Ocean Multi-Use Toolkit

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Authors

Ivana Lukic, Franziska Drews-von Ruckteschell, Ivana Stojanovic - s.Pro – sustainable projects GmbH

Brice Troillet - University of Nantes

Jennifer McCann - University of Rhode Island, Coastal Resources Center

Jean-Baptiste Thomas - KTH Royal Institute of Technology

Céline Rebours - Møreforsking AS

Sereno Ditricksen, Marinez Scherrer - Federal University of Santa Catarina

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Abbreviations

CBA - Cost Benefit Analysis
EEZ - Exclusive Economic Zone
EIA - Environmental Impact Assessment
EU - European Union
MU - Multi-Use
MSP - Marine (or Maritime) Spatial Planning
MUAA - Multi-Use Assessment Approach
OWF - Offshore Wind Farms
TRL - Technology Readiness Level
SWOT - Strengths, Weaknesses, Opportunities, Threats
US - United States

Introduction

What is Ocean Multi-Use ?

Ocean Multi-Use (MU) refers to the sustainable and efficient utilization of ocean space by combining various ocean activities in close proximity, through joint operations, or on the same platform. This innovative approach seeks to reduce the demand for ocean space while offering potential socio-economic and environmental benefits. It involves integrating different ocean uses, such as renewable energy generation, aquaculture, shipping, tourism, and conservation, to optimize the use of marine resources. While Table 7 provides a more extensive definition of multi-use types based on the type of resources shared at any given time, it is important to note that these terms are often used interchangeably in the literature.

Gain a deeper understanding of the multi-use concept by consulting the **Ocean Multi-Use Action Plan**

About MULTI-FRAME project

The MULTI-FRAME project was active from June 2020 to December 2023.
Its primary objective was to provide a practical open-source ocean MU assessment approach, share assessment results, and showcase best practice examples in the field of ocean MU systems. MULTI-FRAME aimed to encourage planners and policymakers to systematically incorporate the concept of MU into their marine spatial planning practices and to align MU with relevant ocean policies.

As part of the project, five MU scenarios were developed in various locations across the globe, including Sweden, the United States, France, Norway, and Brazil. These scenarios involved a collaborative approach, engaging a wide range of stakeholders, including public entities, private enterprises, research organizations, and local communities. This engagement has clarified the opportunities and constraints of multi-use in these locations, making its realization more attainable.

In the Toolkit, this icon directs readers to further reading materials.

Throughout the Toolkit, this icon serves as a marker to highlight real-world examples of how the provided tool or method has been successfully utilized.

The Ocean Multi-Use Toolkit is a comprehensive resource designed to support the integration of ocean multi-use (MU) within marine spatial planning (MSP) and associated policies.

The Toolkit provides guidance and tools for policymakers, planners, stakeholders, and researchers to facilitate the sustainable development of ocean MU. The Toolkit chapters cover a wide range of topics related to MU developments, including:

Policy level considerations of multi-use: This first chapter of the Toolkit provides an overview of the current policy landscape for MU in different world regions, as well as the key policy recommendations per each MULTI-FRAME case study.

Integration of MU activities in MSP: The second chapter provides references on how to integrate MU activities into marine spatial plans, including guidance on zoning, regulation, and management measures.

Assessment of impacts of ocean MU: The toolkit provides guidance on how to assess the impacts of MU activities on the marine environment, including ecosystem services and biodiversity.

MU permitting: As a result of the policy analysis in MULTI-FRAME case study countries and beyond, this chapter identifies key administrative challenges and potential solutions for MU activities.

Stakeholder engagement for MU: The tools and guidance for engaging stakeholders in the MU planning process are outlined in this section, including participatory mapping, vision development, and conflict resolution.

MU business plans: Building on the existing MU pilot projects and their business plans, this chapter provides guidance on how to develop business plans for MU activities, considering not only the economic activities (e.g. offshore wind and aquaculture) but also those that may not result in a direct economic benefit (e.g. nature restoration, regenerative farming).

MU technology: This chapter presents the review of existing MU pilot projects and designs in order to provide a catalogue of deployed technologies and associated readiness levels.

Research gaps and recommendations: The toolkit identifies research gaps and provides recommendations for future research to support the sustainable development of MU activities.

Browse through the **MULTI-FRAME Ocean Multi-Use Blueprints Collection**.

1. Multi-Use on a Policy Level

This chapter serves as an introduction to the landscape of ocean MU policy in different world regions, presenting its state-of-the-art, relevant national policies and policy tools and providing policy recommendations drawn from MULTI-FRAME case studies.

Integration of ocean multi-use into policy frameworks

Integrating ocean MU into policy frameworks enhances visibility and instills confidence in planners and investors. Ocean policies can not only clarify objectives and ensure consistency in the application of MU practices but can also serve as the driving force behind innovation, implementation efficiency, and long-term planning.

Transcending sectoral boundaries

Ocean MU transcends sectoral boundaries, making it essential to mainstream MU principles across sectoral policies and regulations. This integrated approach ensures that MU as a development option is thoroughly considered and addressed in planning and regulation. This can be achieved through regulatory incentives for certain types of multi-use, such as the integration of non-financial tendering criteria that require multi-use, or through the designation of specific multi-use zones in MSP.

The front-runners

The EU, followed by the US has been a front-runner in terms of integrating ocean MU into policy frameworks and practices. Integrating multi-use principles into official policy frameworks raises the profile of this approach. These overarching policies can serve as a beacon of best practices, inspiring EU Member States, and countries worldwide to follow suit and signaling to national governments that MU should be an integral part of their strategies.

International coordination

To foster effective MU planning that extends beyond national borders, cross-border and transnational coordination is essential. Intergovernmental organizations and initiatives like the IOC UNESCO MSP Global can play a crucial role in enhancing the visibility of MU as a common thread in ocean governance and proposing coherent overarching principles for ocean MU. This is particularly important for countries with shared marine ecosystems, joint infrastructural projects, or mutual maritime policy interests.

1.1 National Policy Addressing Multi-Use

European Union (EU)

The EU has been actively engaged in developing the blue economy and acknowledging the immense potential of the ocean for various sectors including renewable energy, aquaculture, shipping and fishing in the last decade. This has also led to promoting the integration of multiple sectors and MU as a concept. Furthermore, conservation and biodiversity preservation have earned an important position on the EU agenda, which calls for innovative use of the marine environment to facilitate both blue growth and nature protection.

Within the European Union, the policy landscape regarding ocean MU is underpinned by several key initiatives, each playing a crucial role in shaping the integration of this concept into maritime governance. The Maritime Spatial Planning (MSP) Directive, a cornerstone of EU ocean governance, provides a structured framework for the sustainable management of marine space, thereby fostering harmonious coexistence among various maritime activities—an essential element in the promotion of MU.

The MSP directive directly addresses and encourages MU by requiring comprehensive mapping of marine space and its activities and structured planning of how to use this space. The Integrated Maritime Policy, on the other hand, acts as a unifying force, bringing together diverse sectors and stakeholders to encourage cross-sectoral collaboration, innovation, and knowledge-sharing, all of which are crucial to realize the full potential of MU.

Furthermore, the Blue Growth Strategy underscores the economic dimension ocean use, highlighting its role in promoting sustainable economic growth while safeguarding marine ecosystems.

Collectively, these EU policies provide a foundation for the integration of MU into the national policy frameworks of its member states, as well as, into a broader maritime agenda, offering a holistic approach to ocean governance that balances economic growth with environmental conservation. Further relevant legislation in the EU, when approaching the topic of MU are the newly adopted EU Restoration law, which builds on the 2030 Biodiversity Strategy and aims to promote healthy ecosystems in the EU and targets to restore 20% of the sea by 2030.

Whilst the law does not refer to MU specifically, it urges EU member states to restructure their use of marine space, making MU ever more important.

These policies, especially the Blue Growth Strategy, have led to further initiatives within the EU promoting research and innovation, also in the marine sectors. The outcome of this is programs such as Horizon2020, Horizon Europe and Mission Ocean, which have identified the restoration of the European seas as one of the key missions and fund several projects on the topic of MU (i.e. MUSES, UNITED, ULTFARMS, OLAMUR).

North America

In contrast to the European Union's cohesive framework supporting ocean multi-use, North America presents a more fragmented landscape shaped by diverse regulatory practices and stakeholders.

MU is recognized for its benefits but lacks the regulatory mandate seen in, for example, the EU's MSP Directive.

In North America, MU, while encouraged, is not a required practice within the current ocean and coastal permitting and other regulatory ocean management practices.

Examples of MU within the United States and Canada can be found within many of the Federally designated Marine Protected Areas (e.g. Stellwagen Bank National Marine Sanctuary (McCann, 2022)) where, for example, managed tourism successfully collaborates with research that results in enhanced data and ocean management in addition to a more informed public.

Often multiple ocean activities achieve a synergistic relationship when a company owns or is involved in both MU activities. For example, an aquaculture lease holder may offer educational tourism tours to diversify their business plan and income, while also contributing to an informed and potentially more supportive constituency towards aquaculture growth.

For offshore wind energy in the United States, while many resource users recognize MU planning, or at least co-existence, remains one of the most likely and key solutions necessary to answer food and energy needs for both the U.S. and the world, this collaboration is not a regulatory requirement, there is minimal funding available to foster this goal, and significant tension and mistrust between all parties discourage advancement.

Latin America

In Latin America, MU development has emphasized the relationship between marine and coastal ecosystems and coastal communities, especially in regards to small scale fisheries. Countries and territories in the region, and notably within the Caribbean, are exploring and gradually implementing Marine Spatial Planning.

In this context, the MU concept has been developed within the establishment of Protected Areas. From conservation, restoration and tourism strategies that value ocean culture and the ways of life of these human groups, its implementation has promoted synergistic use between human activities.

A concrete example of this principle in action can be observed in Brazil, where MU has demonstrated the beneficial combination of community-based tourism, artisanal fishing and conservation activities. This initiative showcases the potential of MU as an opportunity to generate economic benefits and well-being, while also fostering the protagonism of fishers.

Gain a deeper understanding of the multi-use policy in Latin America by consulting the **MULTI-FRAME Brazil Case Study**.

1.2 National policy addressing Multi-Use

The following table showcases an exemplary overview of policies relevant for the development of MU, relevant policy tools that these documents provide and policy actors involved in the policies.

Europe

BELGIUM

Table 1: Selection of Ocean Multi-Use relevant National Policies per World region

Example of Policy Relevant to MU	Focus of the Policy	MU-Relevant Policy Tools	Relevant Policy Actors
North Sea Vision 2050	Development plan of the Belgian North Sea	1. MU as integral part of tenders for fixed installations; 2. MU permitting vision; 3. Establishing MU Working Group	Minister of the North Sea; Ministries of Energy and Environment
Maritime Spatial Plan	Spatial layout of marine activities	1. Offshore wind tenders (MU as small part of tendering condition) 2. MU Environmental permits and assessments (if activities are of the same nature) 3. MU defined as one of the core principles of MSP	Minister of the North Sea; Ministries of Energy and Environment

DENMARK

Example of Policy Relevant for MU	Focus of the Policy	MU-Relevant Policy Tools	Relevant Policy Actors
Maritime Spatial Plan 2021	Spatial coordination of maritime activities	Overlapping Zones: possibility for MU; co-existence licenses to be given out after further assessment	Danish Maritime Authority
Act on the promotion of renewable energy	Promotion of renewable energy, including offshore	Simplified licensing process (One-Stop-Shop)	Ministry of Climate, Energy and Utilities; Danish Energy Agency
Danish Fisheries Act	Regulation on fisheries and aquaculture management/conservation	1. Regulatory frameworks for fishing restrictions due to OWF (i.e. cable protection zones); 2. Compensation structures for fishers in case of offshore wind farm (OWF) development	Danish Energy Agency

FRANCE

Example of Policy Relevant for MU	Focus of the Policy	MU-Relevant Policy Tools	Relevant Policy Actors
Law no. 2016-1087 for the reconquest of biodiversity, nature and landscapes (the four maritime spatial plans in mainland France)	Spatial Planning of Maritime Activities in the French Waters	Spatial priority-maps, encouraging the 'optimal co-existence'	Ministries in charge of the Sea, Energy, Maritime Affairs, Fisheries, and Biodiversity
National Strategy for the Sea and Coast	Long-term strategy to support sustainable growth in the marine and maritime sectors	Addresses biodiversity conservation in different marine sectors	Ministry of Ecological Transition, Ministry of the Sea

GERMANY

Example of Policy Relevant for MU	Focus of the Policy	MU-Relevant Policy Tools	Relevant Policy Actors
Maritime Spatial Plan 2021	Spatial Layout of Marine Activities	Co-existence of activities through overlapping priority areas	Federal Maritime and Hydrographic Agency

NORWAY

Example of Policy Relevant for MU	Focus of the Policy	MU-Relevant Policy Tools	Relevant Policy Actors
Blue Opportunities: The Norwegian Government's updated ocean strategy.	Ocean strategy for sustainable development	Establishing Basic principles for ocean policy (Strengthening the Law of the Sea; Ecosystem conservation; Knowledge-based management; Implementation of international instruments; Integrated approach to ocean management)	Ministry of Trade, Industry and Fisheries
Management plans for marine areas	Value creation and ecosystem-based management	Research-driven ecosystem management; Mapping programs (MAREANO and SEAPOP)	Ministries of Climate and Environment; Trade, Industry and Fisheries
Water Management Regulations	Incorporates EU Water Framework Directive; Marine management plans up to baseline	Monitoring programs	Norwegian Directorate for Water Resources; Research Institutes

