European Commission

Baseline study for the implementation of the lighthouse in **the Baltic and North Sea basins** for the Mission ‘Restore our Ocean and Waters by 2030’

DEL 9 - Final Report

Independent
Expert
Report

Research and Innovation

Baseline study for the implementation of the lighthouse in the Baltic and North Sea basins for the Mission 'Restore our Ocean and Waters by 2030'

European Commission
Directorate-General for Research and Innovation
Directorate B — Healthy Planet
Unit B.4 — Healthy Oceans & Seas
Contact Michaela Gigli
Email Michaela.GIGLI@ec.europa.eu
RTD-PUBLICATIONS@ec.europa.eu
European Commission
B-1049 Brussels

Manuscript completed in September 2022
First edition

PDF	ISBN 978-92-76-60236-1	doi:10.2777/96040	KI-03-22-250-EN-N

Luxembourg: Publications Office of the European Union, 2023

EUROPEAN COMMISSION

Baseline study for the implementation of the lighthouse in the Baltic and North Sea basins for the Mission 'Restore our Ocean and Waters by 2030'

Prepared by:

Vineta Goba
Tatjana Guznajeva
Lisanne Saes
Jules van de Meulengraaf
Laura Roman
Owen McColgan
Gaetan Coatanroch
Anda Ikauniece
Pawel Mawduk
Lorenz Carl Wahler
Ole Kveiborg
George Vourliotakis
Gianluca Trotta
Julija Skolina
Charis Papandonaki
Karolina Kenney

2023 Directorate-General for Research and Innovation
Food, Bioeconomy, Natural Resources, Agriculture and Environment EN

Table of contents

ABSTRACT

This baseline study for the **Mission Restore our Ocean and Waters** aims to provide a comprehensive basis for the development and piloting of the **Baltic and North Sea basin Lighthouse**, and its deployment and upscaling in the future. Its purpose, in line with the Mission Implementation Plan, is to provide a baseline for the implementation of the Lighthouse which focuses on Mission **objective 3: 'Make the sustainable Blue economy carbon neutral and circular'**. The baseline entails mapping of the situation in the lighthouse area in 2021-22 with respect to the Mission objective 3, targets and activities. It covers **maritime transport** (with a focus on passenger ferry transport), **maritime ports and facilities, offshore (and onshore) renewable energy facilities, offshore renewable energy storage facilities, multipurpose platforms, and aquaculture**. The study also proposes **indicators for measuring Mission progress** in these areas during its implementation. Moreover, the study maps **stakeholders and networks** relevant to the implementation of the Mission objective, including a comprehensive mapping of past, ongoing and future key **EU and national projects** in the lighthouse area relevant to the Mission objective and activities. Furthermore, the study produces an analysis of the **S3 Smart Specialisation Strategies** and other regional strategies in the lighthouse analysing the synergies with the Mission objectives and activities and providing recommendations for their alignment with the new S4+ framework for sustainable and inclusive growth linking smart specialisation and Mission-oriented policy for sustainable development. In addition the study maps current **governance** mechanisms incl. **regional, national and macro-regional strategies** and plans, but also **National Recovery and Resilience Plans (RRPs)** aiming to mitigate the economic and social impact of the Covid-19 pandemic, and their alignment with Mission objectives. The study furthermore investigates and maps **citizen engagement and literacy activities**. Moreover, for each sea basin, a general data-base and descriptive overview is provided in terms of **geography, demographics and socio-economic situation, information on governance and administration, and an analysis of regional disparities** has been performed, related to the **differences in the socio-economic performance** of the regions, as well as the differences in the performance and connectedness of the **research and innovation (R&I) ecosystems** to European counterparts. The methodology comprises a multitude of methods such as desk research, data analyses using various open databases, case studies, surveys and stakeholder interviews. The study offers **recommendations** for further implementation of the Mission in the areas covered by the study. The results will feed into activities to implement the Mission, such as the Mission Implementation Platform and the Coordination and Support Actions (CSAs) in the lighthouse.

EXECUTIVE SUMMARY

Introduction

The term "Blue Economy" is understood broadly, encompassing all industries and sectors related to the ocean, seas and coasts, whether they are based in the marine environment (e.g. shipping, fisheries, marine energy generation), or on land (e.g. ports, shipyards, land-based aquaculture and algae production, coastal tourism). It also encompasses innovative sectors that are evolving and growing (the blue bioeconomy, ocean renewable energy, bio-technology, etc). A sustainable Blue Economy could play a significant role in delivering on the European Green Deal. Preserving and increasing the natural capital of the seas and the ocean is also critical to ensure a continued delivery of valuable ecosystem services, enabling the European Union (EU) to achieve its policy objectives and the United Nations (UN) 2030 Agenda Sustainable Development Goals (SDGs). Human activities must be managed in a way that guarantees the health of the ocean and safeguards long-term economic productivity, so that the potential the ocean offers can be realised and sustained over time.

Marine and maritime research and innovation are essential for achieving the EU's ambition to become climate-neutral by 2050, for protecting and restoring marine ecosystems and for enabling the blue economy to reach its full potential.

EU Mission "Restore our Ocean and Waters by 2030"and the focus of this study

European Missions are a new concept which aim to increase the impact of public investments in research and innovation activities, as well as to liaise better with citizens and raise the visibility of science, research, and innovation. The objective of the Mission 'Restore our Ocean and Waters by 2030' is to provide a systemic approach for the restoration of the ocean, seas and waters by 2030. The specific objectives of the Mission are interlinked and mutually supportive:

- Protect and restore marine and freshwater ecosystems and biodiversity, in line with the EU Biodiversity Strategy 2030
- Prevent and eliminate pollution of our ocean, seas and waters, in line with the EU Action Plan Towards Zero Pollution for Air, Water and Soil
- Make the sustainable blue economy carbon-neutral and circular, in line with the European Climate Law and the holistic vision supported by the Sustainable Blue Economy Strategy.

Area-based lighthouses will be the main implementation vehicle of the Mission in its first phase. Lighthouses will act as hubs and platforms for the development, demonstration, and deployment of solutions to those challenges.

The objective of this baseline study is to comprehensively map the situation in the Baltic and North Sea lighthouse areas with regards to the Mission objective "Make the sustainable blue economy carbon-neutral and circular". This includes a mapping of all relevant stakeholders, networks, governance structures, and citizen engagement activities, as well as past, planned and ongoing projects. The aim is to provide a basis for informing the implementation of the Baltic and North Sea Basin Lighthouse. In particular, the study establishes the status quo for the relevant Mission objective as of 2021, against which the progress of Mission implementation can be measured (in 2025 and 2030), as foreseen in the Mission Implementation Plan. The following six Blue Economy sectors were identified in the terms of reference for this study and were analysed during this study to establish the baseline situation of the lighthouse areas:

- Maritime transport (with a focus on passenger ferry transport)
- Maritime ports and facilities
- Offshore renewable energy facilities
- Offshore renewable energy storage facilities
- Multipurpose platforms, and
- Aquaculture.

Based on the data that could be identified and analysed, a set of indicators has been proposed for monitoring the development of the lighthouse area.

This study presents a multitude of relevant initiatives, activities, and projects, which are being undertaken in both the Baltic Sea and the North Sea area in support of the Mission objectives. These are briefly outlined below.

Regional disparities and R&I landscape – the Baltic Sea region

The Baltic Sea region consists mostly of well-developed EU countries. In the north, Germany, Denmark, and Sweden are some of the largest economic powers and longstanding members of the EU. To the east, there are newer EU member countries such as Poland, Latvia, Lithuania and Estonia, as well as Russia (though not an EU member country). Even though, on average, the older EU member countries perform better in terms of socio-economic indicators, disparities exist within their regions too. As a whole, 57% of the regions in the Baltic Sea area are above the EU average for gross domestic product (GDP) per capita[1]. At the same time, all the regions which are above this EU average are from the Northern part of the basin. This shows a North-East income disparity for the lighthouse area. Nevertheless, regions in Sweden and Finland also appear among the bottom ranked regions, showing high intra-country socio-economic disparities for Sweden and Finland. Regarding unemployment rates and at-risk of poverty rates, the basin shows performance roughly equal to the EU average.

In terms of research & innovation (R&I) performance, the Baltic Sea Regional Innovation Scoreboard (RIS) average of 120.5 lies significantly above the EU average (100). The Nordic regions of the Baltic Sea are the best performers on the index, with Sweden's NUTS 2 region average at 155, followed by the Finnish (125), and the Danish (121) scores (Regional Innovation Scoreboard, 2021). Polish regions have an average 51 on the scoreboard, and all score well below EU and Baltic averages. However, the high performance is distributed in only a range of regions (as mentioned above - Nordic), as over half of the Nomenclature of Territorial Units for Statistics (NUTS)2 regions (54%) in the Baltic Sea are below the Baltic Sea area RIS performance. There is a disparity amongst the

[1] Technopolis Group calculations based on Eurostat data

Baltic Sea countries and regions' R&I performance, mainly between the Northern parts of the sea basin (Sweden, Finland) and the countries and regions located on the Eastern coast of the Baltic Sea, such as Estonia, Latvia, Lithuania, Poland. There is high level of concentration of R&I outputs in specific regions that are "R&I hubs" in the Baltic Sea, especially in capital cities such as Stockholm, Helsinki, Copenhagen, or Hamburg. These are also some of the hubs most connected to EU through participating in H2020 projects or other EU initiatives (Digital Innovation Hubs, European Institute of Technology Knowledge and Innovation Communities, etc.).

Regional disparities and R&I landscape – the North Sea region

The North Sea region consists of some of the richest countries in the EU and the world. The region performs consistently better than the EU average on indicators for socioeconomic disparities. However, while the difference between countries are negligible for the majority, high disparities can be seen at the regional level. There are only 31% of regions with a GDP per capita higher than EU average, with more than 55% of them experiencing unemployment rates and at-risk-of-poverty rates higher than EU average. This shows that there are relatively high regional disparities in terms of socio-economic performance.

On the whole, the North Sea area has high levels of R&I intensity that are well above EU average in terms of R&I performance on the EU Regional Innovation Scoreboard (with a score of 143, higher than the Baltic Sea average score of 120). While over 60% of the North Sea regions show lower inputs in R&I activities than the North Sea average, more than half (55%) have a higher innovation performance than the North Sea average. This indicates a relatively significant level of efficiency in the North Sea regions' research and innovation systems. There are peak performers or "R&I hubs", which are more developed in terms of connectivity to EU networks and internal relational capital, while the majority of the North Sea regions show low performance in this sense.

Carbon free and circular Blue Economy - baseline situation

The following sections briefly describe the baseline situation in the six blue economy sectors analysed during the study in relation to the mission objective: "Make the sustainable blue economy carbon-neutral and circular". The main findings are briefly summarised in further text.

Maritime transport

This study analysed the maritime transport in the two lighthouse areas: the Baltic Sea and the North Sea. Particularly, the focus is on the state of decarbonisation of ferries in the lighthouse areas. In this context, 'Ferries' are understood as roll-on/roll-off (Ro-Ro) vessels capable of transporting wheeled cargo and passengers, used for scheduled or regular transport of passengers and cargo and vehicles between ports in the lighthouse area. As ferries often operate on scheduled routes, with frequent access to ports, and over shorter distances (short-sea shipping), they show a higher decarbonisation potential in the medium term compared to deep-sea shipping. This is due to route-predictability and the availability of alternative propulsion systems such as batteries for short-sea shipping.

Regarding maritime transport, data on the ferry fleet and its characteristics in both the Baltic and the North Sea is scattered across different sources and different levels of granularity of data exist across Member States. As such, a central, European source on ferry fleet characteristics does not exist, and therefore national authorities responsible for maritime transport have been contacted and some data has been obtained as part of this study. Data on the use of alternative fuels such as batteries and Liquified natural gas (LNG) powered vessels is available at the EU and global level, but not per sea basin or individual country.

To obtain data, national authorities have been contacted and a range of literature sources were consulted to identify the vessels that operate on the routes in the lighthouse areas. For this purpose, the automatic identification system[2] (AIS) maps that track vessels movements have been used to identify the most used routes. In addition, the major ferry operators in the lighthouse areas were identified and their webpages were reviewed for any information on the routes, vessels used, and the use of alternative fuels. However, some smaller ferry operators or ferries operated by public authorities may not be accounted for.

Our analysis shows that there is a tendency to move towards more sustainable ferry transport via both the usage of alternative fuels and propulsion systems, and the adoption/application of technological and operational measures that result in fuel savings, energy efficiency, and emissions reduction. Ferry operators are increasingly often announcing their plans for ordering electric ferries, further optimising energy efficiency of existing vessels, and /or taking part in different research projects focusing on decarbonisation.

Despite these trends, there is still a significant gap to achieving decarbonisation of maritime transport, and of ferry transport in particular. Very few vessels in the lighthouse areas could be classified as zero emissions (fully electric) ferries, whereas hybrid solutions are more common. This is often linked to a lack of readily available technologies, their higher costs, feasibility considerations, and the voyage length of these vessels. For example, the use of batteries is currently limited on shorter distances. The use of other alternative fuels such as hydrogen and ammonia is still in its infancy, with various research and demonstration projects ongoing.

Ports

The capacity for maritime fleets to transition to greener shipping is highly dependent on existing port infrastructures, i.e. LNG refuelling facilities, onshore power supply (OPS), and supply of other alternative fuels such as hydrogen, methanol, and ammonia. Our analysis shows that an increasing number of both LNG and OPS facilities are developed in the lighthouse areas. Despite that, there is still limited infrastructure available to support other alternative fuels, which is linked to limited use of those fuels in maritime transport (e.g. hydrogen and ammonia). However, it is also noted that there are a number of innovative decarbonization projects being implemented in the lighthouse areas that directly contribute towards the development of green ports. In particular, research has shown that since 2015, there are already 8 projects on decarbonized ports which consider measures contributing to increasing the share of renewable energy use in the ports in a holistic manner, and to the reduction of GHG emission from port operations.

Offshore renewable energy

Offshore waters are likely to be a particular focus area in Blue Economy expansion over the next decades. This is because of the massive upscaling of offshore renewable energy (RE), mainly including offshore wind power and, to a lesser extent, ocean energy technologies (wave and tidal), which are critical to achieving global and national goals of decarbonizing the electricity supply. Other offshore RE technologies such as algal biofuels (biodiesel,

---

2 The automatic identification system (AIS) is an automatic tracking system that uses transceivers on ships and is used by vessel traffic services (VTS).

biogas, and bioethanol), and floating photovoltaic are still at early stages of development but could be promising for the future. Both the Baltic and North Seas have a high natural potential for offshore wind energy and some potential for wave and tidal energy.

The North Sea is the most established sea basin in Europe with almost 79% of all offshore wind capacity in Europe, while the Baltic Sea represents about 9% of the total installed capacity. Moreover, the North Sea basin drives the ocean energy activity.

Our findings show that the main barrier for offshore wind energy deployment is not related to technology, financing or costs, but to permitting. In some cases, rules to get permits for new and repowered wind farms in Europe can be complex, procedures are slow, and permitting authorities are not adequately staffed. Nevertheless, some national maritime spatial plans are increasingly incorporating offshore wind as a key industry, paving the way for further development. Permitting guidelines are in preparation at the EU level and are expected to be published in the near future.

Onshore facilities of offshore renewable energy

Unlocking the low-carbon energy potential of the North Sea and Baltic Sea requires integrated system thinking and interlinked changes in the system rather than merely individual technology improvements. There are good opportunities for collaboration and synergy between sectors. Several options are currently being considered and developed (such as Power-to-X (PtX) e.g., power-to-hydrogen, power-to-methanol, and power-to-ammonia, on offshore platforms and energy islands). The majority of these initiatives are taking place in the North Sea region due to its higher share of offshore wind capacity as compared to the Baltic Sea region. Compared to the other countries in the lighthouse area, Denmark appears to be a frontrunner in the integrated implementation of various offshore RE and for storage systems.

Our findings show that the main barrier for offshore wind energy deployment is not related to technology, financing or costs, but to permitting. In some cases, rules to get permits for new and repowered wind farms in Europe can be complex, procedures are slow, and permitting authorities are not adequately staffed. Nevertheless, some national maritime spatial plans are increasingly incorporating offshore wind as a key industry, paving the way for further development. Permitting guidelines are in preparation at the EU level and are expected to be published in the near future.

Similar to offshore wind energy deployment, the permitting process appears to be a major barrier for ocean energy technologies. This includes lengthy procedures, multiple consent agencies, and a lack of a streamlined processes.

Multipurpose platforms

One of the challenges facing the lighthouse area regarding its ability to support infrastructure for decarbonisation, is the lack of sufficient offshore space. Combining different uses of marine areas into one can help alleviate some of the concerns on expansion of, for example, aquaculture into areas with heavy maritime transport traffic, recreational areas or marine protected areas. Multipurpose platforms (MPPs) have become increasingly popular as possible options for reducing competition for functional marine space. MPPs can also be used as a means to support growth and rehabilitation of biodiversity through the creation and protection of habitats, and through the supply of energy, food, and jobs.

The number of research projects that have already been completed or are ongoing highlights the potential of MPPs for the EU and the future of its marine areas. Multiple pilots (such as the Innovative Multi-purpose off-shore platforms: planning, design and operation (MERMAID), Multi-Use in European Seas (MUSES), A Rich North Sea and H2OCEAN), looked at how to best combine use-types through MPPs to maximize their efficiency and ease implementation challenges.

Despite the benefits outlined above, MPPs are firmly in their inception or pre-inception phase in the EU and even more so in the Baltic and North Sea Regions. Pilot studies and projects (e.g. EU-SCORES) are ongoing but have yet to produce any significant results or data that can signal potential for upscaling.

Aquaculture

The aquaculture industry in the Baltic and the North Sea is characterised by a high potential (with a view to multiple functions and applications), yet slow growth due to different challenges, including the ecological effect on wild fish, nutrient overload, competing interests, as well as lack of regulatory guidance or consistency. In Europe, aquaculture is a steadily growing industry with an annual expansion rate of 8% over the last thirty years. Still, in comparison to the global expansion rate, the EU share of production has decreased over time and is only 3.5% of the global share.

One of the major trends in aquaculture is a growing seaweed industry, either through its collection or its cultivation . Seaweed has a range of applications including for the biofuel industry as well as in pharmaceuticals, cosmetics, food, and ecosystem services (nutrient uptake and CO_2 absorption). The North and Baltic Seas have good conditions for seaweed growth as they are nutrient rich and cold, but there is still a lack of growth compared to the global market or land-based market. Nevertheless, it has been estimated that the seaweed industry could play a meaningful role in removing nitrogen and phosphorous from coastal waters by 2030. The potential for removal of such substances from the World Ocean is between 6,000-20,000 tonnes of nitrogen and 600-2,000 tonnes of phosphorous annually or, approx. 1% of European nutrient load to sea areas.

In many countries of the world, innovative solutions to aquaculture are being developed to meet demand and account for special issues in marine areas. For the EU as a whole, the space used for marine aquaculture represents a small portion of the actual coastline. It is a growing concern that there is not sufficient space for aquaculture as there are numerous competing activities that can interfere with fish farming. These include commercial fishing, recreation, maritime transport, and offshore energy generation. Aquaculture has yet to be a key player as a potential user for sea space. As can be seen in the maritime transport section of this report, creating synergies and involving multiple stakeholders in decision-making on space-use, as well as through financial incentives, solutions can be found to improving marine aquaculture. These solutions include integrated multi-trophic aquaculture (IMTA) and multi-use platforms (still in the pilot phases).

Governance

The governance structures of marine environment and Blue Economy activities in the Lighthouse area consist of multi-level legal/regulatory, institutional, and policy frameworks at difference levels of governance: international/global, (macro)regional, national, and sub-national. Significant differences in governance structures remain due to diverse strategies, priorities, institutional settings, contextual factors, and additional regulations set at the EU, macroregional, national/sub-national levels.

Overall, the governance of maritime space is characterised by a top-down, primarily sectoral approach. Sectoral structures are interlinked, although a greater coordination of regulations, strategies and policies is needed, as well as a clearer framework of cross-institutional collaboration. The national governments decide whether they ratify/adopt, enforce, and implement international laws and regulations.

Our analysis shows that the marine governance of the Baltic and North Sea areas is carried out by a large number of organisations with overlapping mandates and activities at different levels. Some interests and mandates are contradictory or conflicting.

Maritime spatial planning is considered a key tool in ensuring an efficient, safe, and sustainable management of the European waters. In accordance with the EU Maritime Spatial Planning Directive, all Member States must have established maritime spatial plans by 2021. Some plans for the Baltic Sea, however, were approved only recently (early 2022).

European macroregional strategies (MRS) provide strategic fora for addressing regional development and economic issues at a macroregional level. However, currently, for the lighthouse areas of the Baltic Sea and North Sea, only the EU Strategy for the Baltic Sea Region (EUSBSR) is relevant.

Stakeholder engagement

In the governance of regional seas, collaboration fostering initiatives by non-governmental and subnational organisations, as well as transnational stakeholder networks, were found to be particularly influential. Similarly, the bodies that encourage stakeholder participation (such as the Regional Advisory Councils in EU fisheries management and stakeholder forums organised by Baltic Marine Environment Protection Commission (Helsinki Commission (HELCOM), have a high degree of influence on decision-making process.

The roles of various stakeholder groups in marine/maritime governance can be broadly characterised as follows:

- R&D&I - advisory, technical support, monitoring/evaluation, influence policy agenda, provide data or research findings to inform policymakers
- Industry – lobby, collaboration on research, development & innovation (R&D&I, stimulate development of the Blue economy
- Civil society, non-governmental organisation (NGO) – raise attention to societal, environmental, economic issues in the Blue economy, represent groups of maritime stakeholders
- Financial sector – invest, stimulate development of the Blue economy.

Developing an effective strategy for citizen engagement is critical for success of the Mission objectives. Our findings show that locally-focused citizen engagement activities have a higher degree of citizen involvement and a larger impact on implementation of the Mission.

Challenges

It is clear that significant effort is still needed to make the Blue economy in the Baltic Sea and the North Sea regions carbon neutral and circular. There are challenges related to data limitations, but some challenges for the Mission implementation are broader. The main types of challenges are outlined below.

Data related challenges:

As outlined in previous sections, data on the ferry fleet and its characteristics in both the Baltic Sea and the North Sea is scattered across different sources, and different levels of granularity of data can be found across Member States. There is no one central source on ferry fleet characteristics. Data on the LNG and OPS infrastructure is available per sea basin through the European Alternative Fuels Observatory (EAFO). Limited data (often on project basis) is available on supporting infrastructure for hydrogen, methanol, ammonia, which is also linked to limited usage of these fuels in the lighthouse area.

In terms of data on the state of decarbonisation of port facilities and incentive schemes for promoting green shipping, the data is not centrally collected at the EU level. This information has been identified by combining different sources such as reports, studies, and websites of individual ports.

The main performance indicators for offshore wind farms (e.g., average capacity factors and capacity density) and data tracking current and future capacity can be accessed publicly However, there is a lack of a harmonised practice for their collection, processing, and publication, which leads to different levels of data quality. Moreover, most of the publicly available data lack sufficient levels of detail that would enable them to assess the current status and performance of offshore wind farms. The data collection has shown that there is no harmonised practice, and that the available high-level data lack a better distinction of offshore renewable energy and relevant indicators.

Broader challenges for Mission implementation

One of the challenges facing the lighthouse area with regard to its ability to support infrastructure for decarbonisation, is the lack of sufficient offshore space. Combining different uses of marine areas into one can help to alleviate some of the concerns for expansion of, for example, aquaculture into areas with heavy maritime transport traffic, recreational areas, or protected areas.

Multipurpose platforms (MPPs) are clearly in their inception phase in the EU and even more so in the Baltic and North Sea. Pilot studies and projects (e.g. EU-SCORES) are ongoing but have yet to produce any significant results or data that can signal potential for upscaling.

The data gaps for aquaculture are significant. There are cases when reported national statistics on aquaculture do not always distinguish between land-based and marine production if the share of marine aquaculture is not prominent enough. Marine aquaculture faces, particularly in the Baltic Sea, the challenge of nutrient pollution, where a further development of sustainable production technologies is needed.

The marine aquaculture production for advanced applications, such as animal feed and energy feedstocks, is still in its infancy, but also bears a lot of potential in creating more sustainable aquaculture production.

RIS strategies

Looking at synergies between Regional Innovation Strategies (RIS3/RIS4) in the lighthouse area, it was found that the goals set out in the strategies were often on a higher level than the topics of Mission Objective 3. The objectives in the strategies were found on the whole “Blue economy” as well as on shipping, aquaculture, ports, etc, which in some cases also mentioned zero-emission goals. In some strategies there were goals for zero-carbon/ zero-emission/ circular technologies, sometimes including marine technologies/ offshore energy technologies. However, the high level of the goals formulated in the strategies made it difficult to see if and to what extent the strategy could contribute to Mission Objective 3. Where broader themes were mentioned, such as a focus on aquaculture or offshore energy, it was not always clear if this included zero-carbon/ circular solutions (no specific links to Mission objectives were found). The most clear synergies were found in relation to marine technologies and solutions (in both regions bordering the Baltic Sea and regions bordering the North Sea). Synergies on battery, hydrogen or ammonia propelled ferries were also found in a considerable number of the strategies analysed. And, finally, the strategies analysed often had objectives related to aquaculture/ algae production.

Limitations of the study

The study was implemented during first half of 2022 and was therefore limited in initial scope (and new legislation and policies that have been passed and implemented since July 2022 are therefore not reflected upon in the study). In addition, the study was implemented during a relatively short timeframe (7 months) and was based on data accessible via public sources, and a limited number of interviews. Therefore, it has to be taken into the account that the Russian war of aggression to Ukraine, which broke out in February 2022 and the following economic sanctions and rising fuel prices will inevitably influence many areas of European economy. However, due to limited time and resources it was not possible to fully reflect on these effects during our study.

RECOMMENDATIONS

Governance

- Since the marine environment is influenced by variety of sectoral policies and strategies, which developed over the time, and the regulation of most of sectors has been in place long before the sustainability requirements appeared, the full integration of these policies is yet to come. It is expected that adoption and implementation of MSPs in the European seas will enhance the application of the ecosystems approach and thus strengthen the sustainability of marine ecosystems. Therefore, it is suggested by the study that the maritime spatial plans are used as a basis for developing the EU Blue Economy in the lighthouse areas.

- In order to improve governance, it is important to focus efforts on implementing and integrating existing policies, and on fulfilling the intentions behind thematic policy visions.

- Marine environmental monitoring programmes need to be improved (fit- for- purpose and underpinning longer-term scientific objectives which cut across policy and other drivers and consider cumulative effects of multiple pressures).

Maritime transport

- EU-wide statistics should be established on number of ferries operating in both Baltic and North Sea areas, including data on the age of vessels and fuels used. (Some national authorities are collecting this data already, another potential source could be European Maritime Safety Agency (EMSA).)

- Data on decarbonisation of ferry routes is linked to the vessels and as such, should be linked to data of ferries.

- The indicator framework should be set-up based on the data that can be collected centrally through EMSA or national authorities reporting through EMSA.

- Further support R&I in alternative fuels/propulsion systems for application in the ferry transport, including batteries, hydrogen, ammonia and methanol, in particular demonstration projects operating in real conditions demonstrating both technical and economic feasibility of such solutions.

- Support R&I in alternative fuels infrastructure that goes hand in hand with the development of alternative fuels.

- Due to the lifetime of vessels, it is expected that many vessels operating today in the lighthouse areas will still be in operation in the medium term (by 2030), thus incentives to further reduce the overall emissions of ferry fleet should be developed, e.g., retrofitting programmes to improve energy efficiency.

- Support projects focused on overall optimisation of maritime traffic like just-in-time operations and Sea Traffic Management (see next section on ports) leading to fuel consumption savings and higher overall efficiency of operations.

- Showcase and share the best practices on the use of alternative fuels/propulsion systems as well as operational and technical measures to improve energy efficiency.

Ports

- Data collection on decarbonisation of port facilities and existing incentive schemes in accordance with the above proposed indicators by national authorities and reported on an annual basis.

- Together with the development of vessels using alternative fuels/propulsion systems (see section on maritime transport), support development of enabling infrastructure for those vessels.

- Further promote R&I on decarbonisation of port facilities, e.g., through projects like “Docks The Future” that focuses on developing the methodology for a coordinated approach to the clustering, monitoring and evaluation of results of actions under the Ports of the Future topic.

- Promote the introduction of green initiatives for ports to facilitate both decarbonisation of vessels and ports.

- Support projects focused on overall optimisation of maritime traffic like just-in-time operations and Sea Traffic Management.

Offshore Renewable energy (RE)

- Establish a more centralised collection (e.g. Eurostat) of indicators that enables an isolated assessment of offshore RE performance to ensure consistent data quality and avoid the fragmentation of data across national statistics and/or private stakeholders.

- Establish more comprehensive datasets on the performance of offshore RE facilities, such as environmental conditions, operational ability, reliability, and recyclability as well as environmental impact performance. This can be done by obtaining and merging datasets, for example, meteorological data and data from project developers, operators, and owners of offshore RE facilities.

- To support projects and activities that promote knowledge exchange among maritime spatial planners on how to enable a better uptake of offshore RE in MSPs.

- To support projects and activities that increase the uptake of multi-use offshore RE projects, such as in combinations with marine aquaculture or recreational purposes.

- To support projects and activities that help the exchange of effective practices to remove barriers to the permitting processes for offshore RE projects and promote multi-use approaches to offshore RE.

- To support R&I projects that introduce new approaches to achieving full circularity of offshore RE facilities, focusing particularly on materials that are currently not recyclable or difficult to recycle or reuse (e.g. wind turbine blades) and environmental impact.

Onshore facilities of offshore renewable energy

- The low number of operational offshore RE energy storage facilities makes it of limited relevance to ensuring the provision of centrally stored data. However, as more offshore RE storage facilities become operational, it is recommended to ensure that the data underlying the indicators proposed for the baseline are centrally collected, either by national authorities or the European Commission, to ensure harmonised data of sufficient quality.

Since countries championing energy storage are found in the lighthouse area, it is recommended to:

1. Promote projects and activities that research options to establish energy storage facilities on MPPs,
2. Promote projects and activities that investigate offshore energy storage on existing facilities, and particularly geological storage in the North Sea,
3. Promote knowledge exchanges, where championing regions within offshore energy storage (including conversion technologies that turn electricity into carbon-neutral synthetic fuels, known also as Power-to-X) can share their insights and experiences in the lighthouse area,
4. Support early niche applications with promising commercial potential, including scalability of technology, manageable technology risk, and wider societal acceptance.

Multipurpose platforms (MPP)

- Due to the low number of operational MPPs and the overall infancy of the sector, they are currently of limited relevance to ensuring the provision of centrally stored data. However, once the number of operational MPPs starts growing, it is recommended to ensure that the data underlying the indicators proposed above are systematically collected

- The analysis has shown that pilot studies and projects are ongoing but have yet to produce significant results or data that can signal a potential upscaling. It is therefore recommended to gather and disseminate more evidence on the experiences with MPPs, to learn about enabling factors and barriers, notably in terms of permitting and licensing.

It is recommended to:

1. Conduct knowledge dissemination activities on recent and on-going projects piloting the use of MPPs in the lighthouse area,

2. Support activities and projects that support maritime spatial planners on how multipurpose platforms (and multi-use of marine space) can be further integrated into MSPs.

Aquaculture

- EU-wide statistics should be established which further enable the separation of marine aquaculture from land-based aquaculture.

- EU-wide statistics should be established which enable the quantification of sub-types of marine aquaculture production, i.e. ‘low impact’, organic, and biofuels.

- The competition of marine aquaculture with other marine activities, such as transport, fishing, and offshore RE which often take precedence over aquaculture, calls for a more efficient use of aquaculture space and establish a more supportive permitting framework for marine aquaculture.

It is therefore recommended to:

1. Support activities & projects that promote and further mature the use of IMTA (Integrated Multi-Trophic aquaculture) to support more space-efficient marine aquaculture.
2. Support activities & projects that further develop multi-use concepts that make marine aquaculture an attractive addition to other offshore activities, such as offshore wind.
3. Support activities & projects that provide knowledge exchanges among stakeholders on how permitting for the use of marine space can help promote the integration of marine aquaculture with other uses of marine space.
4. Use research funding, e.g., Horizon Europe, to increase the competitiveness and energy efficiency of recirculating aquaculture systems (RAS) for marine production, with a focus on the Baltic Sea.
5. Support activities & projects that promote alternative approaches to mitigating eutrophication and nitrogen overloads in the Baltic Sea (e.g., IMTA and more intensified mussel production).
6. Support activities & projects that develop the production technologies and establish offtake markets for feed production (e.g., mussels for feed production), energy feedstocks (e.g., algae for biofuels), and other bio-based products from marine aquaculture.

Synergies with regional innovation strategies

- A concrete way for the regions to contribute more to Mission Objective 3 would be to add zero carbon as a design parameter for blue economy tenders (e.g. regarding offshore energy, aquaculture and ports).

- It would be useful to provide examples of how the regions can include zero-carbon as a design parameter in ERDF calls.

- Information and best practices should be shared, as an inspiration for regions on what they can do to contribute to a carbon-neutral and circular blue economy and what the region can gain from this. For this, the S3 platform can be used to disseminate information (by contacting nominated contact persons for each RIS3, or organizing workshop).

- For the regions that have working groups, monitoring groups or steering groups in place, these committees can be informed and involved in the Mission.

- A first step in identifying good practices could be to look at the EU macro-regional strategy for the Baltic Sea Region, which has many flagship projects related to the Mission Objective 3 (such as, the work on the flagship ECOPRODIGI, where digital solutions are being sought for increasing efficiency and reducing emissions for ships when at a port).

- National agencies could play an important role in improving the synergies between RIS3/RIS4 and Mission objectives. National agencies could help regions in linking their strengths and smart specialisations to contributing to the Mission, and/or making suggestions to the regions and provide them with more information on the Mission.

Citizen engagement

- The Mission and its goals should be widely promoted towards all groups of relevant stakeholders.

- Endorsement of the Mission should connect to other global programmes like SDGs, UN Ocean Decade, EU Green Deal. It is key to build synergies with other citizen engagement activities.

- The Mission should choose topics and activities which are relevant, relatable, and easily understandable to citizens.

