓	✓	✓	Takes place in the same area, at the same time, with shared services and core infrastructure	Marine renewable energy sources and desalination (Maniopoulou et al., 2017), Scottish Floating Power Plant Design (FPP) (Kafas, 2017)
Type 2: Symbiotic use	✓	✓	✓		Takes place in the same area, at the same time, and peripheral infrastructure or services on sea or land are shared	Proposed aquaculture in OWF in Germany (Buck et al., 2017), combination of Wave Energy generation and aquaculture (Onyango and Papaioannou, 2017)
Type 3: Co-existence/co-location	✓	✓			Takes place in the same place and at the same time	Fisheries in OWF proposed in the United Kingdom (Kafas, 2017) and Germany (Schupp and Buck, 2017)
Type 4: Subsequent use/repurposing	✓				Takes place in the same ocean space but subsequently	Repurposing of offshore structures for new uses like recreational fishing, tourism, aquaculture, or environmental conservation (e.g., Italy) (Ponti et al., 2002; Depellegrin et al., 2019)

Table 1. Typology of ocean multi-use with descriptions and examples given for each identified type, adapted from Schupp et al. (2019)[viii].

When it comes to offshore wind farms, multi-use is being explored with different activities. This policy paper focuses on multi-use involving offshore wind farms on the one hand and fisheries or aquaculture on the other. Following the categorisation above, the following types of multi-use are relevant for this analysis:[ix]

Type 1 Multi-purpose where activities occur in the same area, at the same time and share infrastructure and services. An example is aquaculture in offshore windfarms when the infrastructure is structurally connected to wind farms.

Type 2 – Symbiotic use where activities occur in the same area, at the same time, sharing peripheral infrastructure or services. An example of this category is mussel aquaculture in between turbines.

Type 3 – Co-location where activities coexist in the same place at the same time, without sharing infrastructure or services. Commercial fisheries in offshore wind farms constitute an example of co-location.

Type 4 – Repurposing which involves the sharing of space at different times. When it comes to offshore wind, this type could occur if offshore wind infrastructure is repurposed for other uses after decommissioning. However, no examples currently exist given the limited experience with offshore wind decommissioning.

This paper investigates if and how the sharing of space can bring added value by contributing to the reduction of cumulative pressures of human activities on marine ecosystems. The following overview provides a summary of potential benefits and challenges for multi-use in offshore wind farms with fisheries and aquaculture.

Potential benefits

Multi-use can have potential environmental, social and economic benefits. However, the achievement of these benefits largely depends on its implementation and several challenges and knowledge gaps remain.

In theory, multi-use can:

1. **Relieve pressure on marine ecosystems** by contributing to the reduction of the overall amount of infrastructure and potentially freeing up space for nature, ultimately reducing cumulative impacts. While the evidence is scarce due to the limited practical examples, a recent study argues that cumulative impacts in multi-use configurations can be lower compared to single use[x]
2. **Reduce conflicts between sectors**[xi] and allowing activities traditionally excluded from offshore wind farms to access these areas. When it comes to fisheries, multi-use could allow to reduce displacement. However, in practice, fisheries are mostly excluded from offshore wind farms and technical, legal and safety barriers reduce the viability of this type of multi-use (more information is available in the following section). In the case of aquaculture, multi-use with offshore wind farms would allow to move operations further offshore potentially reducing conflicts with coastal activities
3. **Reduce economic costs for operators** by facilitating the sharing of costs related to infrastructure, maintenance and operations. However, uncertainties deriving from regulatory complexity, technological challenges, managerial and operational uncertainties and a lack of social acceptance can lead to additional costs[xii]

Challenges

Historically, economic considerations have prevailed over environmental concerns in the planning of space at sea. This has resulted in the deterioration of marine ecosystems and severe delays in the implementation of marine environmental and biodiversity targets. Given the historic tendency to overexploit European seas, if poorly implemented, multi-use can risk becoming a tool to squeeze even more activities in the already overcrowded and overexploited space at sea and increase pressures on marine ecosystems.

In addition, many practical barriers and knowledge gaps can hinder the sustainable application of multi-use.

Among others, some of the main obstacles include:

1. **Limited knowledge on the environmental and social impacts of multi-use:** Given the limited real-life examples of multi-use, knowledge on their environmental impact is still limited. In addition, important knowledge gaps on the environmental impact of offshore wind farms, including cumulative impacts and impacts in the decommissioning phase, have implications for multi-use.
2. **Safety and insurance:** Safety concerns can be a barrier in the case of multi-use involving offshore wind and fisheries or aquaculture. No specific insurance exists to cover fishing activities in offshore wind farms, while in some countries general insurance can offer such coverage[xiii]. When it comes to aquaculture, the risk of liability and insurance premiums can be a barrier and, since the practice is new, the evaluation of risk is not based on a large number of practical examples[xiv].
3. **Many countries don't have policies on multi-use:** In an analysis regarding multi-use involving passive fisheries and offshore wind[xv], current legal regulations, the lack of adequate scientific evidence to document economic viability and uncertainties regarding the implementation approach were

mentioned as key barriers the implementation of multi-use. When it comes to aquaculture, regulations have been identified as one of the main barriers as offshore wind and aquaculture are governed by different sets of authorities and regulations, making it difficult for them to work together[xvi].

Policy Landscape

European policies

At European level, several frameworks guide the implementation of multi-use, while recent policy developments provide an opportunity to regulate multi-use and ensure it is implemented with the aim to contribute to the reduction of the cumulative impacts on the marine environment.