POLAND

Example of Policy Relevant for MU	Focus of the Policy	MU-Relevant Policy Tools	Relevant Policy Actors
Maritime Spatial Plan	Maritime Spatial Plan for Polish Sea Areas in scale of 1:200 000	1. Allowable Function: activities that can take place allocated to basic functions 2. Direct Encouragement of MU through OWF tendering procedure 3. Stakeholder Cooperation Facilitation	Ministry of Infrastructure
Local Maritime Spatial Plans (22 plans for 3 lagoons, Gdańsk Bay, intensively used coastal areas and key ports))	Detailed MSP for areas like Szczeciński and Kamieński Lagoons	1. Allowable Function: activities that can take place allocated to basic functions 2. Minor direct enhancement of MU (i.e. wave energy as port infrastructure)	Directors of Maritime offices in Gdynia and Szczecin subordinated to Minister for Maritime Affairs located in Ministry of Infrastructure
Offshore Wind Act	Promotion of offshore wind energy production in Polish EEZ	Tools for ORE area assessment / site selection	Ministry of Climate and Environment, Energy Regulation Office, Ministry of State Assets

PORTUGAL

Example of Policy Relevant for MU	Focus of the Policy	MU-Relevant Policy Tools	Relevant Policy Actors
Law on Maritime Spatial Planning	Legal framework for the management and spatial planning of the Portuguese national maritime space	Maximum co-existence of uses or activities as principle when allocating space to maritime activities	Directorate of Maritime Policies; Directorate of Marine Resources

SWEDEN

Example of Policy Relevant for MU	Focus of the Policy	MU-Relevant Policy Tools	Relevant Policy Actors
Environmental Code	Sustainable management of land and waters	1. Establishment of need to explore co-use when assessing an area for most appropriate use; 2. Permitting procedures for marine actitivies.	Ministry of Climate and Enterprise

THE NETHERLANDS

Example of Policy Relevant for MU	Focus of the Policy	MU-Relevant Policy Tools	Relevant Policy Actors
North Sea Agreement 2020	Long-term wind energy development	1. Area Passports: Area-based zoning; 2.Transition fund: to support the agreement implementation	Ministries of Infrastructure and Water Management, Agriculture, Nature and Food Quality, Economic Affairs
North Sea 2050 Spatial Agenda	Long-term maritime spatial planning	1. Establishing MU as one of 5 central spatial themes; 2. Opportunities and challenges of MU	Ministry of Infrastructure and the Environment
North Sea program 2022-2027	Spatial layout and North Sea development strategy	1. Assessment framework for co-use in wind farms (see chapter 4); 2. Assessment framework for activities in the North Sea (Test 2: choice of location and assessment of space/time use incl. MU)	Ministries of Infrastructure, Agriculture, Economic Affairs, Interior and Kingdom Relations
North Sea 2030 Strategy	Cooperation guidelines for the Dutch North Sea region	Community of Practice establishment	Ministries of Infrastructure, Agriculture, Economic Affairs, Interior and Kingdom Relations
Offshore Wind Energy Act	Legal framework for tendering procedures ORE	Tendering framework for OWF (inclusion of MU as possible criteria)	Ministry of Economic Affairs and Climate Policy

UNITED KINGDOM

Example of Policy Relevant for MU	Focus of the Policy	MU-Relevant Policy Tools	Relevant Policy Actors
Marine and Coastal Access Act 2009	Marine licensing and planning provisions	Offshore Licensing frameworks (OWF co-existence possibilities)	Marine Scotland; Marine Management Organization
British Energy Security Strategy	Energy security strategy	Commitment to achieve offshore energy goals (co-existence as tool)	Department for Business, Energy and Industrial Strategy

Latin America

BRAZIL

Example of Policy Relevant for MU	Focus of the Policy	MU-Relevant Policy Tools	Relevant Policy Actors
National Coastal Management Plan	(Spatial) development of coastal zones, promoting coexistence of uses	Harmonizing and synergizing of human uses and conservation	Ministry of the Environment; Coastal states; Economic and Local Sectors

North America

UNITED STATES

Example of Policy Relevant for MU	Focus of the Policy	MU-Relevant Policy Tools	Relevant Policy Actors
Coastal Zone Management Act	Management and preservation of coastal resources	1. State-level planning; 2. Federal funding and consistency requirements	NOAA; State Coastal Programs

Gain a deeper understanding of the multi-use policy in the United States, by consulting the **MULTI-FRAME United States Case Study**

1.3 Policy Recommendations from the MULTI-FRAME case studies

The following key policy recommendations were identified during the MULTI-FRAME project:

01

Ensure clear policy, spatial planning, and regulatory frameworks for ocean multi-use.

- Integrate MU activities into coastal and MSP frameworks and national policies
- Establish clear guidelines and regulations for the siting, development, and operation of multiuse solutions
- Mainstream MU into relevant sectoral policies

02

Develop and implement transparent and participatory governance frameworks that involve all relevant stakeholders, including governments, industries, NGOs, and local communities.

- Support the authentic and relevant engagement from diverse communities in MSP processes that go beyond public hearing
- Build capacity among stakeholders to support the planning and management of MU activities
- Foster cooperation and collaboration among stakeholders

03

Address power imbalances and financing challenges in ocean multi-use systems.

- Establish financing mechanisms that support the development of MU solutions
- Prioritize the needs of less financially-capable users

04

Provide incentives and support for innovation and collaborative research in ocean multi-use.

- Increase investment in research, monitoring, and evaluation programs of MU activities to better understand their environmental, economic, and social impacts and inform evidence-based decision-making.
- Provide incentives and support for the development of pilot projects, new technologies and innovative approaches to MU that minimize negative impacts on the marine environment, improve the efficiency of MU activities and promote sustainable practices.
- Foster international cooperation and knowledge-sharing to develop best practices and common standards for MU activities.

BRAZIL

Table 2: Policy Recommendation per Case Study

Policy Recommendations
• MU Integration Capacity: Foster capacity-building and training to integrate MU within existing marine uses. • Innovative Use Cooperation: Encourage cooperation between traditional and innovative marine uses. • Regulatory Transparency: Enhance transparency and cooperation in regulatory processes concerning MU.

FRANCE

Policy Recommendations
• MU Network: Establish a permanent network to promote and support multi-use initiatives within marine environments. • MSP Integration: Integrate multi-use strategies into maritime spatial planning frameworks and energy policies to ensure a cohesive approach. • Stakeholder Engagement: Actively encourage and support stakeholders interested in exploring and investing in multi-use opportunities. • MU Experimentation: Facilitate and incentivize experimentation with multi-use projects to evaluate their viability and benefits.

NORWAY

Policy Recommendations
• Integrated Coastal Management and MSP: Utilize MSP as the basis for decision-making regarding human activity in marine areas, while also advocating for regulatory adjustments to fully realize integrated management concepts. • Municipality Planning Inclusion: Include MU strategies in municipal coastal/marine planning to ensure local governance aligns with broader conservation and usage goals. • International Policy Advocacy: Encourage international bodies such as the UN and EU to advocate for national policies that support cross-sectoral regulation of ocean and coastal space utilization. • Food and Feed Regulations Adaptation: Amend food and feed regulations to encourage products from MU and Integrated Multi-Trophic Aquaculture. • Product Labeling Regulation: Incorporate MU and Integrated Multi-Trophic Aquaculture considerations into the labelling of food products, aligning with Regulation (EU) No 1379/2013. • Environmental Impact Documentation: Develop a regulatory framework that mandates clear reporting for the documentation of environmental impacts and benefits of MU.

SWEDEN

Policy Recommendations

- MSP Engagement Platform: Establish a national platform to foster dialogue and knowledge exchange on MSP, coexistence and MU strategies.
- Inclusive Decision-Making: Enhance the inclusivity and authenticity of stakeholder contributions in MSP processes, with an emphasis on transparent decision-making as a trademark of modern marine governance.
- Permitting Process Reform: Reform the permitting processes to accommodate multi-activity licensing, facilitating MU approaches where single-entity, single-activity licenses are currently the norm.
- Risk Management in MU: Strategically prioritize the de-risking of MU initiatives by addressing stakeholder and investor concerns and implementing mitigation actions to minimize risks.
- Environmental Monitoring Support: Promote and support the monitoring of environmental effects resulting from MU, with a specific focus on understanding the long-term impacts on biodiversity, marine toxicity, and plastic pollution.

UNITED STATES

Policy Recommendations

- NOAA Influence: Increase the influence of NOAA's scientific research and expertise in decision-making processes related to coastal and marine environments.
- Public Research Communication: Ensure comprehensive cooperative research and monitoring efforts are publicly communicated and utilized to inform an adaptive management approach.
- Community Capacity Building: Secure significant early-stage funding for coastal communities and resource users to enhance their capacity and engagement in the siting process for marine projects.
- Innovative Solutions Funding: Allocate funds to encourage cooperative development of innovative solutions aimed at MU and minimizing the impacts of offshore wind energy on people and wildlife.

Explore the **Transferability Report providing the comparison of MULTI-FRAME Case Studies**

2. How to integrate multi-use in Marine Spatial Planning

Marine spatial planning can take various forms and approaches, depending on the detail and specificity required for the particular context. Some marine spatial plans may be more **detailed and operational, with specific zoning and restrictions** on activities, such as offshore wind farms, aquaculture facilities, shipping lanes, and marine protected areas. These plans may also include regulations, policies, and guidelines for the location, design, and operation of different activities in each zone. In contrast, other plans may be more **strategic and higher level, focusing on broader objectives, and guiding principles** and priorities for marine management, without necessarily defining specific zones or activities.

When it comes to integrating the ocean MU concept into MSP, there are various approaches that can be employed, depending on the type of MSP in place or intended to be developed. Each approach can be customized to the specific context and needs of the marine area and stakeholders involved.

2.1 Steps for integrating multi-use concepts in MSP

Identification of potential multi-use combinations

One of the first steps in terms of MU consideration in MSP, would be to identify the potential for multi-use development. Identification of areas with the potential for multi-use development, can be done based on an analysis of various factors including the presence of relevant resources, proximity to shore, water depth, currents, seabed topography, proximity to shore, existing infrastructure, and environmental sensitivities for the potential combined uses.

For example, areas of high interest for fisheries can be identified within the offshore wind farm area where potentially a certain type of fishing could be allowed, either throughout the year or during specific periods. These areas should be carefully selected based on criteria such as fishing intensity, fishery resources, environmental sensitivities and navigational safety considerations.

Building trust for a comprehensive stakeholder engagement process is essential for the success of this step, as well as the analysis of the local conditions and needs. The stakeholder engagement may help identify the added values that certain MU combinations may bring to the given space, or potential conflict that it may cause.

Building a vision

The work with stakeholders may help to define the vision, objectives and guiding principles for MU development in specific areas, based on the needs and opportunities. A Handbook for Developing Visions in MSP provides a pallet of resources for visioning exercises that can also be applicable in the MU context. Such processes can be used to build understanding and commitment among stakeholders.

The vision should encompass the desired outcomes and benefits of offshore MU and emphasize the shared goals and values that unite stakeholders. This fosters a sense of ownership and commitment among those who will be affected by or involved in offshore and coastal MU activities.

Using the information structuring tools such as SWOT may be helpful in structuring the discussion and identifying the suitable MU combinations and a guiding vision/objectives for each.

Belgian multi-use vision development process

The Belgian multi-use vision development was initiated in 2017 as an independent process conducted in parallel with the marine spatial plan revision. While the plan considers the timeline 2020-2026, the vision looks up to the year 2050. The plan is legally binding spatial planning document, whereas the vision is a guiding policy document that sets goals and conditions for the long term. The plan can thus be seen as a stepwise instrument to realize the integrated vision on a short term.

The process involved over 100 stakeholders forming an 'user committee' including authorities, the research community and business representatives and all those interested in the process. Among other methods, several interactive workshops were organized, and a modification of SWOT was used to collect and structure the information into a) trends 2050, b) treats, c) opportunities, d) points of attention.

Tradeoff analysis

Tradeoffs in the context of ocean MU refer to the difficult choices and compromises that need to be made when multiple activities vie for the same marine space. These tradeoffs involve deciding which activity should take precedence or how to allocate space resources, time, and funding among competing uses. Tradeoffs often focus on the inherent conflicts and synergies between activities.

For example, when planning an offshore wind farm, tradeoffs could involve deciding whether to prioritize fishing or aquaculture in the same area, considering the impact on local economies, the environment, and social factors.

Tradeoff analysis helps establish the broader priorities and preferences among competing uses. Stakeholders and decision-makers can engage in tradeoff discussions to determine which activities should be given preference in specific areas. This can be supported by participatory and collaborative mapping tools such as SeaSketch which allow development of comprehensive zoning scenarios that reflect stakeholder values in MSP. This initial analysis sets the stage for using multi-criteria siting tools to find the most suitable locations for these prioritized activities.

Multi-criteria siting tools are decision support systems that use quantitative and qualitative data to assess potential locations for offshore activities based on various criteria. These tools help identify suitable areas, taking into account a range of environmental, economic, and social factors simultaneously.

1 Available at: https://www.sciencedirect.com/science/article/pii/S136403212100407X

2 Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0194362

Multi-criteria siting tools provide a structured approach to evaluating and comparing the suitability of different locations for specific activities. For example, such a tool can be used to identify the optimal locations for offshore wind farms by considering factors such as wind speed, seabed conditions, proximity to grid infrastructure, and potential impacts on marine ecosystems. Several siting tools have been used to assess the site's suitability for a specific use. For example, offshore wind siting is done using spatial decision support tools such as INDIMAR (applied in the Canary Islands, 2021[1]) or Marxan (applied in the western Baltic Sea[3]).

Multi-criteria siting tools incorporate the insights gained from tradeoff analysis. For example, if aquaculture is prioritized due to overfishing in a certain area, the multi-criteria siting tool can be configured to favor locations that are more compatible with aquaculture requirements while minimizing impacts on other activities. This ensures that the chosen locations align with the tradeoff decisions.

Siting of nature restoration in offshore wind farms

Almost all locations where historical European flat oyster (Ostrea edulis) beds were present, including most European MPAs with a designated Natura 2000 habitat directive status, are regularly impacted by bottom trawling and hence unsuitable for oyster restoration efforts. However, offshore renewable energy projects have successfully excluded bottom disturbing activities from the concession zones to protect their underwater infrastructure. Consequently, offshore wind farms have received a status as quasi-marine protected areas (Hammar et al., 2015) and are considered suitable areas for large scale offshore nature restoration projects including flat oyster bed restoration (Kamermans et al., 2018). In the UNITED project, a model **[3]** has been developed (which include species-environment interactions and in addition, inter and intra species interactions) for determining site suitability for Ostrea edulis offshore habitat restoration, restorative aquaculture, or oyster-related nature-inclusive designs, in existing and potential future offshore wind farm zones.