- Social innovation needs additional promotion and support to maximise the potential of the sustainable, circular, and carbon-neutral blue economy

- Involvement of local existing resources - networks and actors is critical for the implementation and continuous support of the Mission. The design of citizen engagement activities should be tailored to local needs and context.

CONCLUSIONS

It is apparent that there are many initiatives underway in both the Baltic Sea and the North Sea area contributing to sustainable Blue Economy goals. The North Sea is a pioneer in terms of decarbonizing ferry transport (especially Norway); there are fewer ferries running on alternative fuels operating in the Baltic Sea. Key projects related to decarbonisation of ferries illustrate the ways in which the North Sea is moving towards decarbonisation as well as Blue Growth. These projects are spread out across the lighthouse area and are related to ship conversion to alternative fuels rather than port infrastructure to support.

LNG and OPS infrastructure stand out as leading measures for decarbonisation of ports and vessels in both lighthouse areas. In the North Sea area, Norway dominates in terms of number of both OPS and LNG fuelling facilities. In the Baltic Sea, there are fewer LNG and OPS facilities as compared to the North Sea (with higher number of facilities in Sweden). Other measures to support decarbonisation include port calls optimisation, such as just-in-time operations and the conception of Sea Traffic Management (STM). There are also individual port initiatives for ships across the lighthouse areas to adapt to support greener shipping, e.g., through reduction of port fees, funding, and research.

Offshore wind energy in the Baltic Sea, and, especially in the North Sea has experienced rapid growth in recent years, and the annual cumulative installed capacity is expected to significantly increase in coming years. Untapping such potentials, while preventing degradation of the environment, will require addressing regulatory and legal barriers (e.g., complex permitting rules), strategic maritime and spatial planning, government support, and decommissioning practices.

The projects related to the integrated implementation of various offshore RE and storage systems are at an early stage of development. Unlocking the low-carbon energy potential of the North Sea and Baltic Sea requires integrated system thinking and interlinked changes in the system rather than merely individual technologies improvements. The opportunities for collaboration and synergies between sectors are vast. Several options are currently being considered and developed. The majority of these initiatives are taking place in the North Sea region due to its higher share of offshore wind capacity as compared to the Baltic Sea region.

The aquaculture sector is rapidly growing globally, but in the lighthouse area, the competition for space has made expansion difficult. The sector has significant potential to contribute to the decarbonisation through the contribution to the production of biofuels, for example the seaweed industry or implementing circular feed practices. Combining uses of both aquaculture and offshore wind for example through IMTA or MPPs will help the Baltic and North Seas to account for spatial issues that arise from large fish farms. MPPs and IMTA have yet to see significant uptake and will require regulatory support. Finally, using mussels or oysters to filter nutrients out of coastal waters can lead to an improved acceptance of the sector by environmentalists.

Regarding overall governance situation, the picture regarding implementation of marine/ maritime policies is mixed. Some targeted management measures, or legal obligations, resulting from EU policy have been fully implemented and have been successful in reducing, or even removing, some well-known marine pressures. Other measures/obligations have not been implemented or implemented only in part and/or slowly and with limited success. Furthermore, challenges also remain regarding the amount and quality of information available to evaluate progress. For example, no Member State had adequately reported the up-to-date state of its marine waters by the October 2018 (required by the MSFD). Certain pressures are still addressed through fragmented, ineffective approaches. The problem lies not only in the low rate and slow speed of policy implementation, but also in a lack of coherence and coordination between all the policies aiming to protect European Seas.

The European Mission "Restore our Ocean and Waters by 2030" is very well placed to accelerate actions and stimulate stakeholder engagement and cooperation in the lighthouse areas. However, our findings at the time of writing of this report (June 2022) show that the Mission is not very well known outside the research community, and awareness of citizens about the Mission and its potential contribution to sustainable Blue Economy is very low.

Our findings regarding R&I potential in lighthouse areas show, that there is substantial research potential in both The Baltic Sea and The North Sea area. There are peak performers or "R&I Hubs", which are more developed in terms of connectivity to EU networks (considerably higher proportion of them found in The North Sea area, thus indicating relatively significant level of efficiency in the North Sea regions' research and innovation systems). Besides this, looking at research and innovation results such as patents, H2020 projects and publications, it is clear also that the North Sea basin performs above the EU average on every aspect. However, it is also clear that cities in both lighthouse areas with major universities or industrial strongholds (such as Stockholm, London, Hamburg, Copenhagen, Skane and Vastra Gotaland) consistently show higher innovation performance. This potential is a promising asset in the further development of measures, projects and programmes that will contribute to innovation that will lead to reduction of emissions, implementation of circular economy solutions and other measures leading to sustainable Blue Economy in the lighthouse areas.

RÉSUMÉ EXÉCUTIF

Introduction

L'expression "économie bleue" est comprise au sens large et englobe toutes les industries et tous les secteurs liés aux océans, aux mers et aux côtes, qu'ils soient basés dans l'environnement marin (par exemple, le transport maritime, la pêche, la production d'énergie) ou sur terre (par exemple, les ports, les chantiers navals, l'aquaculture terrestre et la production d'algues, le tourisme côtier), ainsi que les secteurs innovants qui évoluent et se développent (la bioéconomie bleue, les énergies renouvelables des océans, les biotechnologies, etc.) L'économie bleue durable pourrait jouer un rôle important dans la mise en œuvre du "Green Deal" européen. La préservation et l'augmentation du capital naturel des mers et des océans sont également essentielles pour garantir la fourniture continue de services écosystémiques précieux et pour permettre à l'UE d'atteindre ses objectifs politiques et les objectifs de développement durable (ODD) de l'agenda 2030 des Nations unies. Les activités humaines doivent être gérées de manière à garantir la santé des océans et à préserver la productivité économique à long terme, afin que le potentiel qu'ils offrent puisse être réalisé et maintenu dans le temps.

La recherche et l'innovation marine et maritime sont essentielles pour réaliser l'ambition de l'UE de devenir climatiquement neutre d'ici 2050, pour protéger et restaurer les écosystèmes marins et pour permettre à l'économie bleue d'atteindre son plein potentiel.

La mission de l'UE "Régénérer notre océan et nos eaux" et l'objet de la présente étude

Les missions européennes sont un nouveau concept qui vise à accroître l'impact des investissements publics dans les activités de recherche et d'innovation, ainsi qu'à assurer une meilleure liaison avec les citoyens et à accroître la visibilité de la science, de la recherche et de l'innovation. L'objectif de la mission "Régénérer notre océan et nos eaux" est de fournir une approche systémique pour la restauration des océans, des mers et des eaux européennes d'ici 2030. Les objectifs spécifiques de la mission sont liés entre eux et se renforcent mutuellement:

1. Protéger et restaurer les écosystèmes marins et d'eau douce ainsi que la biodiversité, conformément à la stratégie européenne en faveur de la biodiversité à l'horizon 2030 ;
2. Prévenir et éliminer la pollution de nos océans, de nos mers et de nos eaux, conformément au plan d'action de l'UE "Vers une pollution zéro pour l'air, l'eau et le sol";
3. rendre l'économie bleue durable neutre en carbone et circulaire, conformément à la législation européenne sur le climat et à la vision globale soutenue par la stratégie pour une économie bleue durable.

Les "lighthouse" ou initiatives phares seront le principal véhicule de mise en œuvre de la mission dans sa première phase. Les "lighthouse" serviront de centres et de plateformes pour le développement, la démonstration et le déploiement de solutions à ces défis.

L'objectif de cette étude de base est de dresser une carte complète de la situation dans les zones "lighthouse" de la Baltique et de la mer du Nord ean ce qui concerne l'objectif de la mission "Rendre l'économie bleue durable neutre en carbone et circulaire". Cela inclut une cartographie de toutes les parties prenantes, réseaux, structures de gouvernance et activités d'engagement citoyen pertinents, ainsi que des projets passés, planifiés et en cours. L'objectif est de fournir une base pour informer la mise en œuvre du "lighthouse" du bassin de la mer Baltique et de la mer du Nord, la charte de mise en œuvre de la mission. En particulier, l'étude établit le statu quo pour l'objectif pertinent de la Mission à partir de 2021, par rapport auquel les progrès de la mise en œuvre de la Mission peuvent être mesurés (en 2025 et 2030), comme prévu dans le Plan de mise en œuvre de la Mission.

Les six secteurs de l'économie bleue suivants ont été analysés au cours de cette étude afin d'établir la situation de base des zones "lighthouse" :

- Le transport maritime (avec un accent sur le transport par ferry)
- Ports et installations maritimes
- Installations d'énergie renouvelable en mer
- Installations de stockage des énergies renouvelables en mer
- Plateformes polyvalentes, et
- l'aquaculture.

Sur la base des données qui ont pu être identifiées et analysées, un ensemble d'indicateurs est proposé pour le suivi du développement de la zone "lighthouse".

Au cours de la préparation de l'étude, il est apparu clairement que de nombreuses initiatives, activités et projets de grande valeur sont en cours dans la zone de la mer Baltique et de la mer du Nord, qui soutiennent les objectifs de la mission. Ils sont brièvement décrits ci-dessous.

Disparités régionales et paysage de la R&I - la région de la mer Baltique

La région de la mer Baltique se compose essentiellement de pays de l'UE bien développés. Au nord, l'Allemagne, le Danemark et la Suède comptent parmi les plus grandes puissances économiques et sont des membres de longue date de l'UE. À l'est, on trouve des pays membres de l'UE plus récents comme la Pologne, la Lettonie, la Lituanie et l'Estonie, ainsi que la Russie (bien qu'elle ne soit pas membre de l'UE). Même si, en moyenne, les anciens pays membres de l'UE obtiennent de meilleurs résultats en termes d'indicateurs socio-économiques, des disparités existent également au sein de leurs régions. Dans l'ensemble, 57 % des régions de la région de la mer Baltique se situent au-dessus de la moyenne de l'UE pour le produit intérieur brut (PIB) par habitant . Dans le même temps, toutes les régions qui se situent au-dessus de cette moyenne européenne se trouvent dans la partie nord du bassin. Cela montre une disparité de revenus entre le nord et l'est de la zone "lighthouse". Néanmoins, des régions de Suède et de Finlande figurent également parmi les régions les moins bien classées, ce qui montre de fortes disparités socio-économiques à l'intérieur du pays pour la Suède et la Finlande. En ce qui concerne les taux de chômage et les taux de risque de pauvreté, le bassin affiche des performances à peu près égales à la moyenne de l'UE.

En ce qui concerne les performances en matière de recherche et d'innovation (R&I), la moyenne de 120,5 du tableau de bord régional de l'innovation (RIS) de la mer Baltique est nettement supérieure à la moyenne de l'UE (100). Les régions nordiques de la mer Baltique sont les plus performantes, avec une moyenne de 155 pour la région NUTS 2 de Suède, suivie par la Finlande (125) et le Danemark (121) (tableau de bord régional de l'innovation, 2021). Les régions polonaises ont une moyenne de 51 sur le tableau de bord, et toutes obtiennent des résultats bien inférieurs aux moyennes de l'UE et des pays baltes. Cependant, les performances élevées ne sont réparties que dans une série de régions (comme mentionné ci-dessus - nordiques), car plus de la moitié des régions de la Nomenclature des unités territoriales statistiques (NUTS)2 (54 %) de la mer Baltique sont en dessous des performances RIS de la région de la mer Baltique. Il existe une disparité entre les performances en matière de R&I des pays et régions de la mer Baltique, principalement entre les parties septentrionales du bassin maritime (Suède, Finlande) et les pays et régions situés sur la côte orientale de la mer Baltique, tels que l'Estonie, la Lettonie, la Lituanie et la Pologne. On observe une forte concentration des résultats de la R&I dans des régions spécifiques qui sont des "pôles de R&I" dans la mer Baltique, notamment dans les capitales telles que Stockholm, Helsinki, Copenhague ou Hambourg. Il s'agit également de certains des pôles les plus liés à l'UE en participant à des projets H2020 ou à d'autres initiatives de l'UE (pôles d'innovation numérique, communautés de la connaissance et de l'innovation de l'Institut européen de technologie, etc.)

Disparités régionales et paysage de la R&I - la région de la mer du Nord

La région de la mer du Nord est composée de certains des pays les plus riches de l'UE et du monde. Les résultats de la région sont systématiquement meilleurs que la moyenne de l'UE lorsque l'on analyse les indicateurs de disparités socio-économiques. Toutefois, si les différences entre les pays sont négligeables pour la majorité d'entre eux, de fortes disparités peuvent être observées au niveau régional. Seules 31 % des régions ont un PIB par habitant supérieur à la moyenne de l'UE, et plus de 55 % d'entre elles connaissent des taux de chômage et des taux de risque de pauvreté supérieurs à la moyenne. Cela montre qu'il existe des disparités régionales relativement importantes en termes de performances socio-économiques.

Dans l'ensemble, les régions de la mer du Nord présentent des niveaux élevés d'intensité de R&I et se situent bien au-dessus de la moyenne de l'UE en termes de performances de R&I dans le tableau de bord régional de l'innovation de l'UE (avec un score de 143, supérieur au score moyen de 120 de la mer Baltique). Alors que plus de 60 % des régions de la mer du Nord ont une intensité de R&I inférieure à la moyenne de la mer du Nord, plus de la moitié (55 %) ont une performance d'innovation supérieure à la moyenne de la mer du Nord. Cela indique un niveau d'efficacité relativement important dans les systèmes de recherche et d'innovation des régions de la mer du Nord. Il existe des champions ou "R&I Hubs", qui sont plus développés en termes de connectivité aux réseaux de l'UE et de capital relationnel interne, tandis que la majorité des régions de la Mer du Nord affichent de faibles performances dans ce domaine.

Économie bleue circulaire et sans carbone - situation de référence

Les sections suivantes décrivent brièvement la situation de base dans les six secteurs de l'économie bleue analysés au cours de l'étude par rapport à l'objectif de la mission : "Rendre l'économie bleue durable neutre en carbone et circulaire". Les principaux résultats sont brièvement résumés dans la suite du texte.

Transport maritime

Cette étude a analysé le transport maritime dans les deux zones "lighthouse" : la mer Baltique et la mer du Nord. L'accent est mis en particulier sur l'état de la décarbonisation des ferries dans les zones "lighthouse". Dans ce contexte, on entend par "ferries" des navires rouliers capables de transporter des marchandises et des passagers sur roues, utilisés pour le transport régulier de passagers, de marchandises et de véhicules entre les ports de la zone "lighthouse". Étant donné que les ferries opèrent souvent sur des itinéraires réguliers, avec un accès fréquent aux ports, et sur des distances plus courtes (transport maritime à courte distance), ils présentent un potentiel de décarbonisation plus élevé à moyen terme que le transport maritime en haute mer. Cela est dû à la prévisibilité des itinéraires et à la disponibilité de systèmes de propulsion alternatifs tels que les batteries pour le transport maritime à courte distance.

En ce qui concerne le transport maritime, les données relatives à la flotte de ferries et à ses caractéristiques, tant dans la mer Baltique que dans la mer du Nord, sont éparpillées entre différentes sources et il existe différents niveaux de granularité des données entre les États membres. Il n'existe donc pas de source centrale européenne sur les caractéristiques de la flotte de ferries, c'est pourquoi les autorités nationales responsables du transport maritime ont été contactées et certaines données ont été obtenues dans le cadre de cette étude. Les données sur l'utilisation de carburants alternatifs tels que les batteries et les navires fonctionnant au gaz naturel liquéfié (GNL) sont disponibles au niveau de l'UE et au niveau mondial, mais pas par bassin maritime ou par pays individuel. Pour obtenir des données, les autorités nationales ont été contactées et une série de sources documentaires ont été consultées pour identifier les navires qui opèrent sur les routes dans les zones "lighthouse". À cette fin, les cartes des systèmes d'identification automatique (AIS) qui suivent les mouvements des navires ont été utilisées pour identifier les routes les plus utilisées. En outre, les principaux exploitants de ferry dans les zones "lighthouse" ont été identifiés et leurs pages web ont été examinées pour trouver toute information sur les routes, les navires utilisés et l'utilisation de carburants alternatifs. Cependant, certains opérateurs de ferry plus petits ou des ferries exploités par des autorités publiques peuvent ne pas être comptabilisés.

Notre analyse montre qu'il existe une tendance à s'orienter vers un transport par ferry plus durable, à la fois par l'utilisation de carburants et de systèmes de propulsion alternatifs, et par l'adoption/application de mesures technologiques et opérationnelles qui permettent d'économiser du carburant, d'améliorer l'efficacité énergétique et de réduire les émissions. Les exploitants de ferries annoncent de plus en plus souvent leur intention de commander des ferries électriques, d'optimiser davantage l'efficacité énergétique des navires existants et/ou de participer à différents projets de recherche axés sur la décarbonisation.

Malgré ces tendances, il reste encore beaucoup à faire pour parvenir à la décarbonisation du transport maritime, et du transport par ferry en particulier. Très peu de navires dans les zones "lighthouse" pourraient être classés comme des ferries à émissions zéro (entièrement électriques), alors que les solutions hybrides sont plus courantes. Cette situation est souvent liée à un manque de technologies facilement disponibles, à leur coût plus élevé, à des considérations de faisabilité et à la longueur du voyage de ces navires. Par exemple, l'utilisation de batteries est actuellement limitée aux courtes distances. L'utilisation d'autres carburants alternatifs, tels que l'hydrogène et l'ammoniac, n'en est qu'à ses débuts, mais divers projets de recherche et de démonstration sont en cours.

Ports

La capacité des flottes maritimes à passer à une navigation plus écologique dépend fortement des infrastructures portuaires existantes, c'est-à-dire des installations de ravitaillement en GNL, de l'alimentation électrique à terre (OPS) et de la fourniture d'autres carburants alternatifs tels que l'hydrogène, le méthanol et l'ammoniac. Notre analyse montre qu'un nombre croissant d'installations GNL et OPS sont développées dans les zones "lighthouse". Malgré cela, les infrastructures disponibles pour prendre en charge d'autres carburants de substitution sont encore limitées, ce qui est lié à l'utilisation limitée de ces carburants dans le transport maritime (par exemple, l'hydrogène et l'ammoniac). Toutefois, on constate également qu'un certain nombre de projets de décarbonisation innovants sont mis en œuvre dans les zones "lighthouse" et contribuent directement au développement de ports verts. En particulier, les recherches ont montré que depuis 2015, il existe déjà 8 projets de ports décarbonés qui envisagent des mesures contribuant à augmenter la part d'utilisation des énergies renouvelables dans les ports de manière holistique, et à réduire les émissions de GES des opérations portuaires.

Énergie renouvelable en mer

Les eaux offshores sont susceptibles de constituer une zone d'intérêt particulière pour l'expansion de l'économie bleue au cours des prochaines décennies. Cela s'explique par le développement massif des énergies renouvelables (ENR) en mer, notamment l'énergie éolienne en mer et, dans une moindre mesure, les technologies de l'énergie océanique (vagues et marées), qui sont essentielles pour atteindre les objectifs mondiaux et nationaux de décarbonisation de l'approvisionnement en électricité. D'autres technologies d'ER en mer, comme les biocarburants à base d'algues (biodiesel, biogaz et bioéthanol) et l'énergie photovoltaïque flottante, en sont encore aux premiers stades de développement mais pourraient être prometteuses pour l'avenir. La mer Baltique et la mer du Nord ont toutes deux un potentiel naturel élevé pour l'énergie éolienne en mer et un certain potentiel pour l'énergie houlomotrice et marémotrice.

La mer du Nord est le bassin maritime le plus établi en Europe, avec près de 79 % de toute la capacité éolienne offshore en Europe, tandis que la mer Baltique représente environ 9 % de la capacité totale installée. En outre, le bassin de la mer du Nord est le moteur de l'activité liée à l'énergie océanique.

Nos résultats montrent que le principal obstacle au déploiement de l'énergie éolienne en mer n'est pas lié à la technologie, au financement ou aux coûts, mais aux autorisations. Dans certains cas, les règles d'obtention des permis pour les parcs éoliens nouveaux ou renouvelés en Europe peuvent être complexes, les procédures sont lentes et les autorités chargées de l'octroi des permis ne disposent pas d'un personnel suffisant. Néanmoins, certains plans nationaux d'aménagement de l'espace maritime intègrent de plus en plus l'éolien en mer comme une industrie clé, ouvrant ainsi la voie à un développement plus important. Des lignes directrices en matière d'octroi de permis sont en cours d'élaboration au niveau de l'UE et devraient être publiées dans un avenir proche.

Installations terrestres d'énergie renouvelable en mer

Pour libérer le potentiel énergétique à faible émission de carbone de la mer du Nord et de la mer Baltique, il faut penser en termes de système intégré et apporter des changements interdépendants au système plutôt que de se contenter d'améliorations technologiques individuelles. Il existe de bonnes possibilités de collaboration et de synergie entre les secteurs. Plusieurs options sont actuellement envisagées et développées (comme le

Power-to-X (PtX), c'est-à-dire le power-to-hydrogen, le power-to-methanol et le power-to-ammonia, sur des plateformes offshore et des îles énergétiques). La majorité de ces initiatives se déroulent dans la région de la mer du Nord en raison de sa part plus importante de capacité éolienne en mer par rapport à la région de la mer Baltique. Par rapport aux autres pays de la zone « lighthouse », le Danemark semble être un pionnier dans la mise en œuvre intégrée de diverses énergies renouvelables en mer et de systèmes de stockage.

Nos résultats montrent que le principal obstacle au déploiement de l'énergie éolienne en mer n'est pas lié à la technologie, au financement ou aux coûts, mais aux autorisations. Dans certains cas, les règles d'obtention des permis pour les parcs éoliens nouveaux ou renouvelés en Europe peuvent être complexes, les procédures sont lentes et les autorités chargées de l'octroi des permis ne disposent pas d'un personnel suffisant. Néanmoins, certains plans nationaux d'aménagement de l'espace maritime intègrent de plus en plus l'éolien en mer comme une industrie clé, ouvrant ainsi la voie à un développement plus important. Des lignes directrices pour l'octroi de permis sont en préparation au niveau de l'UE et devraient être publiées dans un avenir proche.

Comme pour le déploiement de l'énergie éolienne en mer, le processus d'autorisation semble être un obstacle majeur pour les technologies de l'énergie océanique. Il s'agit notamment de la longueur des procédures, de la multiplicité des organismes d'autorisation et de l'absence de processus rationalisés.

Plates-formes polyvalentes (PPM)

L'un des défis auxquels sont confrontées les zones "lighthouse" en ce qui concerne leur capacité à soutenir les infrastructures pour la décarbonisation, est le manque d'espace offshore suffisant. Le rassemblement de différentes utilisations des zones marines en une seule peut contribuer à atténuer certaines des préoccupations relatives à l'expansion, par exemple, de l'aquaculture dans des zones à fort trafic maritime, des zones de loisirs ou des zones marines protégées. Les plateformes polyvalentes (PPM) sont devenues de plus en plus populaires en tant qu'options possibles pour réduire la concurrence pour l'espace marin fonctionnel. Les PPM peuvent également être utilisées comme un moyen de soutenir la croissance et la réhabilitation de la biodiversité par la création et la protection d'habitats, et par la fourniture d'énergie, de nourriture et d'emplois.

Le nombre de projets de recherche déjà achevés ou en cours souligne le potentiel des PPM pour l'UE et l'avenir de ses zones marines. De nombreux projets pilotes (tels que les projets "Innovative Multi-purpose off-shore platforms : planning, design and operation" (MERMAID), "Multi-Use in European Seas" (MUSES), "A Rich North Sea" et "H2OCEAN") ont étudié la meilleure façon de combiner les types d'utilisation des PPM afin d'optimiser leur efficacité et de résoudre les problèmes de mise en œuvre.

Malgré les avantages décrits ci-dessus, les PPM en sont encore à leur phase de lancement ou de pré-instauration dans l'UE, et plus encore dans les régions de la mer Baltique et de la mer du Nord. Des études et des projets pilotes (par exemple, EU-SCORES) sont en cours, mais ils n'ont pas encore produit de résultats ou de données significatifs susceptibles d'indiquer un potentiel de transposition à plus grande échelle.

Aquaculture

L'industrie de l'aquaculture dans la Baltique et la mer du Nord se caractérise par un potentiel élevé (en vue de fonctions et d'applications multiples), mais une croissance lente en raison de différents défis, notamment l'effet écologique sur les poissons sauvages, la surcharge en nutriments, les intérêts concurrents, ainsi que le manque d'orientation ou de cohérence réglementaire. En Europe, l'aquaculture est un secteur en croissance constante, avec un taux d'expansion annuel de 8 % au cours des trente dernières années. Pourtant, par rapport au taux d'expansion mondial, la part de la production de l'UE a diminué au fil du temps et ne représente que 3,5 % de la part mondiale.

L'une des principales tendances de l'aquaculture est la croissance de l'industrie des algues, que ce soit par leur collecte ou leur culture. Les algues ont une série d'applications, notamment pour l'industrie des biocarburants ainsi que pour les produits pharmaceutiques, les cosmétiques, l'alimentation et les services écosystémiques (absorption de nutriments et absorption de CO_2). La mer du Nord et la mer Baltique présentent de bonnes conditions pour la croissance des algues car elles sont riches en nutriments et froides, mais la croissance est encore insuffisante par rapport au marché mondial ou au marché terrestre. Néanmoins, il a été estimé que l'industrie des algues pourrait jouer un rôle significatif dans l'élimination de l'azote et du phosphore des eaux côtières d'ici 2030. Le potentiel d'élimination de ces substances dans l'océan mondial se situe entre 6 000 et 20 000 tonnes d'azote et 600 et 2 000 tonnes de phosphore par an, soit environ 1 % de la charge nutritive européenne dans les zones maritimes.

Dans de nombreux pays du monde, des solutions innovantes en matière d'aquaculture sont mises au point pour répondre à la demande et tenir compte des problèmes particuliers des zones marines. Pour l'UE dans son ensemble, l'espace utilisé pour l'aquaculture marine ne représente qu'une petite partie du littoral réel. Le manque d'espace pour l'aquaculture est une préoccupation croissante, car de nombreuses activités concurrentes peuvent interférer avec la pisciculture. Il s'agit notamment de la pêche commerciale, des loisirs, du transport maritime et de la production d'énergie en mer. L'aquaculture n'est pas encore un acteur clé en tant qu'utilisateur potentiel de l'espace maritime. Comme on peut le voir dans la section sur le transport maritime de ce rapport, en créant des synergies et en impliquant de multiples parties prenantes dans la prise de décision sur l'utilisation de l'espace, ainsi que par le biais d'incitations financières, des solutions peuvent être trouvées pour améliorer l'aquaculture marine. Ces solutions incluent l'aquaculture multi-trophique intégrée (AMTI) et les plateformes multi-usages (encore en phase pilote).

Gouvernance

Les structures de gouvernance du milieu marin et des activités de l'économie bleue dans la zone "Lighthouse" consistent en des cadres juridiques/réglementaires, institutionnels et politiques à plusieurs niveaux de gouvernance: international/mondial, (macro)régional, national et infranational. Des différences significatives subsistent dans les structures de gouvernance en raison de la diversité des stratégies, des priorités, des cadres institutionnels, des facteurs contextuels et des réglementations supplémentaires établies aux niveaux européen, macrorégional, national et infranational.

Globalement, la gouvernance de l'espace maritime se caractérise par une approche descendante, principalement sectorielle. Les structures sectorielles sont liées entre elles, bien qu'une plus grande coordination des réglementations, des stratégies et des politiques soit nécessaire, ainsi qu'un cadre plus clair de collaboration interinstitutionnelle. Les gouvernements nationaux décident s'ils ratifient/adoptent, appliquent et mettent en œuvre les lois et réglementations internationales.

Notre analyse montre que la gouvernance marine des zones de la Baltique et de la mer du Nord est assurée par un grand nombre d'organisations dont les mandats et les activités se chevauchent à différents niveaux. Certains intérêts et mandats sont contradictoires ou conflictuels.

La planification de l'espace maritime est considérée comme un outil essentiel pour assurer une gestion efficace, sûre et durable des eaux européennes. Conformément à la directive européenne sur la planification de l'espace maritime, tous les États membres doivent avoir établi des plans d'espace maritime d'ici 2021. Certains plans pour la mer Baltique n'ont toutefois été approuvés que récemment (début 2022).

Les stratégies macrorégionales européennes (MRS) constituent des forums stratégiques pour aborder le développement régional et les questions économiques au niveau macrorégional. Toutefois, à l'heure actuelle, pour les zones "lighthouse" de la mer Baltique et de la mer du Nord, seule la stratégie de l'UE pour la région de la mer Baltique (EUSBSR) est pertinente.

Engagement des parties prenantes

Dans le cadre de la gouvernance des mers régionales, les initiatives favorisant la collaboration des organisations non gouvernementales et infranationales, ainsi que les réseaux transnationaux de parties prenantes, se sont avérées particulièrement influentes. De même, les organismes qui encouragent la participation des parties prenantes (tels que les conseils consultatifs régionaux dans la gestion de la pêche de l'UE et les forums de parties prenantes organisés par la Commission de protection de l'environnement marin de la Baltique (Commission d'Helsinki (HELCOM)), ont un degré élevé d'influence sur le processus décisionnel.

Les rôles des différents groupes de parties prenantes dans la gouvernance marine/maritime peuvent être largement caractérisés comme suit :

- R&D&I - conseil, soutien technique, suivi/évaluation, influence sur l'agenda politique, fourniture de données ou de résultats de recherche pour informer les décideurs politiques.

- Industrie - lobbying, collaboration en matière de recherche, de développement et d'innovation (R&D&I), stimulation du développement de l'économie bleue.

- Société civile, organisation non gouvernementale (ONG) - attirer l'attention sur les questions sociétales, environnementales et économiques de l'économie bleue, représenter des groupes de parties prenantes maritimes.

- Secteur financier - investir, stimuler le développement de l'économie bleue.

L'élaboration d'une stratégie efficace d'engagement des citoyens est essentielle à la réalisation des objectifs de la mission. Nos résultats montrent que les activités d'engagement des citoyens axées sur le niveau local ont un degré plus élevé d'implication des citoyens et un impact plus important sur la mise en œuvre de la mission.

Défis

Il est clair que des efforts importants sont encore nécessaires pour rendre l'économie bleue dans les régions de la mer Baltique et de la mer du Nord neutre en carbone et circulaire. Il existe des défis liés aux limitations des données, mais certains défis pour la mise en œuvre de la Mission sont plus larges. Les principaux types de défis sont décrits ci-dessous.

Défis liés aux données :

Comme indiqué dans les sections précédentes, les données sur la flotte de ferries et ses caractéristiques, tant en mer Baltique qu'en mer du Nord, sont dispersées dans différentes sources, et différents niveaux de granularité des données peuvent être trouvés dans les États membres. Il n'existe pas de source centrale sur les caractéristiques de la flotte de ferries. Des données sur les infrastructures de GNL et d'OPS sont disponibles par bassin maritime par l'intermédiaire de l'Observatoire européen des carburants de substitution (EAFO). Des données limitées (souvent sur la base de projets) sont disponibles sur les infrastructures de soutien pour l'hydrogène, le méthanol et l'ammoniac, ce qui est également lié à l'utilisation limitée de ces carburants dans la zone « lighthouse ».

En ce qui concerne les données sur l'état de la décarbonisation des installations portuaires et les régimes d'incitation pour la promotion du transport maritime écologique, les données ne sont pas collectées de manière centralisée au niveau de l'UE. Ces informations ont été identifiées en combinant différentes sources telles que des rapports, des études et des sites web de ports individuels.

Les principaux indicateurs de performance des parcs éoliens en mer (par exemple, les facteurs de capacité moyens et la densité de capacité) et les données relatives à la capacité actuelle et future sont accessibles au public. Cependant, il n'existe pas de pratique harmonisée pour leur collecte, leur traitement et leur publication, ce qui entraîne des niveaux différents de qualité des données. En outre, la plupart des données accessibles au public ne présentent pas un niveau de détail suffisant pour permettre d'évaluer l'état actuel et les performances des parcs éoliens en mer. La collecte de données a montré qu'il n'existe pas de pratique harmonisée, et que les données de haut niveau disponibles ne permettent pas de mieux distinguer les énergies renouvelables en mer et les indicateurs pertinents.

Défis plus larges pour la mise en œuvre de la mission

L'un des défis auxquels est confrontée la zone "lighthouse" en ce qui concerne sa capacité à soutenir l'infrastructure pour la décarbonisation, est le manque d'espace offshore suffisant. La combinaison de différentes utilisations des zones marines en une seule peut contribuer à atténuer certaines des préoccupations liées à l'expansion, par exemple, de l'aquaculture dans des zones à fort trafic maritime, des zones de loisirs ou des zones protégées.

Les PPM en sont manifestement à leur phase de démarrage dans l'UE, et plus encore dans la mer Baltique et la mer du Nord. Des études et des projets pilotes (par exemple EU-SCORES) sont en cours, mais ils n'ont pas encore produit de résultats significatifs ni de données susceptibles de signaler un potentiel de transposition à plus grande échelle.

Les lacunes en matière de données sur l'aquaculture sont importantes. Dans certains cas, les statistiques nationales sur l'aquaculture ne font pas toujours la distinction entre la production terrestre et la production marine si la part de l'aquaculture marine n'est pas suffisamment importante. L'aquaculture marine est confrontée, en particulier dans la mer Baltique, au problème de la pollution par les nutriments, qui nécessite le développement de technologies de production durables.

La production aquacole marine pour des applications avancées, telles que l'alimentation animale et les matières premières énergétiques, n'en est encore qu'à ses débuts, mais elle présente également un grand potentiel pour créer une production aquacole plus durable.

Stratégies RIS

En examinant les synergies entre les stratégies régionales d'innovation (RIS3/RIS4) dans la zone "lighthouse", on a constaté que les objectifs fixés dans les stratégies se situaient souvent à un niveau plus élevé que les thèmes de l'objectif 3 de la mission. Les objectifs des stratégies portaient sur l'ensemble de l'"économie bleue" ainsi que sur la navigation, l'aquaculture, les ports, etc. qui, dans certains cas, mentionnaient également des objectifs de zéro émission. Dans certaines stratégies, il y avait des objectifs pour les technologies à zéro carbone/à zéro émission/ circulaires, incluant parfois les technologies marines/les technologies énergétiques offshore. Cependant, le haut niveau des objectifs formulés dans les stratégies a rendu difficile de voir si et dans quelle mesure la stratégie pouvait contribuer à l'objectif de mission 3. Lorsque des thèmes plus larges étaient mentionnés, tels qu'un accent sur l'aquaculture ou l'énergie offshore, il n'était pas toujours clair si cela incluait des solutions zéro-carbone/ circulaires (aucun lien spécifique avec les objectifs de la mission n'a été trouvé). Les synergies les plus évidentes ont été trouvées en rapport avec les technologies et solutions marines (tant dans les régions bordant la mer Baltique que dans celles bordant la mer du Nord). Des synergies sur les ferries à batterie, à hydrogène ou à ammoniac ont également été trouvées dans un nombre considérable de stratégies analysées. Enfin, les stratégies analysées avaient souvent des objectifs liés à l'aquaculture/la production d'algues.