To ensure that it develops within the carrying capacity of marine ecosystems, multi-use must be part of and coherent with a broader strategy to implement international and EU obligations on biodiversity. These include the Kunming-Montreal Global Biodiversity Framework[xvii] and the EU Biodiversity Strategy[xviii] – which require countries to legally protect at least 30% of seas and strictly protect 10% of seas at the EU and international levels[xix].

In addition, multi-use must be consistent with relevant sectoral targets, such as the requirement to implement the ecosystem-based approach to fisheries management and to minimise the impacts of fisheries and aquaculture on the marine environment in line with the Common Fisheries Policy (CFP).

At planning level, the Maritime Spatial Planning (MSP) Directive[xx] and the Marine Strategy Framework Directive (MSFD)[xxi] are the main frameworks that must guide the implementation of ecosystem-based multi-use, ensuring that it is considered in the early strategic planning phases and that it is coherent with EU and international environmental and sectoral objectives. By aligning multi-use policies with these frameworks, countries can ensure that multi-use strategies are underpinned by the ecosystem-based approach and that synergies between activities are considered only when they can reduce the overall impact of human pressures.

The MSFD provides the framework to assess the environmental impact of multi-use. In particular, the MSFD requires member states to achieve Good Environmental Status by 2020, though it is far from being achieved. To this end, countries must develop Marine Strategies and Programmes of Measures outlining how they aim to reach Good Environmental Status. As outlined by Article 1 of the MSFD, marine strategies shall apply an ecosystem-based approach to the management of human activities, ensuring that the collective pressure of such activities is kept within levels compatible with the achievement of good environmental status and that the capacity of marine ecosystems to respond to human-induced changes is not compromised. Multi-use policies must be coherent with this requirement and be explored only when they seek to limit the cumulative pressures of human activities on marine ecosystems.

The MSP Directive requires member states to adopt maritime spatial plans, applying an ecosystem-based approach to allocate space for nature and human activities at sea. The plans have to be submitted to a Strategic Environmental Assessment (SEA) in line with the SEA Directive[xxii] which also requires to assess the cumulative impacts of the plan.

The current MSP Directive indicates that MSP aims at identifying and encouraging multi-purpose uses. In recent years, the European Commission published a multi-use compendium showcasing projects exploring coexistence and integration between activities to support and inform decision-makers and stakeholders[xxiii] The Second Implementation Report on the MSP Directive[xxiv] published in 2026 recognises that, especially in crowded waters, synergies and co-location opportunities are increasingly being considered, typically involving offshore renewable

energy and aquaculture or energy infrastructure and biodiversity. However, the report also recognises that these approaches remain largely exploratory and rely on project-based experimentation rather than formal procedures.

While marine strategies and MSPs should be closely aligned to ensure that spatial decisions contribute to the achievement of Good Environmental Status, this coherence has so far been neglected. Without being embedded in an ecosystem-based and coherent approach to maritime spatial planning, multi-use risks adding to the cumulative pressures on the marine environment rather than contributing to their reduction.

In 2025, the European Commission adopted the EU Ocean Pact, in which it announced the upcoming Ocean Act, an instrument to bring which shall coherence across EU ocean-related policies, and its intention to revise the Maritime Spatial Planning Directive. The Ocean Pact also highlights the promising potential of multi-use involving offshore wind farms and fisheries, aquaculture or nature. These developments provide a unique opportunity to regulate ecosystem-based multi-use, ensuring it contributes to the reduction of cumulative impact of human activities.

At project level, each project involving multi-use in offshore wind farms must be subject to an Environmental Impact Assessment (EIA) in line with the EIA Directive[xxv]. EIAs allow to determine the environmental impact of a specific project, taking into account the specific features of both the project and the ecosystems, and require an assessment of its cumulative impacts. In addition, if they are likely to impact Natura 2000 sites, an Appropriate Assessment in line with Article 6(3) of the Habitats Directive must be required. However, in practice, these assessments have focused on project level impact in isolation, rather than fully considering cumulative impacts.

In parallel, in 2023, the Renewable Energy Directive has introduced the possibility to grant renewables project exemptions from EIAs and Appropriate Assessments. Given the significant environmental impact of OWF projects and the lack of knowledge surrounding multi-use, EIAs for offshore wind projects broadly, including when they allow for multi-use, must not be waived.

Sea-basin developments

In the North Sea, momentum for cross-border cooperation in MSP has been growing in recent years with the creation of the Greater North Sea Basin Initiative (GNSBI). The GNSBI aims to align and coordinate MSP around the North Sea. Cross-border cooperation in MSP is critical to ensure coherence between national approaches and to reduce cumulative impacts, which extend beyond national borders.

The GNSBI identified multi-use and the need to develop a definition for it as a priority. A joint cross-border definition would ensure that equal principles are applied throughout the North Sea and that the same ambitious environmental standards are followed by all countries when implementing multi-use, with the aim to contribute to the reduction of cumulative impacts on the North Sea. In addition, sea-basin multi-use governance could ensure alignment between national multi-use policies and their implementation timeframes.

@alishabai_Pexels

National approaches

Belgium	The Belgian 2026 – 2034 MSP establishes multi-use as one of three core principles, stating that by 2050 the principle of multiple spatial use is the norm for all spatial use within the Belgian North Sea and that the principle should already be implemented as much as possible for both existing and new activities.
Denmark	Multi-use is currently not facilitated by the Danish MSP. The focus is currently on co-existence between offshore wind and fisheries, and carbon capture and storage.
Germany	The 2025 amendment to the German Spatial Planning Act (§ 7 ROG) clarifies that areas may be designated for multiple compatible uses and functions. This creates a planning basis for integrating multi-use into MSP, particularly through the maritime spatial plan and the site development plan (FEP). To date, only certain forms of passive fisheries and research have been authorised in offshore wind farms, while other forms of multi-use, including aquaculture, remain at the pilot stage.[xxvi] In addition, the "Commission for the future of fisheries (Zukunftskommission Fischerei, ZKF)", a multi-stakeholder process initiated and led by the German government, also recommends exploring the opportunities of multi-use concepts to integrate passive fisheries and low-trophic aquaculture project into offshore windfarms.
the Netherlands	The Dutch government established "area passports" to designate areas within wind farms for different multi-use activities (aquaculture, passive fisheries, nature development, other renewable energy, such as solar energy and areas left open for any usage). Users can apply for a permit in any area but permit applications for the designated activity will be given priority. At the moment the Dutch government is researching if active fisheries and nature resting areas can also be legal multi-use activities.