3 Available at: https://www.frontiersin.org/articles/10.3389/fmars.2023.1224346/full

Stakeholders in Barbuda used SeaSketch for planning Ocean Zones [4]

SeaSketch was used in the Caribbean island of Barbuda to create a comprehensive marine spatial plan. The Barbuda Council (the island's governing body), with invited support from the Waitt Institute, navigated complex trade-offs between spatial uses to design and legally codify zoning for their entire marine jurisdiction. After a year of intensive community engagement under the Blue Halo Initiative, regulations were adopted in August 2014 that established zones for sanctuaries, fish net prohibitions, anchoring/mooring, and shipping. Key data used included a habitat map and a heatmap of fishing value. Barbudans designed all zones, with technical support, using SeaSketch. Throughout the process, the Council incorporated input from fishers and other community members, seeking a final zoning design that would minimize negative impacts on livelihoods and earn broad community support. The final zoning plan balances economic, conservation, and cultural uses. HE MSP4BIO project is using SeaSketch for the trade-off analysis in its MPA test sites together with site-specific stakeholders to create a trade-offs method for protection and restoration in MSP.
For more information, access the report here.

Development of zoning plans

Depending on the detail and binding character of the marine spatial plan, zoning plans can be developed that identify areas for MU, as well as the rules and guidelines associated to the given zone. Some plans (Sweden, Finland) are of non-binding character. They only guide MSP activities.

Other plans are of a regulatory nature but with different details of regulation. For instance, in Estonia the plan regulates in detail mainly renewable energy. Polish and German plans are the most prescriptive, with the only Polish plan regulating each part of the Baltic Sea in detail (what is allowed there and what is not permitted).

For example, a multi-use zone can suggest what use may have priority and what added use may be allowed. Moreover, a guideline or policy may be developed for a specific zone to provide measures to mitigate potential impacts on the environment, which may differ across zones depending on the environmental sensitivities.

Multi-use zones in the Polish Marine Spatial Plan

The Polish marine spatial plans are very detailed, reaching a scale up to 1:5000 in port areas. Multi-use is not required in the Polish plan, but it is encouraged. The plan encourages multi-use between firm or permanent uses such as offshore wind or extraction of hydrocarbons and fishery and aquaculture. Those uses are allowed in the water areas with priority function 'energy' or 'sea mining'. The plan asks for collaboration between relevant stakeholders under the auspices of maritime administration to prepare a detailed modus operandi in the form of an agreement. Other multi-uses are also allowed. Navigation (with limitations due to the length of the ship) and leisure tourism are allowed in the offshore wind areas and coastal tourism in the sea areas devoted to coastal defence. In general, in the sea area with a given priority function, many other allowable functions are permitted. For instance, in the sea areas with a priority function 'renewable energy' the following other functions are also allowed: Research; Aquaculture; Cultural heritage; Transport; Fishing; Sport and Recreation.
For more information, access the Polish MSP here.

4 https://panorama.solutions/en/solution/seasketch-web-based-tool-participatory-marine-spatial-planning

Multi-use zoning for large scale renewable energy projects in Rhode Island

The Rhode Island state policy authorizes the Coastal Resources Management Council to encourage multi-use in areas with the Water Classification Type 4 (multipurpose) zone. Originally in a Type 4 zone, the Renewable Energy Zone (REZ) has been modified as Water Classification Type 4E to show that while this is the preferred site for large scale renewable energy projects in state waters, other activities including but not limited to habitat protection, tourism, fisheries, or research should not be hindered. The regulations are specific to requiring that in these Type 4E waters essential fish habitat should remain protected and there are no significant long-term negative impacts to Rhode Island's commercial or recreational fisheries. Long-term impacts are defined as those that affect more than one or two seasons.
For more information, click here

Humboldt Archipelago Multi-Use Marine Coastal Protected Area (AMCP-MU)

Humboldt Archipelago Multi-Use Marine Coastal Protected Area (AMCP-MU) was approved by the Council of Ministers for Sustainability in Chile in August 2023. The area covers more than 5,700 square kilometers and has a bi-regional character, located between the Atacama and Coquimbo regions. This designation aims to protect one of the most biodiverse ecosystems in the country, while simultaneously promoting sustainable development for local communities encouraging low-impact activities such as artisanal fisheries and sustainable tourism. The recently established area doesn´t affect the aquaculture concessions already granted.
For more information , click here

Evaluation and monitoring

Implementing the MU in the given zone should be monitored and evaluated to ensure that it achieves its objectives and that any necessary adjustments are made based on new information or changing circumstances. For example, a multitude of multi-use pilot projects are currently ongoing (e.g., OLAMUR, ULTFRAMS, WIN@SEA) that will generate results of relevance for future marine spatial planning rounds and updates.

Moreover, monitoring guidelines developed as a result of a strategic environmental assessment (SEA) can establish performance indicators to monitor the effectiveness of MU activities in achieving their environmental, social, and economic objectives.

Multi-Use in French MSP and associated policies

France has introduced an innovative planning approach known as "co-activity," which has garnered interest in countries where fishers were either formally or informally excluded from wind farms. The absence of mutual benefits between offshore wind and fishing doesn't indicate that these sectors lack a close interconnection. In fact, public authorities have initiated consultation and negotiation processes to preserve fishing activities, including those involving active gear, within offshore wind farms to the greatest extent possible.

The establishment of communication channels and agreements between these two potentially conflicting marine uses has been viewed as an advanced form of spatial and social multi-use. While certain activities are restricted within offshore wind farms for safety reasons, such as diving or recreational fishing, representatives of sea users have been actively involved in consultation processes to define co-activity rules, particularly in collaboration with commercial fishers. This presents a significant opportunity for the development of inventive multi-use solutions, especially given that maritime spatial plans explicitly acknowledge the potential for multi-purpose uses within offshore platforms or wind farms at sea, such as the integration of aquaculture into wind farms. The Marine Spatial Planning process has also been of great importance for the facilitation of offshore wind and passive fisheries in the case of the “Banc de Guérande” offshore wind park is located on the French Atlantic Coast, 15 km West of Saint-Nazaire city.
For more information, click here

Table 3: Integration of MU in MSP per MULTI-FRAME Case Study

Country	MU consideration in MSP processes
Brazil	Brazil is in the early phases of developing its MSP process, with MU and synergistic activities between sectors acknowledged as guiding principles. MU promotes an efficient and ecologically sensitive approach to the use of marine spaces.
France	In France, the concept of coexistence is recognized within the MSP processes; however, specific measures to operationalize MU are not yet in place.
Norway	Norway's Integrated Ocean Management Plan (IOMP) actively addresses the concept of MU, referred to as "coexistence" or "activities that intersect." The government's approach is to consider MU in the context of spatial management and the growth of ocean-based industries. The IOMP will be revised, with an emphasis on harmonizing diverse interests and minimizing conflicts.
Sweden	MU is partially incorporated into Sweden's current MSP, with specific areas designated for coexistence. However, the term MU is not formally established in the Swedish language or explicitly outlined within the MSP.
United States	In the United States, MU considerations are present in some MSP efforts, albeit not as a standardized requirement.

3. How to assess impacts of ocean multi-use

Over the last decade, several ocean MU-related projects have tried to provide an assessment framework for MU activities. Several assessment approaches analysed in the MULTI-FRAME project are presented in Table 4. The analysis shows that only a handful of those considered a more holistic integrated assessment of impacts integrating all three elements of sustainability – social, economic and environmental. Most of the approaches focused only on one aspect of sustainability.

On the marine spatial planning level, some early attempts focused on a more general analysis of multi-use potential, such as the MUSES project (2016-2018) Drivers, Added Values, Barriers and Negative Impacts (DABI) used to determine the potential of certain MU combinations in a given area. Such an approach can be used as part of MSP to decide on the best configuration of marine uses and assess overall potential impacts.

More recently, the MULTI-FRAME project has developed the Multi-Use Assessment Approach (MUAA). MUAA provides practitioners and coastal community members with a guide to assess the potential of applying ocean MU to respond to some of the ocean planning issues, specifically challenges around balancing the use of the ocean by different resource users.

Through this 3-phase process – 1. Setting the Stage; 2. Detailed Evaluation; and 3. Final Assessment and Recommendations – practitioners with their partners will walk through 10-steps towards considering MU. This iterative approach can serve to collaboratively create clear goals, build a strong and sustainable commitment from different levels of government and resource users, and establish the capacity and the constituency to implement and advocate for environmental, economic, and social change. While this approach encourages a group to consider MU, it may also encourage them to recognise that MU may not be the appropriate planning tool for their situation.

Through the application of a combination of processes, including workshops, interviews, and/or the application of tools such as the PESTEL analysis, Step 7 within the MUAA is where the project team and partners identifIed major opportunities, benefits, risks, and constraints towards meeting their MU goals and vision.

Step 8 immediately follows where the team identified possible solutions and or next steps that needed to be taken to: 1) overcome some of the risks and constraints; and 2) enhance some of the benefits and opportunities.

On the project level, UNITED has developed an Assessment Framework to assess the impacts of multi-use pilots. While it constitutes an overarching assessment framework, it consists of individual assessments for each dimension—social, environmental, and economic offering a comprehensive understanding of multi-use effects. However, the framework does not set specific criteria for cross-category comparisons, and is thus not weighing the outcomes of the different assessment tools against each other.

Both approaches emphasised the need for an **integrated assessment considering three main aspects of sustainability: society, economy and environment.** Moreover, in the framework of ocean MU, not only cumulative but also combination impacts should be considered. It is, however, important to note that a MU concept may not always be the best option for the given space. A comprehensive consideration of all cumulative and in-combination impacts should take place and the application of the precautionary principle where the knowledge about possible impacts is lacking.

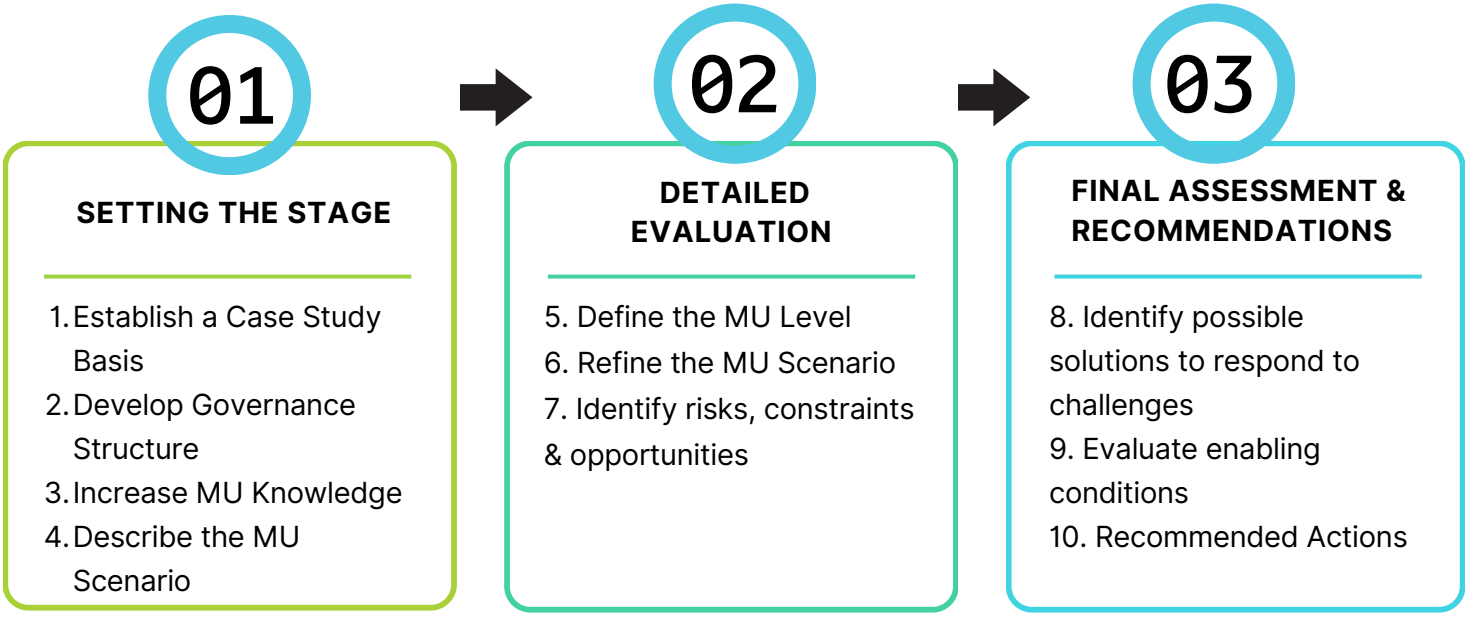


Figure 1 MULTI-FRAME Ocean Multi-USe Assessment Approach Steps

Learn more about ocean multi-use assessment steps by consulting the **MULTI-FRAME Ocean Multi-Use Assessment Approach**

Table 4: Assessment Frameworks MU

Assessment Framework	Description	Type of Sustainability Assessed			References
		Environmental	Social	Economical	
Wind Farm Siting Index (WiFSI)	A wind farm macro siting optimization methodology, which allows the consideration of the ecosystem service constraints in addition to the technological cost in the siting optimization problem. This is synthetized by a nondimensional wind farm siting index. This Index has been used to consider the fisheries services, including commercial and recreational fisheries activities, as well as the sensitive ecological services and could potentially be used to assess the suitability of a certain site for certain type of multi-use from different perspectives.				Grilli, Annette, and Malcolm Spaulding. "Offshore Wind Resource Assessment in Rhode Island Waters." 2013.
Spatial Economic Benefit Analysis (EBA)	This tool can contribute to identifying who benefits from which marine use and where are those beneficiaries geographically located. With the ability to assess what may be the geographical distribution of economic benefit of a potential multi-use.			✓	Weig, Barbara. BONUS BALTSPACE. Spatial Economic Benefit Analysis. 2017.
Drivers, Added Value, Barriers and Negative Impacts (DABIs) of Multi Use	This tool offers a semi-quantitative approach to evaluating the MU potential. MU DABI factors are categorized by considering key issues for MU development, such as policies, administrative/legal aspects, environmental and socio-economic constrains, technical capacity, and knowledge gaps (technology, environmental impacts, health and security issues etc.). This tool has been tested throughout Europe.	✓	✓	✓	MUSES Multi-Use Case Studies 2018.
Design Thinking	An iterative and innovative process and a hands-on method that allows stakeholders to understand the user, challenge assumptions, and redefine the problems. This process identifies alternative strategies and solutions that might not be instantly apparent. Through a series of questions, stakeholders tackle problems that are ill defined or unknown.	✓	✓	✓	Gekeler, M. A practical guide to design thinking. Friedrich-Ebert-Stiftung. 2019.
The Ocean Health Index (OHI)	An assessment framework that evaluates marine environments. It is standardized yet tailorable to different contexts and spatial scales, combines open-source, (freely-available) existing information and societal priorities to score marine systems according to the delivery of a suite of key societal 'goals' representing the benefits and services people expect healthy oceans to provide. This tool brings stakeholders together to develop goals and priorities and incorporate local knowledge and data.	✓	✓	✓	Ocean Health Index.