Limites de l'étude

L'étude a été mise en œuvre au cours du premier semestre 2022 et a donc été limitée dans son champ d'application initial (et les nouvelles lois et politiques qui ont été adoptées et mises en œuvre depuis juillet 2022 ne sont donc pas prises en compte dans l'étude). En outre, l'étude a été mise en œuvre dans un délai relativement court (7 mois) et s'est basée sur des données accessibles via des sources publiques et un nombre limité d'entretiens. Il faut donc tenir compte du fait que la guerre d'agression russe contre l'Ukraine, qui a éclaté en février 2022, ainsi que les sanctions économiques et la hausse des prix du carburant qui ont suivi, influenceront inévitablement de nombreux domaines de l'économie européenne. Cependant, en raison du temps et des ressources limités, il n'a pas été possible de réfléchir pleinement à ces effets au cours de notre étude.

RECOMMANDATIONS

Gouvernance

- Étant donné que le milieu marin est influencé par une variété de politiques et de stratégies sectorielles, qui se sont développées au fil du temps, et que la réglementation de la plupart des secteurs a été mise en place bien avant l'apparition des exigences de durabilité, l'intégration complète de ces politiques reste à venir. On s'attend à ce que l'adoption et la mise en œuvre des plans d’aménagement de l’espace marine dans les mers européennes améliorent l'application de l'approche écosystémique et renforcent ainsi la durabilité des écosystèmes marins. Par conséquent, l'étude suggère que les plans d'espace maritime soient utilisés comme base pour développer l'économie bleue de l'UE dans les zones "lighthouse".

- Afin d'améliorer la gouvernance, il est important de concentrer les efforts sur la mise en œuvre et l'intégration des politiques existantes, et sur la réalisation des intentions derrière les visions politiques thématiques.

- Les programmes de surveillance du milieu marin doivent être améliorés (ils doivent être adaptés à leur finalité et étayer des objectifs scientifiques à plus long terme qui transcendent les politiques et autres facteurs et tiennent compte des effets cumulatifs de pressions multiples).

Transport maritime

- Des statistiques à l'échelle de l'UE devraient être établies sur le nombre de ferries opérant dans les zones de la Baltique et de la mer du Nord, y compris des données sur l'âge des navires et les carburants utilisés. (Certaines autorités nationales collectent déjà ces données, une autre source potentielle pourrait être l'Agence européenne pour la sécurité maritime (AESM)).

- Les données sur la décarbonisation des itinéraires des ferries sont liées aux navires et, en tant que telles, devraient être liées aux données sur les ferries.

- Le cadre des indicateurs devrait être établi sur la base des données qui peuvent être collectées de manière centralisée par l'EMSA ou par les autorités nationales qui font rapport à l'EMSA.

- Soutenir davantage la R&I dans les carburants alternatifs/systèmes de propulsion pour une application dans le transport par ferry, y compris les batteries, l'hydrogène, l'ammoniac et le méthanol, en particulier les projets de démonstration opérant dans des conditions réelles démontrant la faisabilité technique et économique de ces solutions.

- Soutenir la R&I dans l'infrastructure des carburants alternatifs qui va de pair avec le développement des carburants alternatifs.

- En raison de la durée de vie des navires, on s'attend à ce que de nombreux navires exploités aujourd'hui dans les zones "lighthouse" soient encore en service à moyen terme (d'ici à 2030) ; il convient donc de mettre en place des mesures incitatives pour réduire davantage les émissions globales de la flotte de ferries, par exemple des programmes de modernisation visant à améliorer l'efficacité énergétique.

- Soutenir les projets axés sur l'optimisation globale du trafic maritime, tels que les opérations "juste à temps" et la gestion du trafic maritime (voir la section suivante sur les ports), afin de réduire la consommation de carburant et d'améliorer l'efficacité globale des opérations.

- Présenter et partager les meilleures pratiques en matière d'utilisation de carburants et de systèmes de propulsion alternatifs, ainsi que les mesures opérationnelles et techniques visant à améliorer l'efficacité énergétique.

Ports

- Collecte de données sur la décarbonisation des installations portuaires et sur les régimes d'incitation existants, conformément aux indicateurs proposés ci-dessus, par les autorités nationales, et communication de ces données sur une base annuelle.

- Parallèlement au développement de navires utilisant des carburants/systèmes de propulsion alternatifs (voir la section sur le transport maritime), soutenir le développement d'infrastructures favorables à ces navires.

- Promouvoir davantage la R&I sur la décarbonisation des installations portuaires, par exemple, par le biais de projets tels que "Docks The Future" qui se concentre sur le développement de la méthodologie pour une approche coordonnée du regroupement, du suivi et de l'évaluation des résultats des actions dans le cadre du thème "Ports du futur".

- Promouvoir l'introduction d'initiatives vertes pour les ports afin de faciliter la décarbonisation des navires et des ports.

- Soutenir les projets axés sur l'optimisation globale du trafic maritime, comme les opérations en flux tendu et la gestion du trafic maritime.

Énergie renouvelable en mer (ENR)

- Mettre en place une collecte plus centralisée (par exemple, Eurostat) d'indicateurs permettant une évaluation isolée des performances des énergies renouvelables en mer, afin de garantir une qualité de données constante et d'éviter la fragmentation des données entre les statistiques nationales et/ou les parties prenantes privées.

- Établir des ensembles de données plus complets sur les performances des installations d'ER en mer, telles que les conditions environnementales, la capacité opérationnelle, la fiabilité et la recyclabilité, ainsi que les performances en matière d'impact environnemental. Cela peut être fait en obtenant et en fusionnant des ensembles de données, par exemple, des données météorologiques et des données provenant de développeurs de projets, d'exploitants et de propriétaires d'installations d'énergies renouvelables en mer.

- Soutenir les projets et les activités qui favorisent l'échange de connaissances entre les planificateurs de l'espace maritime sur la façon de permettre une meilleure prise en compte des énergies renouvelables en mer dans les plans de gestion de l'espace maritime.

- Soutenir les projets et les activités qui augmentent l'adoption de projets d'énergies renouvelables en mer à usages multiples, par exemple en combinaison avec l'aquaculture marine ou les loisirs.

- Soutenir les projets et les activités qui favorisent l'échange de pratiques efficaces afin de supprimer les obstacles aux processus d'autorisation des projets d'énergies renouvelables en mer et de promouvoir les approches multi-usages des énergies renouvelables en mer.

- Soutenir les projets de R&I qui introduisent de nouvelles approches pour parvenir à une circularité totale des installations d'énergies renouvelables en mer, en se concentrant particulièrement sur les matériaux qui ne sont actuellement pas recyclables ou difficiles à recycler ou à réutiliser (par exemple, les pales d'éoliennes) et sur l'impact environnemental.

Installations terrestres d'énergies renouvelables en mer

- Le faible nombre d'installations opérationnelles de stockage d'énergie ENR en mer ne présente qu'un intérêt limité pour assurer la fourniture de données stockées de manière centralisée. Cependant, à mesure que davantage d'installations de stockage d'énergies renouvelables en mer deviennent opérationnelles, il est recommandé de s'assurer que les données sous-jacentes aux indicateurs proposés pour la ligne de base sont collectées de manière centralisée, soit par les autorités nationales, soit par la Commission européenne, afin de garantir des données harmonisées de qualité suffisante.

- Étant donné que les pays qui défendent le stockage de l'énergie se trouvent dans a zone "lighthouse", il est recommandé de :

  - Promouvoir les projets et les activités qui étudient les possibilités d'établir des installations de stockage d'énergie sur les PPM,

  - Promouvoir les projets et les activités qui étudient le stockage d'énergie en mer sur les installations existantes, et en particulier le stockage géologique en mer du Nord,

  - Promouvoir les échanges de connaissances, où les régions championnes du stockage de l'énergie en mer (y compris les technologies de conversion qui transforment l'électricité en carburants synthétiques neutres en carbone, connus également sous le nom de Power-to-X) peuvent partager leurs idées et leurs expériences dans la zone "lighthouse",

  - Soutenir les premières applications de niche présentant un potentiel commercial prometteur, notamment l'évolutivité de la technologie, un risque technologique gérable et une acceptation sociétale plus large.

Plateformes polyvalentes (MPP)

- En raison du faible nombre de plates-formes polyvalentes opérationnelles et de la jeunesse générale du secteur, elles ne présentent actuellement qu'un intérêt limité pour assurer la fourniture de données centralisées. Toutefois, lorsque le nombre de PPM opérationnelles commencera à augmenter, il est recommandé de veiller à ce que les données sous-jacentes aux indicateurs proposés ci-dessus soient systématiquement collectées.

- L'analyse ci-dessus a montré que des études et des projets pilotes sont en cours, mais qu'ils n'ont pas encore produit de résultats significatifs ou de données susceptibles de signaler une éventuelle montée en puissance. Il est donc recommandé de recueillir et de diffuser davantage de données sur les expériences de PPM, afin de connaître les facteurs favorables et les obstacles, notamment en termes de permis et de licences. Il est recommandé de :

- Mener des activités de diffusion des connaissances sur les projets récents et en cours qui pilotent l'utilisation des PPM dans la zone "lighthouse",

- Soutenir les activités et les projets qui aident les planificateurs de l'espace maritime sur la façon dont les plates-formes polyvalentes (et l'utilisation multiple de l'espace marin) peuvent être davantage intégrées dans les plans d'aménagement de l'espace marin.

Aquaculture

- Il convient d'établir des statistiques à l'échelle de l'UE qui permettent de mieux distinguer l'aquaculture marine de l'aquaculture terrestre.

- Il convient d'établir des statistiques à l'échelle de l'UE permettant de quantifier les sous-types de production aquacole marine, c'est-à-dire les productions à faible impact, biologiques et les biocarburants.

- La concurrence de l'aquaculture marine avec d'autres activités marines, telles que le transport, la pêche et les ER en mer, qui prennent souvent le pas sur l'aquaculture, appelle à une utilisation plus efficace de l'espace aquacole et à l'établissement d'un cadre d'autorisation plus favorable à l'aquaculture marine. Il est donc recommandé de

  - Soutenir les activités et les projets qui favorisent et font évoluer l'utilisation de l'AMTI (aquaculture multi-trophique intégrée) pour soutenir une aquaculture marine plus efficace en termes d'espace.

  - Soutenir les activités et les projets qui développent davantage les concepts d'utilisation multiple qui font de l'aquaculture marine un complément attrayant à d'autres activités en mer, comme l'éolien en mer.

  - Soutenir les activités et les projets qui permettent des échanges de connaissances entre les parties prenantes sur la façon dont les autorisations d'utilisation de l'espace marin peuvent aider à promouvoir l'intégration de l'aquaculture marine avec d'autres utilisations de l'espace marin.

  - Utiliser les fonds de recherche, par exemple Horizon Europe, pour accroître la compétitivité et l'efficacité énergétique des systèmes d'aquaculture en recirculation (RAS) pour la production marine, en mettant l'accent sur la mer Baltique.

  - Soutenir les activités & projets qui promeuvent des approches alternatives pour atténuer l'eutrophisation et les surcharges d'azote dans la mer Baltique (par exemple, l'AMTI et une production de moules plus intensifiée).

  - Soutenir les activités et les projets qui développent les technologies de production et établissent des marchés d'écoulement pour la production d'aliments pour animaux (par exemple, les moules pour la production d'aliments pour animaux), les matières premières énergétiques (par exemple, les algues pour les biocarburants), et d'autres produits biologiques issus de l'aquaculture marine.

Synergies avec les stratégies régionales d'innovation

- Une façon concrète pour les régions de contribuer davantage à l'objectif 3 de la mission serait d'ajouter le zéro carbone comme paramètre de conception pour les appels d'offres de l'économie bleue (par exemple concernant l'énergie offshore, l'aquaculture et les ports).

- Il serait utile de fournir des exemples de la manière dont les régions peuvent inclure le zéro carbone comme paramètre de conception dans les appels FEDER.

- Les informations et les meilleures pratiques devraient être partagées, afin d'inspirer les régions sur ce qu'elles peuvent faire pour contribuer à une économie bleue circulaire et neutre en carbone et sur ce que la région peut en retirer. Pour cela, la plateforme S3 peut être utilisée pour diffuser l'information (en contactant les personnes de contact désignées pour chaque RIS3, ou en organisant un atelier).

- Pour les régions qui ont des groupes de travail, des groupes de suivi ou des groupes de pilotage en place, ces comités peuvent être informés et impliqués dans la mission.

- Une première étape dans l'identification des bonnes pratiques pourrait être de regarder la stratégie macro-régionale de l'UE pour la région de la mer Baltique, qui a de nombreux projets "lighthouse" liés à l'objectif 3 de la Mission (comme le travail sur le projet "lighthouse" ECOPRODIGI, où des solutions numériques sont recherchées pour augmenter l'efficacité et réduire les émissions des navires lorsqu'ils sont dans un port).

- Les agences nationales pourraient jouer un rôle important dans l'amélioration des synergies entre les RIS3/RIS4 et les objectifs de la mission. Les agences nationales pourraient aider les régions à relier leurs forces et leurs spécialisations intelligentes pour contribuer à la mission, et/ou faire des suggestions aux régions et leur fournir plus d'informations sur la mission.

L'engagement des citoyens

- La mission et ses objectifs doivent être largement promus auprès de tous les groupes de parties prenantes concernés.

- L'approbation de la mission doit être liée à d'autres programmes mondiaux tels que les ODD, la Décennie des Nations unies pour l'océan, le Green Deal de l'UE. Il est essentiel de créer des synergies avec d'autres activités d'engagement des citoyens.

- La mission doit choisir des sujets et des activités pertinents, pertinents et facilement compréhensibles pour les citoyens.

- L'innovation sociale a besoin d'une promotion et d'un soutien supplémentaires pour maximiser le potentiel de l'économie bleue durable, circulaire et neutre en carbone.

- L'implication des ressources locales existantes - réseaux et acteurs - est essentielle pour la mise en œuvre et le soutien continu de la mission. La conception des activités d'engagement des citoyens doit être adaptée aux besoins et au contexte locaux.

Conclusions

Il est évident qu'il existe de nombreuses initiatives en cours dans la région de la mer Baltique et de la mer du Nord qui contribuent aux objectifs d'une économie bleue durable. La mer du Nord est un pionnier en termes de décarbonisation du transport par ferry (notamment en Norvège) ; il y a moins de ferries fonctionnant avec des carburants alternatifs en mer Baltique. Les projets clés liés à la décarbonisation des ferries illustrent la manière dont la mer du Nord évolue vers la décarbonisation et la croissance bleue. Ces projets sont répartis dans toute la zone du "lighthouse" et sont liés à la conversion des navires à des carburants alternatifs plutôt qu'à des infrastructures portuaires de soutien.

Les infrastructures de GNL et d'OPS apparaissent comme des mesures clés pour la décarbonisation des ports et des navires dans les deux zones "lighthouse". Dans la zone de la mer du Nord, la Norvège domine en termes de nombre d'installations de ravitaillement en OPS et en GNL. Dans la mer Baltique, il y a moins d'installations de GNL et d'OPS que dans la mer du Nord (avec un nombre plus élevé d'installations en Suède). D'autres mesures visant à soutenir la décarbonisation comprennent l'optimisation des escales, comme les opérations en flux tendu et la conception de la gestion du trafic maritime (STM). Il existe également des initiatives portuaires individuelles pour les navires dans les zones "lighthouse" afin de s'adapter pour soutenir un transport maritime plus écologique, par exemple, par la réduction des frais portuaires, le financement et la recherche.

L'énergie éolienne offshore dans la mer Baltique, et surtout dans la mer du Nord, a connu une croissance rapide ces dernières années, et la capacité annuelle cumulée installée devrait augmenter considérablement dans les années à venir. Pour exploiter ce potentiel, tout en évitant la dégradation de l'environnement, il faudra s'attaquer aux obstacles réglementaires et juridiques (par exemple, les règles complexes d'octroi de permis), à la planification stratégique maritime et spatiale, au soutien des pouvoirs publics et aux pratiques de démantèlement.

Les projets liés à la mise en œuvre intégrée de divers systèmes d'ER et de stockage en mer en sont à un stade précoce de développement. Pour libérer le potentiel énergétique à faible émission de carbone de la mer du Nord et de la mer Baltique, il faut penser en termes de système intégré et apporter des changements interdépendants au système plutôt que de se contenter d'améliorer les technologies individuelles. Les possibilités de collaboration et de synergies entre les secteurs sont vastes. Plusieurs options sont actuellement envisagées et développées. La majorité de ces initiatives ont lieu dans la région de la mer du Nord en raison de sa part plus importante de capacité éolienne en mer par rapport à la région de la mer Baltique.

Le secteur de l'aquaculture connaît une croissance rapide à l'échelle mondiale, mais dans la région "lighthouse", la concurrence pour l'espace a rendu l'expansion difficile. Le secteur a un potentiel important pour contribuer à la décarbonisation par la contribution à la production de biocarburants, par exemple l'industrie des algues ou la mise en œuvre de pratiques d'alimentation circulaire. Combiner les utilisations de l'aquaculture et de l'éolien en mer, par exemple par le biais de l'AMTI ou des PPM, aidera la mer Baltique et la mer du Nord à tenir compte des problèmes spatiaux que posent les grandes exploitations piscicoles. Les PPM et l'AMTI n'ont pas encore été adoptés de manière significative et nécessiteront un soutien réglementaire. Enfin, l'utilisation de moules ou d'huîtres pour filtrer les nutriments des eaux côtières peut conduire à une meilleure acceptation du secteur par les environnementalistes.

En ce qui concerne la situation générale en matière de gouvernance, le bilan de la mise en œuvre des politiques marines/maritimes est mitigé. Certaines mesures de gestion ciblées, ou obligations légales, résultant de la politique de l'UE ont été pleinement mises en œuvre et ont permis de réduire, voire de supprimer, certaines pressions marines bien connues. D'autres mesures/obligations n'ont pas été mises en œuvre ou ne l'ont été que partiellement et/ou lentement et avec un succès limité. En outre, des difficultés subsistent en ce qui concerne la quantité et la qualité des informations disponibles pour évaluer les progrès accomplis. Par exemple, aucun État membre n'avait communiqué de manière adéquate l'état actualisé de ses eaux marines en octobre 2018 (comme l'exige la directive-cadre sur les eaux). Certaines pressions sont encore traitées par des approches fragmentées et inefficaces. Le problème réside non seulement dans le faible taux et la lenteur de la mise en œuvre des politiques, mais aussi dans un manque de cohérence et de coordination entre toutes les politiques visant à protéger les mers européennes.

La mission européenne "Régénérer notre océan et nos eaux" est très bien placée pour accélérer les actions et stimuler l'engagement et la coopération des parties prenantes dans les zones « lighthouse ». Cependant, nos conclusions au moment de la rédaction de ce rapport (juin 2022) montrent que la Mission n'est pas très connue en dehors de la communauté des chercheurs, et que la sensibilisation des citoyens à la Mission et à sa contribution potentielle à une économie bleue durable est très faible.

Nos résultats concernant le potentiel de R&I dans les zones "lighthouse" montrent qu'il existe un potentiel de recherche important dans les régions de la mer Baltique et de la mer du Nord. Il y a des performances de pointe ou des "pôles de R&I", qui sont plus développés en termes de connectivité aux réseaux de l'UE (la proportion de ces pôles est considérablement plus élevée dans la région de la mer du Nord, ce qui indique un niveau d'efficacité relativement important dans les systèmes de recherche et d'innovation des régions de la mer du Nord). En outre, si l'on considère les résultats de la recherche et de l'innovation, tels que les brevets, les projets H2020 et les publications, il est également clair que le bassin de la mer du Nord obtient des résultats supérieurs à la moyenne de l'UE à tous les égards. Toutefois, il est également clair que les villes situées dans les zones "lighthouse" dotées de grandes universités ou de bastions industriels (comme Stockholm, Londres, Hambourg, Copenhague, Skane et Vastra Gotaland) affichent systématiquement des performances supérieures en matière d'innovation. Ce potentiel est un atout prometteur pour la poursuite du développement de mesures, de projets et de programmes qui contribueront à l'innovation qui conduira à la réduction des émissions, à la mise en œuvre de solutions d'économie circulaire et à d'autres mesures conduisant à une économie bleue durable dans les zones "lighthouse".

BACKGROUND

With the 2019 European Green Deal, the climate and environment are at the top of the EU political agenda. This new growth strategy aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient, and competitive, circular and carbon neutral economy where economic growth is decoupled from resource use. It also aims to protect, conserve, enhance the EU's natural capital, and to protect the health and well-being of citizens from environment-related risks and impacts. Given the scale of this transition, new collaboration models are needed to bring together citizens in all their diversity, with national, regional, local authorities, civil society and industry working closely with the EU's institutions and consultative bodies.

The European Green Deal priorities include:

- protecting biodiversity and ecosystems
- reducing air, water and soil pollution
- moving towards a circular economy
- improving waste management
- ensuring the sustainability of our blue economy and fisheries sectors.

By working on these key areas, the EU will address environmental problems, reduce greenhouse gas emissions, and improve the health and quality of life of its citizens. In order to implement the Green Deal, the European Commission adopted a set of proposals to make the EU's climate, energy, transport, and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels.

The European Commission officially launched the European Missions on the 29th of September, 2021.These European Missions are a new initiative under the Horizon Europe research and innovation programme for the 2021-2027. The 5 Missions are:

- Adaptation to Climate Change: support at least 150 European regions and communities to become climate resilient by 2030
- Restore our Ocean and Waters by 2030
- Cancer: working with Europe's Beating Cancer Plan to improve the lives of more than 3 million people by 2030 through prevention, cure and solutions to live longer and better
- 100 Climate-Neutral and Smart Cities by 2030
- A Soil Deal for Europe: 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

The Mission "Restore our Ocean and Waters by 2030" will contribute to the European Green Deal by restoring ecosystems and biodiversity, eliminating pollution, and making the blue economy carbon-neutral and circular.

Due to the transboundary nature of waters, and considering existing governance structures, Mission implementation coordination and regional cooperation will be organised at the scale of sea basins and river basins.

To accomplish a successful Mission, the implementation process will be conducted in two phases. First, there is a “development and piloting” phase (2022-2025). During this phase, foundations will be laid for the implementation of the three Mission objectives and enabling actions. Second, a “deployment and upscaling” phase (post 2025) will take place. In this phase the solutions developed and piloted in the first phase to deliver on the Mission and European Green Deal objectives will be further deployed, replicated, and scaled up through rounds of open calls for scale-up actions.

Area-based “lighthouses” will be the main implementation vehicle of the Mission "Restore our Ocean and Waters by 2030 in its first phase. These lighthouses will demonstrate in large areas that the specific objectives of the Mission are achievable. Lighthouses will act as hubs and platforms for the development, demonstration, and deployment of solutions to the complex challenges of European sea and river basins. In the second phase (after 2025), the Mission will support the scaling-up of projects across the EU and associated countries, supported by complementary funding from a variety of sources. The lighthouses’ governance will build on existing governance and cooperation structures and will be established through a political implementation charter concluded among relevant Member States, the European Commission and other partners.

1. Introduction

In December 2021, the European Commission launched baseline studies to support the implementation of the Mission during its first phase. The purpose of two of these studies is to ascertain the status of the implementation of the Mission objectives in the areas of the four Mission lighthouses, i.e. in the Danube river basin, Atlantic and Arctic sea basin, Mediterranean sea basin and in the Baltic and North sea basin, to propose a set of indicators to monitor the future progress of the implementation of the Mission objectives in the four Mission lighthouse areas and to collect information about existing governance structures, ongoing citizen engagement initiatives and to assess the state of alignment of Smart Specialisation Strategies with the Mission objectives.

The present study constitutes the final deliverable of the Baseline study for the implementation of the lighthouse in the Baltic and North Sea basins for the Mission “Restore our ocean and waters by 2030”.

It comprises updated versions of all project deliverables (5 reports and 3 databases), and integrated Recommendations and Conclusions.

2. The objective of the assignment

The objective of the baseline study is to comprehensively map the situation in the lighthouse areas with regards to the Mission “Restore our ocean and waters by 2030” objective “Make the sustainable blue economy carbon-neutral and circular”. This study covers all relevant stakeholders, networks, governance structures and citizen engagement activities, as well as past, planned and ongoing projects, to provide a basis for the implementation of the lighthouse and to support the creation the Implementation Charter for the lighthouse. The study also aims to establish the status in 2021 for the relevant Mission objective, against which the success of Mission implementation will be measured (in 2025 and 2030).

3. Methodology

The methodological approach has been defined in line with the Terms of Reference (ToR) and further refined and finetuned during first month of the study. The approach was presented and discussed during 1st Interim meeting (on January 18th, 2022).

The term "Blue Economy" is understood broadly, as it encompasses all industries and sectors related to oceans, seas and coasts, whether they are based in the marine environment (e.g. shipping, fisheries, energy generation) or on land (e.g. ports, shipyards, land-based aquaculture and algae production, coastal tourism). It also encompasses innovative sectors that are evolving and growing which are relevant to the sector (the blue bioeconomy, ocean renewable energy, bio-technology, etc). For the purposes of overall consistency, in Tasks 2 to 5 we will mainly focus on the sectors[3] that have been already identified in ToR:

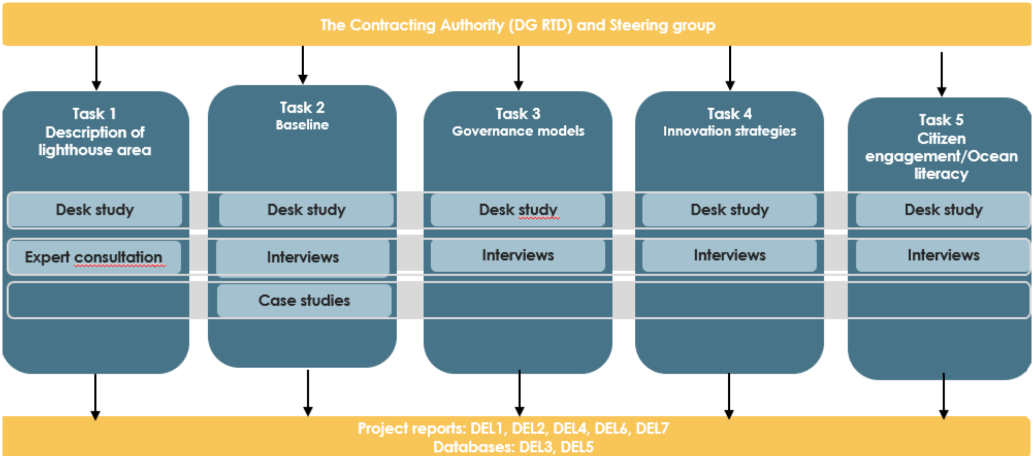
- maritime transport,
- maritime ports & facilities
- renewable energy and its offshore facilities
- offshore renewable energy storage facilities
- multipurpose platforms
- aquaculture.

Other areas, such as waste, circular economy, fisheries, integrated coastal zone management, coastal tourism, blue bioeconomy, were considered based on the degree of relevance to the Mission objective.

The tasks in this project were implemented in a coherent and consistent manner, building on each other. It is pivotal that activities are well integrated and that the deliverables of each task feed into subsequent tasks (see Figure 1 and Table 1). Work was carried out in parallel in both lighthouse areas, thus ensuring consistency of approaches and results in data/information collection and analysis, in order to ensure the most homogeneous baseline possible. Figure 1 below depicts our main tasks, activities, and deliverables.

3 In the report the six sectors will also be referred to as thematic areas.

Figure 1 Main project tasks, activities, and deliverables



During the assignment, a mix of methods was used: desk review (including collection and analysis of available statistical data and information), interviews, case studies (Task 2 only), and expert consultations. An overview of the strengths and weaknesses of methods applied is provided in Table 1).

Table 1 Overview of study methods, their strengths and weaknesses

Method	Strengths	Weaknesses
Desk study	Access to the documents and data was relatively easy as either documents are freely available via public websites, or, in case of non-published documentation, were made available by the EC,. Documentary review is a non-reactive method without stakeholder involvement. It provides valuable input for other data collection methods: it lays out the baseline for further data collection work and highlights the gaps in terms of missing data.	Documentary review is a qualitative method and analysing is a time-consuming task. Some information found in the documentation needed further explanation and contextualisation, especially data. This was addressed in the interviews and case studies in order to realise triangulation of evidence and results.
Interviews	Access to people with specific expertise on the study's object (gathering detailed background information on the mission implementation and contextual factors)	Significant time resources required for preparation, implementation, and analysis. Can be difficult to contact and coordinate some appointments; responsiveness can be increased

	Possibility to gather different stakeholder perspectives and opinions. A confidential atmosphere allows discussion and exploration of sensitive topics Flexible interviewing: inclusion of new points of view, expansion or shortening of intended questions by the interviewers depending on the course of the interview.	through cover letters, signed by the contracting authority. Subjectivity of opinions, validation with other data (e.g. desk research) is needed. Occurrence of interview effects are possible, i.e., interviewers influence the response behaviour. The interviews were, however, conducted by an experienced and well-trained team of interviewers.
Case studies	The case study method allows for an intensive study of a unit under investigation and explores an event thoroughly and deeply. The method is very useful for formulating and testing certain hypothesis. This method is also particulary useful for understanding how and why interventions yield certain outputs and results. Our case study method provides grounds for generalisation of data for illustrating statistical findings and it is a comprehensive method of data collection in social research.	Due to a narrow focus of a case study, generalisation is not easy task. Next to that, classification is not possible due to studying a small unit. This increases the chances of the errors of memory and judgment. The method is difficult and using it requires experience. One has to be aware that, due to limitations in the number of interviews that can be conducted in case studies, biases or prejudice can occur. The method is also costly and time consuming as compared to other methods of data collection. The documentary analysis will be used as factual evidence to underpin case study results.
Expert consultation	Two designated macroregional governance experts (one for the North Sea, and one for the Baltic Sea region) were part of project team, and available for consultations on short notice	Broad scope of the study would only allow inputs at high level of generalization

In order to compile the information required for DEL3, 5 and 7 obtained using the previously mentioned methods Excel databases for the purposes of this study were developed. This helped to present information in a well-structured, user-friendly format. Furthermore, the Excel format also enables data analysis using Power Queries.

For DEL3, the projects that were deemed as relevant for the Mission objective have been identified through several steps. The database provides key information on project descriptions, -outputs, and -results, geographical focus, project duration, funding amount, and project partners. The team made use of this database by first screening the project databases of the respective funds using the following keywords: “ferry”, “ferries”, “fuel”, “port”, “renewable”, “wind”, “ocean”, “tidal”, “storage”, “offshore”, “multi-use”, “multiuse”, “multi-purpose”, “multipurpose”, and “aquaculture”. This resulted in more than 1,000 relevant projects. These were then screened during the second phase of our study for their relevance to any of the six thematic areas, based on their project title and project description. Finally, projects that were not directly focused on the North Sea and Baltic Sea were excluded. The final list comprises 158 projects in the database.

Furthermore, as a part of DEL3, an Excel-based indicator framework was developed. Each indicator proposed under Task 2 has been logged into the Excel database, and these indicators are categorised into the relevant Mission Objective Outcomes, as well as other relevant sub-categories. Furthermore, the indicators are developed and categorised in line with the Better Regulation Guidelines. Accordingly, output, outcome, and impact indicators were developed that are specific to each of the six thematic areas of the Mission.

For DEL5 and DEL7, the initial database formats and information to be included were presented in the Technical proposal submitted for this study. The approach and scope of stakeholders to be included in DEL5 was further developed during the first month of the project and discussed with the EC during the first Interim meeting. The approach and scope of citizen engagement activities for DEL7 was presented during the third interim meeting and further developed since then. Information for databases was retrieved through an extensive literature review of publicly available sources, including the webpages of key governance stakeholders, existing networks, projects, cooperation partners, initiatives, etc. In addition, for DEL7, the interviewees of case studies provided additional suggestions for the database of citizen engagement activities.

4. Project Deliverables

The following deliverables have been prepared and submitted for EC review during first half of 2022:

DEL1 – General overview of lighthouse area for the Baltic and North Sea basin lighthouse (MS Word file)

DEL2 – Baseline for the Baltic and North Sea basin lighthouse (MS Word file)

DEL3 – Baseline database (project data and indicator overview) (Excel file)

DEL4 – Analysis of lighthouse area governance structures and stakeholder involvement (MS Word file)

DEL5 – Governance and Stakeholder database (Excel file)

DEL6 – Analysis of Smart Specialization Strategies (RIS3) and other regional/macroregional strategies (MS Word file)

DEL7 – Analysis of Citizen engagement, Blue Economy and ocean and water literacy activities in the lighthouse area (MS Word file)

DEL8 – Citizen engagement database (Excel file)

The final versions (updated after EC comments) of these deliverables 1, 2, 4, 6, and 7 forms an integral part of this report (are enclosed as sections 5 – 9 of this report). The deliverables 3, 5 and 8 (databases) are included as Annexes.

5. DEL1: Description of the lighthouse areas

This chapter comprises a general overview of the lighthouse areas (The Baltic Sea basin and the North Sea basin) in terms of; geography, demographics and socio-economic situation, information on governance and administration, regional, national and macroregional strategies and plans as well as their implementation.

The structure of the report is based on the structure proposed in our Technical Proposal and is as follows:

Chapter 5.1 Data collection

Chapter 5.2 Overview of governance structures

Chapter 5.3 Description of lighthouse areas

Chapter 5.4 Regional disparities.

Chapter 5.1 introduces the geographical scope of the report by defining the geographical boundaries of the two sea basins in the lighthouse area and outlines the methodology used to identify the regions that are included in the analysis. The chapter describes the key indicators for which data was collected, as well as the key information sources. The limitations and encountered data gaps are also stated in this chapter.