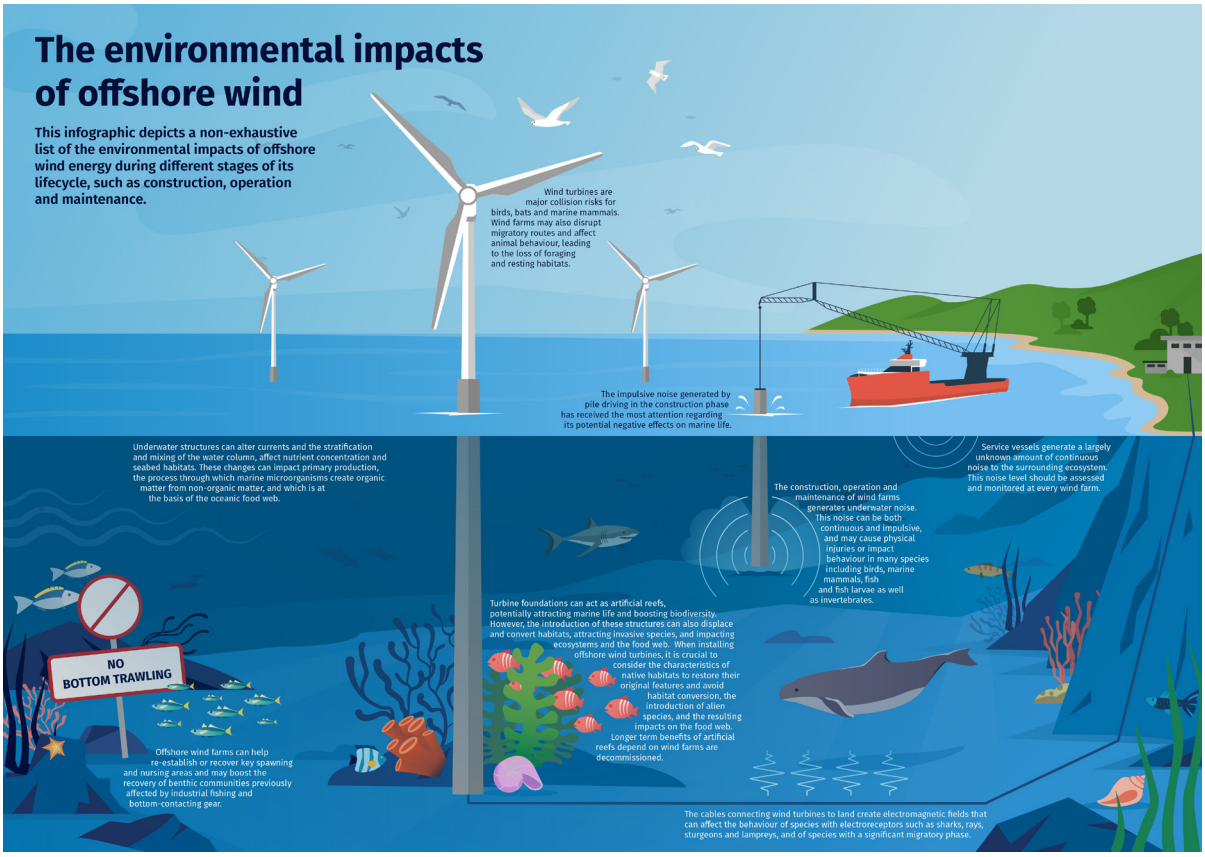

Figure 1. Seas At Risk (2024). The environmental impacts of offshore wind.

Environmental limits and conditions for multi-use

Biodiversity as a pre-requisite, not multi-use

The combination of offshore wind with marine protection or restoration has been labelled as multi-use in different contexts, including the European Ocean Pact. However, offshore wind and marine protection are fundamentally incompatible and restoration within offshore wind farms should not be labelled as multi-use. Healthy ecosystems are at the basis of all human activities and should not be label as a "use" on equal footing with human activities.

The incompatibility with marine protection is linked to the significant environmental impacts of offshore wind on the marine environment. While specific impacts vary depending on the site, they include bird collision and displacement, marine mammal displacement, habitat disturbance and alteration to currents[xxvii]. Other impacts include the "artificial reef effect", through which bottom-fixed monopiles can attract hard-substrate species, and the exclusion of fisheries from offshore wind farms. Both have sparked a debate on potential positive impacts of offshore wind on the marine environment. However, knowledge gaps remain on the broader impacts of increased biodiversity in offshore wind farms on marine ecosystems[xxviii]. Overall, impacts are site-specific and several knowledge gaps remain, including the cumulative impacts of multiple offshore wind farms and their impact in combination with other human activities, as well as impacts in the decommissioning phase. In evaluating the ecological value of biodiversity in offshore wind farms, due consideration should be given to whether the offshore wind farm fundamentally changes the habitats and biodiversity or whether the habitats and species which develop in offshore wind farms, are valuable in connection to broader international, European and national conservation and restoration objectives, as well as with the objective of achieving Good Environmental Status.