The IUCN Red List of Ecosystems (RLE)	A standardized, globally recognized framework for assessing the status of ecosystems at local, national, regional and global levels. Assessments determine the level of risk that an ecosystem faces, with a risk classification system that mirrors the Red List of Species (Fig. 2). An RLE assessment is precise, realistic, and simple. It is based on a set of rules, or criteria, formulated on the hypothesis that ecosystem risk is a function of the species that compose them, their interaction, and the ecological processes they depend on.	✓			Red List of Ecosystems.
Scenario Planning	Scenario Planning allows participants, often from diverse backgrounds, to create and explore a set of plausible future scenarios that could happen. It can identify uncertainties and help to find solutions and approaches that can be useful in multiple possible futures.	✓	✓	✓	Frens, Kathryn, and Wendy Morrison. Scenario Planning: An Introduction for Fishery Managers. NOAA. 2020.
SWOT Analysis	A tool that analyzes both internal and external factors and identifies Strengths, Weaknesses, Opportunities, and Threats for a specific situation. SWOT can serve as a tool to assist in developing successful strategies and uncover gaps.	✓	✓	✓	Goffetti, Giulia, et al. "Disaggregating the SWOT Analysis of Marine Renewable Energies." 2018.
Coastal Governance Policy Cycle	The GESAMP Cycle is a widely used framework for documenting coastal governance processes, consisting of five steps: problem analysis, course of action formulation, policy commitment, implementation, and evaluation. The concept suggests that ecosystem governance involves continuous learning and adaptation through multiple cycles, addressing various issues and geographic areas. The Orders of Outcome is another framework used to assess progress in ecosystem-based management. It consists of two to five indicator categories in each order, indicating different levels of achievement towards the ultimate goal of sustainable development. These frameworks help guide and evaluate coastal management processes.	✓	✓	✓	Olsen, Stephen. "Frameworks and Indicators for Assessing Progress in Integrated Coastal Management Initiatives."2003. Olsen, Stephen Bloye, et al. "Governance Baselines as a Basis for Adaptive Marine Spatial Planning." 2011.
UNITED Assessment Framework	The UNITED assessment framework, a product of the UNITED project, provides a practical tool for evaluating multi-use projects.	✓	✓	✓	UNITED project
UNITED Cumulative Impact Assessment Tool	The UNITED Cumulative Impact Assessment Tool, developed in the UNITED project, is a framework tailored to assess how MU projects impact the environment. This tool's primary focus is on cumulative impact assessment. This assessment tool offers an insight into environmental consequences that arise when two marine activities are combined.	✓			UNITED project

Multi-Use Assessment Approach (MUAA)	The MUAA provides practitioners and coastal community members with a guide or approach to assess the potential of applying ocean multi-use (MU) as a tool to respond to some of the ocean planning issues, specifically challenges around balancing the use of the ocean by different resource users.	✓	✓	✓	Jen McCann et al. Multi-Use Assessment Approach (MUAA). 2023.
PESTEL analysis	A tool or framework that can be used to analyze and screen the external environment of the MU scenario. PESTEL is broken down into six categories referencing factors that can or will affect the topic chosen for the analysis. They are: Political, Economic, Sociocultural, Technological, Environmental, and Legal.	✓	✓	✓	PESTLE Analysis. The PESTEL Framework Explained: 6 Important Factors. 6 Feb. 2022.
Balancing profitability of energy production, societal impacts and biodiversity in offshore wind farm design	The assessment tool, designed to guide the establishment of offshore wind farms in Finland, takes a multifaceted approach to ensure a delicate balance between profitability, societal well-being, and the conservation of biodiversity. It evaluates potential locations across multiple dimensions, including biodiversity preservation, spatial life cycle cost analysis for profitability, assessment of societal impacts such as visual and noise effects, and considerations for various restrictions and enablers, such as military areas and environmental factors like hypoxia. This comprehensive tool not only aids in pinpointing the most suitable areas for offshore wind farms but also facilitates the identification of zones where wind energy projects can coexist with other activities, contributing to sustainable energy solutions in the region.	✓	✓	✓	VASAB
Ecosystem or multi use risk assessments	Assessments that apply a common framework for the risk assessment of mulit-use at sea, consisting of 6 steps - Exploring, Understanding, Appraising, Deciding, Implementing and Evaluating and Communication. This risk assessment encompasses and integrates an alaysis of food and feed safety aspects, the safety of people and equipment, and ennvironmental safety aspects. Allows for an integrated analysis and considers safety. It assesses risk at different stages of multi-use. It is meant to assist operators to develop safe operational practices which includes operating within the current setting of allocating marine space to activities (MSP) and operating under a multitude of legislative and licensing practices - which in the case of multi use may imply that not only the legal framework of the 2 individual activities need to be taken into account by that the combination of activities may invoke additional legislation.	✓			Hoof, L. van, et al. “Can Multi-Use of the Sea Be Safe? A Framework for Risk Assessment of Multi-Use at Sea.” 2020. Jin, Di, et al. “Risk Assessment in Open-Ocean Aquaculture: A Firm-Level Investment-Production Model.” 2005.

4. Multi-use Permitting

Permitting is a cornerstone of the maritime industries, holding significant implications for businesses engaged in maritime activities. It serves as the regulatory framework governing a spectrum of operations, including shipping, offshore energy exploration, fisheries, and coastal development.

Understanding and navigating this permitting landscape is crucial to ensure compliance with environmental regulations, maintain operational safety, and unlock opportunities for sustainable growth. In the case of multi-use, however, permitting frameworks are rather underdeveloped. In most countries, there is no specific licensing system in place that allows for MU. This lack of regulatory framework hinders the development of ocean MU projects as it significantly raises transaction costs, increases insecurities and limits competitiveness. Often, permitting is done in separate processes for each sector rather than giving out one MU permit as such joint MU permits usually do not exist.

The following table showcases the permitting challenges encountered in each of the case study countries and suggests solutions to overcome these challenges in the future.

Table 5: Permitting challenges and proposed solutions per case study

Country	Permitting Challenges	Proposed Solutions
Brazil	There's a lack of transparency and significant bureaucratic hurdles in the permit process.	Enhance cooperation and transparency in the permit and licensing process.
France	Stakeholders find it challenging to perceive the benefits of multi-use over simple coexistence. Ambitious offshore wind targets alongside strong marine protection goals are at odds with multi-use development.	Tie the development of offshore wind farms to the achievement of multi-use development goals.
Norway	Permitting and licensing systems are sector-specific, hindering cross-sector collaboration.	Provide clear guidance on the permit application process and develop procedures to enable cross sectorial collaboration.
Sweden	The application process is lengthy, costly, and must be undertaken individually by each maritime user.	Develop licensing processes tailored for MU that allow multiple parties to jointly apply for a collective license.
United States	MU is not actively encouraged or supported through funding or forums.	Developers should include in their applications scenarios that are supported by resource users that promote MU. A commitment to MU strategy should be enforced.

Explore the **Ocean Multi-Use Policy Recommendations provided by the MULTI-FRAME project.**

4.1 Multi-use Permits and Licensing – key challenges and possible solutions

Navigating the permitting process for ocean MU in situations where one primary use is already established raises important considerations. When a primary user holds rights or permits for a maritime zone, or their activities are well-developed, secondary users often face the challenge of legislated access to the primary user's priority areas. This access is typically granted only if the secondary use can demonstrate its compatibility and absence of harm to the primary use. Regulatory frameworks facilitating MU are crucial when integrating secondary uses alongside established primary activities in marine environments.

Multi-Use Procedure Belgium and the Netherlands

Both Belgium and the Netherlands have developed a Multi-Use Procedure that allows secondary marine activities to apply for a co-use permit in wind farm zones. Under the Wind & Wier project, a procedure guide was set up to lead possible applicants through the process of planning their project, selecting a suitable site, developing the secondary use, aligning with wind farm regulations and applying for permits.
For a more detailed overview, click here.

Multi-Use zoning of Aquaculture in German EEZ

Although Germany currently lacks commercial aquaculture facilities in EEZ, and areas for offshore aquaculture have not yet been designated, the German MSP determines that aquaculture activities are restricted to regions with pre-existing offshore installations. This regulation establishes a legal foundation for utilizing aquaculture as a secondary activity, for instance, in areas prioritized for OWFs.
For the German MSP, click here.

A clear regulatory framework supporting pescatourism in Italy

Pescatourism on the Eastern Sardinian coast was facilitated by the Italian legal framework. In fact, Italy was one of the first countries to recognize and encourage pescatourism. This concept was officially defined in 1982, with fishing-tourism activities being allowed in 1992 and regulated in 1999 through the Decree No. 293 of the Ministry for Agricultural and Forestry Policies. Since then, Italy has been a world leader in pescatourism together with Greece. The Italian legislation, which allows tourists to participate in fishing activities, was improved in 2012 to give fishers easier access to pescatourism permits and licenses.
For more information, click here

Determining which secondary use is to be granted permission in a specific area can introduce further challenges to the permitting process. To address this, the adoption of a regulatory assessment framework might be advised, as it can provide a structured approach to making well-informed and strategic decisions in this regard. This framework ensures that choices regarding secondary uses align with broader policy goals and objectives, optimizing the utilization of marine spaces while minimizing potential conflicts or adverse impacts.

Assessment Framework for multi-use in offshore wind farms in the Netherlands

Step 1: Initial Consultation and Activity Description
The process begins with preliminary consultations between the initiator and the competent authority, often involving other stakeholders like wind farm operators. These discussions aim to explore the proposed multiple-use activities within offshore wind farms, emphasizing integration and collaboration. The initiator provides a detailed description of the activities, including spatial requirements and potential environmental impacts. This stage also invokes the ecosystem approach and the precautionary principle to assess effects on the broader ecosystem and Natura 2000 areas. It's essential that co-use activities do not hinder wind energy generation or jeopardize safety, making early cooperation with wind farm operators highly beneficial.

Step 2: Preliminary Assessment
In this step, the competent authority evaluates the proposed activity based on policy preferences established for the specific wind farm zone. There are two potential outcomes. If the proposed activity aligns with the preferred activity for the area and location, the formal permit procedure begins immediately. However, if the proposed activity isn't the preferred one, the authority announces its intention to issue a permit for the specific location. During this period, other initiators can express interest and demonstrate their intent to develop co-use activities in the area within a specified timeframe. If no other initiators come forward, the formal permit procedure commences. If another candidate registers a preferred activity within this period, consultations are conducted to determine if both initiatives can coexist.

Step 3: Activity Assessment and Location Selection
Following the submission of the formal permit application, a comprehensive assessment process begins. The application is scrutinized based on specific criteria, encompassing spatial and operational impacts, safety, environmental compliance, and even cultural values. Permits are typically issued with specified durations, and the permit holder must initiate the approved activity within a set timeframe. Additionally, removal obligations and financial security may be required to cover potential removal costs. This step ensures sustainable co-use in offshore wind farms, taking into account environmental protection, safety, and collaboration with wind farm operators. The specific requirements may vary depending on the wind farm zone and evolving regulations.

Possible secondary use - Derogation procedure of the European ecological network "Natura 2000"

The European ecological network "Natura 2000" covers almost one fifth of the European Union's (EU) land area and around 10% of its marine area (around 28,000 sites), making it the world's largest network of protected areas (EEA, 2023). The sites in the Natura 2000 network are designated under the 'Nature Directives', i.e. the Birds and the Habitats Directives (HD). All proposals for development affecting these sites must be previously assessed for their implications for the site's conservation objectives. In cases where it cannot be ascertained that there is no adverse effect on the integrity of a Natura 2000 site, the proposal for development can only be approved within the scope of a derogation assessment pursuant to Article 6(4) of the HD [5] which helps to align economic and social with conservation interests. In addition to the designation and management of these sites, those plans and projects, which are not directly connected with or necessary to the management of the site, but likely to have a significant effect on the integrity of a Natura 2000 site must be the subject of an appropriate assessment.

Authorization for such proposed developments may be given only on condition that the competent authorities are certain that the plan or project will not have lasting adverse effects on the integrity of that site. These strict requirements are mitigated by the option for a derogating authorization in favor of other public interests. In cases of priority natural habitat types or priority species of Annex I and II of the Habitats Directive, an exemption is only justified by considerations associated with human health and public safety or has beneficial consequences of primary importance for the environment or further to an opinion from the European Commission. The European Commission has produced guidance and memoranda to aid Member States in their application of Article 6 HD. [6]

If a project or plan must be prohibited in accordance with the outcomes of the assessment, the responsible authority may overrule this and authorise a proposed development under the standard conditions given in Article 6(4) HD:

- **The plan or project must be carried out for imperative reasons of overriding public interest (IROPI), including those of a social or economic nature.**

A derogation is only permissible if the proposed development is required due to imperative reasons of overriding public interest, including those of a social or economic nature. The public interest must significantly outweigh the conservation interests.