Chapter 5.2 briefly touches upon the governance structure in the lighthouse area. The key governing bodies are covered and an assessment of the administrative capacity and quality of governance in the areas is given (governance in this report is understood broadly and covers not only governing bodies of the Mission, but broad range of international and regional actors, national governments, maritime bodies, etc.) This task will serve as the basis for DEL4 and explains the underlying framework conditions in the lighthouse areas, which can influence the implementation of the Mission.

Chapter 5.3 provides an overall description of the lighthouse area along dimensions such as geographic and natural capital landscape, demography, status and pressures of the marine environment.

Chapter 5.4 provides information about socio-economic situation, and research and innovation performance; including an assessment of the intraregional cohesion and disadvantaged areas at the level of the lighthouse area (including observation how the Research and Innovation ecosystem supports the execution of strategies, as well as on how it effects and facilitates policy making and social dynamics).

5.1. Data collection

The team commenced work by identifying the key information sources available for the lighthouse areas, as well as the key relevant indicators to consider in the descriptive baseline. Following this stage, background descriptions were produced along dimensions such as; geographic and natural capital landscape, socio-economic and research and innovation performance, as well as key governance and administrative performance.

5.1.1. Key indicators and key data sources

To comprehensively establish an understanding of the status quo in the lighthouse area, key indicators related to geography and delineation of areas, demography, socio-economic variables, and the Research and Innovation (R&I) landscape and R&I networks were selected (based on their relevance and availability within the timeframe of the task, as per the initial set of indicators proposed in the Technical Proposal for this project). The set of indicators was expanded further during the first month of the project, based on EC suggestions during the kick-off meeting. Table 2 provides an overview of the indicators.

Table 2 Overview key indicators collected per type

Geography and delineation	Demography	Socio-economic indicators	R&I landscape	R&I networks
Area	Population density	Gross Value Added	R&I intensity (expenses)	Number of H2020 projects
Coastline	Population structure	GDP (gross, growth, per capita)	Human resources in science and technology	Participation in European networks[4]
Borders	Life expectancy at birth	Degree of urbanisation	R&I performance on the Regional Innovation Scoreboard	Share of public-private owned patents
Landscape description	Population change (last 5 years)	Employment rate	Patents	

[4]European Digital Innovation Hubs, EIT KICs, European Strategic Cluster Partnerships, etc.

Resources and importance		Unemployment rate	Scientific publications	
		Youth unemployment rate		
		Dependency ratio, labour productivity		
		Tertiary educational attainment (%of people aged 25-34)		
		Enterprise birth rate		
		Material and social deprivation rate		
		At-risk-of-poverty rate		

Data on these key indicators were extracted from reputable data sources such as Eurostat, OECD, the World Bank, the Blue Economy report, the World Factbook CIA, the European Environment Agency, and the Office for National Statistics (UK).

Data limitations and gaps include; missing and/or confidential data, data incompatibility due to different revisions of the NUTS classification (data available in NUTS2016 or NUTS2021 revisions). During the data collection, these data limitations were dealt with by using the latest available data, by compiling data using the methodologies set out by the data providers or, in case granular regional data was missing, taking more aggregate regional or national data. Nevertheless, in some cases, the data could not be collected. Coverage of some of non-EU countries (Russia, UK) was limited (data of sub-national level for Russia is unavailable from international sources), therefore, was not included in the analysis. At the national level, aside from the Russian data, the length of the Swedish coastline per sea basin is missing. At the NUTS2-level, data for the Gross Expenditure on R&D for France was not available, therefore the national average was used. Furthermore, due to the changes between NUTS2016 and NUTS2021, some indicators for Norway are lacking. In addition, in some cases data from the Åland region is missing and regional data for at-risk-poverty in Germany is missing, therefore, the national average is taken. Furthermore, at the NUTS3-level some UK data is missing and due to the previously mentioned changes in NUTS regions, and some data in Norway at the same NUTS-level is missing.

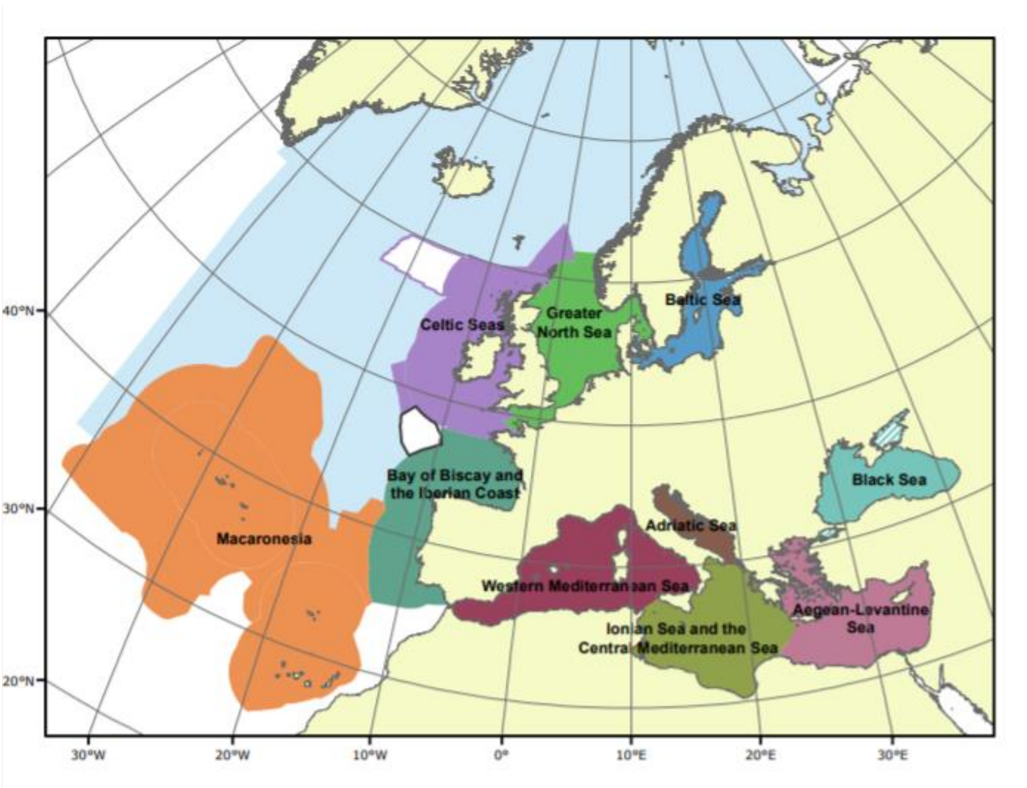
5.1.2. Geographical delineation

The lighthouse area is composed of two sea basins, namely the Baltic and North Sea. In order to define the geographical scope of the report, three legal frameworks were considered, namely the EU Marine Strategy Framework Directive (MSFD), the OSPAR Convention and the Helsinki Convention.

In 2008, the EU Marine Strategy Framework Directive was adopted with the aim to protect more effectively the marine environment across Europe. The MSFD aims to achieve Good Environmental Status (GES) of the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend.

To achieve its goal, the Directive establishes European marine regions and sub-regions on the basis of geographical and environmental criteria. The Directive lists four European marine regions – the Baltic Sea, the North-east Atlantic Ocean, the Mediterranean Sea and the Black Sea (art. 4). These are located mainly within the geographical boundaries of the existing Regional Sea Conventions cooperation between the Member States of one marine region and with neighbouring countries which share the same marine waters.

Figure 2 European marine regions and sub-regions



Source: Technical document on Delineation of the MSFD Article 4 marine regions and subregions (EEA, 2017)

One challenge of the Directive is that the MSFD does not specify the boundaries of the marine regions and subregions, and no formal definition of the marine regions and subregions exists elsewhere. As such, a process was initiated in 2010 to help define the individual marine boundaries under the MSFD Common Implementation Strategy.

The map of the marine regions and subregions describes the geometric delineation of those identified within the MSFD, art. 4. These regions are, to the extent possible, harmonized with other EU legislation where maritime boundaries are of relevance and specifically, the biogeographic regions of the Habitats and Birds Directive as well as the Maritime regions of Maritime Spatial Planning Directive. The map was agreed by the MSFD Committee in 2016.

The two regional sea conventions Helsinki Convention (HELCOM) and OSPAR Convention (OSPAR) provide more guidance for determining the boundaries of the lighthouse area. First, the HELCOM has 10 contracting parties that are all bordering the Baltic Sea. Second, OSPAR defines five different maritime regions within the overall OSPAR maritime area of which one is relevant to this report: the Greater North Sea, also called Region II (more information on these two regional sea conventions is provided in section 5.2).

The geographical scope is defined using the delineations set out by the HELCOM and OSPAR regional sea conventions. The outline of the overall scope of the two sea basins in the lighthouse area provides the basis for an overview of the countries in the sea basins.

Table 3specifies the countries in lighthouse area per sea basin, with 3 countries pertaining to both.

Table 3 Countries in the Lighthouse Sea basins

Baltic Sea Basin	North Sea Basin
Denmark	Belgium
Estonia	Denmark
Finland	France
Germany	Germany
Latvia	Norway
Lithuania	Sweden
Poland	the Netherlands
Russia	United Kingdom
Sweden	

Subsequently, to support a more in-depth analysis of the lighthouse area, the socio-economic situation and intraregional cohesion, a refined list of regions in scope (at the NUTS1-, NUTS2-, and NUTS3-level) was compiled. The criteria to be included in the scope is based on the Eurostat statistical definition of coastal regions at the NUTS3-level[5]. Therefore, the regions included into this report either have a sea border (1) or have more than half of its population within 50 km from the sea (2).

A total of 239 regions correspond to the criteria and therefore are in the scope of this report (180 regions have a sea border (1), and 59 regions have more than half of its population within 50 km from the sea (2)). The NUTS2-level regions that are in scope of this baseline are mapped based on the previously mentioned Eurostat definition of coastal regions at the NUTS3-level. This means that if a NUTS3-region can be classified as a coastal region, the NUTS2-region also is considered within the scope of this baseline. An overview of the regions in scope at different NUTS-levels is included in Annex A.

[5] https://ec.europa.eu/eurostat/web/coastal-island-outermost-regions/methodology

5.2. Governance

5.2.1. Introduction

The governance of marine environments is complex, as it is regulated by legal documents, policy frameworks and institutions that have a specific mandate at different levels: international/global, (macro)regional if applicable, and national. Moreover, the governance of marine and coastal areas in many countries and in international waters to date is primarily sectoral, with fisheries agencies regulating fisheries catches; environmental agencies dealing with pollution prevention; and other specialized agencies regulating shipping, mining, and oil and gas extraction. The cross-sectoral nature of marine-related issues calls for a coordination of regulations, strategies and policies that focus on biodiversity and environment, fisheries, climate change and poverty reduction. As a result, there is a diverse set of agencies that are involved in their design and implementation.

The cumulative impacts on marine environments cannot effectively be managed in isolation. Multiple stressors (e.g., impacts of various human activities, combined with the effects of climate change) call for integrated management, which means that there is an urgent need to develop a more holistic approach to ocean/maritime governance.[6] The old pattern (sectoral management) will not be efficient enough to address the increasing degradation of the oceans. The need to understand and manage the interactions and cumulative effects of multiple stressors has been identified as one of the most important questions in marine ecology today[7].

Given the multi-level nature of marine governance in the Baltic/North Sea area, this chapter will provide an overview of key policy-makers, legislative and policy documents at four levels: international, EU, macroregional, national.

Table 4 Governance levels in the lighthouse Sea basins

Level	Type of organization	Role
International	UN agencies and bodies	Policy/decision-makers
	Other international organizations (non-UN): International Hydrographic Organization, Global Green Growth Institute, International Union for Conservation of Nature etc.	Support for policy design and implementation
EU	DG MARE, DG RTD, DG CLIMA, DG ENV, DG CNECT, DG ENER, DG MOVE	Policy/decision-makers

[6] https://www.sciencedirect.com/science/article/pii/S0048969720360939

[7] Global Marine Governance and Oceans Management for the Achievement of SDG 14 | United Nations

	Other EU organisations: European Fisheries Control Agency, European Research Council, European Marine Biological Resource Centre etc.	Support for policy design and implementation
Macroregional	HELCOM, OSPAR	Coordination and policy-making on environmental governance
	Other macroregional organisations: Council of Baltic Sea States, Nordic Council, Submariner, Baltic Innovative Research and Technology Infrastructure etc.	Generic policy-makers for the Baltic/North Sea area, support for policy design and implementation
National	National level ministries and agencies of the Member States	Policy/decision-makers
Sub-national (regional and sub-regional)	Regional development agencies, municipalities, local businesses, port authorities	Support for policy design and implementation

Short descriptions of the main international, EU, macroregional and national level actors are provided in the next section. Detailed description and assessment of stakeholders at all levels will be provided in DEL4 and DEL5.

5.2.2. Governance at the international level

Globally and regionally, the oceans/seas are governed by international law in the form of the United Nations Law of the Sea Convention (UNCLOS) covering seabed resources, as well as the Regional Seas Programme of United Nations Environment Programme (UNEP). Table 5 presents an overview of key UN agencies that are governing the oceans/seas and their mandates.

There are several international conventions that govern pollution prevention (MARPOL), preparedness and response (OPRC 90), ballast water management (BWM Convention), ship recycling (Hong Kong Convention), marine pollution by dumping of wastes and other matters (London Convention), as well as specific guidelines on biofouling (Biofouling Guidelines – Resolution MEPC.207(62)). The UN body International Maritime Organisation (IMO) that governs shipping has been the major force behind the adoption of these conventions.

In 2011, IMO adopted mandatory technical and operational energy efficiency measures which are expected to significantly reduce the amount of Greenhouse gas (GHG) emissions from international shipping. Amendments to MARPOL Annex VI on Data collection system for fuel oil consumption of ships entered into force on 1 March 2018. Under the amendments, ships of 5,000 gross tonnage and above are required to collect consumption data for each type of fuel oil they use (as well as other, additional, specified data including proxies for transport work). The Energy Efficiency Design Index (EEDI) for new ships is the most important technical measure and aims at promoting the use of more energy efficient (less polluting) equipment and engines. The EEDI requires a minimum energy efficiency level per capacity mile (e.g. tonne per mile) for different ship type and size segments[8].

Table 5 Overview of UN agencies and their mandates

Agency	Mandate
UNEP/ Regional Seas programme (RSP)	Protection and development of oceans and coastal areas (one of 6 major areas)
International Oceanographical Commission	Marine Scientific investigations
International Maritime Organization (IMO)	Shipping (including emissions and pollution from shipping)
International Seabed Authority (ISA)	Responsibility for mineral resources of the seabed
Food and Agriculture Organization (FAO)/ Committee on Fisheries	Regulation of fish stocks/fishery/aquaculture activities

[8] IMO, 2021

World Meteorological Organisation (WMO)	Global meteorology (weather and climate), operational hydrology and related geophysical sciences

Overall, as shown above, marine environmental management is overseen by different autonomous UN organisations, resulting in complex arrangements. However, none of these organizations have a mandate to work with marine environmental issues in a comprehensive way. Each agency pursues its own programme and defends its mandate. In practice, there have been many coordination problems and conflicts between the organizations involved in ocean and sea use management. In the conservation field, such tensions and sometimes conflicts can be found between, for instance, UNEP/RSPs and FAO/Regional Fishery Organizations on environmental impact of fisheries and marine protected areas, and between UNEP/RSPs and IMO on environmental effects of shipping[9].

Despite the above-mentioned complexity challenges, given its historic and prominent role, it is expected that the UN system will continue to play an important role in the environmental protection and the resource use management of the oceans and seas.

Acknowledging that achieving the targets of SDG 14 requires novel science-based solutions, and their transformation into policies and decisions, the Intergovernmental Oceanographic Commission of UNESCO (IOC) and its partners have launched an International Decade of Ocean Science for Sustainable Development (2021-2030).This initiative will provide Member States and all relevant stakeholders with a framework for coordinating and consolidating the observations and research needed to achieve SDG14.

The key objectives of the Decade are :

- Stimulate a global partnership on the marine science requirements needed to support implementation of Agenda 2030;
- Understand the impacts of cumulative stressors and seek sustainable solutions for sustaining benefits from the ocean;
- Share knowledge and enhance interdisciplinary marine research capacities through the transfer of marine technology, leading to economic benefits for all Member States, particularly for Small Island Developing States (SIDS) and Least Developed Countries;
- Gain a better quantitative knowledge of ocean ecosystems and their contribution to society, through the whole ocean column, from the surface to the bottom;
- Map the ocean floor and its resources to support their sustainable management.[10]

[9] Redpath, Stephen Mark; Bhatia, Saloni; Young, Juliette. 2015. Tilting at wildlife: reconsidering human-wildlife conflict. Oryx, 49 (2). 222-225. 10.1017/S0030605314000799

[10] Intergovernmental Oceanographic Commission, 2017, The Ocean we need for the future we want : proposal for an International Decade of Ocean Science for Sustainable Development (2021-2030), retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000247898

Furthermore, a new international legally binding instrument under the United Nations Convention on the Law of Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (General Assembly resolution 72/249) is currently in preparation[11].

Intergovernmental organizations and international NGOs

There are also many intergovernmental and non-governmental organisations (NGOs) outside the United Nations system that play important roles in supporting the UN – the global policy-maker and promoting global and regional marine-related research and management.

Among the most prominent intergovernmental organizations are the International Council of Scientific Unions (ICSU). ICSU promote international cooperation and coordination in the advancement of science. The International Council for the Exploration of the Sea (ICES) are concerned with marine and fisheries sciences, and scientific advice on marine and fisheries management to regulatory commissions. ICES works in the North Sea as well as in the Baltic Sea and has published reports and advice on fisheries and marine ecosystem issues in the lighthouse area.

The International Union for Conservation of Nature (IUCN) provides a forum for governments and NGOs to discuss global and regional nature conservation issues.

Among the many different types of environmental NGOs involved in both global and regional marine issues are the World Wildlife Fund (WWF), Greenpeace, Oceana, Birdlife International and Seas at Risk (an umbrella organisation of environmental NGOs from across Europe).

Oceana is the largest NGO focused entirely on ocean conservation, protecting marine ecosystems and endangered species. An example of another kind of NGO is the Regional Advisory Councils (RACs) connected to the work of the EU Common Fisheries Policy (CFP). The RACs involve different stakeholders, such as fishermen, vessel owners, processors, traders, fish farmers, women's fisheries groups, environmental and consumer organizations and others. Their role is to submit opinions to the European Commission and Member States on different aspects of fisheries management.

5.2.3. Governance at the EU level

The EU participates in a marine management/governance in various ways, developing and implementing its own policies, being party of Regional Seas Conventions, and cooperating with various other international organizations. At the European level, the European Commission, through its Directorate General for Maritime Affairs and fisheries (DG MARE), is responsible for developing and implementing the Commissions' policies on maritime affairs and fisheries. The mandate of DG MARE is to ensure that the ocean resources are used sustainably and that coastal communities and the fishing sector have a prosperous future; to promote maritime policies and stimulate a sustainable blue economy; and to promote ocean governance at international level.

[11] https://www.un.org/bbnj/

In 2007, the European Commission set the basis for an integrated maritime policy, inviting Member States to better coordinate activities at sea[12]. In 2007, the Integrated Maritime Policy (IMP) was adopted to support sustainable (economic) development of the European Seas. The IMP seeks integration between sectors at the EU level.

Maritime Spatial Planning

One of the tools of IMP is the Marine Spatial Planning (MSP). This resulted in the adoption of the Maritime Spatial Planning (MSP) Directive in 2014. The Maritime Spatial Planning (MSP) is a process by which the relevant Member State's authorities analyse and organise human activities in marine areas to achieve ecological, economic and social objectives. MSP is an integrative process to cope with the increasing demand for maritime space from both traditional and emerging sectors, while preserving the proper functioning of the marine ecosystems. MSP can result in plans, permits and other administrative decisions that decide on the spatial and temporal distribution of existing and future activities and uses in the marine waters. The effect of MSP can also be represented by non-binding, political documents like strategies, concepts guidelines and other. In the process of preparation of MSP, Member States' plans must apply a holistic approach with the involvement of stakeholders, cross-border cooperation, and application of ecosystem-based approach, promoting the co-existence of activities and land-sea interaction. The main stakeholders for MSP are: fishery communities, industrial sectors, NGOs, researchers and academia, neighbouring countries, and international organisations (regional and global) The maritime spatial planning is a key tool in ensuring an efficient, safe, and sustainable management of the European Seas, and facilitating various (sectoral and national) interests and potential uses. The plans need to be reviewed every 10 years.

At the time of preparation of this report (June 2022), Member States have varied levels of advancement with respect to their MSP. The situation differs between the 2 lighthouse areas - all plans in the North Sea are in place, while some MSP in the Baltic Sea were approved very recently. A detailed overview about status of MSP in the two lighthouse areas is provided in DEL2.

Maritime Strategy Framework Directive

The environmental pillar of the IMP, which ensures the sustainable ecological use of the seas, is the Marine Strategy Framework Directive (MSFD) adopted in 2008.

The Maritime Strategy Framework Directive is aims to achieve Good Environmental Status (GES) of the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend. It is the first EU legislative instrument related to the protection of marine biodiversity, as it contains the explicit regulatory objective that "biodiversity is maintained by 2020", as the cornerstone for achieving GES. The Directive enshrines in a legislative framework the ecosystem approach to the management of human activities having an impact on the marine environment, integrating the concepts of environmental protection and sustainable use.

In order to achieve GES by 2020, each Member State was required to develop a strategy for its marine waters (or Marine Strategy). In addition, because the Directive

[12] COM(2007)575 final Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions -An Integrated Maritime Policy for the European Union

follows an adaptive management approach, the Marine Strategies must be kept up-to-date and reviewed every 6 years. Article 23 of the MSFD mandates the European Commission to review the Directive by 2023 and propose amendments. The review of the MSFD started in 2021 with an impact assessment and public consultation. The results of the consultation should be released before the end of the year 2022.[13]

A new approach for Sustainable Blue Economy

To meet the European Green Deal objectives at sea, the Communication on a new approach for sustainable blue economy in the EU, dated 17 May 2021, sets a vision for a transformation of the blue economy related to the Green Deal.[14] Complementing other framework initiatives adopted or planned by the European Commission, it identifies concrete transformations in the different sectors of the Blue Economy that could guide public and private initiatives. This novel approach aims to provide coherence across the blue economy sectors, facilitate their coexistence and look for synergies in the use of maritime space, without damaging the environment. This innovative approach seeks also to increase coordination and cooperation between different policy areas, across sectors and between international, national, regional and local decision makers. It also underlines the need for investment in research, skills and innovation.

EU Strategy for the Baltic Sea Region

The Strategy constitutes an integrated framework to address common challenges, i.e. the urgent environmental challenges related to the Baltic Sea, and to contribute to the economic success of the region and to its social and territorial cohesion, as well as to the competitiveness of the EU.

The Baltic Sea Region is a highly heterogeneous area in economic, environmental and cultural terms, yet the countries concerned share many common resources and demonstrate considerable interdependence. This means that actions in one area can very quickly have consequences for other parts, or the whole, of the region. In these circumstances, the area could be a model of regional co-operation where new ideas and approaches can be tested and developed over time as best practice examples.

Many challenges require action at the level of the Baltic Sea Region: responses at national or local level may be inadequate.

Four key challenges have been identified as requiring urgent attention:[15]

---

[13] European Commission, https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/review_of_the_directive.htm#:~:text=The%20review%20of%20the%20MSFD%20will%20follow%20a,launched%20the%20public%20consultation%20on%2022%20July%202021.

[14] COM(2021)240 final Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a new approach for a sustainable blue economy in the EU Transforming the EU's Blue Economy for a Sustainable Future

[15] EN (europa.eu)

- To enable a sustainable environment
- To enhance the region's prosperity
- To increase accessibility and attractiveness
- To ensure safety and security in the region.

Foremost among these is the environment (as highlighted by the European Council).[16] The urgent problems that need to be addressed include the impact of excess nutrients in the Baltic Sea (leading to eutrophication and algal blooms), damage to the ecological balance due to overfishing, land-based pollution, rising sea temperatures, the presence of hazardous substances and other pressures. Adaptation to climate change is also a growing challenge. The impacts are becoming so widespread that leisure activities and small-scale commercial uses suffer in many areas. The main economic challenges are to overcome the wide disparities (and realise the high potential of the region) in research and productive innovation and to remove impediments to the single market. Priority issues for accessibility are the improvement of networks, eliminating the energy isolation of parts of the region, and ensuring sustainability of transport modes. Finally, priorities in the field of safety are to reduce risks posed to the region's citizens, infrastructure and environment by hazards from a variety of sources, in particular accidental marine pollution and organised crime.

Since its approval by European Council in 2009, the EU Strategy for the Baltic Sea Region (EUSBSR) has achieved a variety of results. As a key achievement, it has brought together stakeholders across countries, sectors, and levels. New networks and projects of macro-regional relevance have been created and existing ones intensified. The Strategy has also contributed to policy shaping and development (e.g. in the fields of energy, navigation, environment and climate change), to a better implementation of existing legislation and to the further development of synergies and complementarities between existing cooperation frameworks in the region. By providing a strategic framework, it has brought legitimacy to macro-regional cooperation and increased recognition of the challenges and opportunities in the macro-region.

Some concrete examples include:[17]

- The nutrient inflows to the Baltic Sea are being reduced through the implementation of projects such as PRESTO and Interactive water management (IWAMA);
- Business development and integration are being stimulated in the Baltic Sea region thanks to closer cooperation between companies and students which is being promoted through projects like the Baltic Training Programme;
- Maritime safety and accident prevention in the Baltic Sea is being improved by carrying out projects like Efficient, Safe and Sustainable Traffic at Sea (EfficienSea) and its

---

[16] European Council Conclusions of 14 December 2007, Retrieved from https://ec.europa.eu/regional_policy/en/information/publications/communications/2008/european-council-conclusions-of-14-december-2007

[17] EC, 2022

follow up EfficienSea2 which focus on developing and testing infrastructure and services for e-Navigation.

The revised EUSBSR Action plan (2021) streamlines policy areas and places them in a strategic context, assesses their contribution to the UN Sustainable Development Goals and provides links to "embed" the strategy into EU policies and funding programmes.[18] Furthermore, it empowers stakeholders and increases their ownership by providing clear roles and responsibilities, effective decision-making and reinforced results-orientation. Clear links to policy-making at the national level serve to increase the engagement of line ministries and to solidify political support and implementation in the EUSBSR Member States.

The revised action plan is more focused, with 14 policy areas covering 44 actions. The new Action plan also states that climate change aspects are to be mainstreamed into all 14 policy areas. This will allow each policy area to tailor the implementation of climate change adaptation and mitigation, ensuring that climate aspects are properly taken into account. The important functions of communication and capacity building are consolidated with support from the Baltic Sea Strategy Point, which also provides administrative and technical support for the EUSBSR management, development and implementation.

The North Sea Region 2020 and 2030 strategy

The initial North Sea Region 2020 Strategy was adopted in 2016 for the period until 2020. The thematic scope of the North Sea Region 2020 Strategy was based around four priority areas[19], which reflected shared regional development concerns in line with the Europe 2020 Strategy, and relevant national policy priorities, and have the scope to benefit from joint/collaborative actions:

- tapping into "blue" resources
- promoting a more environmentally friendly and efficient transport sector
- addressing energy and climate issues facing the region
- promoting local businesses and partnerships in order to help create vibrant local communities.
- In pursuing these aims the Strategy promotes innovation and seeks to support a skilled and relevant workforce for the future.

During the Annual Business Meeting in 2018, it was decided to begin the process of developing a North Sea Region post 2020 Strategy.

The North Sea Region Strategy 2030 was produced under the Conference of Peripheral Maritime Regions (CPMR) North Sea Commission. It is a cooperation platform for regions around the North Sea. Their mission is "to strengthen partnerships between regional

[18] https://www.balticsea-region-strategy.eu/attachments/article/590824/Action%20Plan%202021.PDF

[19] North Sea Region Strategy 2020 – CPMR North Sea Commission (cpmr-northsea.org)

authorities which face challenges and opportunities presented by the North Sea".[20] The North Sea Commission consists of member regions, often North Sea coastal and provincial authorities.[21]

The process led to the adoption of the North Sea Region 2030 Strategy. In the Strategy, regional authorities across the North Sea have jointly defined the most pressing issues and topics where there is an added value in transnational cooperation and action. It is also a priority list, where the North Sea Commission believe that the North Sea Region, and the EU, can take the lead in the transition towards the green economy and delivering on the European Green Deal and the Paris Agreement, and contributing to the UN Sustainable Development Goals. The four new priority areas for cooperation until 2030 are:[22]

- a productive and sustainable North Sea;
- a climate neutral North Sea;
- a connected North Sea region;
- a smart North Sea region.

The Strategy is implemented by the North Sea Commission (NSC) Executive Committee and received support from the NSC thematic working groups. Action plans are adopted biennially and the current plan is covering the 2020-2022 period. The action plan described per working group (each covers one of the four main themes) key topics and goals, meetings and events, mapping and reports, policy positions and projects. The described goals are generic e.g. "Lower emissions and reduced disposal of waste into the North Sea", without quantitative data, or reference years; or "Better coordinate Maritime Spatial Planning across national borders and administrative levels", etc.

In summary, the leading organisation in the 2030 North Sea Region Strategy is an interregional consortium aiming to raise awareness about four major themes connected to the North Sea that operates via four working groups, that are guided by biennial action plans. However, there is no clear information about quantitative targets, nor about formal review and monitoring and reporting obligations. Focus lies on awareness building, lobbying and information exchange.

Interreg

Both above mentioned strategies are implemented through Interreg – one of key instruments of the European Union supporting cooperation across borders through project funding. In the context of the lighthouse area, the Interreg programmes Interreg Baltic Sea and Interreg North Sea are of interest. Both macroregional programmes are focussed on tacking major common challenges, including marine/environment-related, and fostered shared solutions in the regions. An overview of the two Interreg programmes is provided in Table 6.

---

[20] https://cpmr-northsea.org/who-we-are/

[21] A map of members is found here: https://cpmr-northsea.org/who-we-are/member-directory-map/

[22] North Sea Region 2030 Strategy – CPMR North Sea Commission (cpmr-northsea.org)

Table 6 Overview of Interreg programmes in the Lighthouse area during the periods of 2014-2020 and 2021-2027

	Interreg Baltic Sea	Interreg North S
Geographical coverage	Denmark Estonia Finland Latvia Lithuania Poland Sweden Germany Belarus Norway Russia	Belgium Denmark France23 Germany the Netherlands Norway Sweden United Kingdom24
Projects 2014-2020 (and aggregate value)	140 projects (281 EUR mio)	73 projects (177 EUR mio)
Funding available 2021-2027	250 EUR mio	Approx. 175 EUR mio
Call 1 2021-2027	42 applications (10 applications for “Water-smart societies” objective 2; and 14 applications for “Climate-neutral societies” objective 3)	24 full applications (9 applications for Priority 2:” Green transitions”; 6 applications for Priority 3” Climate Resilience”)

[23] France was not included in the Interreg VB North Sea Region programme Area 2014-2020. However, in the proposal for the future programme's geography the Programme Preparation Group has included some French regions.

[24] The United Kingdom was part of the Interreg VB North Sea Region programme Area 2014-2020. However, in the proposal for the future programme's geography the United Kingdom is not included.

Figure 3 Interreg Baltic Sea area

Source: Interreg Baltic Sea programme, 2022

Figure 4 Interreg North Sea area

Source: Interreg North Sea programme, 2022

5.2.4. Governance at the macroregional level

In the lighthouse area, two important intergovernmental organisations act as governing bodies of two regional sea conventions. HELCOM (Baltic Marine Environment Protection Commission, or the Helsinki Commission) is the intergovernmental organisation relevant to the Baltic Sea basin. OSPAR (Convention for the Protection of the Marine Environment of the North-East Atlantic) is the regional stakeholder relevant to the North Sea basin. HELCOM and OSPAR recommendations are legally binding for contracting parties. As the Contracting Parties of both HELCOM and OSPAR include non-EU countries, the organisations act as collaborative platforms, where the Contracting Parties discuss common challenges and objectives related to the sea basins.

HELCOM, OSPAR and their Contracting Parties support the work of the International Maritime Organisation to achieve effective protection of the marine environment at an international level. As bodies that are predominantly operating in the EU, HELCOM and OSPAR assist their member states to deliver on commitments under the EU Marine Strategy Framework Directive.

HELCOM and OSPAR have a common vision of an ecosystem approach to managing human activities impacting on the marine environment. As a result, since 2003 these organisations have been actively collaborating in a number of fields, such as biodiversity, underwater noise, invasive species, marine litter, climate change, pollution and contamination by pharmaceuticals.

HELCOM

In the Baltic Sea, the Baltic Marine Environment Protection Commission (HELCOM) represents the regional platform for environmental policy making. The Convention on the Protection of the Marine Environment of the Baltic Sea Area – also known as the Helsinki Convention - seeks to protect the Baltic Sea from all sources of pollution from land, air and sea, as well as to preserve biological diversity and to promote the sustainable use of marine resources.

HELCOM was established in 1974, when the Convention on the Protection of the Marine Environment of the Baltic Sea Area was signed. It aimed to address the increasing environmental challenges from industrialisation and other human activities. The Helsinki Convention includes the protection of the Baltic Sea from all sources of pollution from land, air and sea. It also commits the signatories to take measures on conserving habitats and biological diversity and for the sustainable use of marine resources. Since 1992, the Convention includes ten Contracting Parties - Denmark, Estonia, the European Union, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden.[25]

The Helsinki Commission (HELCOM) Secretariat coordinates the work and meetings of the Helsinki Commission and ensures that the contracting Parties meet their obligations under the Helsinki Convention. The Headquarters of HELCOM, and the Secretariat, is located in Helsinki, Finland.

HELCOM has eight main groups – the HELCOM Working Groups – which handle specific topics related to the Baltic Sea's environment or maritime activities. The groups are major

---

[25] https://helcom.fi/about-us/convention/

contributors to the HELCOM work, gathering science and technical expertise and translating their findings into policies, strategies or recommendations best suited for responding to a particular issue affecting the Baltic Sea. In addition, HELCOM also has a variety of expert groups and networks that are supervised by and fall under the responsibility of a main HELCOM Working Group.