In light of this, offshore wind farms are incompatible with marine protection and should not be installed in MPAs, Natura 2000 sites, marine reserves and other

sensitive areas such as important migratory routes for birds and mammals and carbon sinks. Instead, environmental sensitivity mapping must guide the site selection for offshore wind farms away from such areas.

Furthermore, the combination of nature restoration and offshore wind farms must not be labelled as multi-use.

Restoration in OWFs can help restore degraded habitats and/or degraded populations of key species. However, its impacts depend on the local characteristics of the habitat, and its efficacy depends on the decommissioning strategy applied. When full removal is chosen as a decommissioning option, the potential benefits of restoration measures risk being undermined. Considering the overall environmental impact of offshore wind farms and knowledge gaps, restoration in offshore wind farms must not count towards restoration targets[xxix].

When aimed at restoring valuable habitats in line with international, European and national biodiversity and environmental objectives, restoration in offshore wind farms should be incentivised. In particular, nature enhancing measures - which design offshore wind turbine foundations to increase habitat complexity and provide shelter, feeding grounds, and nursery habitat for species[xxx] - and non-price criteria in offshore wind auctions can support restoration in offshore wind farms. Such restoration strategies require long-term planning and regulatory clarity on the decommissioning options and on the management of the area after the decommissioning.

The Rich North Sea Programme, a Dutch initiative focusing on restoring natural oyster reefs destroyed by decades of overfishing, provides a great example of the integration of offshore wind and restoration. The Programme has also created a toolbox to facilitate the sharing of best practices on nature-inclusive offshore wind.

@ North Sea Foundation

Offshore wind and aquaculture

Multi-use involving offshore wind farms and aquaculture has received increasing attention, especially when it comes to Low-Trophic Aquaculture (LTA) which involves the farming of species on the bottom level of the food-web (for example mussels, oysters and seaweed). Instead of requiring external feed made from other fish, these organisms feed on naturally occurring nutrients, sunlight, or plankton.

Besides the sharing of space, infrastructure and costs, placing aquaculture further offshore can reduce the conflict with other uses, which are more concentrated in the coastal area[xxxi]. However, weather conditions further offshore can be harsher which can lead to difficulties in monitoring and loss of yield. Seaweed aquaculture can also bring about environmental benefits, such as absorbing CO2 and removing nutrients. However, these benefits are limited because the substances can be released in the environment depending on how the final product is used.

Multi-use can be an asset to scale-up low trophic aquaculture. While considering its benefits, low trophic aquaculture must still be scaled up responsibly, focused on native species, restoring native ecosystems and in small-scale exploitations. This is all encompassed in the Ecosystem Approach to Aquaculture (EAA), which focuses on aquaculture development within the wider ecosystem[xxxii]. In addition, as it is the case for all multi-use types, environmental impacts and the feasibility are site-specific and should be evaluated for each project.

In parallel, the combination of aquaculture and offshore wind farms raises health and environmental concerns due to the leaching of aluminium and zinc from sacrificial anodes preventing the corrosion of steel structures. These metals can accumulate in mussels, oysters and seaweed. Insufficient monitoring and data availability make it hard to assess the extent of these impacts. As offshore wind farms expand in the North Sea, improving knowledge and reducing these effects becomes increasingly important[xxxiii].

In order to ensure that multi-use strategies aim to reduce the cumulative impacts of human activities, multi-use with OWFs and aquaculture must only be explored with low-impact aquaculture such as low-impact LTA. Intensive aquaculture must not be allowed in OWF as the combination of these activities would not help reducing but would rather add to the cumulative impact of human activities on the marine environment.

Offshore wind and fisheries

Offshore wind expansion has led to an increase in spatial conflicts with fisheries[xxxiv]. Among others, area closures for OWF can lead to the displacement of fishing effort and an increase in distances and costs needed to reach fishing grounds. On the other hand, the artificial reef effect in OWF and the closure of the area to fisheries can lead to an increase in species with potential wider effects on fisheries and a spill-over effect. However, the extent and impact of these dynamics on ecosystems and, as a result, on fisheries is still debated[xxxv] and can vary considerably from site to site.

In this context, several strategies are being explored to reduce spatial conflicts with fisheries. When no access to offshore wind farms can be granted, instruments like early dialogue, monetary compensation, the creation of corridors during the construction phase to access different fishing grounds and the involvement of fisheries in the monitoring of resources can promote coexistence.

In order to ensure that multi-use strategies aim to reduce the cumulative impacts of human activities, multi-use with offshore wind farms and fisheries must only be explored with low-impact fisheries – for example passive gears such as bycatch-safe pots and traps. Destructive fishing practices such as bottom trawling, must not be allowed in offshore wind farms as the combination of these activities would not help to reduce but would rather add to the cumulative impact of human activities on the marine environment. In addition, efforts to incentivise nature restoration in OWFs would be completely undermined if bottom trawling and other destructive fishing techniques would be allowed in offshore wind farms.

Multi-use involving low-impact fisheries and offshore wind farms could help reduce fishing effort outside of offshore wind farms while providing income opportunities to low-impact fisheries and contributing to preserving coastal communities. However, there is not enough evidence to assess whether passive fisheries in offshore wind farms could provide equal economic returns compared to fishing in other areas and currently real-life examples are rare mostly due to safety regulations and complex insurance schemes[xxxvi]. At the same time, available evidence suggests that small-scale, low-impact fisheries generate higher socio-economic value per tonne of fish caught, create more jobs per unit of catch, and contribute significantly

to the resilience of coastal communities[xxxvii]. The 2026 evaluation of the Common Fisheries Policy highlighted that, despite receiving a comparatively smaller share of public support, the small-scale fleet delivers substantial social and economic benefits and remains essential for the viability of many coastal regions[xxxviii]. Further research is therefore needed to assess whether multi-use could help maintain and strengthen these benefits while ensuring environmental sustainability and fair access to marine space.