- **There is no alternative solution.**

Aiming to specifically protect the integrity of Natura 2000 sites, no alternative solutions to the proposed project can exist and evidence for this must be provided. An alternative, to be taken into consideration cannot result in a different project, must be realizable and not associated with disproportionate costs, cannot have a significant adverse impact on other public interests and must be more advantageous to both the affected site and to the entire Natura 2000 network.

- **The Member State takes all compensatory measures required to ensure that the overall coherence of the Natura 2000 network is protected.**

All necessary compensatory measures with a high probability of effectiveness are to be taken and monitored for their effectiveness to ensure that the global coherence of Natura 2000 is protected. The costs are essentially to be borne by the developer, whereby government subsidies are possible.

5 Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:01992L0043-20130701

6 Managing Natura 2000 sites: The provisions of Article 6 of the Habitats Directive 92/43/EEC (2019/C 33/01)

Berwick Bank Wind Farm Derogation Case (still awaiting all approvals)

Berwick Bank Offshore Wind Farm is proposed to be located in the Scottish part of the North Sea, in the outer Firth of Forth, and has the potential to deliver up to 4.1 GW of installed capacity, making it one of the largest offshore opportunities in the world. Berwick Bank Offshore Wind Farm is now at an advanced stage of development. In late 2022, a planning application was submitted to the Scottish Government seeking consent to develop and enter construction. If approved for delivery, Berwick Bank could increase Scotland's overall renewable energy capacity by nearly 30%.

In the derogation case [7], appropriate assessment outcomes have been described using different approaches identifying adverse effects on the integrity of different Special Protection Areas (SPAs). Nevertheless, the need for the Project has been highlighted also through key role that the Project should play in delivering Scottish and UK targets such as in addressing climate change emergency. That set a basis for their requests for authorisation of IROPI arguing that decarbonisation and security of supply of affordable energy supplies are in the overriding long-term public interest and demonstrably outweigh any Adverse Effect on Integrity which is predicted in respect of the identified SPAs. In addition to that, it has been argued that no feasible alternative solutions were identified that could meet the project objectives and detailed compensation measures have been presented resulting from extensive consultation and research suggesting that that the overall coherence of the national site network will be protected if they are implemented. The case shows how the complex derogation procedure stipulated in the Habitat Directive can be implemented.
For more information on the case, click here

7 BERWICK BANK WIND FARM Derogation Case (December 2022). Available at: https://marine.gov.scot/sites/default/files/eor0766_berwick_bank_wind_farm_application_-_1._derogation_case.pdf

4.2. Joint Multi-Use Permits

In cases where no primary use has been established yet, and MU is deemed to be beneficial, it is advised to have **simultaneous development of multi-use within a marine area.** This proactive strategy enables comprehensive planning from the beginning, reducing the need for later revoking existing permits, modifying operations and decommissioning plans and modifying or obtaining additional insurance certificates. Environmental assessments are a vital part of most single sector permitting procedures, however, in order to facilitate a combined permitting process, the relevant environmental assessment framework needs to address multi-use and associated cumulative and in-combination effects that may result from a combined use of the ocean resources.

Non-financial tendering procedure in the Netherlands

The Netherlands operates a new tendering procedure, integrating non-financial criteria into the decision-making process. At “site VI” of the Hollandse Kust West site fifty percent of the scoring is related to the project's environmental impact. This encourages the integration of other marine uses, such as nature protection, restoration or low trophic aquaculture into the project design from the start.
For more information, click here.

Assessment framework for the Polish offshore wind farm tendering procedure

The polish OWF tendering system supports multi-use by awarding points to applicants that analyze and showcase the potential for the existence of a secondary use. Wind farm operators integrating a secondary use, such as fishing, aquaculture or resource extraction in their application for a potential OWF site area can be favored in the tendering process.

4.3. Permits for repurposing offshore installations

Repurposing offshore infrastructure, including decommissioned oil rigs and in the future potentially offshore wind farms, presents a unique set of permitting challenges and opportunities. As repurposing existing offshore structures can potentially reduce costs and environmental impacts associated with decommissioning and removal, setting up a framework that facilitates permitting in these cases might be of relevance. Challenges regarding the permitting framework, often stem from the absence of a comprehensive regulatory framework or the constraints imposed by existing regulations.

For example, the OSPAR Convention, mandates the complete removal of all ocean infrastructure, prohibiting any remains to be left in the ocean and therefore it is presently not possible to establish this type of MU in the North Sea. Additionally, challenges may arise concerning liability, insurance, and financial responsibility for repurposed structures. Who is responsible for any future costs arising or damages done to the marine environment due to i.e., oil leaks? Finally, there is no certainty about the environmental and social impacts that this type of MU has on the long run, which further complicates the permitting process.

Re-use of offshore installations: 'Rigs to reefs' technology example

How are the artificial reefs made?
Three general methods are used for removing and “reefing” a retired structure:
1) tow-and-place: involves severing the structure from the sea floor either using explosives or mechanical cutting techniques and then towing it to the selected reef for deployment,
2) topple-in-place: also detaches the structure from the seabed. The detached structure is then toppled onto its side, and;
3) partial removal: generally does not use explosives. The top portion of the structure is severed at a permitted navigational depth, typically 85 feet deep, and placed on the sea floor next to the base of the remaining structure.
For more information about the technology of the Rigs to Reefs concept, click here

Rigs-to-Reefs Program in the Gulf of Mexico

In the Gulf of Mexico the Bureau of Safety and Environment Enforcement (BSEE) is in charge of the permitting and decommissioning processes of offshore infrastructure on the Outer Continental Shelf (OCS). The BSEE established a Rigs-to-Reefs (RtR) program which allows oil rig operators to only partially remove the rig structures and turn the remaining infrastructure into a permanent artificial reef, if deemed suitable. The oil rig operator needs to pay a fee to the respective state, which contributes to maintain the RtR, however, these costs will often still be lower than removing the offshore structure entirely. The Gulf of Mexico’s RtR program has had great success with over 550 offshore oil and gas platforms converted to permanent artificial reefs since the 1980s.
For more information, click here

5. Stakeholder engagement for multi-use

Multi-stakeholder planning can create management actions that are accepted and sustained over time by engaging a complex set of stakeholders, their interests and expectations. MU planning needs to be an inclusive participatory process that has an essential role in gathering stakeholders around the same table to discuss different planning options, collect and share data and build capacities. This kind of process can also address conflicts between newer users — such as offshore renewables versus more traditional users such as the fishing industry — allowing science and local knowledge to drive informed decisions.

An integrated approach to planning, should aim to engage not only different tiers of government but also representatives of different ocean industries, research and academia, NGOs and civil society. An inclusive, transparent stakeholder engagement process is key to successful MU planning to ensure long-term and sustainable social acceptability. Moreover, using a fair, participatory process that includes disadvantaged populations and indigenous peoples and their perspectives and going beyond a one-time public consultation can ensure proper consideration of local issues and improve local resilience.

5.1 Key steps in organizing the public process for multi-use

The MULTI-FRAME Ocean Multi-Use Assessment Approach (MUAA) has embraced the following three step public process in five case study regions with an aim of raising the awareness and initiating a wider discussion about the concept of multi-use and its possible integration in maritime spatial planning. Three key steps of a multi-use public process in line with the MUAA:

Define your stakeholders:

The step 2 of the MUAA help planners to determine who the primary and secondary collaborating stakeholders are. And provides guidance on the evaluation of the existing enabling conditions necessary for a strong governance structure that allows for establishing a framework towards accountability, a strong and diverse constituency, capacity and knowledge for informed decision-making, and authority to make decisions.
It defines the stakeholder collaborators as:

- **Core Collaborators** are individuals who represent organizations that will be directly impacted by MU development and implementation. This may include institutions that have the regulatory authority for the geographic area and/or use being considered for MU, resource users that represent the uses being considered for MU and/or may be impacted by this effort, private or civic organizations that may represent a resource user including wildlife, and possibly researchers. Core Collaborators, as the basis of governance structure, will be made up of these entities and will help to move through the MUAA to assess the potential of MU.

- **Secondary Collaborators** are individuals who represent organizations that may experience an indirect impact from this process and/or could contribute expertise and resources. They are interested in engaging and/or could also help in the communication of MUAA and MU implementation, but may not have the interest or time to engage as Core Collaborators. They contribute to building a broader community understanding (important for the long-term) of what MU is as the process moves forward.

Participatory Governance in Peru and Ecuador

The Coastal Fisheries Initiative in Latin America project is implemented in Ecuador and Peru. The project promotes the generation of enabling conditions to improve the participatory management of marine ecosystems, especially into mangrove areas. Participatory management encourages the participation of fishing communities in the management of natural areas and sustainable fisheries management, transforming fishing communities into custodians of the preservation and restoration of ecosystems. The communities are responsible for monitoring the state of the mangrove flora and fauna, and if there is evidence of loss of vegetation or species, they must report it to the environmental authorities so that together they can implement restoration actions.
The project has worked to strengthen the management capacities of fishing communities, local authorities and other stakeholders to improve the sustainable management of fisheries and marine ecosystems, including the development of ecotourism in the intervention areas.
For more information, click here

Humboldt Archipelago Multi-Use Marine Coastal Protected Area (AMCP-MU)

The Multi-Use Marine Coastal Protected Area Humboldt Archipelago has been recently established in Chile after extensive citizen participation led by the Ministry of Environment, which only in the consultative process included 12 workshops and meetings held with organizations and people (fishermen, neighborhood associations, sports clubs, and environmental organizations) from the bi-regional localities involved between the end of 2022 and the beginning of 2023, in addition to several virtual workshops. Originally, the proposal was articulated by the Regional Consultative Council in 2009, supported by the Humboldt Alliance from the very beginning, a network to which more than 150 organizations from both regions involved adhere. During the process, a bi-regional committee led by the regional governments of Atacama and Coquimbo, as well as a bi-regional public services were established. The proposal for this Multi-Use Marine Coastal Protected Area includes establishment of a Local Management Council and a Management Plan.
For more information, click here

Using a stakeholder cloud can facilitate the stakeholder mapping process and provide a structured overview of the relevant actors within a specific project. The figure below provides an example of the stakeholder cloud, illustrating the actors involved in the Brazilian MULTI-FRAME case study.

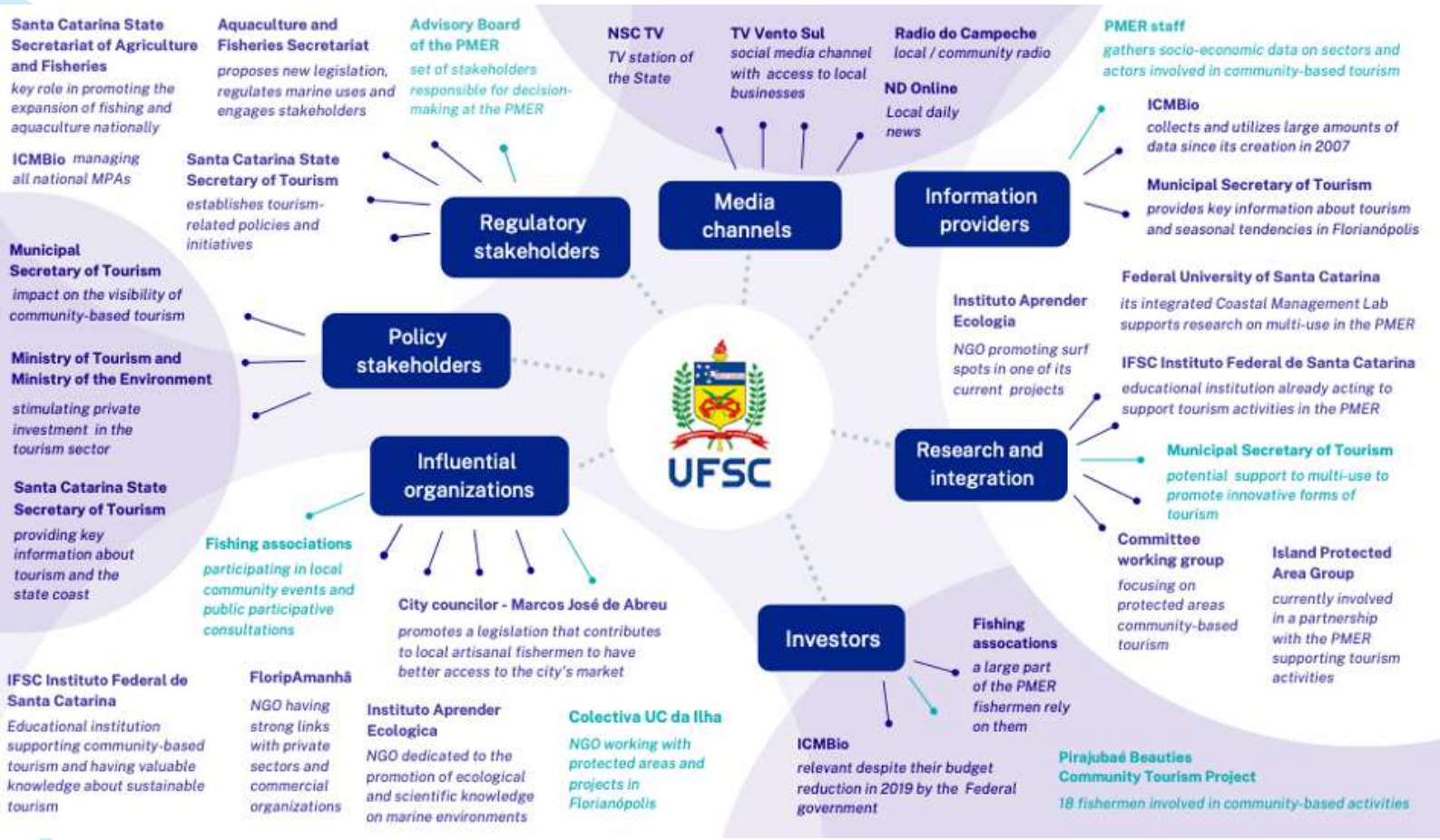


Figure 1 Example of the stakeholder cloud, illustrating the actors involved in the Brazilian MULTI-FRAME case study.