In 2007, a collective action plan, the Baltic Sea Action Plan (BSAP) implemented by the HELCOM, was established aiming to restore the good environmental status of the sea. BSAP was updated in 2021, including measures and actions for achieving good environmental status of the sea, ultimately leading to a Baltic Sea in a healthy state. HELCOM's updated ecological measures and actions need to be implemented by 2030 at the latest.

The HELCOM Commission has been collaborating with a number of international organisations including the International Maritime Organization (IMO), the United Nations Environment Programme (UNEP), the International Council for the Exploration of the Sea (ICES), BONUS, Baltic Pilotage Authorities Commission (BPAC), Baltic Sea Parliamentary Conference (BSPC), Council of the Baltic Sea States (CBSS), International Atomic Energy Agency (IAEA), Baltic Sea Parliamentary Conference (BSPC), World Meteorological Organization, Black Sea Commission (BSC), Nordic Environment Finance Corporation (NEFCO).

OSPAR

In the North Sea, the OSPAR Commission implements the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention, 1992), which identifies threats to the marine environment in the North-East Atlantic area and puts in place programmes and measures to ensure effective collective and national action to combat them. Thus, OSPAR is facilitating intergovernmental cooperation, monitoring and assessing the environmental status of the seas and setting internationally agreed goals. The OSPAR Commission is the forum through which Contracting Parties cooperate. It meets once a year. The OSPAR Secretariat is based in London, the United Kingdom.

The Commission is supported by five main committees, some of which are supported by working groups. In addition, the Heads of the Delegations of the Contracting Parties meet regularly to prepare the meetings of the Commission, to advise on management and to oversee the development and implementation of the agreements made by the Commission.

The Contracting Parties of the OSPAR Convention are Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom, together with the European Union. Finland is not on the western coasts of Europe, but some of its rivers flow to the Barents Sea and, historically, it was involved in the efforts to control the dumping of hazardous waste in the Atlantic and the North Sea. Luxembourg and Switzerland are Contracting Parties due to their location within the catchments of the River Rhine.

To further strengthen cooperation the OSPAR Commission has agreed Memoranda of Understanding or Agreements of Cooperation with a number of relevant international organisations including the North-East Atlantic Fisheries Commission (NEAFC), the International Maritime Organization (IMO), the International Council for the Exploration of the Sea (ICES), the UN Economic Commission for Europe (UN ECE), the International Atomic Energy Agency (IAEA), the North Atlantic Salmon Conservation Organization

(NASCO), the International Seabed Authority (ISA). Close collaboration is also maintained with the European Commission and the European Environment Agency.

There is well established and ongoing cooperation between HELCOM and OSPAR (more detailed description is included in DEL4).

5.2.5. Governance at the national level

At the Member State level, there are various sectoral authorities involved in marine governance: Ministries of Environment/Water, Ministries of Transport, Ministries of Agriculture/Fisheries, Ministries of Energy, Ministries/authorities responsible for spatial planning, etc. (comprehensive overview of Member State organizations is provided in DEL4 and DEL5).

In addition, there are also various regional and local NGO, sectoral associations and knowledge organizations (universities, specialised consultancies, etc.) that are involved in marine research, monitoring and governance (comprehensive overview of these organizations is also provided in DEL4 and DEL5).

Preliminary conclusions on quality of governance

The analysis shows that the marine governance of the Baltic and North Sea area is made up of national, macroregional, European and international structures, which is the outcome of continuous disparate processes over the years, rather than the result of a well-organised, intentional design. As a result, there is a large number of organisations with overlapping mandates and activities at different levels. However, the key policy-makers can be distinguished at all levels and for all marine-related sectors. This points to an orderly core structure of marine governance.

The governance of maritime space is characterised by a top-down approach, where international organisations, policies and legal conventions regulate marine resources, activities and stakeholders, superseding the EU, macroregional or national laws. Thus, EU, macroregional and national laws are, generally, in harmony with the international agreements. However, the national governments remain in control over their territory and decide whether they ratify/adopt, enforce and implement international laws and regulations.

International laws and organizations do not guarantee good governance, but can provide a basis for responsible and effective management by individual countries. The effective adoption of international regulations and policies would ensure clarity of procedures, standards and facilitate collaboration on marine-related issues between countries. However, many intergovernmental agreements lack effective enforcement procedures and thus are less effective than they purport to be.

A large number of organisations that deal with similar marine-related challenges does not result in effective resolution of these challenges. Coordination problems, conflicts of interests between and within organisations have been affecting the quality of governance in the Lighthouse area.[26] Even within the UN, each body seeks to achieve own specific objectives, according to its mandate. Overall, the marine governance at the international level is based on collaboration and consultation between different stakeholders. An

[26] https://link.springer.com/article/10.1007/s13280-016-0847-9

illustrative example of this is the case when the EU had set higher targets of cutting carbon emissions than the IMO Directive (MARPOL). A series of discussions with the IMO and international partners resulted in stricter global environmental standards.

For the EU Member States, the EU policies and regulations apply, therefore the national governments are obliged to adopt and implement both international and EU regulations and policies. Gradually, the EU has been expanding its policy and regulatory scope, fostering both regionalism at the EU and macroregional/sea level. At the European level, there is no single policy or set of policies to manage the marine environment. Instead, there is a complex web of interacting and overlapping policies that leave significant problems unresolved. The integration of various EU policies is needed to address conflicting interests of stakeholders, such as those engaged in fisheries and those in nature conservation, to stimulate achievement of set goals and targets (e.g., EU Green Deal) and to ensure a coherent, consistent and comprehensive approach to marine governance.

Another issue is a lack of implementation of EU regulations and policies at a national level. For example, the EU Directive on MSP aimed to stimulate the development of the integrated maritime policy across member states. However, two-thirds of EU countries failed to submit plans for sustainable management of their seas on time.[27]

Similarly, there are substantial issues with implementation of MSFD. According to the Directive, Member States were supposed to reach Good Environmental Status (GES) for their waters by 2020. In practice, it is very complex to verify whether this key requirement of the Directive is met or not. Many of the Member States' definitions of 'good environmental status' are not specific enough to be measurable and are not regionally coherent. The process of defining GES is quite complex despite efforts deployed until now to simplify and harmonise it. This hampers assessment of progress achieved towards GES as well as the enforcement of the directive. Member States' programmes of measures are not always sufficiently focused on tackling actual pressures on the sea, despite the significant number of measures reported. The effectiveness of measures in preventing or mitigating the impacts of human activities on the marine environment has not been fully quantified. In addition, the MSFD timelines and reporting processes appear to be time-consuming and heavy. Member States are systematically late in their reporting. This prevents the Commission from providing timely analysis and recommendations. The reported information is not always comparable, thus making the communication of EU-wide results to the general public challenging. There are still important information gaps, such as the extent to which GES has been achieved for different topics (descriptors) and areas.

Still, so far the MSFD has not always been a key driver for better regulating activities and pressures on the seas. Sustainability requirements (strengthened by the European Green Deal, the Biodiversity Strategy to 2030 (and the EU Nature Restoration Law which is planned to be published 22 June 2022), the Zero Pollution Action Plan and the post-COVID 19 Recovery Plan for Europe, etc) are still not fully integrated into key Blue economy activities affecting marine ecosystems (e.g. fisheries, aquaculture, agriculture, shipping, offshore oil and gas extraction, renewable energy production). This is due to fact that marine environment is influenced by variety of sectoral policies and strategies, which developed over the time, and the regulation of most of sectors has been in place long before the sustainability requirements appeared, therefore, the full integration of these

[27] https://www.wwf.eu/?2717941/Two-thirds-of-EU-countries-fail-to-submit-plans-for-sustainable-management-of-their-seas-on-time

policies is yet to come. Next to that, agriculture is most difficult to regulate due to indirect link to the sea.

The MSFD has been, however, a key driver for EU policy to address marine litter, notably through the Single Use Plastics Directive. In summary, while the MSFD has driven work towards better integration on its various descriptors within and across the four marine regions defined in its Article 4, the level of international cooperation and coordinated action could be improved. Furthermore, the financial and human resources devoted to implementing the Directive do not seem to match the actual needs.[28]

The EU has been stimulating creation of the (macro)regional intergovernmental arrangements to improve collaboration between coastal countries, address common challenges and improve coordination with non-EU member states that have access to the seas. The regional agreements for the protection of the marine environment (HELCOM and OSPAR) promote the ecosystem approach to the management of human activities. They represent an effective platform of intra-regional collaboration, contributing to protection and preservation of the environment, reducing the potential of conflicting situations between member states in the Baltic and North Sea area, and increasing cross-border cooperation in marine-related areas. In addition, both HELCOM and OSPAR are involved in monitoring and evaluation of developments and activities in the seas, tracing progress in achieving specific goals. However, the collection of data and analysis is not comprehensive. However, both HELCOM and OSPAR lack decision-making and enforcement power.

Nevertheless, from the current level of analysis it can be concluded that despite a prominent coordination and monitoring role of HELCOM and OSPAR, they do not have a strong decision-making and enforcement power. The EU member states in the Baltic and the North Sea area continue to hold the ultimate control at the national level over maritime affairs and do not tend to form stronger regional/macroregional governance structures. The current governance model for the Baltic Sea and the North Sea to date is not comprehensive enough to address most urgent problems and to deliver solutions that would ensure implementation of the Green Deal, and Mission objectives.

New (or enhanced) structures are needed to deliver efficient solutions for these new policies. This is especially important since demand for marine space is expected to grow rapidly, decarbonization measures need to be implemented across all sectors, and sectoral interests also need to be better integrated in order to ensure sustainable marine management. Next to that, all EC Member States have also to ensure meeting targets of new EU Biodiversity Strategy to 2030.

[28] Inception impact assessment - Ares(2021)2411326

5.3. Description Lighthouse area

This section provides context and background information on the two sea basins in the lighthouse area, namely the Baltic Sea region and the North Sea region. It addresses different perspectives of the lighthouse area as it covers in terms of geography, environmental pressures, demographics and socio-economic variables. Firstly, this general overview of the Baltic Sea region is presented. Following that, the North Sea region is covered.

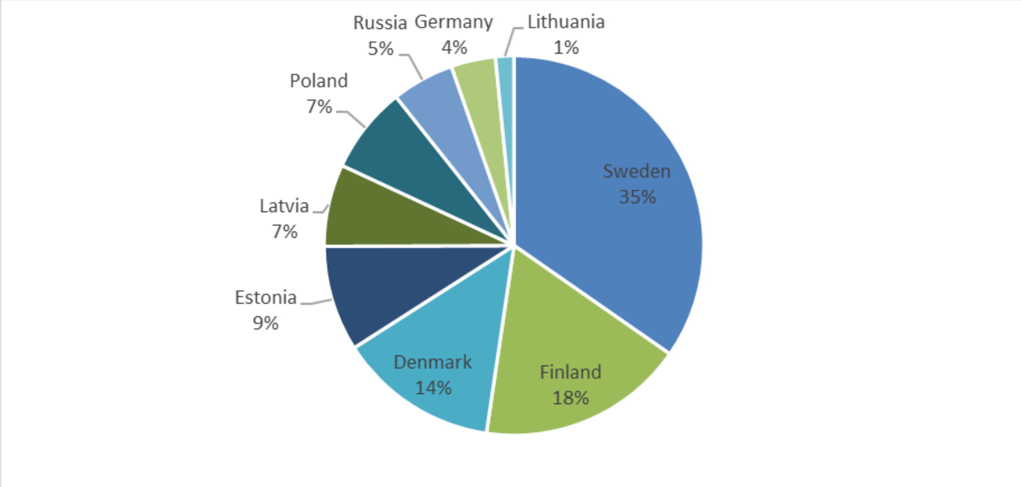
5.3.1. The Baltic Sea region

The Baltic Sea is one of the largest bodies of brackish (mix of fresh and saline) water in the world with, with a surface area of 420,000 km^2. The drainage area of the Baltic Sea is about four times larger than its surface area. More than one third of the Baltic Sea is shallower than 30 meters, giving it a small total water volume in comparison to its surface area. There are significant salinity differences between sub-basins. Only 3% of the water (by volume) is exchanged each year – i.e. more than 30 years for the total volume. Rivers drain a land area four times larger than the sea itself with a population of nearly 90 million.

The Baltic Sea area is an important European region, as there are eight EU Member States that border it. The region is constituted of diverse territories, with big differences in country sizes, geographical and environmental features and connecting infrastructures to the rest of Europe. Major economic activities in the Baltic Sea include agriculture, tourism, forestry, shipbuilding and maritime logistics. The region is also home to important oil and gas transportation routes, such as the Nordstream pipelines. The Baltic Sea historically has been and currently still is one of the most frequently traversed sea areas of the world. In addition to that, the Baltic Sea region holds great potential for offshore renewable energy generation.

The countries bordering the Baltic Sea include Germany, Poland, the Baltic countries (Estonia, Latvia and Lithuania), the Nordic countries (Denmark, Sweden and Finland) and Russia. According to the biogeographical region classification, the majority of the region is Boreal (dominating landscape - forests and wetlands). Parts of Denmark and Germany border the Atlantic, aside from the Boreal regions. In Sweden, some of mountainous regions belong to an Alpine biogeographical region. Finally, all of Poland belongs to a Continental biogeographical region. The Baltic Sea is enclosed by the previously mentioned countries and is connected to the North Sea through the Kattegat and the Skagerrak strait (in between Denmark, Sweden and Norway).

Figure 5 Exclusive Economic Zones (EEZ) per country in Baltic Sea (in %)



Source: calculations Technopolis Group using Maritime Boundaries Geodatabase[29]

Figure 5 presents an overview of the sizes of each country's Exclusive Economic Zone (EEZ).[30] Within this EEZ, countries have 'functional jurisdiction' to regulate particular activities or functions of the area (for more information: see DEL4 and DEL5) as opposed to the sovereignty countries have in their territorial waters. Within the Baltic Sea basin, Sweden, Finland and Denmark have the largest EEZs, which means that these countries have relatively large responsibility to achieve ecological, economic and social objectives. In terms of the length of the coastlines, Sweden, Estonia and Denmark have the longest coastlines within the Baltic Sea basin and Lithuania has the smallest coastline with only 90km of coast. The Baltic Sea region is connected to large parts of Northern, Central and Eastern Europe, due to the fact that the catchment area is more than four times as large as the surface area of the Baltic Sea itself. It reaches into the territories from countries that are not part of HELCOM such as Norway, Russia, Ukraine, Belarus, Slovakia and the Czech Republic. The influence of the Baltic Sea therefore reaches much further than only to the states it borders.

The average life expectancy at birth in the Baltic Sea basin (78,9 years with Russia included, 79,6 years without Russia) is lower than the average at the European level (81.3 years in 2019).[31] Within the Sea basin, a division can be observed between the northern/western countries, where life expectancy is higher than the European average, and the southern/eastern countries, where it is lower. Life expectancy at birth is an

---

[29] Flanders Marine Institute (2019). Maritime Boundaries Geodatabase, version 11. Available online at https://www.marineregions.org/. https://doi.org/10.14284/382.

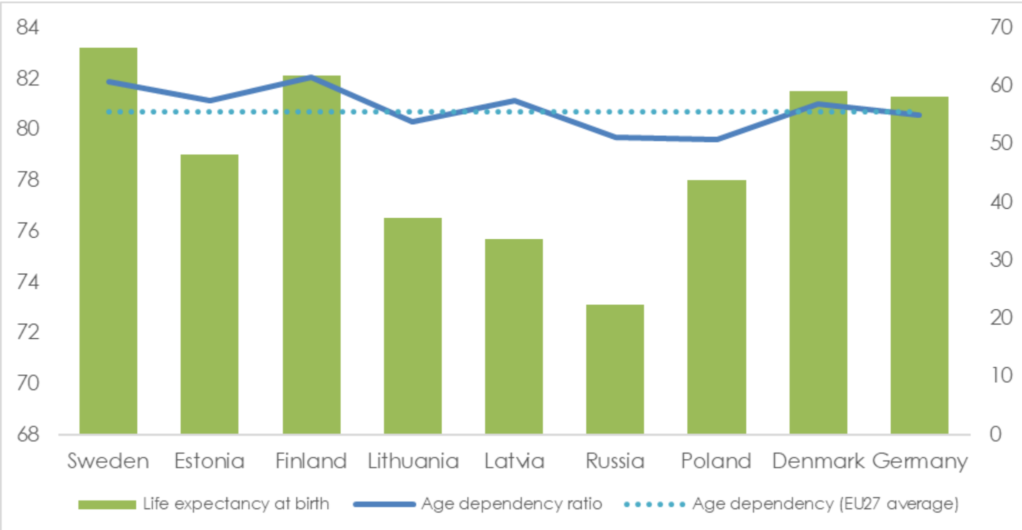
[30] Marine Regions makes available all areas included in the provisions of the United Nations Convention on the Law of the Sea (UNCLOS). These areas are Exclusive Economic Zones (EEZ), Territorial Seas (TS), Contiguous Zones (CZ), Internal Waters (IW), Archipelagic Waters (AW) and High Seas (HS). For the delineation of EEZ, the archipelagic waters and the internal waters of each country are included (a deviation from the UNCLOS EEZ definition).

[31] Eurostat, Life Expectancy at birth, DEMO_MLEXPEC

important indicator for assessing the health and general well-being of the population, as it can be ascribed to factors such as better access to quality health services, education, high living standards, good education and state of the environment.

The differences between the northern/western countries and the southern/eastern countries are to a lesser degree also reflected in the population structure within the Baltic Sea basin, as indicated in Figure 6. Especially in Sweden and Finland, there are relatively more people dependent on the population of working age.[32] A high age dependency ratio also indicates that those countries have an ageing population. As illustrated in the figure below, half of the Baltic Sea countries are slightly below the EU and the other half slightly above the EU average of 55,5%. The Nordic countries show the highest dependent population.

Figure 6 Population Structure in Baltic Sea basin

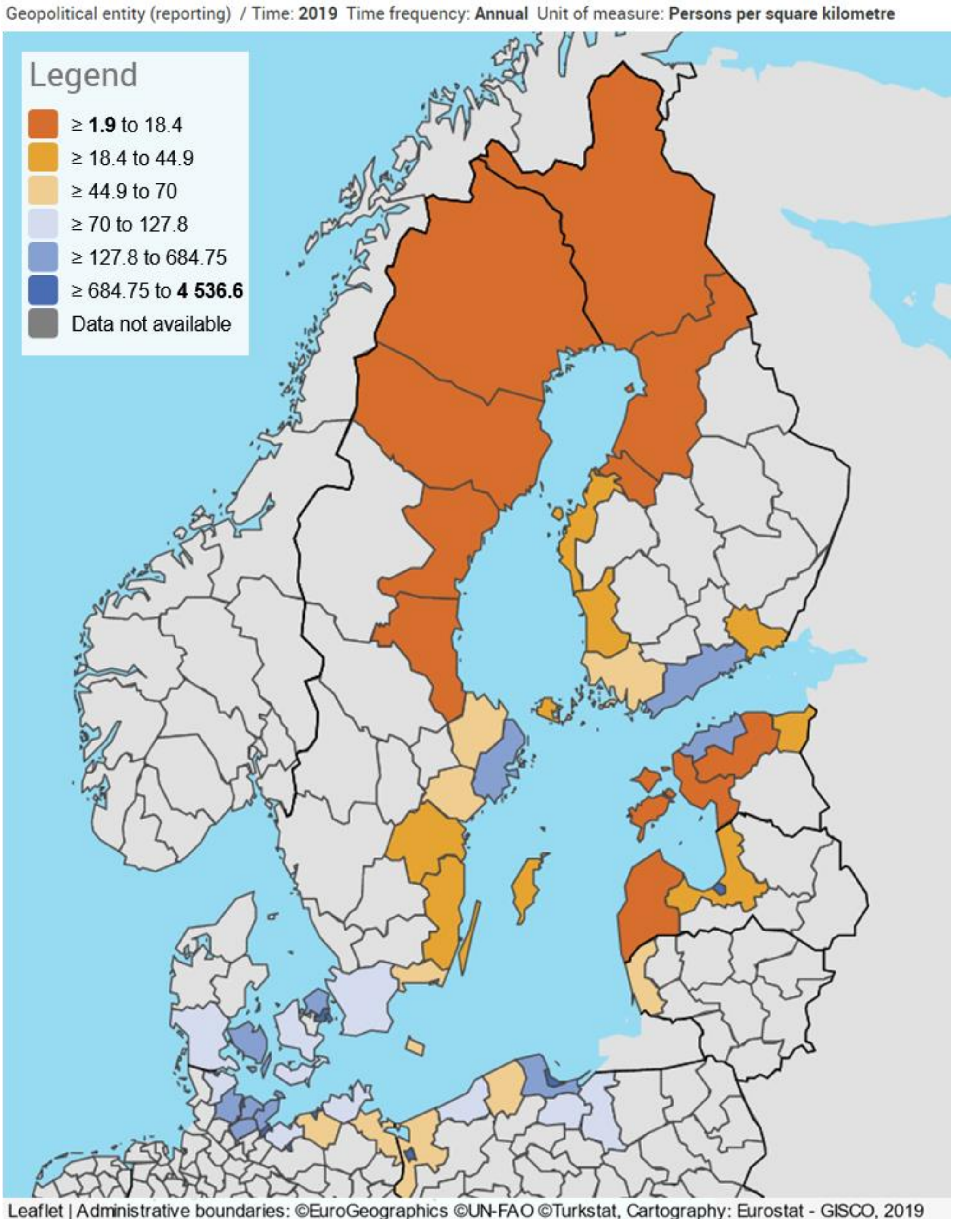


Source: calculations Technopolis Group using Eurostat data

The Baltic Sea basin can be characterised as a region with a low population density with many predominantly rural areas. Nevertheless, there are some urbanised areas, which often are bordering to the Baltic Sea. This can be seen in Figure 7, which provides an overview of the population density in the Baltic Sea basin.

[32] Eurostat, Age dependency ratio, DEMO_PJANIND, 1st variant. The age dependency ratio is an indicator that provides insights into the pressure of the non-working part of the population on the working part of the population. It is measured as a ratio of the dependent part of the population (0-14 and 65+) over the independent part of the population (15-64).

Figure 7 Population density at NUTS3-level in the Baltic Sea basin

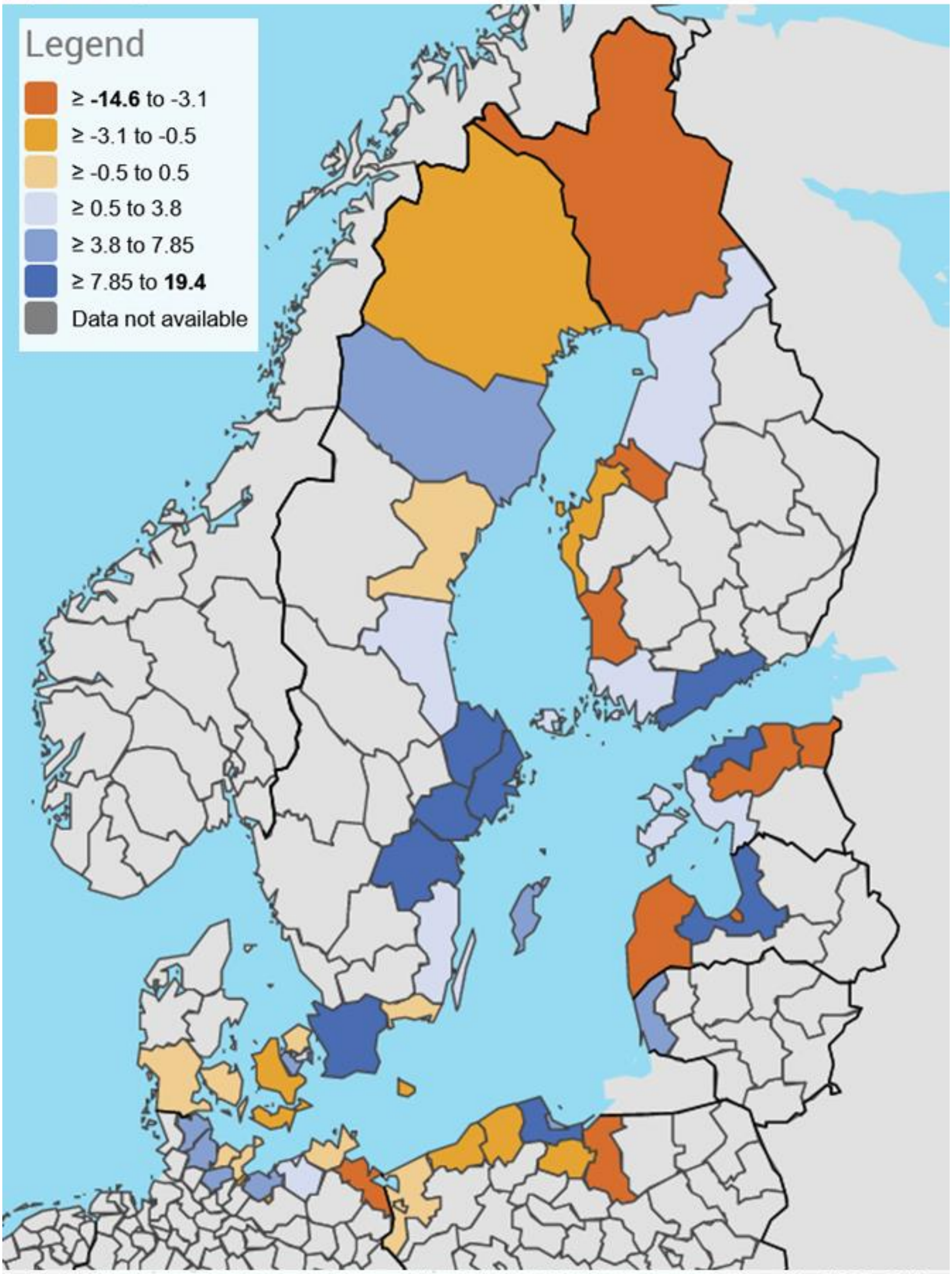


Source: Eurostat

In terms of the population change in the area, generally the predominantly urban areas or areas close to cities have experienced the largest population growth, as is shown in Figure 8. Especially in Finland and Estonia, it can be seen that all areas have had a decrease in population except the urban/capital areas.

Figure 8 Population change at NUTS3-level in the Baltic Sea basin

Geopolitical entity (reporting) / Time: **2019** Time frequency: **Annual** Demographic indicator: **Crude rate of total population change**



Leaflet | Administrative boundaries: ©EuroGeographics ©UN-FAO ©Turkstat, Cartography: Eurostat - GISCO, 2019

Source: Eurostat

From a socio-economic perspective, differences along the North-South and West-East axes of the Baltic Sea basin area can be observed. On the one hand, the Baltic countries and Poland are lagging behind in some aspects, many regions are also classified as transition or less developed regions according to the European Regional Development Fund (ERDF) classifications.[33] The Nordic countries on the other hand are more developed. Generally, key indicators such as Gross Value-Added (GVA), employment rates of recent graduates, tertiary educational attainment score higher in Nordic countries. However, not all regions within these countries benefit from the high socio-economic standards of the countries (more information on regional disparities and intraregional cohesion will be provided in Chapter 5.4).

Due to its enclosed nature and relatively low biodiversity, the Baltic Sea is especially vulnerable to environmental pressures. The long winter season limits its productivity, and the brackish water creates challenging conditions for both marine and freshwater organisms. Due to the limited water exchange with other seas, inputs of nutrients and other substances from the drainage area accumulate in the Baltic Sea and are only slowly diluted. The land-based inputs, together with pressures arising from human activities at sea (maritime transport, fisheries, offshore energy generation, etc.), influence the status of habitats and species, and eventually also impact on human well-being. Poor oxygen conditions at the sea floor restrict productivity and biodiversity in the Baltic Sea.

Typical pressures occurring in the Baltic Sea include eutrophication (excessive richness of nutrients in a water body due to run-off from the land, which causes a dense growth of plant life), contamination, marine litter, the introduction and spread of non-indigenous species, underwater sound, fishing and hunting, as well as habitat loss and disturbance.

The Baltic Sea heavily suffers from eutrophication. Excessive input of nutrients to the marine environment enhances the growth of phytoplankton, leading to reduced light conditions in the water, oxygen depletion at the seafloor (as excessive primary producers are degraded), and a cascade of other ecosystem changes. At least 97% of the region was assessed as eutrophied in 2011–2016 according to the integrated status assessment. Nutrient inputs from land have decreased as a result of regionally reduced nutrient loading, but the effect of these measures has not yet been detected by the integrated status assessment. Although signs of improvement are seen in some areas, effects of past and current nutrient inputs still predominate the overall status.[34]

Sustainable management of sea-based activities is essential for achieving good environmental status of the Baltic Sea. Emissions and discharges from shipping continue to have harmful impacts on the Baltic Sea environment, despite the reinforced existing and developed new international regulations concerning ship-source pollution. Energy efficiency of ships is improving, and a downward trend is also evident for other types of emissions and discharges. Nevertheless, shipping still contributes to emissions and discharges to the Baltic Sea, including nitrogen oxides (NOx), sulphur oxides (SOx), particulate matter (PM), sewage and discharges from exhaust gas cleaning systems, leading to pollution and eutrophication of the marine environment. In addition, shipping contributes to several pressures on the marine environment that are not yet covered by mandatory international regulations, such as underwater noise, biofouling, and grey water discharges. Oil spills

[33] Transition regions: GDP per capita is between 75% and 100% of the EU average; less-developed regions: GDP per capita is below 75% of the EU average

[34] http://stateofthebalticsea.helcom.fi/pressures-and-their-status/eutrophication/

observed by aerial surveillance have been decreasing in both numbers and size, and while preparedness and response to spills of oil and hazardous noxious substances at sea and on shore are rather advanced in the Baltic Sea, there is still a need for improvement.

The strategically important shipping, fishing and aquaculture industries bring along harmful side effects to the Baltic Sea. The majority of Baltic Sea commercial fish stocks are not in good status with respect to biomass and there are concerns with fishing mortality for many stocks. Physical disturbance to the seabed from bottom trawling and by-catches of birds, marine mammals and non-target fish species in fishing gear constitute other pressures on the ecosystem. Fishing activities contribute to shifts in the food web, alterations in size-age distribution, as well as reductions in reproductive capacity and resilience of both fish and other marine organisms.

In the Baltic Sea, offshore oil and gas exploration and production mainly takes place along the Polish coast and in Russian territories. However this industry and the amount of oil and gas reserves is much smaller as compared to the North Sea. The Baltic Sea seabed is also home to other minerals, such as sand and gravel, minerals and metals in/on the seabed or chemical elements dissolved in water. The majority of the sand and gravel are located in the southwestern sea areas of the Baltic Sea, but activities are increasing in other sea areas as well. The project GeoERA-MINDeSEA "Seabed Mineral Deposits in European Seas: Metallogeny and Geological Potential for Strategic and Critical Raw Materials"[35] gives an overview of principal types of seabed mineral resources in the European Seas. According to this study, the Baltic Sea seabed has high levels of marine mineral occurrences in terms of Polymetallic nodules[36] and some occurrences of mineral placers.[37] The presence of these minerals, and the potential to extract them from the seabed, could lead to more independence regarding the supply of raw material as these minerals are often needed in the value chains of 'green technologies', such as the battery industry. However, whether marine mining will become a commercially viable activity is still uncertain.

In addition to shipping and fishing, activities such as mineral extraction, dredging, installation of offshore wind farms, other forms of marine energy production, and laying of underwater cables and pipelines have negative effects on the marine environment. One of the effects from these activities is physical disturbance and loss of the seabed. About 40% of the Baltic Sea seabed is estimated to be potentially disturbed, with many underwater biotopes and species in unfavourable conservation status. Along with submerged hazardous objects such as sea-dumped munitions, warfare materials and wrecks containing oil, activities causing disturbance to the seabed contribute to the potential release of harmful substances that may affect the marine environment and activities in the Baltic Sea.[20]

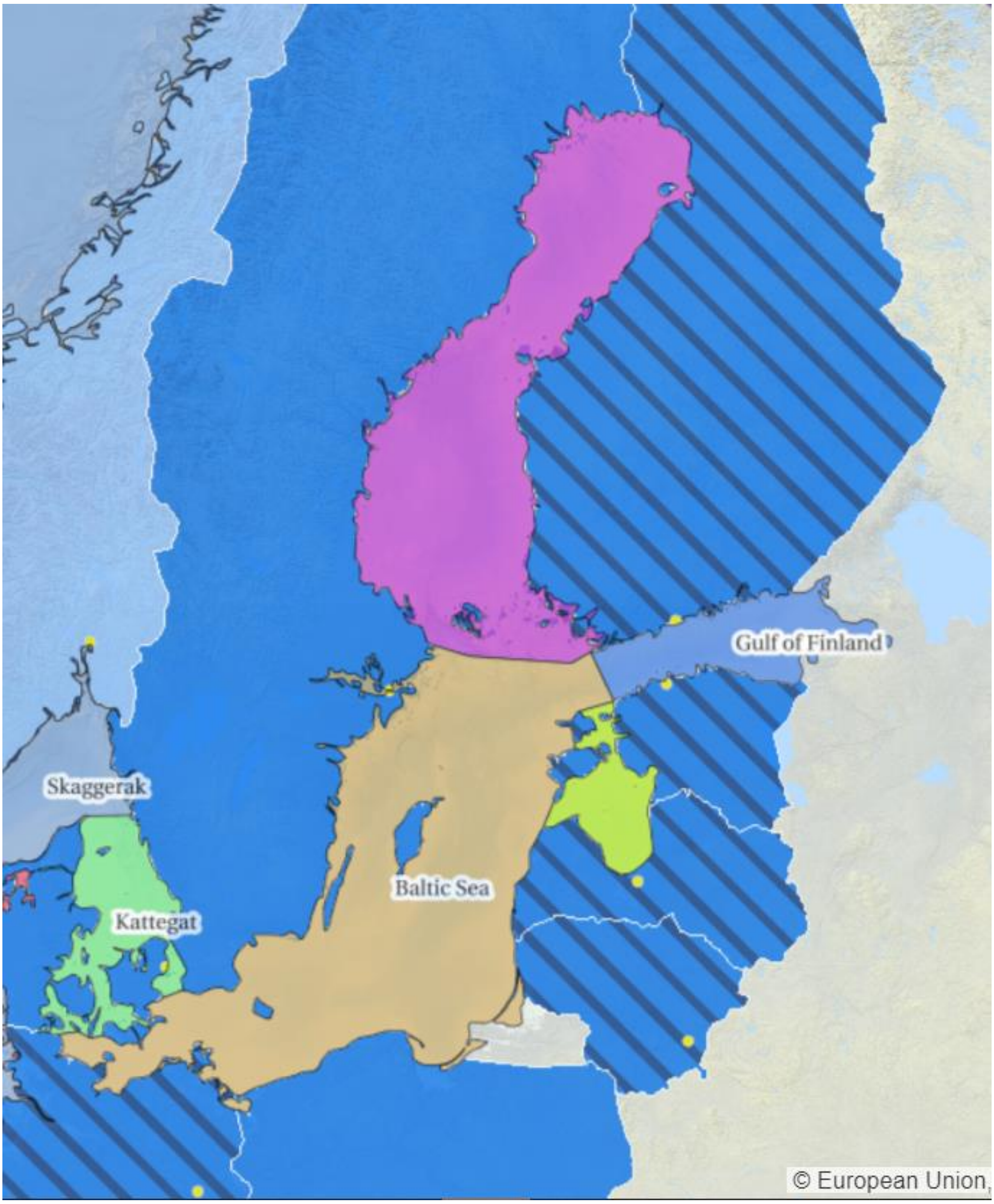
---

35 For more information : https://geoera.eu/projects/mindesea2/

36 These nodules are mostly rich on manganese but have economic interest for other elements, such as copper,nickel, cobalt, molybdenum, titanium, lithium and REEs (2021 EU Blue Economy Report, for more information: https://blueindicators.ec.europa.eu/).