Similarly to the case of aquaculture, the lack of knowledge on the ecological impacts of multi-use with offshore wind farms and fisheries is a challenge. In order to improve knowledge and facilitate adaptive management, where corrective action is taken when negative impacts are registered, mandatory monitoring must be required in multi-use projects within offshore wind farms.

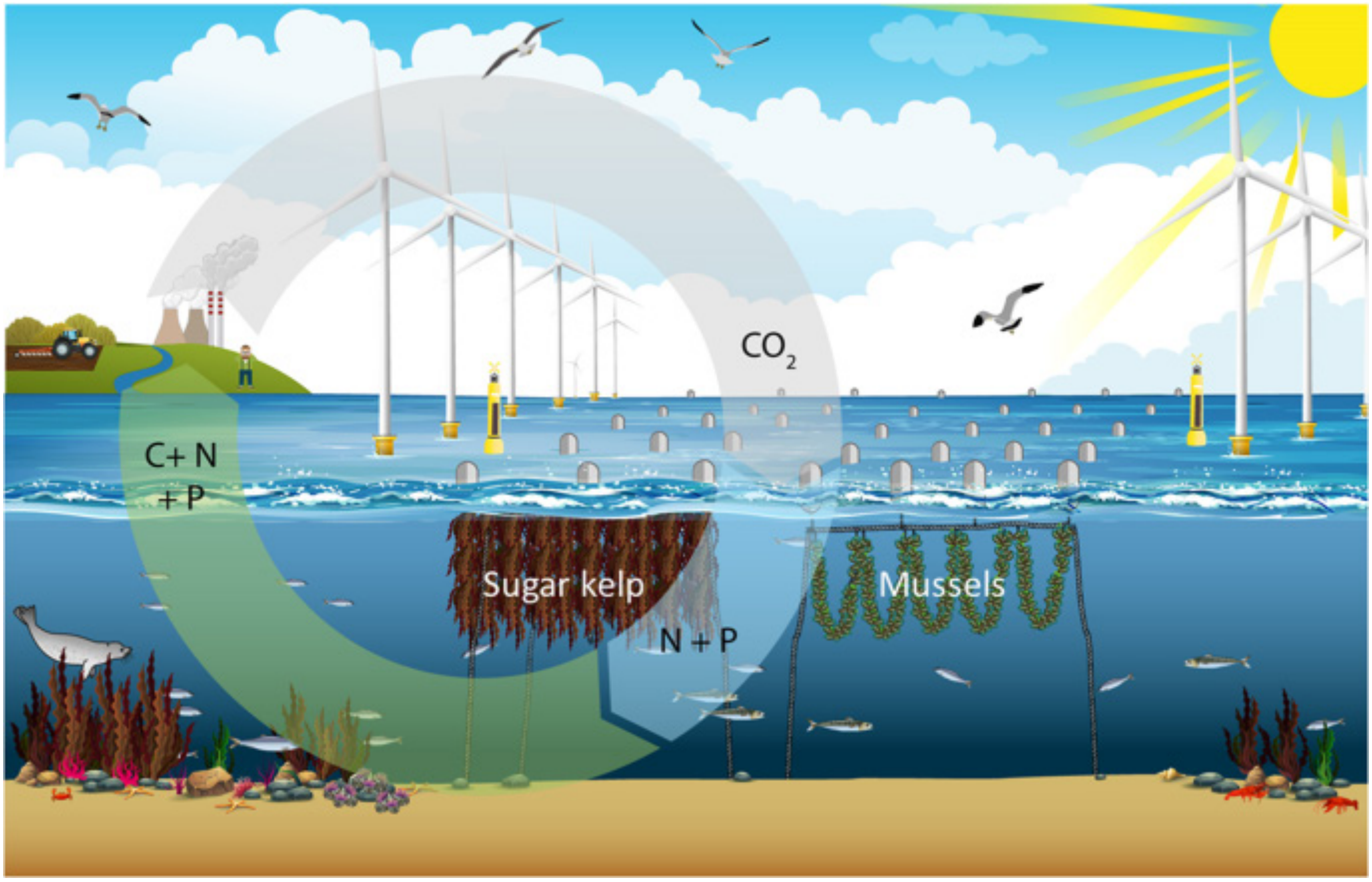

Figure 2.Communications Earth & Environment (Commun Earth Environ) (2020). Multi-use in offshore wind farms with farming of blue mussels and sugar kelp can deliver emission free energy, nutritious seafood, and positive ecosystem services through emission (CO2 and nutrients) capture and utilisation.

Policy recommendations

Based on the analysis above, the North Sea Alliance puts forward the following recommendations for ecosystem-based multi-use:

Develop common principles for multi-use at the EU and North Sea level, requiring multi-use to contribute to the reduction of cumulative impacts

The revision of the MSP Directive and the GNSBI definition of multi-use provide an opportunity to develop a common language around the concept of multi-use. Common principles for multi-use must require that it is explored only when it contributes to the reduction of cumulative impacts on marine ecosystems through a more efficient use of marine space. To this end, multi-use in offshore wind farms should explore synergies between activities to reduce disturbance, by for example incentivising the sharing of infrastructure and services. Multi-use should also consider whether the combination of activities can free up space for nature protection and recovery elsewhere. Any multi-use proposal should demonstrate clear environmental benefits compared to single-use development.