02

Empower and engage:

The step 3 of the MUAA provide guidance to ensure the people within the multi-use governance structure, stakeholders, have a good understanding of MU and are able to discuss some of the associated opportunities and constraints.

A communication strategy that responds to the MU knowledge gaps to begin some interactive discussions and learnings amongst your stakeholders (videos, fact sheets and other resources that may help prompt the conversation).

Discussions between stakeholders within planning arenas for the inclusion of pasive fisheries in the Banc de Guérande wind farm

The development of the Banc de Guérande wind farm generated tensions with established sea users, especially with fishers. In fact, navigation and fishing activities were to be limited within the park due to safety issues. However, wind developers, fishers and other stakeholders succeeded in reaching agreements to ensure their co-existence which was critical to the success of the Banc de Guérande project. For more than a decade, they actively discussed within Maritime Spatial Planning and ad hoc arenas about the location, design, construction, and operation of the wind farm. Finally, the park was designed based on a distance of 1 km between each turbine so that navigation would still be possible. Its construction and connection to the electrical grid were staggered to reduce socio-economic impacts in space and time. Fishers using passive gears are allowed within the park and those using active gears will receive financial compensations.
For more information on this example of multi stakeholder engagement and dialogue, click here

Montenegrin MPA engagement and communication campaigns

After the establishment of first Marine Protected Areas in 2021, Montenegrin institutions and NGOs created different awareness campaigns on MPAs aiming to involve local communities and citizens in MPA management and sustainable use. Different MPA clean-up actions were organized, together with MPA manager, national and local authorities, NGOs, local fishermen and divers, including children and schools in educational activities.

A few video materials have been prepared, including on MPA Stari Ulcinj supported by the EU Strategy for Adriatic and Ionian Region in which the beauty of the area was captured, showing the reasons for protection and some of the consequences of the exploitation of the resources. Emotional stories on the importance of the area, its ecological, cultural, and social value were told by local fishermen and people from their own experience, expressing support for the established protection of the area and their expectations from the efficient implementation of the measures. In the promotional event of the video, fishermen were invited to present it to a wider audience and show ownership of the vision to effectively preserve this area, despite some of the restrictions imposed on them with protection measures.
To watch the videos, click here.

Establish ongoing stakeholder engagement forums

In this step, we emphasize the importance of employing long-term engagement approaches that extend beyond one-time consultations. The goal is to bring stakeholders together in a solution-oriented manner, fostering collaboration and trust-building over time. Here are the key elements of this approach:

1. Community of Practice initiatives: Implement community of practice initiatives that provide stakeholders with a dedicated platform for ongoing interaction. These initiatives serve as a space for continuous dialogue, learning, and problem-solving.

2. Informal and long-term engagement: Facilitate long-term, informal engagement opportunities that occur outside of formal political processes. These engagements are essential for nurturing trust among stakeholders, allowing them to work together effectively.

3. Building trust: Recognize the significance of building trust among diverse stakeholders. Trust is the foundation for productive collaboration and can be achieved through consistent and constructive engagement.

4. Dedicated discussions and forums: Create dedicated discussions and forums where planners, industry representatives, and conservation interests can come together. These forums should focus on exploring mitigation possibilities, the role of nature-based solutions, and defining limits for offshore renewable energy (ORE) expansion. e.g. Take inspiration from the European Commission's initiative to launch a Blue Forum, bringing together marine stakeholders from across the European Union. This coordinated dialogue can serve as a model for fostering collaboration at regional or national levels.

Community of Practice North Sea

The Dutch Ministry of Agriculture, Nature and Food Quality (MinANFQ), being strongly involved in the development of the North Sea 2030 strategy, realized that practice was overtaking policy discussions on ORE use combinations. It was also identified that coordination and exchange of experience were needed to advance ORE use combinations. This resulted in a decision to start the Dutch Community of Practice North Sea (COPNS). The Netherlands Enterprise Agency (RVO) was tasked with setting up a platform on which all North Sea stakeholders meet and debate, where initiatives are forged and where people work together on solutions.

The COPNS was set up to ensure that initiators are responsible for developing their business cases, risks and investment decisions. The Dutch Government is responsible for facilitating licensing, at appropriate moments, by creating frameworks and commissioning a strategic investigation into (cumulation of) environmental impact. The COPNs meetings have a steady attendance of between 50 and 70 participants including the Government, offshore energy companies, research institutes, the fishing industry, water sports and the financial sector. The first meeting focused on how to support entrepreneurs involved in or interested in ORE use combination pilots, so that needs could be addressed in subsequent COPNS meetings. Subsequent meetings have covered different topics including OWF and multi-use, nature conservation and development, food production, policy and regulations, funding for research and innovation, and restoration of shellfish beds, amongst others.
For more information, click here.

Common interests of local stakeholders in the case of Aquaculture, Fishing, and Tourism in the Bay of Arcachon, France

Aquaculture-based tourism in the Bay of Arcachon was enabled by a joint effort of local stakeholders to further involve oyster producers in tourism based on the *pescatourism* model. This multi-use was intended to reverse the oyster production decline resulting from economic and environmental changes. The Fishing and Marine Breeding Committee and the Shellfish Farming Committee played an active role in representing and assisting oyster producers interested in diversifying their activity through tourism. Through joint efforts together with public authorities, a new tourism offer aiming at discovering oyster production sites, techniques and traditions was designed and implemented, launching in 2010 the initiative called "Embarquez avec les ostréiculteurs et les pêcheurs du bassin d'Arcachon" and integrated it into its local development strategy.
For more information, click here

Stellwagen Bank National Marine Sanctuary community-based management body

Stellwagen Bank National Marine Sanctuary located in the Massachusetts Bay has a comprehansive education agenda to build the awareness and conservation commitment of the public with many whale watching companies contributing to this agenda. The Sanctuary Advisory Council is the formal organizational link to the sanctuary's user community and others interested in the management of this nationally significant area of the marine environment. The non-governmental members are selected to represent local user groups, conservation and other public interest organizations, scientific and educational organizations, or members of the public interested in the protection and multiple-use management of sanctuary resources. Major responsibilities for this community-based body are to advise the sanctuary super-intendent on issues relevant to the effective implementation of the sanctuary management plan and serve as a liaison between communities and the sanctuary by keeping sanctuary staff informed of issues and concerns, as well as performing outreach to their respective communities on the sanctuary's behalf. In addition to the Sanctuary Advisory Council, Stellwagen organizes public scoping sessions to assess needs, opportunities, and challenges. The local knowledge has also been crucial in making informed management decisions. For example, in 2007, upon a petition from the Sanctuary and partners, the International Maritime Organization (a United Nations entity) made a 12-degree northward adjustment of the Boston Traffic Separation Scheme (shipping lanes). This change protected the critically endangered North Atlantic right whale by moving ships away from their feeding ground. It also protected other baleen whales (e.g. humpbacks and finback) by moving ships into a less desirable foraging area. This adjustment reduced the risk of ship strikes to critically endangered right whales by up to 58 percent and to other large baleen whales by up to 81 percent.
For more information, click here

5.2 Learnings from the Public Process in MULTI-FRAME Case Studies

The table below outlines the challenges faced during the stakeholder engagement process of the MULTI-FRAME case studies and provides proposed solutions to address these challenges:

Table 6: Challenges and Solutions in Stakeholder Engagement from Selected MF Case Studies

Country	Challenges in Stakeholder Engagement	Proposed Solutions
Brazil	Mistrust among different stakeholders. Coastal communities and resource users lack capacity. Financial resources are limited. Inadequate infrastructure.	Enhance local resource user capacity through training. Foster partnerships with scientific and technical bodies. Encourage government agency dialogues for better MU implementation.
Norway	Limited understanding of MU in coastal communities and government agencies. Resource users lack capacity. Financial resources are constrained. Insufficient infrastructure. No common forums for cross-sectoral dialogue.	Facilitate sector-wide dialogue meetings involving the government. Organize discussions with regulatory bodies to develop integrated regulatory frameworks. Offer state incentives to businesses investing in MU technology, such as tax benefits. Provide research grants from the Norwegian Research Council for MU technology and impact monitoring (already ongoing). Supply innovation funding from Innovation Norway to support industry in establishing MU scenarios (partially ongoing). Train personnel in MU practices.
Sweden	Absence of a dedicated platform for discussing MU which leads to a focus on mere coexistence. Conflicts have arisen due to differing interests. The MSP process lacks transparency and inclusivity, with some stakeholders feeling marginalized.	Establish a national platform for dialogue on coexistence and MU, facilitated by an impartial entity to find common ground. Improve transparency and participation in the MSP process to ensure all voices are heard and considered.
United States	Distrust among stakeholders. Coastal communities and resource users lack the capacity to engage effectively. Insufficient mechanisms for fostering collaboration.	Strengthen trust and cooperation through: Increasing the influence of NOAA's scientific expertise in decision-making. Publicly sharing comprehensive cooperative research and adaptive management strategies. Providing substantial early-stage funding for community and resource user capacity building. Allocating funds to support cooperative development of MU solutions and to mitigate the impact of Offshore Wind Energy (OWE) on communities and wildlife.

6.Multi-Use Economics and Business Development

Several projects have contributed to an evolving understanding of the economic landscape and business structures of MU systems. The MUSES project initially explored the economic benefits that could be offered by MU systems. As shown in the table below the business analysis of MU has grown in complexity and depth over the course of different projects.

Notably, the UNITED project has taken a significant step forward by publishing an **Ocean Multi-Use Commercialization Roadmap.** This document provides an extensive market analysis for various maritime sectors, outlining the economic potential of MU combinations. It furthermore presents an array of business models and investment strategies, based on the different MU combinations covered by 5 pilot projects (Lukic et al., 2023). Building on this, the ULTFARMS project is now translating these insights into action by developing actual business plans. This work represents the next critical phase in moving from theoretical models and potential benefits to tangible business strategies and practical implementations.

Evolution of Economic Assessments and Commercialisation in Multi-Use projects

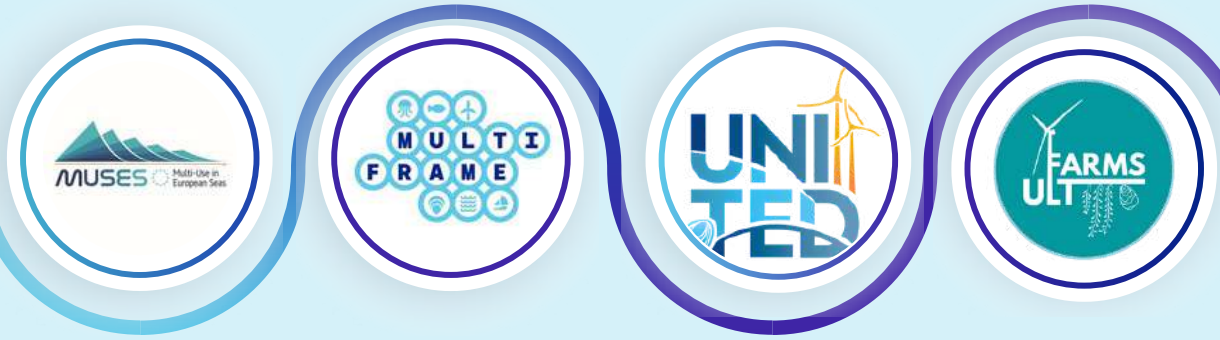
MUSES
2016-2018
General discussion on economic benefits of MU

MULTI-FRAME
2020-2023
Establishing the framework condition for business analysis and business plans

UNITED
2020-2023
Business Model Canvas

ULTFARMS
2023 – 2027
Developing Business Plans

2016



2027

6.1 Enhancing the Socio-Economic Added Value of Multi-Use

Gaining insights into the broader socio-economic advantages of MU is instrumental in the planning phase and in determining the most suitable type of MU for a given area. The MULTI-FRAME case studies have brought to light numerous economic benefits that demonstrate the potential for enhanced societal and economic value in MU projects.

Potential Economic Value of Multi-Use

1. **Job Creation:** MU activities can generate new employment opportunities across diverse sectors, including marine management, construction, and maintenance.
2. **Facilitation of Blue Growth:** By integrating various marine and maritime activities, MU can act as a catalyst for sustainable development within the blue economy.
3. **Local Economic Stimulation:** Combining multiple marine activities can provide a substantial boost to local economies.
4. **Unique Marketing Opportunities:** Products like "turbine-caught fish" could offer distinctive branding options, appealing to niche markets and environmentally conscious consumers.
5. **Diversification of Income:** Fishers, farmers, and other stakeholders may benefit from alternative income streams, reducing reliance on traditional, single-industry incomes.
6. **Enhanced Economic Feasibility:** Sharing resources and infrastructure in offshore environments can lower costs and improve the economic viability of various activities.
7. **Energy Synergy:** In cases where MU includes offshore energy, there is an advantage of having a direct energy source for secondary uses, such as powering automated aquaculture facilities.
8. **Aquaculture Expansion:** The presence of wave protection from wind farms can make previously untenable offshore regions viable for aquaculture, potentially expanding the industry's reach.

6.2 Multi-Use Cost-Benefit Analysis

At the MU project level, economic evaluation plays a critical role in assessing financial feasibility, risks, and potential advantages associated with different investment strategies. One valuable tool for conducting this assessment is Cost-Benefit Analysis (CBA), which systematically compares the quantified costs and benefits of various options, converting them into a common monetary currency for direct comparison. CBA facilitates **the extraction of added value in multi-use scenarios by comparing the costs and benefits of a single-use scenario with those of a multi-use scenario.** It takes into account financial, environmental, and social factors, enabling decision-makers to make informed choices based on the net benefits each alternative offers (Araujo et al., 2021).