37 Minerals found in marine placer deposits include zircon, monazite, xenotime (Y and P) ilmenite, rutile, magnetite, chromite, cassiterite and fine-grained gold and platinum (2021 EU Blue Economy Report).

Figure 9 Overview different sub-basins in the Baltic Sea



Source: European Maritime Atlas, 2022

The features of the Baltic Sea vary across the sub-basins, though, and consequently, environmental challenges also differ. Here we describe the 10 natural sub-basins of the Baltic Sea, according to their oceanographic and biological features:

Kattegat differs from the other regions in the Baltic Sea. It has markedly higher salinity (up to 25 times exceeding the one of adjacent waters) and considerably greater biodiversity and stability of its biota. Both vertical and horizontal salinity stratification is well-pronounced.

Due to the high nutrient loading, oxygen depletion in bottom waters can occur. The primary production is higher than in the Baltic Proper (open part of the Baltic Sea). Out of more than 1500 species of marine animals in the North Sea, about 836 are found in the Kattegat, including some exploitable fish and invertebrate species. Industries in the Kattegat area include maritime transport, wind energy, extraction of raw material, fishery and aquaculture, and tourism.[38]

Belts and the Sound (The Danish Straits) is a shallow area with variable salinity. In this region, normally three different water masses occur: Baltic surface water, Kattegat surface water and Kattegat deep water. Eutrophication status and conditions vary: the open areas have a good water exchange, while there are also closed coastal areas where local processes are of vital importance. Primary production and biodiversity are high in both pelagic and benthic communities. Oxygen deficiencies with occasional occurrence of hydrogen sulphide have affected benthic animals though, especially in the inner areas. In direction from the Kattegat to the Belts and the Sound, the number of marine species declines sharply – to 436 in the Belts. The Danish Straits are critical to Europe's crude oil and petroleum trade. An estimated 3.2 million b/d of crude oil and petroleum products flowed through the Danish Straits in 2016.[39]

Arkona basin already has lower salinity, causing serious osmotic problems for marine and freshwater species. Therefore, the Arkona Deep represents the eastern limit of the distribution of several invertebrate and fish species. The variation in biodiversity here is high, but the number of marine species decreases to 145. The economic sectors of the area include fishery, mineral extraction, offshore renewable energy production and some tourism.[40] One major offshore wind project was installed in 2018 in the Arkona basin southeast, with a total capacity of 385 MW and a substation on a net area of approximately 39 km2.[41]

Southwestern region of the open Baltic Proper is under a strong and continuous impact of inert oceanic systems. Saltwater intrusions varying in strength take place from time to time. After rather short periods of increased salinity and oxygen concentration, stagnation with possible occurrence of hydrogen sulphide may take place. The environmental conditions are less variable and much more favourable for marine species than in other parts of the open Baltic. The biodiversity clearly depends on the saltwater influxes.

In the **Eastern Baltic Proper**, there are several large deeps, the largest being the Gotland Deep and the Gdansk Deep. However, whereas many inflows reach the Bornholm Deep in the Southwestern region, only strong and moderate saltwater inflows can occur at the Gotland Deep. This means that an oxygen deficit is more common in the Eastern deeps and the periods of oxygen deficiency in the deep layers are considerably longer than in the Bornholm Deep. In the Gotland Deep, hydrogen sulphide occurs in the deeper half of the

---

[38] https://dce.au.dk/udgivelser/vr/nr-401-450/abstracts/no-403-regional-marine-planning-in-the-western-kattegat-natural-business-and-social-conditions-and-scenarios/

[39] For more information : https://www.eia.gov/todayinenergy/detail.php?id=32552

[40] For more information : https://maritime-spatial-planning.ec.europa.eu/sites/default/files/baltseaplan-developing-a-pilot-maritime-spatial-plan-for-the-pomeranian-bight-and-arkona-basin.pdf

[41] For more information: https://www.rwe.com/en/the-group/countries-and-locations/arkona-offshore-wind-farm

water column due to combination of the natural and anthropogenic factors. The Gotland Basin has the largest accumulated pool of nutrients in the Baltic. The Gdansk Deep possesses a separate circulation system and nutrient pool, therefore hydrological and chemical conditions are different. Both the production processes and the composition of organisms differ between the deeps.

In the **Northwestern Baltic Proper** the severest winters for the Baltic can occur. The region is strongly impacted by fresh water discharged into the northern part of the open sea and the Gulfs of Finland and Bothnia. Only very strong saltwater inflows reach the deep layer of the Northwest region and their impact on the oxygen situation is not large. Deep waters of this area are usually stagnant, and the oxygen concentration can increase mostly due to the vertical mixing. In the Western Gotland Basin, currents mainly transport nutrients southwards. Considering the distance from the coast, for the three Baltic Proper regions maritime transport and fishing are the central economic activities.[42]

The Gulf of Riga is connected with the open sea via two shallow straits - Irbe Strait and the Vainameri area. Biological productivity in the Gulf of Riga is high, although the number of species is quite low. Anthropogenic influences are stronger in the southern part of the gulf near the estuaries of large rivers. The region is characterised by the dynamic capital city Riga and its ports. The Gulf of Riga is one of the most productive marine areas in the Baltic Sea in terms of produced biomass. Innovative and sustainable use of marine resources is a key factor for the long-term prosperity of the region. The natural resources of the Gulf have created opportunities for the development of medical products and services (e.g., medical spa treatments). The RIS3 identified the bioeconomy as a specific sector of interest in the future (bio-medicine, medical technologies, bio pharmacy, etc).[43]

No sill exists between the Baltic Proper and **the Gulf of Finland**. The differences between the eastern, central and western areas of the gulf in salinity, temperature and other environmental parameters form the background for the existence of a clear transition from the brackish-marine species in the western parts to the brackish-freshwater communities in the central and eastern parts. Periodic anoxic conditions can occur in the deeper areas of the gulf. The southern coast of the gulf contains the Leningrad Nuclear Power Plant and a network of ports and unique natural and historical places. The gulf is also rich in natural mineral resources. Fishing is another important activity. The region has progressively turned to sustainable practices, such as renewable energy production and the improvement of sustainable transport.

In the **Bothnian Sea**,_the oxygen conditions are favourable for living in the whole water column. For a number of species, the northern borders of occurrence run through the southern part of the Bothnian Sea and thus the diversity of the benthic soft bottom macrofauna is extremely low compared to the Baltic Proper and the Gulf of Finland. The Åland Sea and the Arhipelago Sea as parts of the Bothnian Sea have distinctive ecological systems and high biological productivity. The principal sectors of the Bothnian Sea include

---

[42] https://www.researchgate.net/publication/40801878_Economic_Efficiency_of_Fisheries_Management_Measures_in_an_Innovative_Evaluation_Framework_Perspective/figures?lo=1

[43] For more information, see https://www.submariner-network.eu/files/sbr-factsheets/sbr_factsheet_riga.pdf

aquaculture, maritime transport and tourism. The maritime sector in the area employs over 1600 people, mainly related to maritime transport and tourism activities.[44]

The ecosystem of **Bothnian Bay** is considerably different from other areas of the Baltic Sea. The conditions in the bay depend on the oceanographic properties of the shallow (up to 25 m) Northern Quark strait controlling the water exchange between the Bothnian Sea and Bothnian Bay. Phosphorus concentrations are considerably lower and nitrogen concentrations higher than in the Bothnian Sea. Phytoplankton primary production is low, and it is not the dominant energy source like in the other parts of the Baltic Sea. Meiofauna is as important as the macrofauna for biological production. Marine bivalves are absent. The short growing period is typical of arctic conditions.[45] The Bothnian Bay is dominated by traditionally strong blue economy activities such as shipbuilding and ship repair, transport, fisheries and offshore activities that are located in the coastal municipalities and are economically important for the surrounding regions.

Due to slow progress towards meeting environmental goals, the Baltic Marine Environment Protection Commission (HELCOM) has adopted in October 2021 an updated Baltic Sea Action Plan (BSAP). Initially launched in 2007, the plan was revised when it became clear that the goal of "good environmental status" – a clean, healthy and productive Baltic Sea unaffected by pollution and other human pressures – would not be attained by 2021, as revealed by HELCOM's latest assessment of the Baltic Sea.[46] The updated plan contains about 200 concrete actions that were developed to tackle the pressures the Baltic is facing today (including biodiversity, eutrophication, hazardous substances, and sea-based activities, such as shipping and fisheries). In addition, the new plan also addresses now climate change, marine litter, pharmaceuticals, underwater noise, and seabed disturbance. All actions of the updated BSAP are to be implemented by 2030 at the latest. It should be noted though that effects of BSAP implementation will be visible after longer period and climate change effects should be considered.[47]

The unique features of the Baltic Sea, and its environmental pressures, demand a macroregional approach to combat its long-term deterioration. This has been long recognised, including through joint action in HELCOM, although there is a need for increased coordination among sectoral policies.

---

[44] Jenny Katila et al, 'Defining and quantifying the sea-based economy to support regional blue growth strategies – Case Gulf of Bothnia', Marine Policy Volume 100, February 2019

[45] E. Ojaveer (2017). Ecosystems and Living Resources of the Baltic Sea. Springer International Publishing AG. DOI 10.1007/978-3-319-53010-9_1. ISBN 978-3-319-53010-9.

[46] For more information, see https://helcom.fi/helcom-adopts-the-updated-baltic-sea-action-plan-charting-a-way-forward-for-a-healthy-baltic-sea/

[47] Murray CJ, Müller-Karulis B, Carstensen J, Gustafsson BG and Andersen JH (2019) Past, Present and Future Eutrophication Status of the Baltic Sea. Front. Mar. Sci. 6:2. doi: 10.3389/fmars.2019.00002

5.3.2. The North Sea region

The North Sea is situated on the continental shelf of north-west Europe. It opens into the Atlantic Ocean to the north and, via the English Channel to the south-west, and into the Baltic Sea to the east. The seabed is mainly composed of mud, sandy mud, sand and gravel. The variety of marine landscapes is important: fjords, estuaries, sandbanks, bays, or intertidal mudflats.

The North Sea is surrounded by densely populated, highly industrialised countries, such as the United Kingdom, Western European countries (Belgium, France, Germany and the Netherlands) and several Nordic countries (Denmark, Sweden and Norway). Major activities in the North Sea include fishing, the extraction of sand and gravel, offshore activities related to the exploitation of oil and gas reserves including the laying of pipelines and in recent years the erection of offshore wind farms and related renewable electricity transmission infrastructure. The North Sea is one of the most frequently traversed sea areas of the world with two of the world's largest ports situated on its coasts (Rotterdam and Hamburg), and the coastal zone of the North Sea is used intensively for agriculture and recreation. Due to the shallow waters and favourable wind conditions, the North Sea has a great potential for offshore renewable energy generation. The capacity of offshore wind farms in operation, under construction and consented within the North Sea Region adds up to around 12.6 GW.[48]

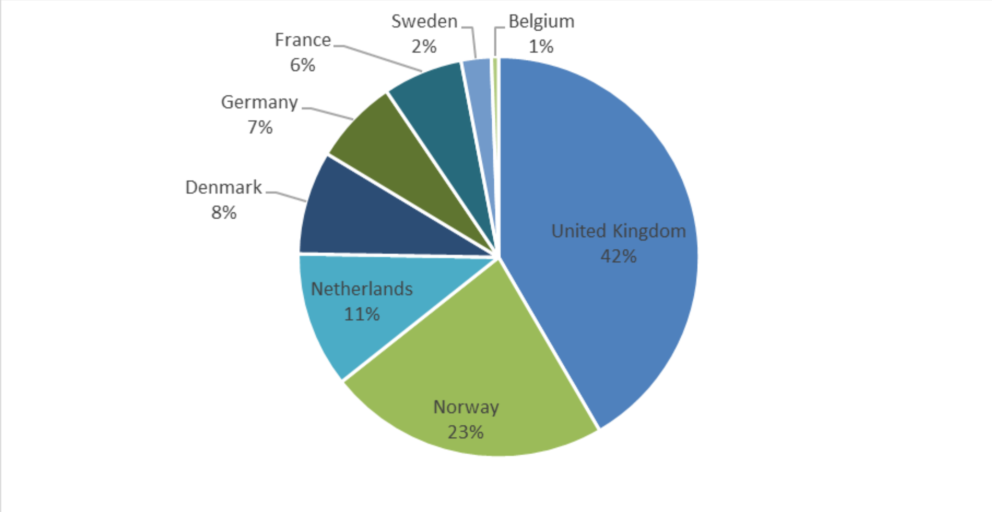
The main biogeographical region in the North Sea area is Atlantic. The North Sea is situated in temperate latitudes with a climate that is strongly influenced by the inflow of oceanic water from the Atlantic Ocean and by the large-scale westerly air circulation which frequently contains low pressure system. Extreme weather conditions have a direct impact on hydrography, which is characterised by water exchange with surrounding ocean areas, and strong tides. Other biogeographical regions include Alpine (the mountainous areas in Norway and Sweden) and Boreal (Denmark and Germany).

Within the North Sea basin, the United Kingdom has the largest Exclusive Economic Zone, followed by Norway and the Netherlands. The larger the EEZ a country has the more it can adopt maritime spatial plans to these areas (e.g., plan offshore renewable energy zones, extract gas or oil, etc.). Yet, even though Sweden and Belgium have relatively small EEZs within the North Sea basin, both countries have developed MSPs for the areas within the EEZs (for more information see DEL4). In terms of the length of the coastline, the United Kingdom and Norway possess the longest coastlines. However, compared to the size of the Dutch EEZ, the Netherlands has a relatively small coastline. To a smaller degree the same holds true for Denmark. Within the North Sea basin, Belgium has the shortest coastline. The catchment area of the Greater North Sea reaches from the Northern, Eastern and Southern parts of the United Kingdom, from Brittany to Zurich, Prague, Berlin, parts of Denmark and Southern parts of Sweden and Norway. The catchment area is around 850 000 km2 as compared to the 750 000 km2 surface area of the Greater North Sea. Overall, the North Sea basin is a key area, also due to the (multimodal) infrastructure that connects the North Sea countries to the rest of Europe.

---

[48] https://northsearegion.eu/northsee/e-energy/offshore-renewable-energy-developments-offshore-wind/

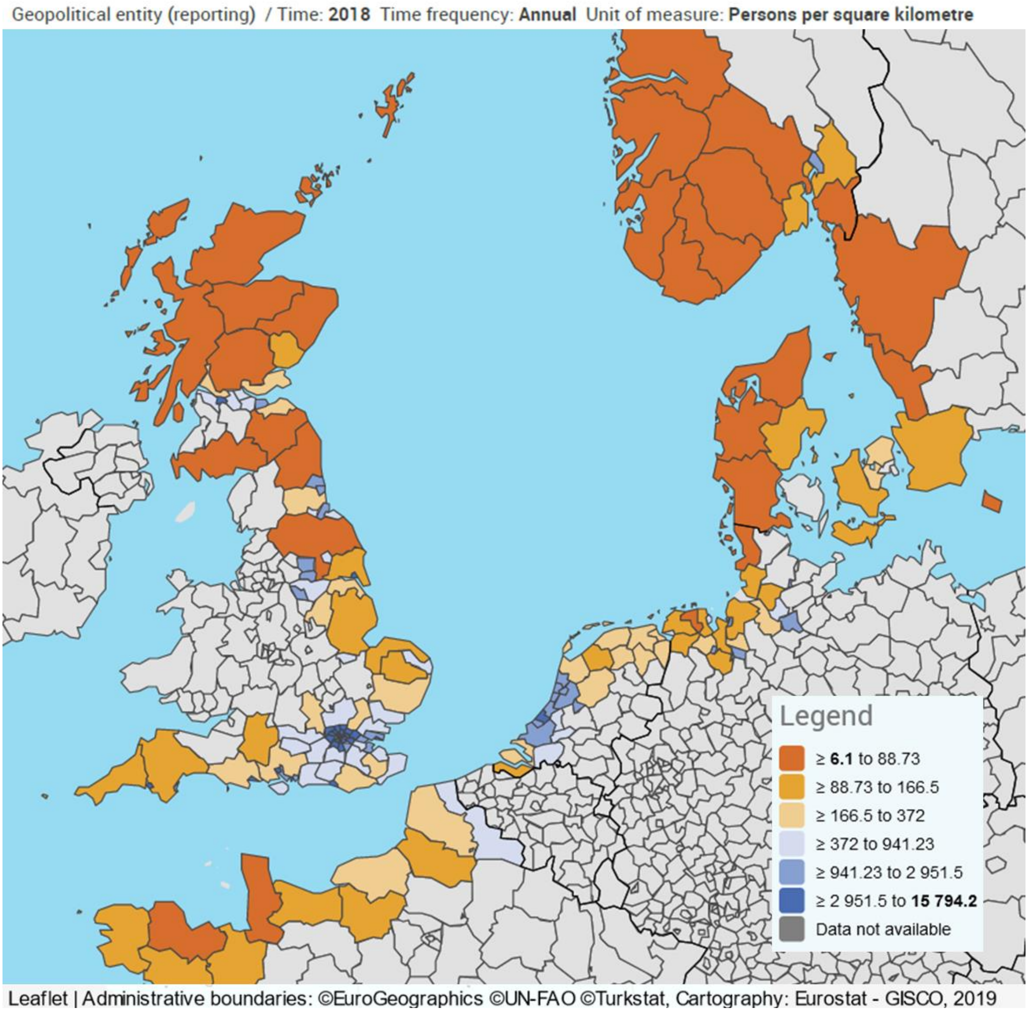
Figure 10 Exclusive Economic Zones (EEZ) per country in North Sea (in %)



Source: calculations Technopolis Group using Maritime Boundaries Geodatabase[49]

[49] Flanders Marine Institute (2019). Maritime Boundaries Geodatabase, version 11. Available online at https://www.marineregions.org/. https://doi.org/10.14284/382.

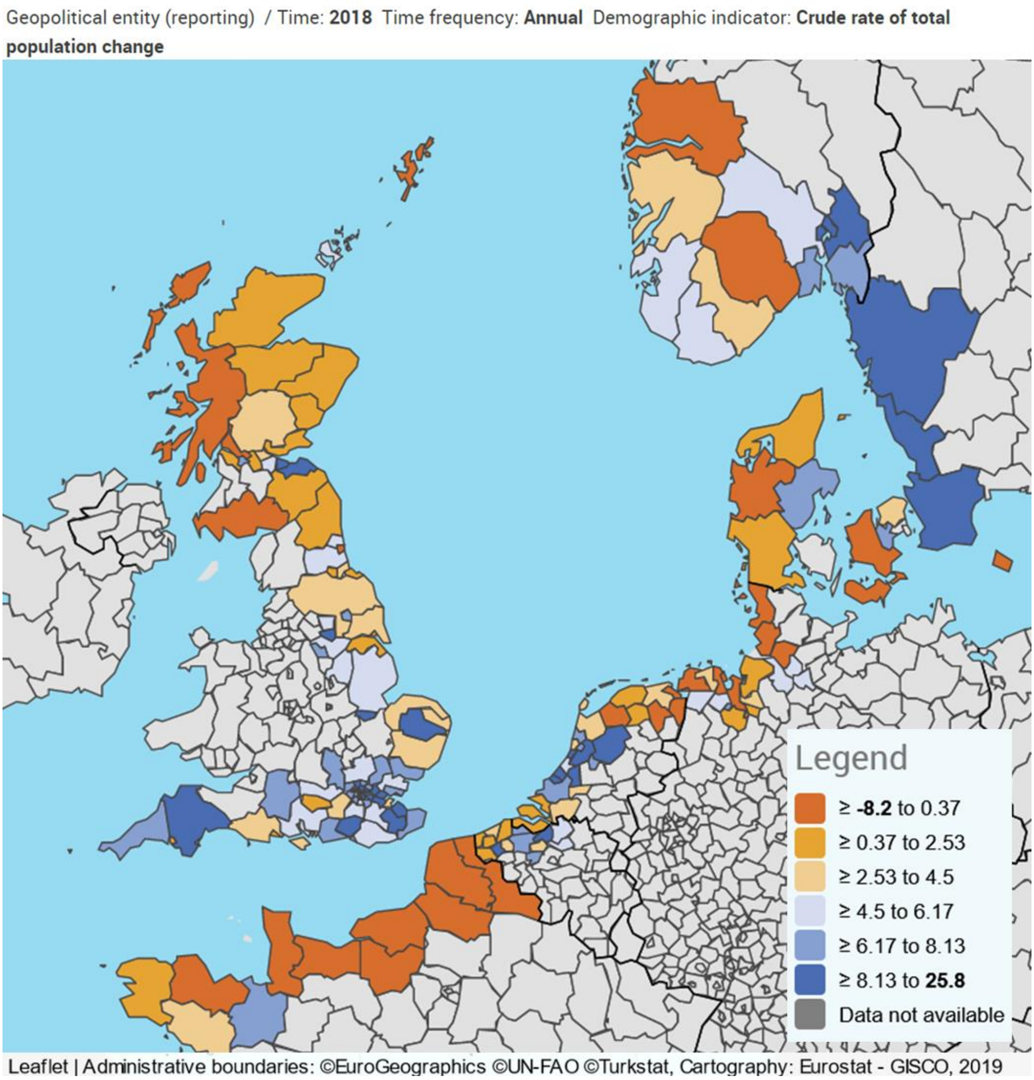
Figure 11 Population density at NUTS3-level in the North Sea basin



Source: Eurostat

In the North Sea area, the areas with the highest levels of population density are in the Netherlands, Belgium, the United Kingdom as can be seen in Figure 11. In the other countries, many of the coastal regions are sparsely populated with the exceptions of capitals or other big metropolitan areas, such as Hamburg, Copenhagen and Oslo. Many coastal regions also experience low rates of population growth, in some cases even experience a decline in population. As for the Baltic Sea, capitals or highly urbanised areas also experience growth.

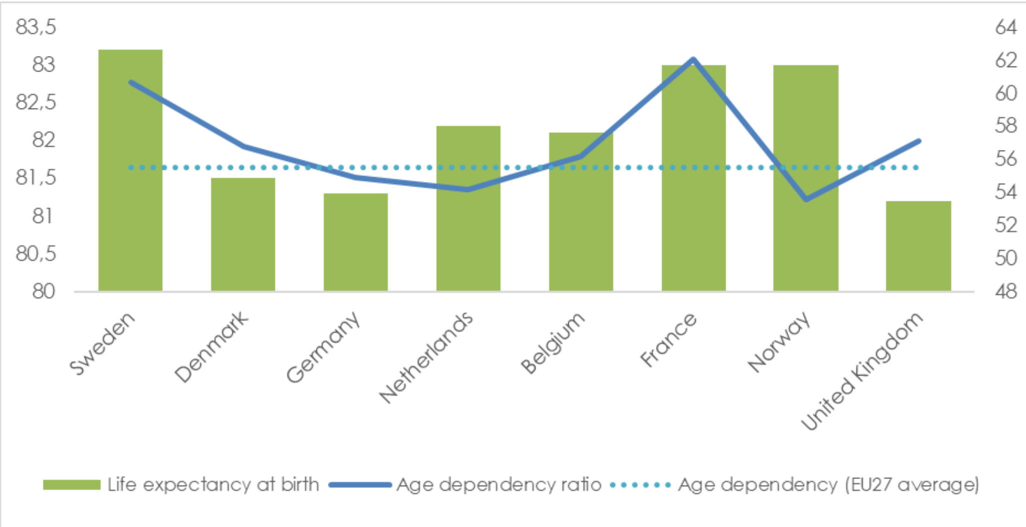
Figure 12 Population change at the NUTS3-level in the North Sea basin



Source: Eurostat

The life expectancy at birth of all countries in the North Sea basin is higher than the average at the European level (81.3 years in 2019)[50], with the exception of the United Kingdom (0.1 percent point lower than the EU Average). This exemplifies the general well-being of the population in those countries. Life expectancy at birth is a good indicator for assessing the health of the population. In terms of the population structure of countries in the North Sea basin especially France and Sweden stand out due to their high levels of age dependency ratios, especially also when compared to the average EU27 age dependency ratio of 55,5. The higher this ratio is the more people are dependent on the population of working age. The higher level could also indicate that those countries have an ageing population.

Figure 13 Population structure in the North Sea basin



Source: calculations Technopolis Group using Eurostat data

Most of the countries in the North Sea region can be characterised as developed and industrialised areas. With some exceptions, most countries in the North Sea basin score better on the various socio-economic indicators than the EU average. Out of the 67 NUTS2 areas in the North Sea basin only 20 can be classified as transition regions (GDP per capita varying between 75-100% of the EU-27 average, whereas the rest of the regions are more developed regions (GDP per capita is above 100-% of the EU average). The same holds for the regional levels of GVA, which also reflect the relatively high levels of welfare in the North Sea region. It is also reflected in other indicators such as the level of tertiary educational attainment. Nevertheless, regional differences and disadvantaged areas within the North Sea basin exist. For instance, the majority of the transition regions within the North Sea basin lie in France's coastal regions. Section 5.4 will provide more information on the regional differences and disadvantaged areas within the North Sea area.

As stated in the Orientation Paper Transnational Cooperation Programme, North Sea Region Programme 2021-2027, a document published by the EC, January 2020[51]: *"The*

[50] Eurostat, Life Expectancy at birth, DEMO_MLEXPEC

[51] https://northsearegion.eu/media/12417/annex-1-north-sea-region-programme-orientation-report.pdf

North Sea is one of the most heavily used sea basins in the world supporting fishing, shipping, trade, energy, recreation, defence and dredging. The common marine sea basin means there is a proven rationale and scope for focus on marine and maritime issues, although hinterland/inland areas are also addressed. There are strong connections and share development concerns in the region, and a real need to territorial cooperation on issues such as blue growth, communications, climate change and environmental protection. An example is the fact that the North Sea is an Emission Control Area for air pollution (SOx)". [52]

To summarise, the North Sea has an economic function, with several ports that are among the largest of the world, it is heavily used for fishing, it acts as a practice territory for national defence bodies, it contains large storage fields for oil and gas and is a key area for renewable energy via large offshore wind farms. Among all these functions, the North Sea region is a nature area that needs protection, not only for the undersea and above see flora and fauna, but also for the sensitive coastal nature areas.

Eutrophication that is resulting from nutrient enrichment (primarily nitrogen and phosphorus) is affecting mostly the coastal zone in the greater North Sea area, particularly estuaries and fjords. Nutrient-related problems are widespread in the Wadden Sea, the German Bight, the Kattegat and the eastern Skagerrak.[53] The occurrence of low oxygen levels in seawater is highly dependent on hydrographical conditions, and is a problem only in some areas of the North Sea.[54]

Changes in benthic populations are correlated with changes in eutrophication level.[55] Benthic biomass in muddy areas of the German Bight has tripled during the past 10 years, perhaps partly because of eutrophication. In the Wadden Sea, dense macro-algal mats of green algae reduce the oxygenation of sediments, and in the Ythan Estuary in Scotland the adverse impact of algal mats on invertebrate assemblages has been well documented.

Oil and gas exploration and production in the North Sea is an important economic activity in the sea basin, due to the presence of large oil and gas reserves. The industry is in a mature phase. Due to increasing extraction costs, decreasing fossil fuel reserves, new (inter)national policy plans, a changing public opinion and favourable location for renewable energy, different stakeholders are investing in offshore renewable energy (storage) facilities. For instance, exhausted gas fields can be used for the storage of CO^2.

The North Sea seabed is also home to other minerals, aside from oil and gas. In the North Sea mining activities where sand and gravel is extracted for land reclamation, sea defences and commercial uses takes place. The other minerals can also include sand and gravel,

---

[52] IMO considers that some marine areas are particularly sensitive to emissions. As a result, the level of suplhur oxides and particulate matter emission is supposed to be lower in the basin than in other areas. The establishment of Emission Control Areas (ECA) is regulated under MARPOL Annex VI. The North Sea has been an ECA since 2006.

[53] Aertebjerg G, Carstensen J, Dahl K, Hansen J, Nygaard K, Rygg B, Soerensen K, Severinsen G, Casartelli S, Schrimpf W, Schiller C, Druon J. Eutrophication in Europe`s Coastal Waters.. EEA Topic Report (7); 2001. JRC22631

[54] The North Sea — European Environment Agency (europa.eu)

[55] OSPAR, 2000

minerals and metals in/on the seabed or chemical elements dissolved in water. The project GeoERA-MINDeSEA "Seabed Mineral Deposits in European Seas: Metallogeny and Geological Potential for Strategic and Critical Raw Materials"[56] gives an overview of principal types of seabed mineral resources in the European Seas. According to this study, the Greater North Sea area only has some occurrences of mineral placers.[57]

Three major transitions are taking place that impact the North Sea Region:

- the nature conservation transition. The North Sea is a 'common', an asset owned by all, which requires a responsibility by all that surround it and make use of it. This transition is about nature conservation, protecting and strengthening biodiversity and securing the ecosystem as a whole, while in interaction with that system

- the food transition. The way of operation of the fishery sector needs to be adjusted to fit within the planetary boundaries

- the energy transition. In shifting from fossil to renewable energy generation the role of the potential of the North Sea will be inevitable, but has to be aligned with the other transitions.

5.3.3. Pressures/Status

At the scale of marine regions, all European marine regions are almost entirely affected by at least some anthropogenic effects. The most extensive combined effects [58] in the shelf areas mostly occur in the North Sea and partly in the Baltic (and Adriatic Sea). These areas are under several anthropogenic pressures, especially physical loss and disturbance due to intensive fisheries, multiple coastal activities and pollution.[59]

---

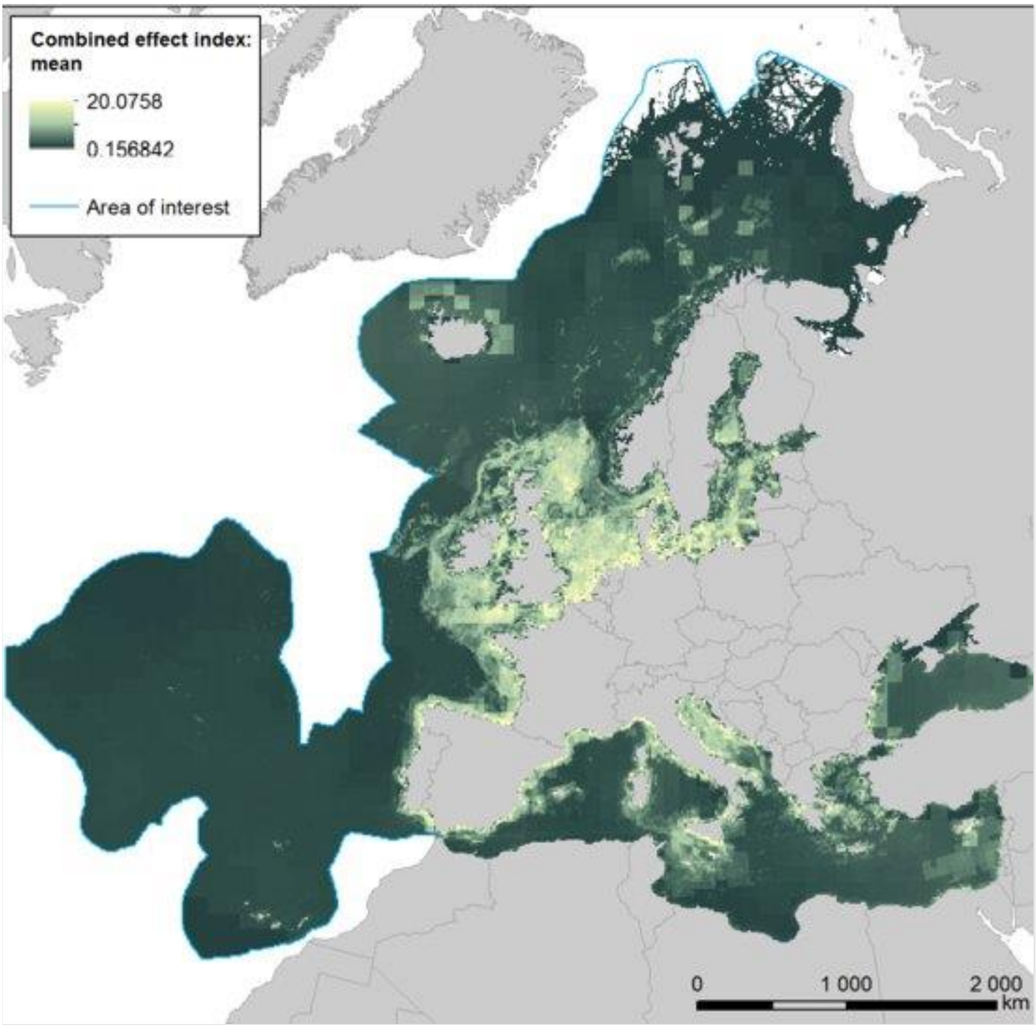
[56] For more information : https://geoera.eu/projects/mindesea2/

[57] Minerals found in marine placer deposits include zircon, monazite, xenotime (Y and P) ilmenite, rutile, magnetite, chromite, cassiterite and fine-grained gold and platinum (2021 EU Blue Economy Report).