To reduce the spatial squeeze, activities which are not in line with EU and international strategic objectives such as oil and gas extraction, must be phased out.

Require multi-use to be integrated in ecosystem-based MSP and improve multi-use governance at sea-basin level

The revision of the MSP Directive must require member states to consider multi-use in ecosystem-based MSPs, ensuring it is subjected to SEAs and coherent with environmental targets and sectoral objectives.

In parallel, the GNSBI definition should promote coherence across national approaches to multi-use in the North Sea, ensuring that all countries embed multi-use in ecosystem-based MSP. Stronger sea-basin governance would help ensure minimum environmental standards and greater alignment in multi-use policies across the North Sea.

Biodiversity as the premise, not multi-use

As recognised by the ecosystem-based approach, healthy ecosystems are the basis of all human activities. In line with this, nature should not be considered a sector and a "use" of marine space, but rather as the supporting basis of any blue economy activity.

Because offshore wind farms have significant environmental impacts on the marine environment, they are incompatible with marine protection and should not be installed in MPAs, N2000 sites, marine reserves and other sensitive areas.

Restoration seeking to bring back valuable habitats must be incentivised, including through non-price criteria. However, considering the environmental impact of offshore wind farms and the remaining knowledge gaps, including regarding the decommissioning phase, restoration measures within offshore wind farms must not count towards restoration targets. To harness the potential of restoration measures in offshore wind farms, OSPAR's approach to decommissioning must allow for case-by-case assessment where decommissioning decisions are based on ecological criteria and long-term monitoring.

Multi-use involving fisheries and aquaculture in offshore wind farms must only be explored in combination with low-impact activities

The revision of the MSP Directive and the GNSBI definition must also require multi-use involving fisheries or aquaculture and offshore wind farms to be considered only in combination with low-impact activities such as LTA and low-impact fisheries. Destructive fishing techniques, including bottom trawling, and intensive aquaculture cannot be allowed in offshore wind farms. Mandatory monitoring of multi-use projects in offshore wind farms should be required to support policies and adaptive management.

Require EIAs alongside monitoring and data collection to better understand the ecological and health impacts of multi-use

Each multi-use project in offshore wind farms must be subject to an Environmental Impact Assessment (EIA) in line with the EIA Directive. EIAs allow to determine the environmental impact of a specific project, taking into account the specific features of both the project and the ecosystems, and require an assessment of its cumulative impacts. While EIAs are essential to understand the environmental impact of specific projects, they often rely on partial and outdated data. This risk is even higher for multi-use, where the knowledge of environmental impacts is particularly limited. Mandatory monitoring to improve data collection is therefore critical and must be supported by stronger sea-basin cooperation within GNSBI and with other regional fora such as

OSPAR to facilitate the collection, harmonisation and sharing of monitoring data and best practices.

Improve dialogue and stakeholder participation in planning and project-level processes

Besides its environmental benefits, multi-use can have positive social impacts by reducing conflicts and preserving or creating space for low-impact activities at sea. The public consultation requirements of the MSP, SEA and EIA Directives must be effectively implemented to ensure early and meaningful stakeholder and citizen engagement in multi-use. The revision of the MSP Directive provides an opportunity to strengthen public participation provisions requiring stakeholders and coastal communities to be involved from the outset and ensuring their early, meaningful and continuous engagement throughout both planning and project-level processes. In parallel, national policies must require early and continuous dialogue between OWF operators, affected stakeholders and coastal communities throughout the different phases of a project and support such engagement with transparent information sharing and participatory decision-making processes. To support such efforts, data collection on the social impacts of multi-use must be improved.

Increase EU funding for research and monitoring on the cumulative effects of multi-use at sea

Significant knowledge gaps remain regarding the environmental, social and economic impacts of combining offshore wind farms with other maritime activities, such as low impact fisheries and aquaculture. While multi-use can potentially reduce spatial conflicts and contribute to the reduction of cumulative impacts, the extent and consequences of these interactions remain highly site-specific and poorly understood. The next MFF, notably through Horizon Europe and related funding instruments, should provide dedicated support for long-term, independent research, monitoring and data collection on the cumulative impacts of multi-use, including effects on biodiversity, fisheries, aquaculture, ecosystem functioning and coastal communities. Improved evidence is essential to ensure that decisions on multi-use are based on the precautionary principle and ecosystem-based management, and that multi-use is only promoted where it is environmentally sustainable and socially equitable.

Bibliography

i OSPAR Commission. (2023). Quality status report 2023. https://oap.ospar.org/en/ospar-assessments/quality-status-reports/qsr-2023/

ii Belgian Federal Government. (2023, April 24). Ostend declaration on the North Seas as Europe's green power plant. North Sea Summit II. https://northseasummit23.be/en/ostend-declaration/

iii Federal Ministry for Economic Affairs and Energy. (2026, January 26). The Hamburg declaration of the heads of state and government. Federal Ministry for Economic Affairs and Energy (BMWE). https://www.bundeswirtschaftsministerium.de/Redaktion/EN/Downloads/M-O/nordsee-gipfel-2026/the-hamburg-declaration.pdf?__blob=publicationFile&v=5

iv WindEurope (2026) Wind energy in Europe: 2025 Statistics and the outlook for 2026-2030

v Schupp, M. F., Bocci, M., Depellegrin, D., Kafas, A., Kyriazi, Z., Lukic, I., Schultz-Zehden, A., Krause, G., Onyango, V., & Buck, B. H. (2019). Toward a common understanding of ocean multi-use. Frontiers in Marine Science, 6, 165. https://doi.org/10.3389/fmars.2019.00165