Variables to be considered when conducting a multi-use cost-benefit analysis

1. **One-Off Costs**: This category encompasses all capital expenditures necessary for the planning, development, and initial setup of multi-use activities. These investments are typically of high value and occur once, at the project's inception.
2. **Ongoing Costs:** Operational expenses constitute recurring costs, including infrastructure maintenance, regulatory compliance, and other continuous financial outlays essential for sustaining multi-use activities.
3. **Income:** This refers to the revenue generated through the provision of goods or services associated with the multi-use project.
4. **Environmental Externalities:** These externalities are evaluated through Environmental Impact Assessments (EIAs), which examine the effects of marine activities on ecosystem services and overall human well-being.
5. **Socio-economic Externalities:** This category encompasses a wide range of social and economic impacts, including effects on employment, educational opportunities, energy security, and food supply.
6. **Opportunity Cost:** When choosing one marine use over another, it's important to consider what is foregone. Opportunity cost is quantified as the net benefit that would have been realized had the next best alternative been selected.
7. **Transaction Costs:** These costs are associated with economic transactions and may include various fees, expenditures related to legal compliance, and efforts expended in negotiations and contract enforcement.

6.3 Business Structures based on Multi-Use type

When developing a business plan for multi-use ventures, it is first essential to consider the different models of multi-use and categorize the planned combination, based on their degree of connectivity and resource sharing. Different models guide different strategic approaches, which help create a sustainable and profitable business.

Schupp et al. (2019), divide the **multi-use types** into four categories:
1) subsequent use/repurposing,
2) co-existence,
3) symbiotic use and
4) multi-purpose/multifunctional.

Table 7: Types of Multi-Use based on Schupp et. al (2019)

Type of Multi-Use	Description
Subsequent Use/ Repurposing	The Subsequent Use/Repurposing revolves around repurposing a permanent maritime installation, such as an old oil and gas platform or an offshore wind structure, for a different maritime use after its initial intended lifetime. When setting up a business plan, the possibilities of repurposing existing infrastructure to create value need to be considered. For instance, converting an old oil or gas platform into a research station can be a cost-effective way to repurpose a valuable asset.
Co-existence	Co-existence involves sharing both space and time. When developing a business plan, how multiple activities or industries can peacefully coexist within the same geographical area and timeframe should be explored. Careful management of interactions should be emphasized to minimize interference. A practical example for co-existence is fishing operations within offshore wind parks, where both activities can thrive side by side.
Symbiotic Use	In the Symbiotic Use, the focus is on connecting spatial, termporal and provisional dimensions to achieve cost savings and operational efficiency, however this does not involve a direct sharing of physical infrastructure or platforms. In order to achieve these objectives, opportunities to create mutually beneficial relationships between different activities need to be identified. For instance, mussel aquaculture located between offshore wind turbines can be a prime example of how two industries can enter a symbiotic relationship and benefit from each other.
Multi-Purpose/ Multi-Functional	Multi-Purpose/Multi-Functional use centres on combining multiple functions within the same space and at the same time, with shared provisioning services. The key aspect here is that the main functions are inherently connected, leading to cost-effective and efficient operations. When setting up a business plan, it is essential to think about how shared resources and interconnected activities can be leveraged to maximize utility and sustainability. A multi-purpose/multi-functional ventrue could, for example, be marine platforms, like floating power plants (FPPs), which harness various marine renewable energies, from wind to tidal and wave power, in one location.

Knowing on which levels the two or more marine uses will be combined and which resources can be shared lays the groundwork to determine how the business will be set up logistically and legally.

The question that should be answered here is, which **business structure** is most suitable for the specific multi-use combination in question?
Different forms of business entities offer particular advantages or disadvantages depending on the case. The right choice of business structure depends on multiple factors, such as the scale of maritime activities, the level of integration required, the degree of risk involved, and the long-term goals of the collaboration.

In cases involving multiple business entities in a MU scenario, legal agreements among the parties are crucial. These agreements should address various aspects, including the sharing of resources, technology, and data, as well as matters related to liability, insurance, and environmental impacts.

Developing **decommissioning agreements** is especially vital to account for potential temporal variations in ocean activities. The agreement should encompass questions such as: How does one user's permit get affected when the other user needs to cease operations?

Swedish Case on creation of a subsidiary to overcome permitting process barriers

The current licensing process in Sweden requires a separate license from each entity seeking to conduct activities at sea. As such, in order to apply for permissions and licenses for multi-use or coexistence of different activities, each entity must apply for separate licenses - a process which is time-consuming, administratively cumbersome, costly and high risk as there is no guarantee it will be accepted.

One proposed strategy to navigate this challenge is to create a subsidiary company shared by two or more entities that are seeking the necessary licenses/permissions. In this way, all the relevant activities would be carried out by this daughter company and thus only it would need to make the necessary applications, which would be processed together as part of a single process. This can pose as a possible pathway to overcome licensing process barriers currently being experienced by e.g. OW partners who are seeking to initiate coexistence projects on the Swedish West Coast. It has also been suggested that operating through a daughter company could strengthen operational efficiency and enhance motivations for achieving synergies.
To read more about the Swedish Case Study, click here.

Local cooperative ownership in Denmark

Middelgrunden wind farm is located 3.5 km from Denmark's capital, Copenhagen, visible from certain city beaches and rooftops. It was celebrated as the world's largest offshore wind farm when it opened in 2000 and produces up to 100,000 MWh of electricity annually, three per cent of Copenhagen's total power consumption. The wind farm consists of 20 turbines, each 2 MW, which are equally shared (i.e. 10 each) by its developers "Københavns Energi" (today HOFORutility) and "Middelgrundens Vindmøllelaug" (Middelgrunden Cooperative), a private cooperative partnership with 8000 owners.
Its operations are managed individually by each of the owners.
The local ownership has had an important role in the wind turbines' development in Denmark from 1980–2010. The local engagement in the planning and layout of the farm ended up being the pre-condition for the acceptance and rollout of the multi-use. The fact that 10 of the turbines are owned by the cooperative makes it easier to have access to the turbine and develop additional related add-ons such as tours and educational programs.
To read more about the Danish case, visit the UNITED project website.

BUSINESS STRUCTURES SUITABLE FOR DIFFERENT MULTI-USE COMBINATIONS

SUBSIDIARY

An independent business entity owned and controlled by another company, known as the parent company, with its own operations but subject to the parent company's authority and ownership. The Swedish case study of MULTI-FRAME concluded that the subsidiary would be the most suitable approach for combining offshore wind and aquaculture in the current regulatory context.

Advantages:
1. Innovation and agility
2. Low entry barriers
3. Potential for high growth

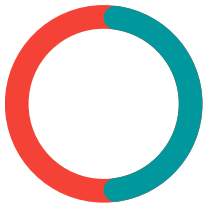
Disadvantages:
1. Complex management
2. Possible loss of control

APPLICABILITY IN THE MULTI-USE CONTEXT

Often, the best setup from the regulatory perspective is when the activities from the same industry are being put together in a multi-use setting (e.g. different types of renewables together). Nevertheless, the low trophic aquaculture and nature restoration within wind farms can also potentially be acquired or become a subsidiary as an important ESG/ CSR component of the offshore wind business giving the offshore wind business more CSR leverage/visibility. Additionally, the establishment of a subsidiary can be utilized to overcome licensing challenges, combining multi-use activities within a singular daughter company to simplify the permitting process and increase operational efficiency. This approach can also serve to strengthen the drive for realizing synergistic outcomes. The Swedish case example provided beneath the table offers further elaboration on this strategy.

START-UP

A newly established company or business venture typically characterized by its innovative ideas, entrepreneurial spirit, and a focus on addressing specific market needs or challenges. Startups often operate in dynamic, fast-paced environments, striving to disrupt traditional industries or create entirely new markets. Almost all of the aquaculture companies currently involved in multi-use pilots are startus (e.g. Ocean Rainforest, NordicSeafarm, Klelmeeresfarm).



Advantages:
1. Risk mitigation
2. Specialization
3. Access to resources
4. Diverse portfolio

Disadvantages:
1. High risk
2. Limited resources
3. Market uncertainty

APPLICABILITY IN THE MULTI-USE CONTEXT

The aquaculture industry involved in the multi-use initiatives is mainly comprised of start ups with limited financial capacity. This can pose a power imbalance in combination with offshore wind. It would be good if more startups would emerge for the pescatoursim activity as an alternative, innovative approach to attract young people in sustainable fishing sectors and maintain the fishery tradition while focusing on artisanal sustainable practices.

JOINT VENTURES

In UNITED project both Colruyt (food chain selling sustainable seafood among others) and ParkWind (offshore wind developer) are a part of the same joint venture which has eased the decision-making process for the formation of the UNITED pilot in Belgium that tested offshore seaweed and oysters aquaculture within wind farms.

Advantages:
1. Pooling of resources
2. Risk sharing
3. Access to new markets
4. Cost efficiency

Disadvantages:
1. Complex decision-making
2. Share of control and profits
3. Coordination challenges

APPLICABILITY IN THE MULTI-USE CONTEXT

Suitable for combining the activities from the same industrial brunch esp. for fixed offshore installations where adjusting the safety zone access restrictions, design, insurance, etc. would be difficult later on e.g. different types of renewables combined, or integrated multitrophic aquaculture.

COOPERATIVE (CO-OP)

A business organization owned and operated by its members, who are also its customers, employees, or stakeholders, with the aim of collectively providing goods, services, or benefits in a democratically controlled manner. In Denmark, Middelgrunden wind farm has used this model and developed boat tours to the cooperatively owned wind farm.

Advantages:
1. Collective ownership
2. Shared resources
3. Community and collaboration
4. Risk mitigation
5. Wider social benefits

Disadvantages:
1. Complex decision-making
2. Limited capital
3. Management challenges

APPLICABILITY IN THE MULTI-USE CONTEXT

Recommended especially in the cases where tourism is one of the sectors as the engagement with local cooperative members can generate creative ideas on how to diversify local tourism by combining it with e.g. offshore wind or aquaculture. As exemplified by the Danish Middelgrunden wind farm example, the cooperative members can also have an active role in facilitating the development of associated tourism offers and thus derive additional benefits for the cooperative and the region

6.4 Business Models

Strategic management tools can be beneficial, especially in the case of ocean MU to effectively set up or revise a business model and combine different maritime uses. An understanding and optimization of the business models that drive ocean MU projects is vital. Strategic management tools can be beneficial, especially in the case of ocean MU to effectively set up or revise a business model and combine different maritime uses. An understanding and optimization of the business models that drive ocean MU projects is vital.

Using management tools, such as Business Model Canvas and Lean Canvas, may help when setting up an MU business to extract the synergies and, therefore, identify the opportunities for cost reduction and added value of MU.

Business Model Canvas was employed in the UNITED project to conduct a business analysis of the five pilots and to describe how the pilot creates, captures, and delivers value (Zaiter et al., 2022). The difference between Business Model Canvas and Lean Canvas and the areas of application can be found in the table on the next page.

Table 8: Business structures suitable for different Multi-Use combinations

Management Tool	Description	Suitability /Area of Application	Building blocks
Business Model Canvas	A strategic planning and management tool developed by Alex Osterwalder in 2004. It serves as a comprehensive framework that allows businesses to map out and visualize their entire business model in a single, cohesive canvas. This canvas is widely used for strategic decision-making, innovation, and business planning. It provides a structured approach to understanding, designing, and refining a business's key components.	Established companies	1. Customer Segments 2. Value Proposition 3. Channels 4. Customer Relationships 5. Revenue Streams 6. Key Resources 7. Key Activities 8. Key Partnerships 9. Cost Structure
Lean Canvas	The Lean Canvas, created by Ash Maurya, is a one-page business planning template ideal for entrepreneurs in Lean Startups. Adapted from the Business Model Canvas, it simplifies the business model into a single page, with a primary focus on addressing problems and refining product concepts. This tool helps startups align their solutions with customer needs and market conditions, making it a powerful asset for business planning.	Start ups and less developed companies	1. Problem 2. Solution 3. Key Metrics 4. Value Proposition 5. Unfair Advantage 6. Customer 7. Channels 8. Customer Relationships 9. Cost Structure 10. Revenue Structure

Multi-use of Marine Protected Areas bringing additional socio-economic benefits to the region

Other examples of business cases and models based on the ocean multi-use principles such as sustainable economic activities in Marine Protected Areas have been studied in different EU and global projects and initiatives. Recently conducted review of business cases and business incubators in the Horizon Europe Ocean Mission BLUE4ALL projects shows variety of examples in the EU and beyond. Among the business incubator models, “The Blue Business Incubator” and “Mediterranean Experience of EcoTourism (MEET)” are both (eco)tourism-based models, their revenue streams rely on the quality of the marine environment; thus, both are possible to link to blue finance if the business would like to seek financing or investment. “Blue Parks Initiative” and “BLUEprint” are two incubators to support MPAs globally, the first one support locals and provide opportunities to boost eco-tourism through an award; whereas the second supports a broader variety of business activities by providing a guideline to establish sustainable finance models for different business as well as guidance for planning and developing MPAs.

For the reviewed business cases mostly found in the Mediterranean Sea region, the economic boost is represented through the creation of new jobs and income opportunities for the local community, increased inclusion of women in maritime jobs, a boost in eco-tourism and fishing tourism, and the initiation of small-scale businesses with a focus on blue finance. Tourism- and fishing-related businesses are commonly found, but some diversity and innovation among the cases has also been identified. For example, for the cases related to fishing, it varies from production, process, and marketing. Other cases like the business combination of research (water monitoring and wind power), label for marketing, and carbon and biodiversity credits were also identified. [8]

6.5 Multi-Use Funding and Investment

International Public Collaborative funding:

International collaboration funding refers to financial support provided by governments to facilitate collaborative projects and initiatives involving participants from multiple countries. This type of funding is designed to promote international cooperation, research, development, and other activities that address global challenges, foster innovation, and enhance cross-border collaboration. For example, EU funding options for ocean MU projects include research and innovation programs like Horizon 2020, Horizon Europe, Mission Ocean, and regional development funds e.g. Interreg.

Multi-Frame project

The Belmont Forum, JPI Oceans and Future Earth brought together several countries from around the globe to collaborate on funding the series of collaborative international research projects focusing on Ocean Sustainability Research. MULTI-FRAME was one of the projects funded under this programme.