[58] The combined effects assessment method consists of (1) mapping human activities, (2) describing their pressures in a spatial context, (3) mapping ecological elements, i.e. species and habitats, (4) describing their sensitivity to the set of pressures, and (5) combining the information to establish the connections needed to inform management (EEA, 2019).

[59] ETC/ICM Report 4/2019: Multiple pressures and their combined effects in Europe's seas — Eionet Portal (europa.eu)

Figure 14 Combined pressures in the European Seas



Source: Eionet, 2019.

Practically the entire European marine area, but especially shelf areas and coastal zone is under multiple pressures – such as hazardous substances, fish stock exploitation, climate change, underwater noise, non-indigenous species, seafloor damage, marine litter and nutrient enrichment. Shelf areas and coastal zone are affected by physical disturbance of seabed, eutrophication and non-indigenous species.

The intensity of the combined effects differs between the marine areas. In the Baltic Sea the combined effect (per 10x10km cell) is 2–3 times greater than in the other regions.

5.3.4. Conclusion

Overall, it is clear that sustainable management of Blue economy related activities should take into consideration all the pressures and their combined effects, and the current ecological limits of marine ecosystems.

This could be done (for marine part) by means of maritime spatial planning. This would serve to identify and manage the opportunities and constraints that lie within Exclusive Economic Zones, to inform policy formulation, adoption, and investment processes towards long-term environmental sustainability.

Ecosystem services approach would also help to provide shared perspectives and to resolve conflicts related to use of European seas (including accommodation of needs of the marine ecosystem).

Furthermore, national strategies and political priority-setting need to highlight the importance of decarbonization, sustainable Blue economy and healthy marine (and freshwater) aquatic ecosystems. The need for strong, resilient marine and freshwater ecosystems should be clear to all levels of society and resource users. Long-term solutions need national implementation and action supported by regional cooperative frameworks to ensure local priorities and obstacles are acknowledged and respected between the stakeholders sharing marine resources.

5.4. Regional Disparities

This section provides an overview of the disparities in socio-economic development, as well as research and innovation performance. As described in this chapter, both the Baltic Sea and North Sea show high levels of disparities, but with different patterns. Both the Baltic Sea and the North Sea show high intra-country cohesion disparities. There is a divide in socio-economic and R&I performance between the regions located in the North side of the Baltic Sea lighthouse area and the regions in the Eastern side.

This chapter also provides an overview of the research and innovation (R&I) performance in the Baltic Sea and North Sea, and attempts to identify disadvantaged areas in terms of research and innovation networks. As shown below, both the Baltic Sea and North Sea region are areas hosting regions with high innovation potential, including some of the leading innovation regions, capital cities, university and industry hubs in Europe. The North Sea has a relatively higher R&I average performance than the Baltic Sea, as ranked by the Regional Innovation Scoreboard, and showcases higher efficiency in its research and innovation systems on average.

In order to identify disadvantaged areas in terms of R&I connectedness, we have used the data generated by an EU-funded project collecting the information on NUTS3 regions' patenting and publications activities, participation in EU-funded Framework Programme projects (Horizon2020) and their participation in EU Research and innovation support structures (e.g. Digital Innovation Hubs, European Institute of Technology Knowledge and Innovation Communities – EIT KICs, EU Strategic Partnerships, Knowledge Alliances, etc.).[60] As showcased in the following chapters, it is difficult to pinpoint to specific disadvantaged areas in terms of R&I connectedness, as the data for both North Sea and Baltic Sea in fact showcases that the regions are split into rather few R&I "hubs" (roughly 25-35% of all regions), who have above average results in terms of patenting, publications, and participation in H2020 projects, and the rest of the roughly 65-75% of the regions who are less R&I intense and less connected to EU R&I networks.

5.4.1. The Baltic Sea Region socio-economic landscape

Socio-economic disparities in the Baltic Sea Region - Summary analysis

The Baltic Sea region consists mostly of well-developed EU countries. In the north, Germany, Denmark, and Sweden are some of the largest economic powers and longstanding members of the EU. To the East, there are newer EU member countries such as Poland, Latvia, Lithuania, and Estonia. Even though, on average, the older EU member countries do perform better in terms of socio-economic indicators, disparities exist within their regions.

In summary, Table 7 provides an aggregated overview of the Baltic regions' socio-economic status. As illustrated in Table 7, 57% of the regions are above the mean for GDP per capita which is positive, however, the range in GDP per capita is quite large at around 60000 EUR. At the same time, all the regions which are above the mean are all from the northern region of Europe and none of them being from Baltic countries. This is showing a North-East income disparity for this lighthouse area. Nevertheless, regions in Sweden and

[60] AIT, Technopolis Group, IDEA Consult (forthcoming): Knowledge ecosystems in the new ERA. Analytical report, project funded by the EU Commission, DG RTD

Finland also appear among the bottom ranked regions, showing high intra-country socio-economic disparities.

For unemployment rate and at-risk of poverty rate the basin is roughly evenly split with both indicators being roughly the EU average. Nonetheless, there is clearly a North-East divide for indicators overall with most above-average performing regions (in terms of GDP per capita, at-risk of poverty rate) being located in the Nordic region of Europe. unemployment rates are higher than the Baltic Sea average in 52% of the regions respectively. This shows a pattern of social cohesion disparities between the regions.

Table 7 Socio-economic disparities in the Baltic Sea basin

	GDP per capita (EUR)	Unemployment rate (%)	At-risk of poverty rates (%)
Baltic Sea average	38158.03	6.28	15.93
% Above average Baltic Sea	57%	48%	53%
% Below average Baltic Sea	43%	52%	47%
Bottom Performers	9,646 to 30,244	7.7 to 10.5	18.5 to 23
Disadvantaged Performers	30,244 to 38,891	6.2 to 7.7	16.2 to 18.5
Above Average	38,891 to 45,469	4.7 to 6.2	12.43 to 16.2
Top Performers	45,469 to 69,152	3.1 to 4.7	7.4 to 12.43
	GDP per capita (EUR)	Unemployment rate (%)	at-risk of poverty rates (%)

Source: Technopolis Group, 2022

Looking at the individual performance groups from Table 8 which is ranked in order by regional type, it appears that most of the bottom performers are from eastern Europe with Estonia (Esti), Latvia (Latvija), and Lithuania (Vidurio ir vakarų Lietuvos regionas) all having their one and only region in the basin considered as bottom performers. The other two regions come from Sweden (Norra Mellansverige and Östra Mellansverige). All of these regions score very poorly across the three indicators.

Those who are considered disadvantaged are the regions which consistently score in the 50th to 74th percentile for unemployment rate and at-risk poverty, while for GDP per capita it is 25th to 49th. It consists of three Swedish and Finnish regions each, two German, and one from Poland.

All three Finnish regions fall in the same categories for performances across the three indicators. Länsi-Suomi, Etelä-Suomi and Pohjois- ja Itä-Suomi are all disadvantaged for GDP, in the bottom for unemployment rate, however, they are above average for at-risk poverty rate.

The three Swedish regions: Småland med öarna, Sydsverige and Mellersta Norrland also behave in a similar way. All regions are above average for GDP per capita. However, two of them are amongst the worst for unemployment rate with one being disadvantaged. For at-risk poverty, two are disadvantaged while the other would be in the bottom for performances.

Once again, the two German regions: Mecklenburg-Vorpommern and Lüneburg along with the Polish region, Warmińsko-mazurskie all behave in a similar way. They are amongst the worst performers for GDP per capita and at-risk poverty rate, however, at the same time they are the top performers for unemployment rate.

Those who are considered above average score in the top 50th to 74th percentile for GDP per capita and in the 25th to 49th percentile for unemployment rate and at-risk poverty. The group of regions consists of four German regions, two Polish regions, two Swedish and one from Denmark.

Top performing regions are those who lie in the 75th to 100th percentile for GDP and 1st to 24th percentile for unemployment and at-risk poverty. The group of regions consists of four Danish regions, Hovedstaden, Nordjylland Syddanmark and Midtjylland. There are two Finnish regions Helsinki-Uusimaa and Åland. Stockholm, Sweden, is the last region. All these regions come from Nordic countries. However, none of them would be considered top performers in unemployment rate with them being considered either above average or disadvantaged.

Table 8 Overview of Baltic Sea Regions Socio-Economic Performance Ranking

Performance	Country	Label	NUTS
Bottom Performers (Regions with an aggregate score in the top 25%)	Latvia	Latvija	LV00
	Lithuania	Vidurio ir vakarų Lietuvos regionas	LT02
	Estonia	Eesti	EE00
	Sweden	Norra Mellansverige	SE31
	Sweden	Östra Mellansverige	SE12
Disadvantaged performers (Regions with an aggregate score in the top 25% to 50%)	Finland	Länsi-Suomi	FI19
	Finland	Etelä-Suomi	FI1C
	Finland	Pohjois- ja Itä-Suomi	FI1D
	Germany	Mecklenburg-Vorpommern	DE80
	Germany	Lüneburg	DE93
	Poland	Warmińsko-mazurskie	PL62

	Sweden	Småland med öarna	SE21
	Sweden	Sydsverige	SE22
	Sweden	Mellersta Norrland	SE32
Above average (Regions with an aggregate score in the bottom 50% to 25%)	Germany	Weser-Ems	DE94
	Germany	Schleswig-Holstein	DEF0
	Sweden	Västsverige	SE23
	Germany	Bremen	DE50
	Germany	Hamburg	DE60
	Sweden	Övre Norrland	SE33
	Denmark	Sjælland	DK02
	Poland	Zachodniopomorskie	PL42
	Poland	Pomorskie	PL63
Top performers (Regions with an aggregate score in the bottom 25%)	Finland	Åland	FI20
	Denmark	Hovedstaden	DK01
	Denmark	Nordjylland	DK05
	Finland	Helsinki-Uusimaa	FI1B
	Sweden	Stockholm	SE11
	Denmark	Syddanmark	DK03
	Denmark	Midtjylland	DK04

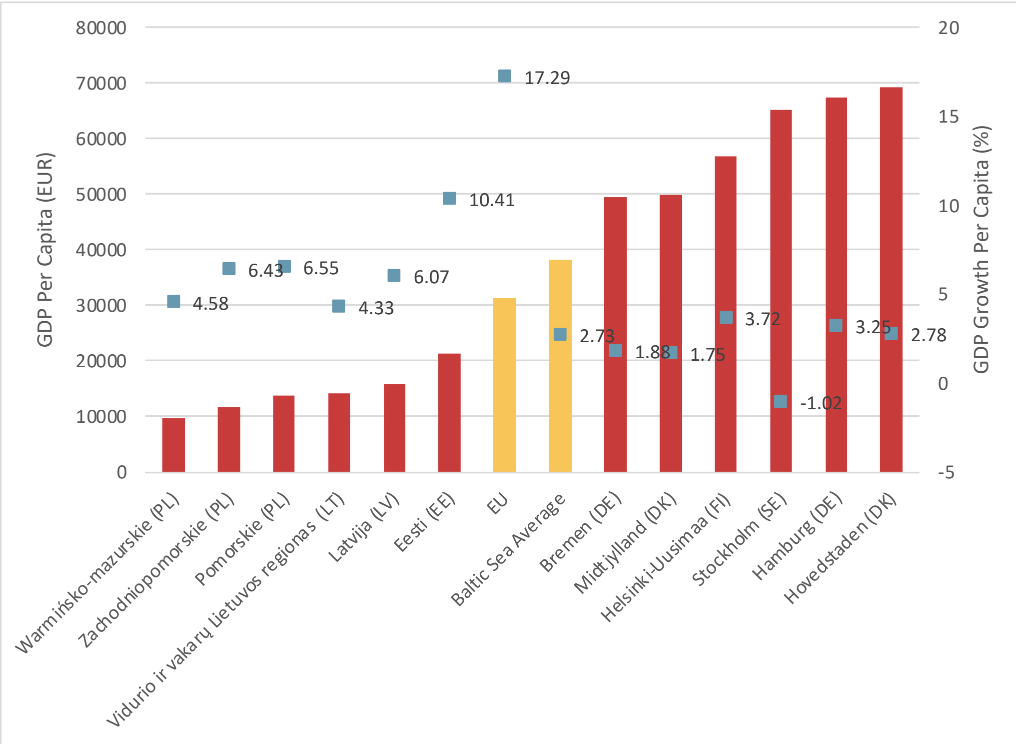
Source: Technopolis Group calculations based on Eurostat, 2022

Socio-economic performance analysis by indicator

The average GDP per capita across regions is 38,158 EUR which is higher than the EU average of 31,200 EUR. When averaged at country level, however, Germany (40,894 EUR), Denmark (49,766 EUR) and Sweden (43,559 EUR) have the largest GDP per capita (Eurostat). Latvia (15,846 EUR), Estonia (21,219 EUR) and Poland (11,672 EUR) are well below average (Eurostat). The same results can be seen when comparing regions with the top 6 regions being made up of territories from Finland, Sweden, Germany and Denmark and the bottom six regions being made up of territories from Poland, Latvia and Estonia. Hovedstaden (69,152 EUR) has the highest GDP and Warmińsko-mazurskie (9,646 EUR) has the lowest, leading to a large difference of 60,000 EUR per capita between top and bottom regions, as shown in

Figure 15.

Figure 15 GDP per capita (2018) and GDP growth per capita (2018-2017), (%), Baltic Sea region, Top 6 regions, bottom 6, EU average and Baltic Sea average



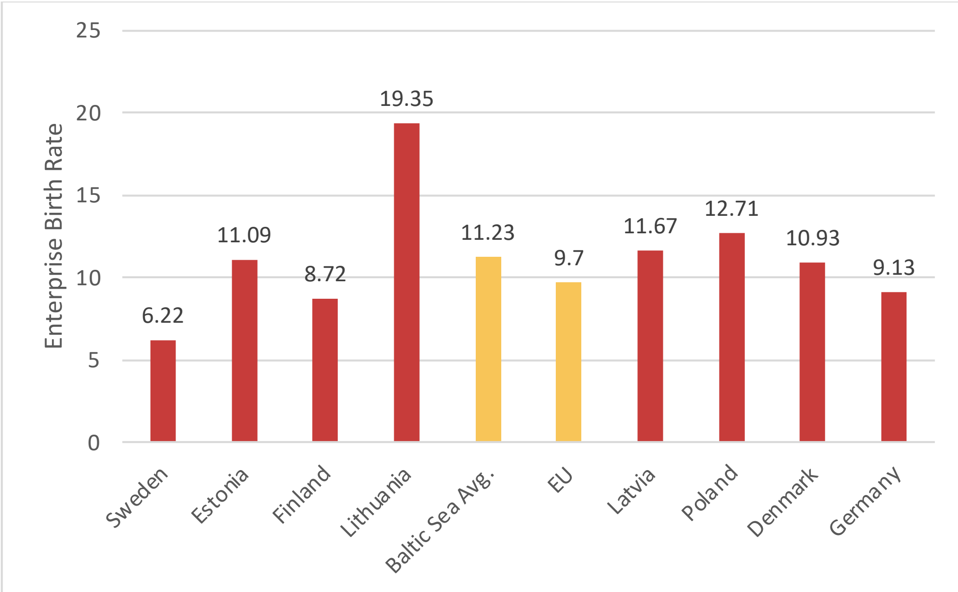
Source: Technopolis Group based on Eurostat, 2022

As shown in

Figure 15, mean GDP per capita growth (from 2017 to 2018) throughout the Baltic Sea area regions comes to 2.73%. It varies widely, from -7.77% being the lowest GDP growth in Wesermarch, Germany, and the highest growth of 17.65% is seen in Kirde-Eesti, Estonia (Technopolis Group calculation based on Eurostat). At the country level, Poland (6.26%) experiences quite substantial growth on average across its regions (Technopolis Group calculation based on Eurostat). The same can be said for Estonia (10.41%). On average Germany (2.5%) falls in line with the average, while Swedish GDP mean growth is contracting (-1.28%) across its regions (Technopolis Group calculation based on Eurostat).

The majority of countries in the Baltic area are above EU average or similar to EU average in terms of entrepreneurial dynamism, as measured through enterprise birth rates (except for Sweden and to some extent Poland). Lithuania has the highest national enterprise birth among the Baltic Sea countries at 19.35%, nearly 7% higher than Poland (12.71%) (Eurostat) and Latvia (11.67%). Sweden and Finland have the lowest rates, 6.22% and 8.72%, well below the average for the Baltic at 11.22% (Eurostat).

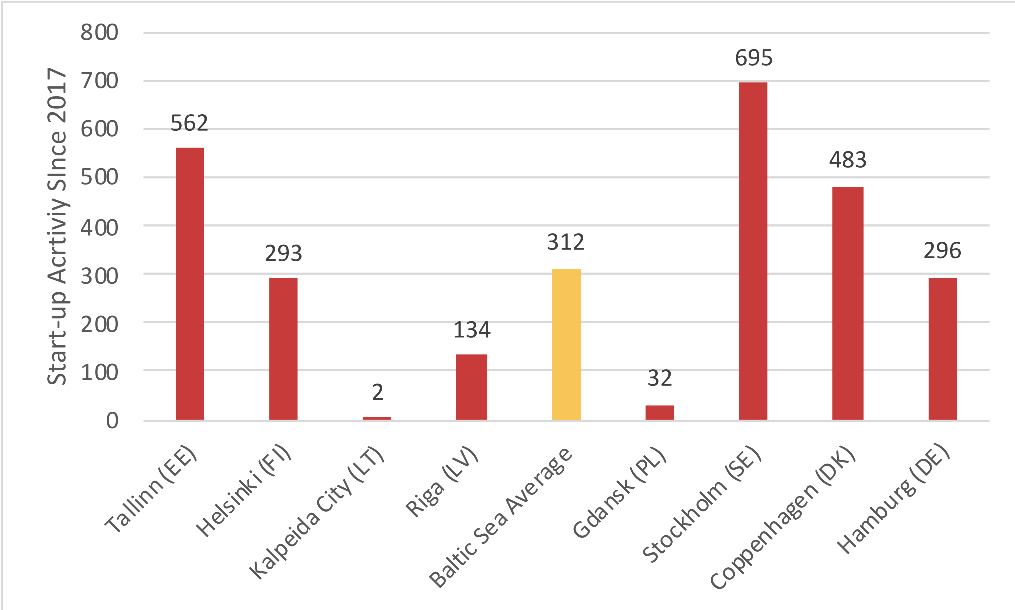
Figure 16 Enterprise Birth Rate (%) (2020), Baltic Sea region, Top 6 regions, bottom 6, EU average and Baltic Sea average



Source: Technopolis Group based on Eurostat, 2022

The innovative start-up scene in the Baltic Sea regions is another sign of a mostly healthy entrepreneurial dynamism, as R&I Hubs of Stockholm and Helsinki have over 695 and 293 startups, respectively, since 2017. Copenhagen (483) in Denmark and Tallinn in Estonia (562), also have high numbers of startups (own calculations based on Crunchbase). Regions with less scale for their start-up hubs include Klaipeda or Gdansk.

Figure 17 Number of start-ups (2017-20) in Baltic Sea region identified R&I Hubs, and average across all the selected hubs

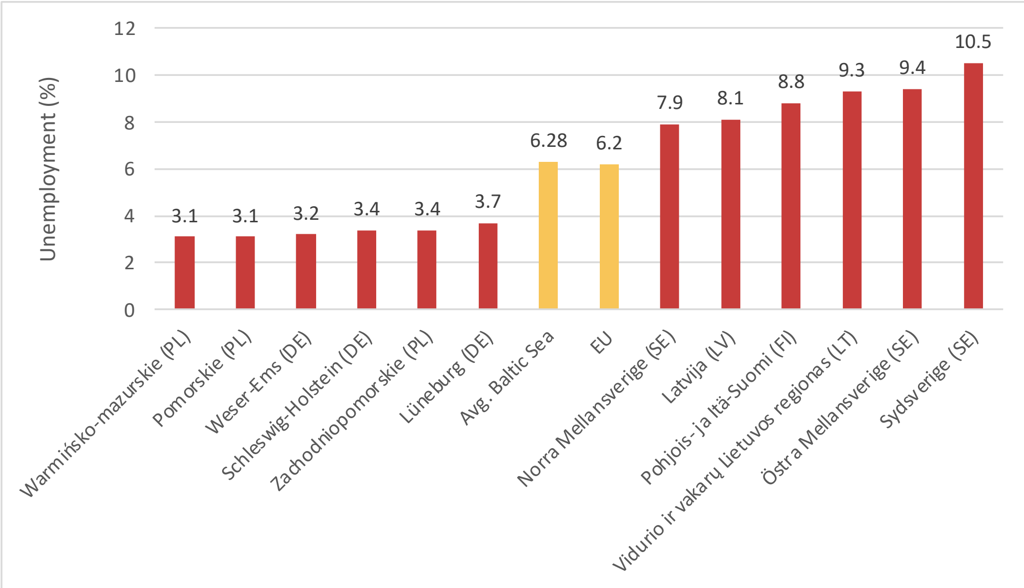


Source: Technopolis Group based on Crunchbase

Social cohesion disparities in the Baltic Sea

The unemployment rate for the Baltic Sea basin across its NUTS 2 regions is marginally higher than the EU average, 6.28% and 6.2% respectively (Eurostat). Poland (3.3%) and Germany (3.65%) have the lowest rates; while the more northern countries, Sweden (10.1%) and Finland (10.5%) have the some of the highest (Eurostat). Stockholm also suffers from a higher-than-average unemployment rate and youth unemployment (7.42%) rate for the Baltic region (6.3%), at 7.6% and 10.2% respectively. Also, the Swedish region Sydsverige has the highest unemployment rate (10.5%) and highest youth unemployment rate (12.1%) of the regions within the Baltic.

Figure 18 Unemployment Rate (%) (2020), Baltic Sea region, Top 6 regions, bottom 6, EU average and Baltic Sea average.

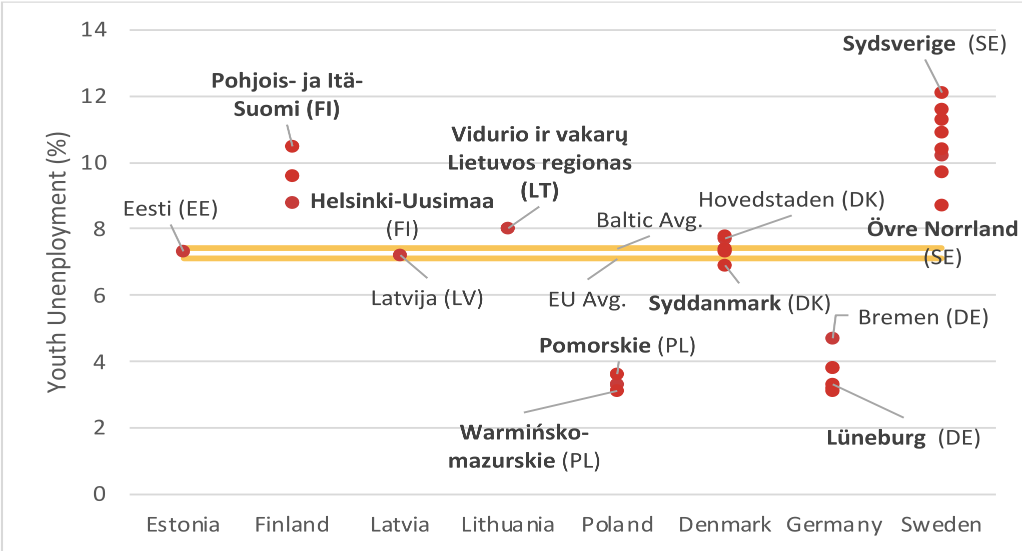


Source: Technopolis Group based on Eurostat

German regions have very low rates of youth unemployment with all falling well below the EU and basin average. The cities of Bremen (4.7%) and Hamburg (3.8%) have very low rates of youth unemployment, with Bremen having the highest rates of the German regions (Eurostat). Poland also has very low youth unemployment. Denmark is clustered in-between the two averages for youth unemployment. However, Sweden and Finland have all their regions above the averages which can be seen in

Figure 19.

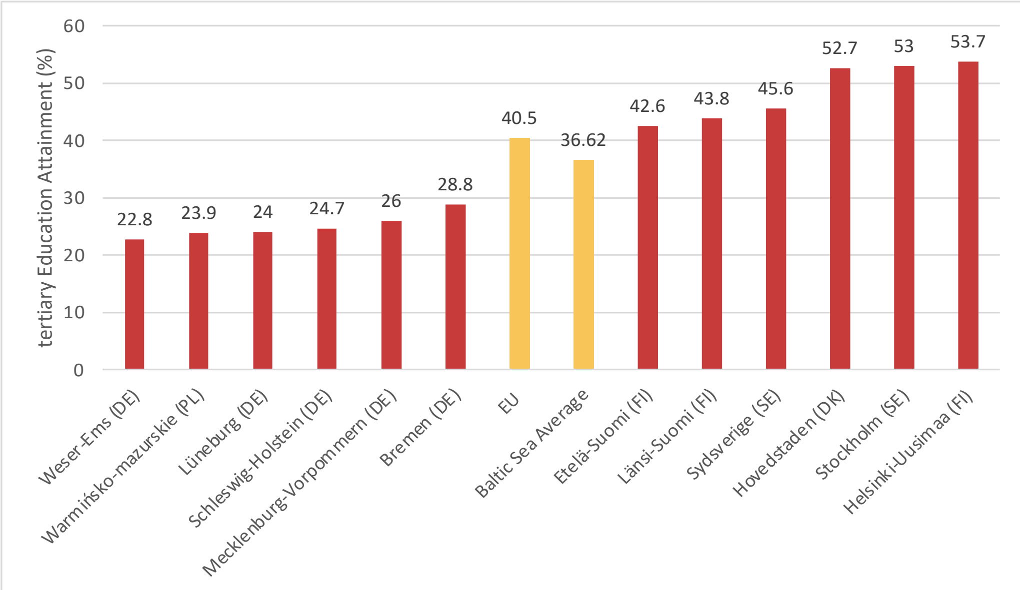
Figure 19 Youth Unemployment Rate (%), (2019) Baltic Sea region, all regions, EU average and Baltic Sea average.



Source: Technopolis Group based on Eurostat

Average tertiary education attainment for the Baltic basin is lower than the EU average, however, it does vary considerably between the lowest and highest rate (with difference over 30%).

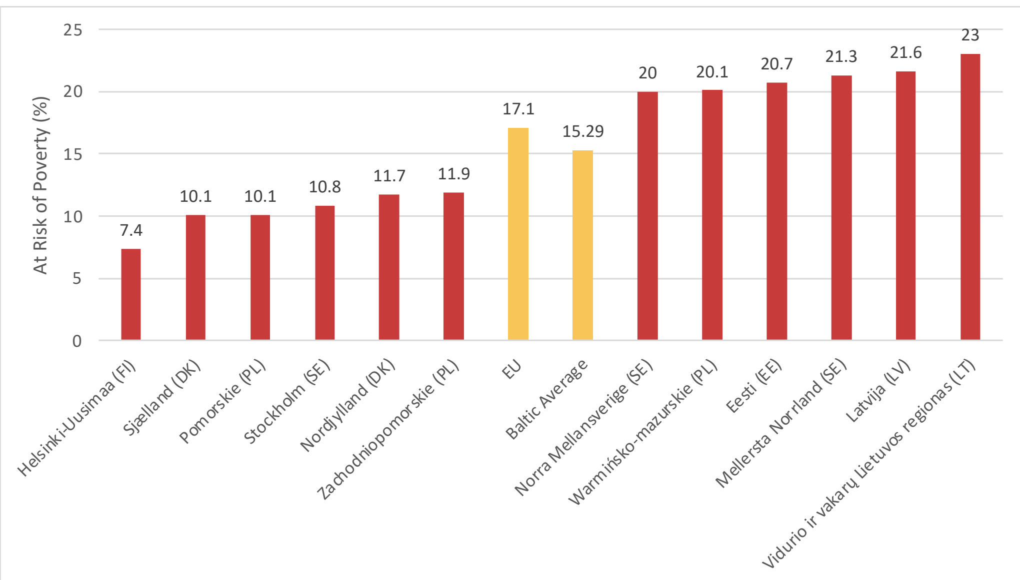
Figure 20 Tertiary Education Attainment (%) (2019), Baltic Sea region, Top 6 regions, bottom 6, EU average and Baltic Sea average.



Source: Technopolis Group based on Eurostat

Lithuania has the NUTS2 region with the highest rate of people at risk of poverty (Vidurio ir vakarų Lietuvos regionas), (21.6%), Latvia has the second highest rate and Estonia the fourth highest. Sweden has one NUTS2 region in the top six (with less risk of poverty) and bottom six, with Stockholm (10.1%) having approximately half the at-risk poverty rate of Meellersta Norrland (21.3%).

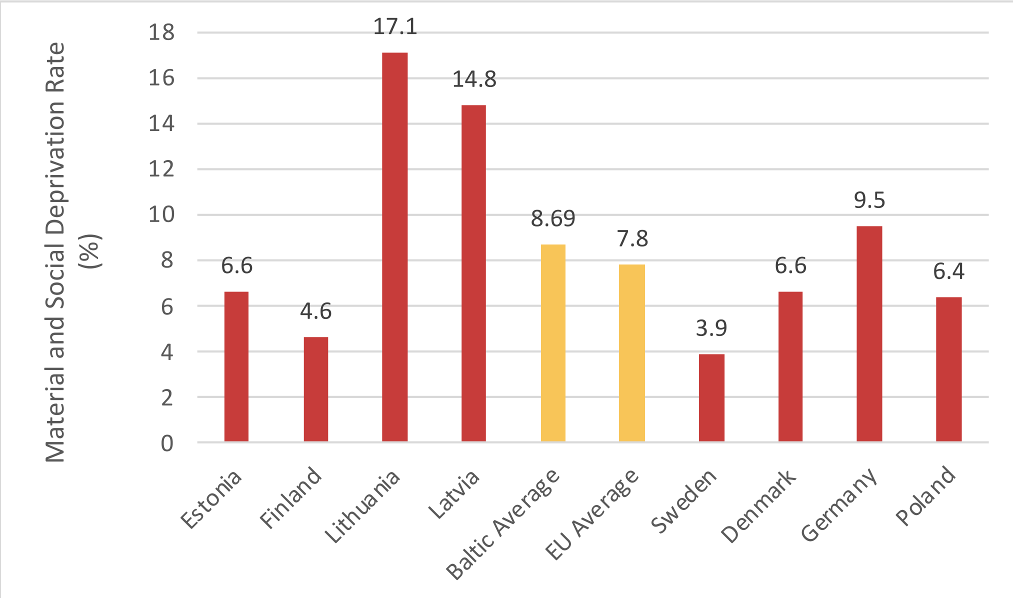
Figure 21 At Risk of Poverty Rate (%), Baltic Sea region, Top 6 regions, bottom 6, EU average and Baltic Sea average.



Source: Technopolis Group based on Eurostat

At the national level, northern Baltic countries have much lower rates of material and social deprivation than the Baltic Sea average and EU average. Sweden (3.9%) and Finland (4.6%) have the two lowest scores, while, the more eastern countries Latvia (14.8%) and Lithuania (17.1%) have the highest rates and bring the average of the Baltic Sea region to 8.68%. Germany (9.5%) is the only other country above the average (Eurostat).

Figure 22 Material and Social Deprivation Rate (%) (2020), national level, Baltic Sea region average and EU average



Source: Technopolis Group based on Eurostat

5.4.2. R&I Landscape & Performance in the Baltic Sea

This section provides an overview of the research and innovation landscape in the Baltic Sea area, and the discrepancies between the research and innovation performance between regions in the Baltic Sea, by looking at indicators such as the Regional Innovation Scoreboard scores, inputs into the R&I activities such as gross expenditures on R&D and business expenditures on R&D, as well as R&I activities' results such as patents and publications. In addition, this section will provide the overview of the regions' connectedness to EU initiatives.

Summary analysis of the Baltic Sea R&I performance and disparities

The Baltic Sea area shows higher than the EU average research and innovation performance overall. However, the high performance is distributed in only a range of regions, as the majority of the NUTS2 regions (54%) in the Baltic Sea are below the Baltic Sea area performance. Based on the analysis in this chapter, there is a disparity amongst the Baltic Sea countries and regions' R&I performance, mainly between the Northern parts of the sea basin (Sweden, Finland) and the countries and regions located on the Eastern coast of the Baltic Sea, such as Estonia, Latvia, Lithuania, Poland. The Baltic Sea area countries' performance is concentrated in highly innovative capital cities such as Stockholm, Copenhagen, and Helsinki, but also in industry intense regions, such as Hamburg, or Vastra Gotaland.

Table 9 Comparative R&I performance for the Baltic Sea NUTS2 regions

Baltic Sea basin	Gross R&D expenditure per inhabitant and as % of GDP (GERD)	Human resources in science and technology	Regional Innovation Scoreboard index
Average	2.04	50.41	120.50
% Above	40%	43%	46%
% Below	60%	57%	54%
Bottom Performers	0.34 to 1.08	37.1 to 45.78	42.51 to 104.34
Disadvantaged Performers	1.08 to 1.73	45.78 to 49.15	104.34 to 119.54
Above Average	1.73 to 2.61	49.15 to 53.05	119.54 to 138.41
Top Performers	2.61 to 5.15	53.05 to 67.7	138.41 to 191.62

Source: Technopolis Group based on Eurostat

Table 10 provides an overview of the regions' connectedness to EU R&I networks and internal connectedness. It is striking that only 26% of the regions show numbers of H2020 projects higher than the Baltic Sea lighthouse area average, and roughly 42% regions have more than 3 EU structures represented in their region (mainly EU Digital Innovation Hubs and clusters participating in the European Clusters Collaboration Platform). From this perspective, we can speak more of "R&I hubs" instead of areas that are disadvantaged in terms of R&I networks, as the latter seem to make up the majority of the regions in the Baltic Sea. This is similar when looking at the internal connectedness of the regions, as illustrated through the share of public-private co-patenting activities, where only 34% of the regions show values above the Baltic Sea average.