vi Schupp, M. F., Bocci, M., Depellegrin, D., Kafas, A., Kyriazi, Z., Lukic, I., Schultz-Zehden, A., Krause, G., Onyango, V., & Buck, B. H. (2019). Toward a common understanding of ocean multi-use. Frontiers in Marine Science, 6, Article 165. https://doi.org/10.3389/fmars.2019.00165

vii Smith, S. L., McCann, J., Bingham, J. A., Diederichsen, S., Gröndahl, F., Guyot, J., Rebours, C., Thomas, J.-B. E., Weiss, C. V. C., & Walsh, J. P. (2025). Advancing multi-use in offshore wind energy planning: Perceived opportunities and barriers in southern New England, U.S. Marine Policy, 181, 106851. https://doi.org/10.1016/j.marpol.2025.106851

viii Schupp, M. F., Bocci, M., Depellegrin, D., Kafas, A., Kyriazi, Z., Lukic, I., Schultz-Zehden, A., Krause, G., Onyango, V., & Buck, B. H. (2019). Toward a common understanding of ocean multi-use. Frontiers in Marine Science, 6, Article 165. https://doi.org/10.3389/fmars.2019.00165

ix Schupp, M. F., Bocci, M., Depellegrin, D., Kafas, A., Kyriazi, Z., Lukic, I., Schultz-Zehden, A., Krause, G., Onyango, V., & Buck, B. H. (2019). Toward a common understanding of ocean multi-use. Frontiers in Marine Science, 6, Article 165. https://doi.org/10.3389/fmars.2019.00165

x Tamis, J. E., Jongbloed, R. H., Rozemeijer, M. J. C., Grundlehner, A., de Vries, P., Van Gerven, A., Jak, R. G., & Piet, G. J. (2024). Assessing the potential of multi-use to reduce cumulative impacts in the marine environment. Frontiers in Marine Science, 11. https://doi.org/10.3389/fmars.2024.1420095

xi Zuidema, C. (2025). Spatial conflict resolution in marine spatial plans and permitting procedures for offshore wind energy: an analysis of measures adopted in Denmark, England and the Netherlands. Frontiers in Marine Science, 12, 1468734. https://doi.org/10.3389/fmars.2025.1468734

xii Ciravegna, E., van Hoof, L., Frier, C., Maes, F., Rasmussen, H. B., Soete, A., & van den Burg, S. W. K. (2024). The hidden costs of multi-use at sea. Marine Policy. https://doi.org/10.1016/j.marpol.2024.106001

xiii Bonsu, P. O., Letschert, J., Yates, K. L., Svendsen, J. C., Berkenhagen, J., Rozemeijer, M. J. C., Kerkhove, T. R. H., Rehren, J., & Stelzenmüller, V. (2024). Co-location of fisheries and offshore wind farms: Current practices and enabling conditions in the North Sea. Marine Policy, 159, Article 105941. https://doi.org/10.1016/j.marpol.2023.105941

xiv van den Burg, S. W. K., Röckmann, C., Banach, J. L., & van Hoof, L. (2020). Governing risks of multi-use: Seaweed aquaculture at offshore wind farms. Frontiers in Marine Science, 7, Article 60. https://doi.org/10.3389/fmars.2020.00060

xv Bonsu, P. O., Letschert, J., Yates, K. L., Svendsen, J. C., Berkenhagen, J., Rozemeijer, M. J. C., Kerkhove, T. R. H., Rehren, J., & Stelzenmüller, V. (2024). Co-location of fisheries and offshore wind farms: Current practices and enabling conditions in the North Sea. Marine Policy, 159, Article 105941. https://doi.org/10.1016/j.marpol.2023.105941

xvi Stuiver, M., Soma, K., Koundouri, P., Van den Burg, S., Gerritsen, A., Harkamp, T., Dalsgaard, N., Zagonari, F., Guanche, R., Schouten, J.-J., Hommes, S., Giannouli, A., Söderqvist, T., Rosen, L., Garção, R., & Norrman, J. (2016). The governance of multi-use platforms at sea for energy production and aquaculture: Challenges for policy makers in European seas. Sustainability, 8(4), Article 333. https://doi.org/10.3390/su8040333

xvii Secretariat of the Convention on Biological Diversity. (2022). Kunming-Montreal global biodiversity framework (Decision CBD/COP/15/4). Convention on Biological Diversity. https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf

xviii European Commission. (2020). 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 (COM(2020) 380 final). Publications Office of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0380

xix European Parliament & Council of the European Union. (2024). Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869. Official Journal of the European Union, L 2024/1991. https://eur-lex.europa.eu/eli/reg/2024/1991/oj/eng

xx European Parliament & Council of the European Union. (2014). Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning. Official Journal of the European Union, L 257, 135–145. https://eur-lex.europa.eu/eli/dir/2014/89/oj/eng

xxi European Parliament & Council of the European Union. (2008). Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). Official Journal of the European Union, L 164, 19–40. https://eur-lex.europa.eu/eli/dir/2008/56/oj/eng

xxii European Parliament & Council of the European Union. (2001). Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment. Official Journal of the European Union, L 197, 30–37. https://eur-lex.europa.eu/eli/dir/2001/42/oj/eng

xxiii European MSP Platform. (n.d.). Co-existence and multi-use of activities. European Commission. https://maritime-spatial-planning.ec.europa.eu/msp-resources/co-existence-and-multi-use-activities

xxiv European Commission. (2026). Report from the Commission to the European Parliament and the Council outlining the progress made in implementing Directive 2014/89/EU establishing a framework for maritime spatial planning: Second report (COM(2026) 174 final). Publications Office of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2026:174:FIN

xxv European Parliament & Council of the European Union. (2011). Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (codification). Official Journal of the European Union, L 26, 1–21. https://eur-lex.europa.eu/eli/dir/2011/92/oj/eng

xxvi Schultz-Zehden, A., Drews-von Ruckteschell, F., Dittmer, P. A., Smolka, U., Staufenberger, T., Strothotte, E., & Schatz, V. (2025). Expert study on ocean multi-use in the German Exclusive Economic Zone (EEZ) of the North and Baltic Sea: Summary report. Federal Maritime and Hydrographic Agency (BSH), on behalf of the Federal Ministry for Housing, Urban Development and Building (BMWSB).