UNITED project

The UNITED project serves as an example of an EU-funded MU project. The UNITED project was co-funded under the Horizon2020 initiative to run from 2020 to 2023. The project provided evidence for the viability of ocean multi-use through the development of five demonstration pilots in the real European marine environment.

8 Lai, T.-Y. et al. (2023). Deliverable D1.3: Review of socio-ecological framework and methodologies (Draft). BLUE4ALL.

Pescatourism as a socio-economic development strategy

Beyond the national context, pescatourism in Sardinia was enabled by the proactivity of local stakeholders. About 120 professional fishers, seven aquaculture farmers, inland fishing cooperatives and representatives from public authorities united in 2010 to create the East Sardinia Fishery Local Action Group (FLAG). The FLAG led a socio-economic analysis to define a Local Development Strategy (LDS) based on key priorities and actions to foster pescatourism.

The East Sardinia FLAG was created to request technical assistance and financial support from the European Union. Most actions defined within its LDS called “East Sardinia in 2020” were funded through the European Fisheries Fund (EFF) between 2010 and 2013. The FLAG defined a more ambitious plan in 2014, which was supported by the European Maritime Fisheries Fund (EMFF). Integrating European programs was also an opportunity to create links with other groups engaged in pescatourism in Italy, France and Greece.
Read more here

Government funding:

Government funding for ocean MU projects can come in the form of grants, subsidies, tax incentives, or through public-private partnerships. Governments support projects that have proven interesting for their region and showcase a promising technical readiness level (TRL).

Wave Energy Scotland Initiative

The Wave Energy Scotland initiative, which aims to overcome challenges within the wave energy sectors and increase the viability of wave energy, was initiated and is funded by the Scottish government. Within this initiative, the combination of wind and wave energy is currently being tested in the FloWave-Facility at the University of Edinburgh.
Read more here

Investor funding:

Investor funding involves private sector entities such as venture capitalists, impact investors, and corporate investors providing equity or debt financing for ocean MU projects. This funding can take the form of direct investments, project financing, or joint ventures. Investor funding generally only takes place if the project has moved past its initial research stages, demonstrates a high TRL and a promising financial future.

Amazon Investment to combine OWF und Aquaculture in the Netherlands

Amazon has invested EUR1.5 million in the North Sea Farmer led project, aiming to install seaweed farms within offshore wind farms. The money was drawn from Amazon’s Right Now Climate Fund and now enables a scaling up of seaweed production, as well as further research and innovation.
Read more here

7.Technology

The technology readiness level of MU solutions has notably increased in the last decade, mainly due to the support that the numerous pilot projects have received through the EU research and innovation funds. Nevertheless, the policy push has also initiated several industry initiatives such as the offshore wind and seaweed first commercial farm. The section below provides an overview of the current state of the art regarding the MU TRL for various MU combinations involving offshore installations.

7.1 Offshore Wind and Aquaculture

From a technological perspective, there are two key scenarios for combining Offshore Wind Energy with aquaculture:

Direct Attachment or Multi-Purpose Platforms: This concept involves directly attaching various installations (e.g., seaweed or mussel longlines) to offshore wind turbine foundations or developing fully integrated multi-purpose platforms. While this approach offers the potential for efficient use of offshore space, it requires engineering solutions to be integrated during the pre-planning phase of offshore wind farm development. Both pilot and commercial experience are currently lacking, and there are no established safety or construction standards, resulting in unknown risks and high insurance premiums. This concept is most feasible for OWFs in the pre-planning stage before specific use and technology licenses have been granted. This approach is expected to gain more importance with the further development of concepts such as offshore energy islands, which are currently being developed in the North Sea Dogger Bank. Apart from aquaculture, different forms of energy generation, such as solar or wave, could also be developed in conjunction with offshore wind farms.

Co-location within Wind Farm Security Zones: This concept involves placing installations within the security zones of operational or planned wind farms. Several pilots have taken place to test this solution. Most recently, pilots in UNITED, ULTFARMS, and OLAMUR have conducted testing of different technologies, raising the overall TRL to 7.

7.2 Offshore Wind and Nature Restoration

Offshore wind farm areas can be utilized to protect or restore the marine environment. This combination can be implemented through several means such as

- **Nature-inclusive design of offshore wind farms. For example, holes in wind turbine foundations** create extra habitat and shelter for all species which can fit through the holes (either as larvae or adults). The Ritch North Sea studies show that the life inside the monopile ranges from simple algal growth to an inquisitive seal.
- **Use of materials and coatings that encourage the growth** of marine organisms such as mussels and oysters.
- **Scour protection that enhances biodiversity** (i.e., rock dumps).
- **Concrete blocks and artificial reefs** can mimic natural reef structures and provide shelter and substrate for marine organisms to attach.
- **Oyster broodstock structures** enable the restoration of native oyster species in the North Sea. They can be employed on the scour protection of offshore wind turbines or as stand-alone if the surface is stable enough for larger structures.

The Ritch North Sea Programme working together with industry partners on the nature restoration within Dutch offshore wind farms

Under the umbrella programme of the Rich North Sea, working together with indurty partners, different research projects are being conducted within OWFs that are investigating the technological and ecological aspects of combining OWF and nature restoration. For example:

- Cod pipe reefs - In Borssele 1+2 Orsted placed concrete pipes of different sizes in piles on the seafloor. The Rich North Sea initiated a project with Orsted and WMR to monitor lobster behaviour around the structures and one monopile.
- Oyster broadstock structures - In the Winpark Eneco Luchterduinen oyster broadstock structures were positioned on the scour protection of the wind turbines. In the Borsele 3&4 area, Blauwwind, together with The Rich North Sea, used flat oyster broodstock structures to outplace the adult flat oysters. 2023 recorded 70% survival and larvae in the water column.

Read more on the Rich North Sea Programme here.

Oyster restoration in Belgium

In the Belgium pilot of UNITED project piloted the North Sea native oyster restoration within Belwind offshore wind farm. The tables of 1m50 height in galvanized steel, foreseen with cages or with 1 cage divided into compartments, proved to work well to test scour material as settlement substrate. The shortcoming of this approach is that it was not representative of scour protection around the turbine (too small). Another limitation was that only scientific divers on board research vessels were allowed to take samples. On a positive note, tables on top of the scour protection were high enough to allow flat oysters to survive and probably reproduce and settle. Tables proved to possess the stability required to withstand a hydraulic load of wave action and currents. Tables stayed upright and did not sink into the sand, which was crucial in order to evaluate their potential for restoration. This is relevant as sand would smother the oysters and not allow oyster growth. The pilot has concluded that in general tables on top of the scour protection can work to test flat oyster settlement and fouling development. Granite (especially size category 0-200 mm) provided good settlement, even better than limestone.

Read more on the Belgian pilot here.

7.3 Offshore Wind and Tourism

The technology consideration for offshore wind farms and tourism MU involves the integration of infrastructure on turbine foundations, the design of suitable tourist boats, safe transfer methods from boats to platforms, consideration of turbine age and structure, adherence to safety standards, and accounting for environmental conditions.

Infrastructure on turbine foundations: For tours involving climbing wind turbine nacelle, the age and structure of the turbine are crucial factors. Climbing to the nacelle is typically feasible in older turbine models predating 2007, which have multiple floors within the turbine structure. Modern wind turbines, with smaller gaps between floors, require the use of safety equipment for climbing. The infrastructure on turbine foundations may include divers' platforms and restaurant facilities. These structures should be designed to withstand offshore conditions, such as strong winds and waves. When turbine climbing activities are offered, safety equipment should also be provided for tourists. This equipment should adhere to safety standards and regulations, ensuring the protection of tourists during the climb.

Access to the Middelgrunden turbine with a boat showcasing the ladder system in use.

Structural characteristics of tourist boats: Tourist boats play a crucial role in transporting visitors to the wind turbines. These boats need to be appropriately equipped and designed for safe transportation. The size of the boat should consider factors such as wind and wave strength, water depth, the number of tourists it can carry, and which activities are to be conducted on the boat. Larger boats may be preferable for stability, but they need to navigate shallow waters safely to avoid collisions with the turbine foundations. Technology and navigation systems can help prevent such incidents.

Crossing from boat to platform: The technology for transferring tourists from the boat to the turbine platform should ensure stability, especially in rough waters. One option is to provide a ladder construction that is resistant to water disturbance, either attached to the turbine foundation or stored onboard the boat. The advantage of using a boat with its own ladder construction stems from the ability to choose the direction from which the turbine is approached which makes it less exposed to the waves and weather conditions.

7.4 Aquaculture and Tourism

Several technological considerations become relevant when combining aquaculture and tourism, including scheduling software, vessel characteristics, sensors and cameras, and power and internet supply.

Proper scheduling is relevant for the efficient coordination of aquaculture and tourism activities. Scheduling software can assist in planning multi-use activities and schedules based on weather conditions or unforeseen maintenance works that might interfere with tourism activity.

The type of vessel to employ for the tourism activity depends on the nature of the activity itself and the size of groups hosted on the ship. If tourists are taking a trip to the aquaculture site, aquaculture maintenance vessels could possibly be used. However, to be able to conduct lectures and other interactive activities on board, the layout and stability of the boat, as well as the noise of the boat engine are relevant factors to consider. Another relevant factor is the environmental impact of the vessel in use. For example, in Norway, electric boats are being employed to avoid air and water pollution.

Sensors, cameras and ROVs, which are generally already used in single-use aquaculture sites, can also be used to monitor parameters critical to aquaculture as well as tourism activities in MU setups. On the one hand, real-time monitoring enables informed decision-making regarding aquaculture operations and quick responses to water quality changes and infrastructure damages. On the other hand, cameras facilitate the surveillance of tourist activities underwater which ensures the safety of the tourists and the protection of the aquaculture infrastructure and product and can serve as proof in case of insurance questions. Furthermore, footage obtained from fish surveillance can be used to give the tourists an insight into the underwater workings of the aquaculture site. It is important that sensors and cameras are well maintained and regularly cleaned to sustain their accuracy and value.

Ensuring steady power and internet supply is crucial for maintaining real-time monitoring, supporting the feeder system, and communicating with personnel at sea. Power and internet connectivity can be established through either cable connections or remote/on-site electricity generation. However, it's important to note that cables are susceptible to damage from propellers, anchors, maintenance activities, tourists, or third-party boats. In places like Norway, it's common for fish farmers to employ solar panels for on-site power generation and maintain constant internet access to ensure farm functionality since the feeder and monitoring instruments must function continuously.

The on-site infrastructure should be adapted to welcome tourists and ensure their comfort. It may involve providing amenities like toilets, implementing additional safety measures for tourists navigating the farm infrastructure, and ensuring their warmth and dryness.

8. Next Steps for Multi-Use Research

For MU to be developed successfully in the coming years, it must be built on a solid foundation of knowledge and science-based policy. Key knowledge gaps can be identified amongst the take-home messages (pp. 15-22) of the MULTI-FRAME Transferability Report. Combined, these measures would resolve key uncertainties and boost confidence in MU. In particular:

01

Safety and risk mitigation are critical and are often overlooked in MU conceptualization, only to become hinderances or barriers during implementation.

Activities at sea are subject to a number of risks, to begin with, and marine activity practitioners have expressed concern that not enough has been done to evaluate and mitigate possible risks of multiple activities coming together in the same place and at the same time.

02

Authentic inclusion is critical for sustainable ocean planning - i.e. early involvement of parties of interest, inclusion in decision processes at all levels and transparency about how decisions are made.

Stakeholders across a number of the MULTI-FRAME project cases express a lack of or declining trust in licensing or larger OWE development processes. Decision-making processes are often expensive, lengthy, and not inclusive in nature, which puts off investors and has been the cause of frustration by long-established sea-use actors like fishers. In order to facilitate the development of a sustainable blue economy that features MU, stakeholders from several of the MULTI-FRAME cases expressed the need for streamlined, transparent and fair MSP processes with authentic inclusion at their core.

03

Economic benefits from MU are not guaranteed for all parties – but there can be other additional benefits (e.g. increased acceptance, favorable consideration in MSP/licensing for attempting to integrate uses), or secondary economic benefits (e.g. access to new offshore areas or new growth opportunities).

Research is needed to explore the potential benefits and trade-offs from MU in a number of case studies as they emerge.

04

Oftentimes, environmental advantages are presumed, usually based on the belief that there are biodiversity benefits from the reef effect caused by sea infrastructure, or from synergies resulting from improved efficiency.

It should be noted that in some cases MU enables a net increase in human activity (relative to single use(s)) which in turn can increase anthropogenic pressures (e.g. noise, pollution, local waste emissions, energy use), resulting in environmental impacts.

05

MU development is extremely context dependent. Every case of MU is different and specific to the country's regulatory landscape, local geographies and culture.

In addition to the points raised above, it should always be highlighted that MU will be highly location, case and context dependent. Further research will need to be carefully designed in order to embrace this challenge and effectively steer a tailored MU development for each given situation.

BRAZIL

Table 9: Research gaps per case study

Research Gaps
Research on adapting different fishing practices for inclusion in MU activities. Analysis of coastal community challenges and the potential of MU to address them. Examination of the legal framework and possibilities to promote MU.

FRANCE

Research Gaps
Deepening understanding of how 'multi-use' and 'coexistence' are used in discourse and practice among maritime stakeholders. Demonstrating the added value of MU in economic, social, environmental, and spatial terms, making MU an achievable goal for local stakeholders.

NORWAY

Research Gaps
The establishment of a Demonstration site for MU as well as the development and application of advanced scientific methods to assess the environmental and economic impacts of MU systems will bolster social acceptance and demonstrate benefits or impacts of MU.

SWEDEN

Research Gaps
Development of inclusive, transparent, and participatory processes for MSP that supports MU integration and the corresponding legal framework. Gathering evidence on the local environmental impacts of various proposed MU combinations in different maritime areas such as the West Coast, Baltic proper, estuaries, and archipelagos. Investigation into the socio-economic benefits of MU through case studies to ensure advantages are distributed across all stakeholders and not just large corporations.

US

Research Gaps
Research to demonstrate the added value (economic, cultural, environmental) of MU.

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