xxvii Galparsoro, I., Menchaca, I., Garmendia, J. M., Borja, Á., Maldonado, A. D., Iglesias, G., & Bald, J. (2022). Reviewing the ecological impacts of offshore wind farms. npj Ocean Sustainability, 1, Article 1. https://doi.org/10.1038/s44183-022-00003-5

xxviii Li, C., Coolen, J. W. P., Scherer, L., Mogollón, J. M., Braeckman, U., Vanaverbeke, J., Tukker, A., & Steubing, B. (2023). Offshore wind energy and marine biodiversity in the North Sea: Life cycle impact assessment for benthic communities. Environmental Science & Technology, 57(16), 6455–6464. https://doi.org/10.1021/acs.est.2c07797

xxix Seas At Risk. (2025, December 16). Briefing: Implementing the EU Nature Restoration Regulation at sea — Guidance for policy-makers and civil society. https://seas-at-risk.org/publications/briefing-implementing-the-eu-nrr-at-sea/

xxx Glarou, M., Zrust, M., & Svendsen, J. C. (2020). Using artificial-reef knowledge to enhance the ecological function of offshore wind turbine foundations: Implications for fish abundance and diversity. Journal of Marine Science and Engineering, 8(5), 332. https://doi.org/10.3390/jmse8050332

xxxi Maar, M., Holbach, A., Boderskov, T., Thomsen, M., Buck, B. H., Kotta, J., & Bruhn, A. (2023). Multi-use of offshore wind farms with low-trophic aquaculture can help achieve global sustainability goals. Communications Earth & Environment, 4, 447. https://doi.org/10.1038/s43247-023-01116-6

xxxii Seas At Risk. (2026). Less and better: Reshaping the EU seafood system. https://seas-at-risk.org/wp-content/uploads/2026/05/Less-and-better_Reshaping-the-EU-seafood-system.pdf

xxxiii Watson, G. J., Banfield, G., Watson, S. C. L., Beaumont, N. J., & Hodkin, A. (2025). Offshore wind energy: assessing trace element inputs and the risks for co-location of aquaculture. npj Ocean Sustainability, 4, Article 1. https://doi.org/10.1038/s44183-024-00101-6

xxxiv Bonsu, P. O., Letschert, J., Yates, K. L., Svendsen, J. C., Berkenhagen, J., Rozemeijer, M. J. C., Kerkhove, T. R. H., Rehren, J., & Stelzenmüller, V. (2024). Co-location of fisheries and offshore wind farms: Current practices and enabling conditions in the North Sea. Marine Policy, 159, Article 105941. https://doi.org/10.1016/j.marpol.2023.105941

xxxv Bonsu, P. O., Letschert, J., Yates, K. L., Svendsen, J. C., Berkenhagen, J., Rozemeijer, M. J. C., Kerkhove, T. R. H., Rehren, J., & Stelzenmüller, V. (2024). Co-location of fisheries and offshore wind farms: Current practices and enabling conditions in the North Sea. Marine Policy, 159, Article 105941. https://doi.org/10.1016/j.marpol.2023.105941

xxxvi Bonsu, P. O., Letschert, J., Yates, K. L., Svendsen, J. C., Berkenhagen, J., Rozemeijer, M. J. C., Kerkhove, T. R. H., Rehren, J., & Stelzenmüller, V. (2024). Co-location of fisheries and offshore wind farms: Current practices and enabling conditions in the North Sea. Marine Policy, 159, 105941. https://doi.org/10.1016/j.marpol.2023.105941

xxxvii Seas At Risk, Sciaena, Ecologistas en Acción, & BUND. (2025, April 15). Study: Power structures shaping EU fisheries — How the political economy favours industrial over small-scale, low-impact fishing. Seas At Risk. https://seas-at-risk.org/publications/study-power-structures-shaping-eu-fisheries-how-the-political-economy-favours-industrial-over-small-scale-low-impact-fishing/

xxxviii European Commission. (2026). Commission staff working document (SWD(2026) 120 final). European Commission. https://ec.europa.eu/transparency/documents-register/detail?ref=SWD(2026)120&lang=en

Acknowledgements

Author: Ljuba Ferrario (Seas At Risk)

Special thanks to: Aliki Kovolou (WWF EU), Isabel Seeger (Deutsche Umwelthilfe), Lisa Babak (WWF Germany), Sarah Vanden Eede (WWF Belgium), Sophie de Reus (North Sea Foundation) and Stine Gro Jensen (WWF Denmark)

Ref: Making space for nature: recommendations for ecosystem-based multi-use_North Sea Alliance_2026

Contact

secretariat@seas-at-risk.org

@SeasAtRisk Seas At Risk @SeasAtRisk.bsky.social

@seasatrisk_ngo Seas At Risk

Funded by the European Union and the Gieskes-Strijbis Foundation. Views and opinions expressed are, however, those of the North Sea Alliance only and do not necessarily reflect those of the funders. The European Union and the Gieskes-Strijbis Foundation cannot be held responsible for them.

North Sea Alliance

Deutsche Umwelthilfe The North Sea Foundation SEAS AT RISK WWF