Table 10 Overview of regions' connectedness to EU R&I networks and internal connectedness

Baltic Sea basin	H2020 Projects	Number of patents	Number of publications	Participation in EU R&I networks and structures
Average	249.93	1863.33	16072.80	2.77
% Above	27%	30%	40%	37%
% Below	73%	70%	60%	63%
Bottom Performers	0 to 25	0 to 232	0 to 1457	0
Disadvantaged Performers	25 to 128	232 to 686	1457 to 9750	0 to 1
Above Average	128.5 to 310	686 to 3030	9750 to 25404	1 to 3
Top performers	310 to 1302	3030 to 10399	25404 to 72120	3 to 15

Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming).

At the individual level the patterns of R&I being heavily concentrated in the more northern parts of the basin continue and the eastern part being disadvantaged in terms of R&I (see Table 11).

The worst performers are those who consistently fall in the 0 to 24th percentile for the selected indicators. It consists of two Swedish regions (Småland med öarna and Mellersta Norrland), two Polish regions (Warmińsko-mazurskie and Zachodniopomorskie) and there is one region each from Finland (Åland), Denmark (Sjælland), Germany (Lüneburg) and Lithuania (Vidurio ir vakarų Lietuvos regionas). These regions consistently were either the worst performers or disadvantaged performers for all the indicators. Very seldom did the region lie in the above average region for any.

Those who are considered disadvantaged consistently scored in the 25th to 49th percentile. Within this category, it consisted of two Swedish (Norra Mellansverige and Övre Norrland), two German (Weser-Ems and Mecklenburg-Vorpommern), and one each from Denmark (Nordjylland), Latvia (Latvija) and Poland (Pomorskie).

When analysing this category, there is no consistent pattern amongst the regions and the category that their indicator lies in. However, overall, they do perform slightly better for the output categories (H2020 projects, patents, publications, and R&I connectedness) than their inputs (GERD and HRST). The German region of Weser-Ems has a regional innovation score close to the EU average. Along with that the HRST and GERD of the region is above the average of the Baltic Sea basin area. However, it is still found to be disadvantaged since the remaining indicators all fall in the bottom performing category.

All regions which consistently scored in the 50th to the 74th percentile were categorised as preforming well. This consisted of three regions from Finland, two from Germany and Estonia and Demark have one each.

The top performing regions consistently scored in 75th to 100th percentile. In this category, there are four Swedish regions (Östra Mellansverige, Stockholm, Sydsverige and Västsverige), two Danish regions (Midtjylland and Hovedstaden), and Finland (Helsinki-Uusimaa) and Germany (Hamburg) both had one region each. The regions consistently lay in the top performing or above average regions across indicators. However, for Participation in EU R&I networks and structures, two regions were amongst the worst performers.

Table 11 Overview of Baltic Sea Regions R&I Performance by category of region

Performance	Country	NUTS	Region
Bottom Performers (Regions with an aggregate score in the bottom 25%)	Poland	PL62	Warmińsko-mazurskie
	Germany	DE93	Lüneburg
	Lithuania	LT02	Vidurio ir vakarų Lietuvos regionas
	Finland	FI20	Åland
	Poland	PL42	Zachodniopomorskie
	Sweden	SE21	Småland med öarna
	Denmark	DK02	Sjælland
	Sweden	SE32	Mellersta Norrland
Disadvantaged Performers (Regions with an aggregate score in the bottom 50% to 25%)	Germany	DE94	Weser-Ems
	Sweden	SE31	Norra Mellansverige
	Germany	DE80	Mecklenburg-Vorpommern
	Sweden	SE33	Övre Norrland
	Poland	PL63	Pomorskie
	Latvia	LV00	Latvija
	Denmark	DK05	Nordjylland
Above Average (Regions with an aggregate score in the top 25% to 50%)	Estonia	EE00	Eesti
	Denmark	DK03	Syddanmark
	Germany	DEF0	Schleswig-Holstein
	Finland	FI19	Länsi-Suomi
	Finland	FI1C	Etelä-Suomi

	Finland	FI1D	Pohjois- ja Itä-Suomi
	Germany	DE50	Bremen
Top performers (Regions with an aggregate score in the top 25%)	Sweden	SE12	Östra Mellansverige
	Denmark	DK04	Midtjylland
	Germany	DE60	Hamburg
	Sweden	SE11	Stockholm
	Denmark	DK01	Hovedstaden
	Finland	FI1B	Helsinki-Uusimaa
	Sweden	SE22	Sydsverige
	Sweden	SE23	Västsverige

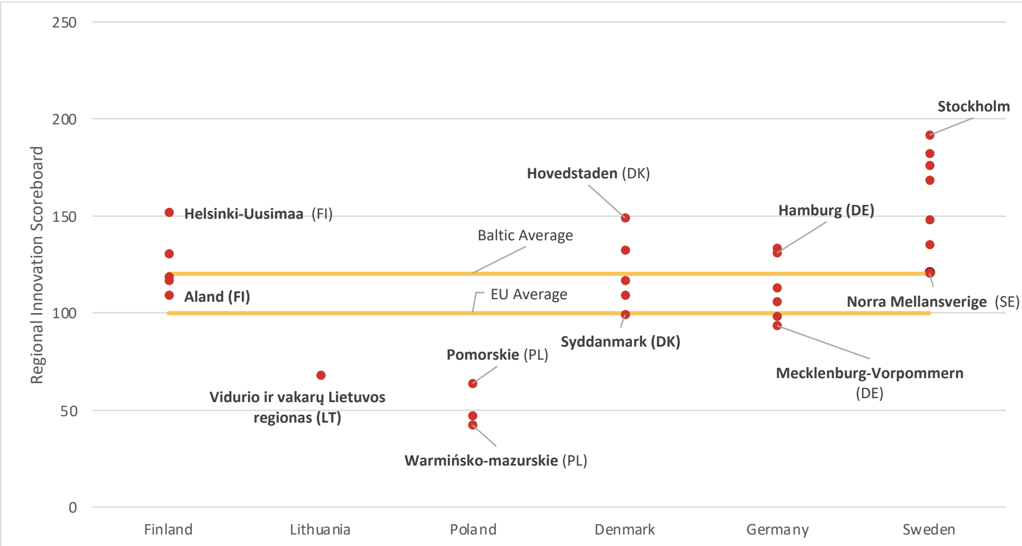
Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming); Eurostat.

Analysis of Baltic Sea R&I performance by indicator

The Baltic Sea Regional Innovation Scoreboard[61] average of 120.5 lies a sizable amount above the EU average (100). The Nordic regions of the Baltic Sea are the best performers on the index, Sweden's NUTS 2 region average at 155, followed by Finnish (125), and Danish (121) (Regional Innovation Scoreboard, 2021). Polish regions average 51 and all score well below EU and Baltic average, with Warmińsko-Mazurskie (42) the least innovate region according to the index. Sweden's worst performing region, Norra Mellansveirge (121), still lying marginally above the Baltic average. Stockholm (191.6) is by far the most innovative region within this sea basin, with Helskini-Uusimma (151) and Hovestaden (149) the next most innovative regions. However, all the regions are capital regions with major universities (Regional Innovation Scoreboard, 2021). Most German regions are clustered in-between the two averages, and Hamburg (133) being the most innovative region (Regional Innovation Scoreboard, 2021).

[61] The regional innovation scoreboard (RIS) is a regional extension of the European innovation scoreboard (EIS), assessing the innovation performance of European regions on a limited number of indicators

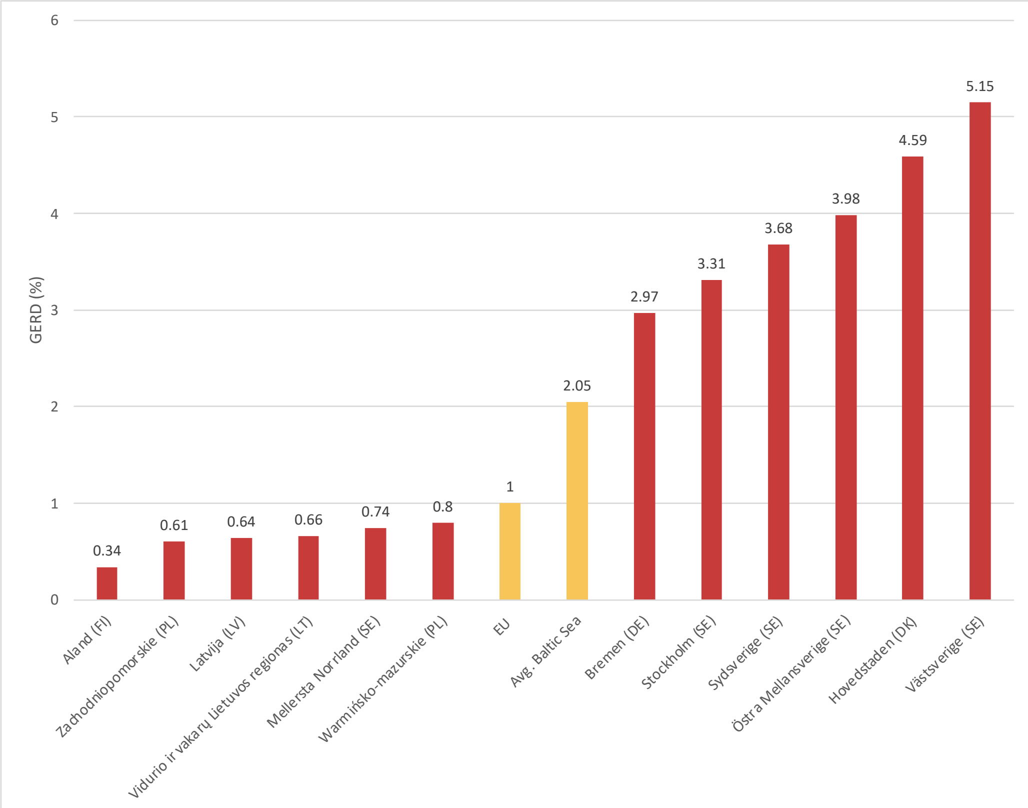
Figure 23 Index for Regional Innovation Scoreboard (2021), Baltic Sea region, EU average and Baltic Sea average



Source: Technopolis Group based on European Commission, 2021

The Baltic Sea basin regions' average gross expenses on R&D as a percentage of GDP is twice as large the EU's, indicating that the regions in this area place significant weight on the role of research and innovation in their policy mix. Four out of the six top regions for this R&D indicator come from Sweden (which is a leading innovator country in EU). One Swedish region also appears in the bottom five. Västsverige, which hosts the university city of Gothenburg, has the highest gross expenditure on R&D as % of GDP among all Baltic Sea regions. Latvia's and Lithuania's only NUTS 2 regions in the Basin are in the bottom six for expenditure and very far away from the average. Two Polish regions out of all three located within the Baltic Sea lighthouse area are also ranked among the bottom six regions in terms of R&D expenditure.

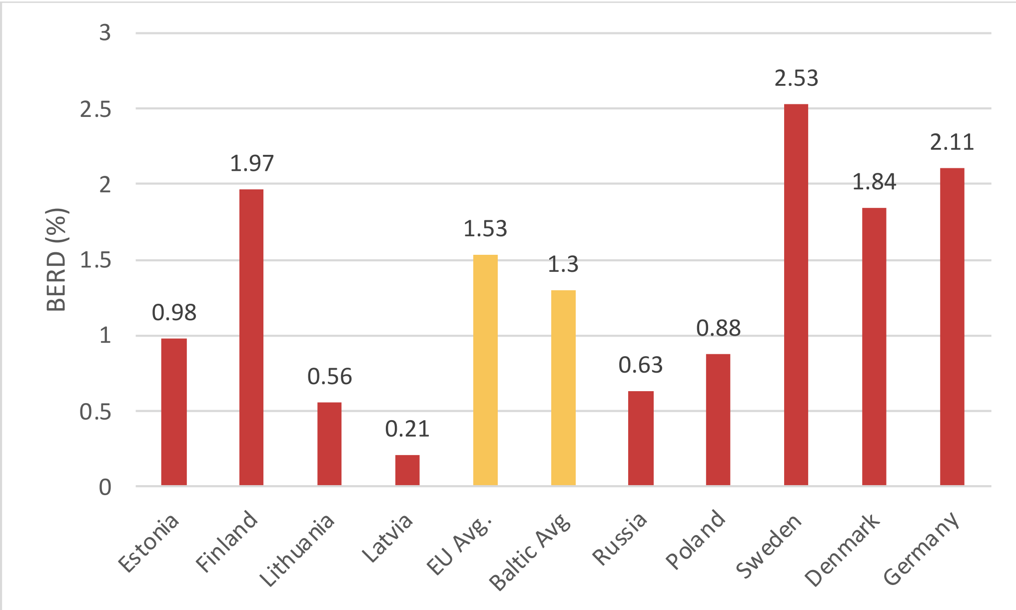
Figure 24 Gross Expenditure on R&I as % of GDP (2019), Baltic Sea region, Top 6 regions, bottom 6, EU average and Baltic Sea average.



Source: Technopolis Group based on Eurostat

While the regions have high Gross R&D expenses as a share of GDP, the average national Business R&D expenditures (BERD) amount to 1.3% of GDP in the Baltic Sea, which falls below the EU average. This is to some extent explained by the very low BERD levels in some of the Baltic States, which are below 1% of GDP. Sweden (2.53%), Germany (2.11%), Finland (1.97%), and Denmark (1.84%) have the highest percentage Business enterprise Expenditure on R&D as share of GDP. The other countries have significantly lower percentage than the average of the EU and Baltic Basin with Latvia (0.21%), Lithuania (0.56%) and Russia (0.63%) having the lowest percentages (Eurostat).

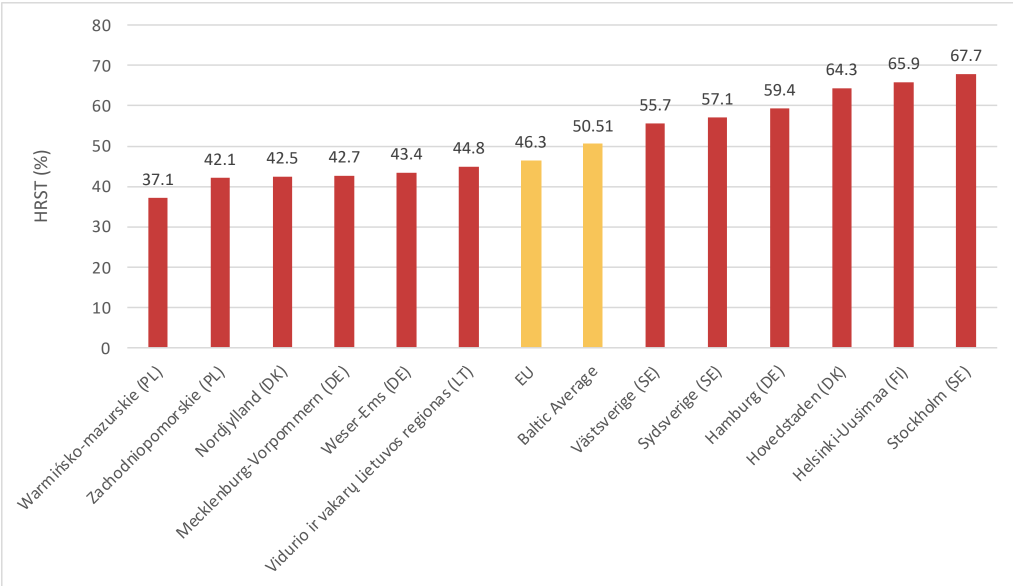
Figure 25 Business Expenditures in R&D (BERD) as % of GDP, (2020), national level, Baltic Sea region average and EU average



Source: Technopolis Group based on Eurostat

Figure 26 shows the percentage of the work force employed in science and technology at a NUTS 2 level. The Baltic basin itself is above the EU average however, most regions in the bottom six are only a few percentages off the EU average. There is a wide range of 30% from least employed in those sectors, Warmińsko-Mazurskie (37.1%) and Stockholm (67.7%) (Eurostat). As expected, the regions that contain cities and universities have the highest percentage. Two of Poland’s three regions have the lowest share of human resources in the two sectors as well as Lithuania’s only NUTS2 region in this group.

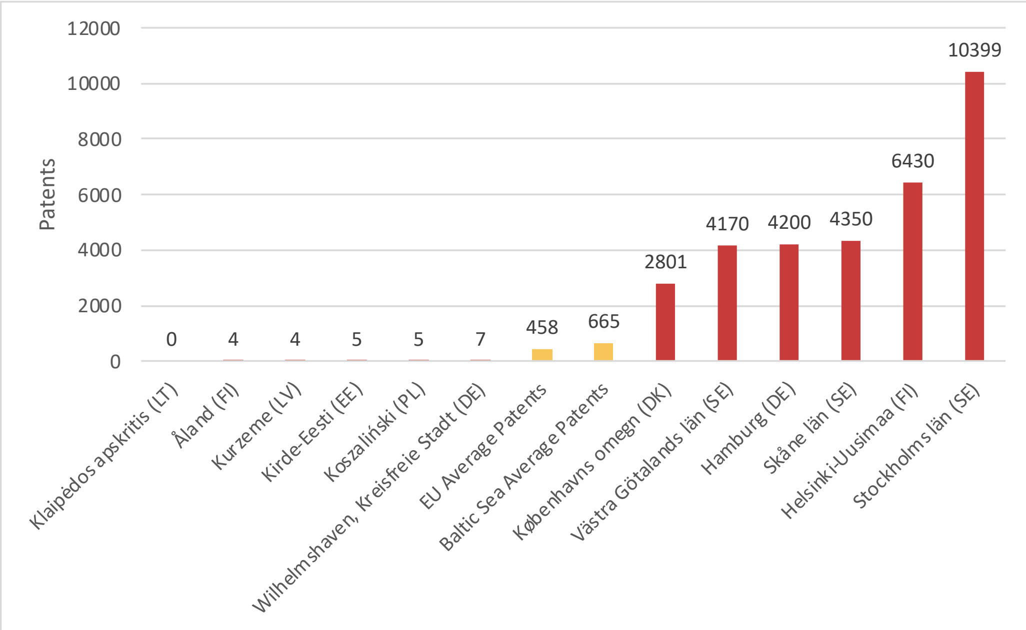
Figure 26 Human Resources in Science & Technology as a % of Population (2020) Baltic Sea region, Top 6 regions, bottom 6, EU average and Baltic Sea average.



Source: Technopolis Group based on Eurostat

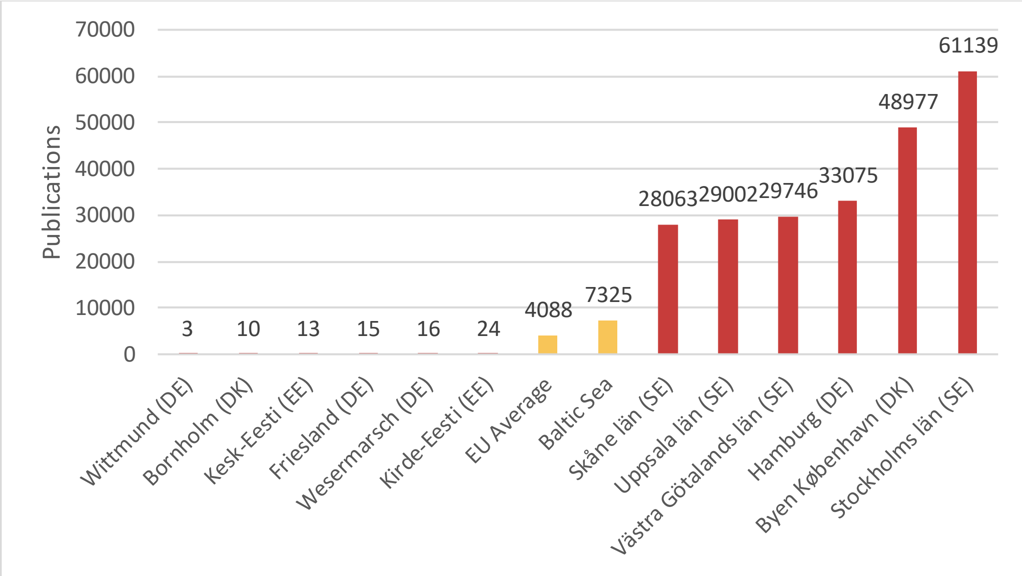
Analysing the regions' scientific results in terms of the production of patents, publications, and performance in H2020 projects (see Figure 27, Figure 28 and Figure 29), the pattern emerges of the localisation of scientific results in the region: these R&I indicators are consistently highest for cities with universities, with capital cities Stockholm, Helsinki, Copenhagen Hamburg being the most prominent regions. Other Danish, German, Swedish and Finnish regions do appear in the top six. The figures below portrays R&I disparities in the Baltic Sea countries.

Figure 27 Patents (2015-2019) Baltic Sea region, Top 6 regions, bottom 6, EU average and Baltic Sea average.



Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming).

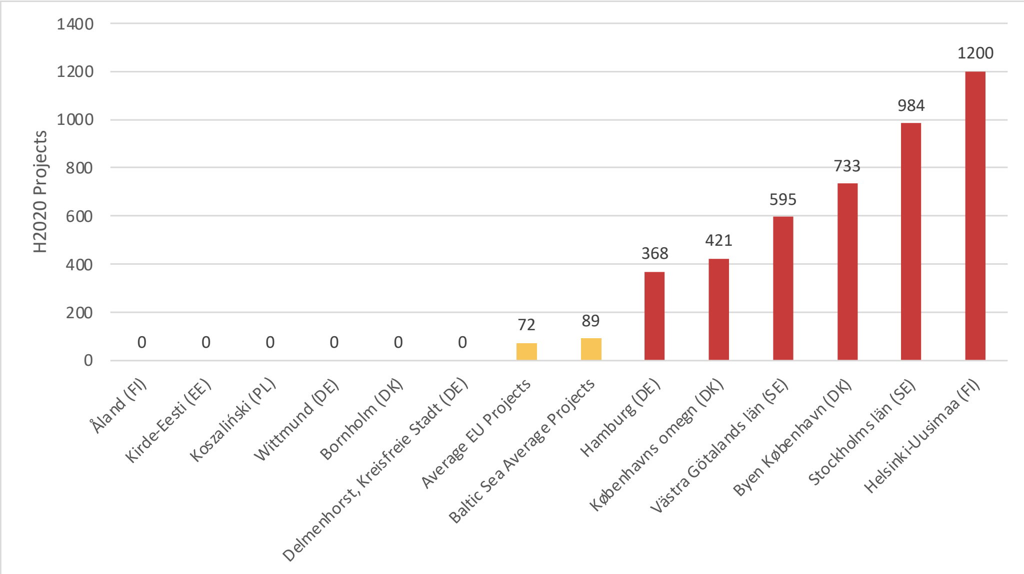
Figure 28 Number of Publications (2015-2019), Baltic Sea region, Top 6 regions, bottom 6, EU average and Baltic Sea average.



Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming).

Figure 29 shows the number of Horizon 2020 projects with participants from the Baltic Sea regions, showcasing the capacity of the R&I actors in the Baltic Sea region to attract such funding and cooperate at EU level in Horizon projects. Actors in the Baltic Sea NUTS3 regions are participating in more EU projects than the EU average actors. The regions oscillate between zero Horizon 2020 projects, to 1200 project participations in Helsinki-Uusimaa region in Finland. Other top regions include Stockholm, Copenhagen, Vaestra Gotaland and Hamburg.

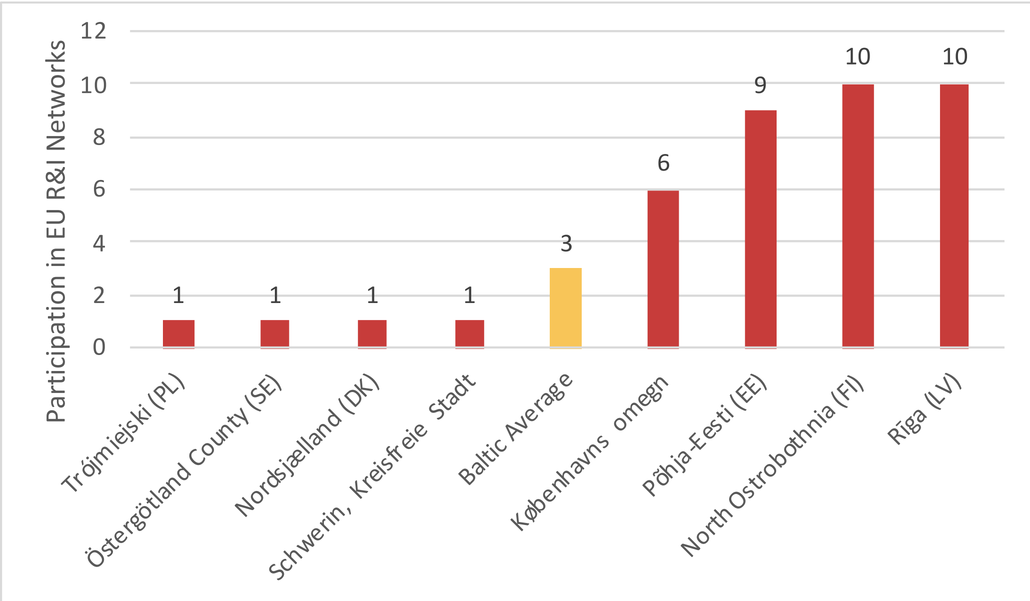
Figure 29 Number of H2020 Projects, top 6 Baltic regions, bottom 6, EU average and Baltic Sea average



Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming).

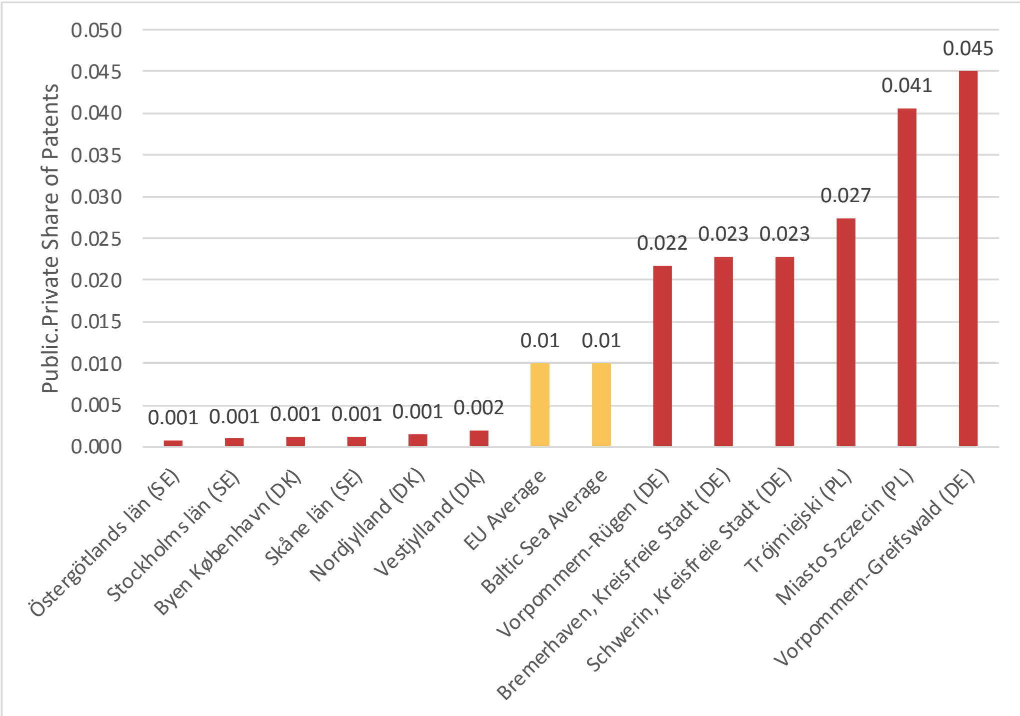
In terms of the participation in EU Research and innovation structures, the regions in the Baltic Sea seem to be mainly connected to the EU Digital Innovation Hubs Network, and European Cluster Collaboration Platform. Interestingly, there are no actors connected to the network of e.g. EIT KICs, Knowledge Alliances or Strategic R&I Partnerships, based on the data collected (see Figure 30 and Figure 31).

Figure 30 Number of EU structures (e.g. DIH and EU Strategic Cluster Collaboration Partnerships), Baltic Sea region, top 4 regions, bottom 4, Baltic Sea average



Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming).

Figure 31 Public Private Share of Patents, 2015-2019, Baltic Sea Region, Top 6, Bottom 6, EU average and Region Average



Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming).

5.4.3. The North Sea Region socio-economic landscape

Summary analysis of socio-economic disparities in the North Sea area

The North Sea region consists of some of the richest countries in the EU and the world. The region performs consistently better than the EU average when analysing socio-economic disparities indicators, however, while the difference between countries are negligible for the majority, high disparities can be seen at the intra-country level. There are only 31% of regions with a GDP per capita higher than average, with more than 55% of them experiencing unemployment rates and at-risk-of-poverty rates higher than average. This shows that there are relatively high regional disparities in terms of socio-economic performance.

Table 12 Overview of North Sea Socio-Economic Performance

North Sea basin	GDP Per Capita (EUR)	Unemployment Rate (%)	At-Risk-of Poverty (%)
Average	41,401.80	4.71	15.43
% of all regions above average	31%	37%	48%
% of all regions below average	69%	63%	52%
Top Performers	44,857 to 207,590	2.1 to 3.25	9.3 to 13.8
Above Average (scoring in the top 25%-50%)	36,803 to 44,857	3.25 to 4.3	13.8 to 14.3
Disadvantaged Performers	30,742 to 36,803	4.3 to 5.55	14.3 to 17.25
Bottom Performers	26,051 to 30,742	5.55 to 10.5	17.25 to 21.3

Source: Technopolis Group based on Eurostat.

Looking at the individual performance groups from Table 13 which is ranked in order by region, the UK has six regions in the bottom performance category, and there are five from France, four from Sweden and two from Germany. Overall, these regions performed consistently poor across the three indicators. However, interestingly three of the four Swedish regions were amongst the top performers in terms of GDP but were amongst the worst performers for at-risk poverty and unemployment.

Those who are considered disadvantaged are the regions which consistently score in the 50th to 74th percentile for unemployment rate and at-risk poverty, while for GDP per capita it is 25th to 49th. This category consists of 12 regions from the UK, four from Germany, three from the Netherlands and Sweden each and one from Norway. The three Swedish regions, three Netherlands regions and the Norwegian region all perform similarly. All of them, apart from one, are either the top performers or above average in GDP per capita. The majority of them also consistently fall in the disadvantaged category or worst performers for both unemployment rate and at-risk poverty rate, however, performing better for the indicator at-risk poverty.

All the German regions in the North Sea lighthouse area are consistently in the bottom performers for at-risk poverty, while they have mixed results in the other two indicators.

Those who are considered above average score in the 50th to 74th percentile for GDP per capita and 25th to 49th percentile for unemployment rate and at-risk poverty. It consisted of five regions from the UK, three Danish regions, Norway and the Netherlands had two regions each and Sweden had one region.

Top performing regions are those who lie in the 75th to 100th percentile for GDP and 1st to 24th percentile for unemployment and at-risk poverty. It consists of six regions from the UK, three regions each from the Netherlands and Belgium and two Danish regions. The regions are all performing consistently well across the three indicators.

Table 13 Overview of North Sea's Regions Socio-Economic Performance

Performance	Country	Region	NUTS
Bottom Performers	United Kingdom	Tees Valley and Durham	UKC1
	United Kingdom	Northumberland and Tyne and Wear	UKC2
	Germany	Mecklenburg-Vorpommern	DE80
	Sweden	Norra Mellansverige	SE31
	United Kingdom	East Yorkshire and Northern Lincolnshire	UKE1
	United Kingdom	South Yorkshire	UKE3
	France	Basse-Normandie	FRD1
	France	Haute-Normandie	FRD2
	France	Nord-Pas de Calais	FRE1
	France	Picardie	FRE2
	France	Bretagne	FRH0
	Germany	Lüneburg	DE93
	Sweden	Östra Mellansverige	SE12
	Sweden	Sydsverige	SE22
	Sweden	Mellersta Norrland	SE32
	United Kingdom	West Yorkshire	UKE4
	United Kingdom	Outer London - East and North East	UKI5
	Germany	Schleswig-Holstein	DEF0
	Netherlands	Groningen	NL11
	Sweden	Småland med öarna	SE21
	Sweden	Västsverige	SE23
Disadvantaged performers	United Kingdom	Lincolnshire	UKF3
	United Kingdom	West Central Scotland	UKM8
	Norway	Vestlandet	NO0A
	Germany	Bremen	DE50
	Germany	Hamburg	DE60
	Germany	Weser-Ems	DE94

	Netherlands	Friesland (NL)	NL12
	Sweden	Övre Norrland	SE33
	United Kingdom	North Yorkshire	UKE2
	United Kingdom	Derbyshire and Nottinghamshire	UKF1
	United Kingdom	Outer London - South	UKI6
	United Kingdom	Southern Scotland	UKM9
	Netherlands	Zuid-Holland	NL33
	United Kingdom	Outer London - West and North-West	UKI7
	United Kingdom	Kent	UKJ4
	United Kingdom	Cornwall and Isles of Scilly	UKK3
	United Kingdom	Devon	UKK4
	United Kingdom	Highlands and Islands	UKM6
Above Average	United Kingdom	Eastern Scotland	UKM7
	Norway	NO01 (Oslo)	NO08
	Norway	NO04 and NO03 (Agder og Sør-Østlandet)	NO09
	Denmark	Hovedstaden	DK01
	Denmark	Sjælland	DK02
	Denmark	Nordjylland	DK05
	Netherlands	Drenthe	NL13
	Netherlands	Flevoland	NL23
	Sweden	Stockholm	SE11
	United Kingdom	East Anglia	UKH1
	United Kingdom	Essex	UKH3
	United Kingdom	Inner London - West	UKI3
	United Kingdom	Inner London - East	UKI4
	United Kingdom	Dorset and Somerset	UKK2
Top performers	Belgium	Prov. West-Vlaanderen	BE25
	Denmark	Syddanmark	DK03
	Denmark	Midtjylland	DK04
	Netherlands	Noord-Holland	NL32
	United Kingdom	Bedfordshire and Hertfordshire	UKH2
	United Kingdom	Surrey, East and West Sussex	UKJ2
	United Kingdom	Hampshire and Isle of Wight	UKJ3
	United Kingdom	Gloucestershire, Wiltshire and Bristol/Bath area	UKK1
	United Kingdom	North Eastern Scotland	UKM5
	Belgium	Prov. Antwerpen	BE21

	Belgium	Prov. Oost-Vlaanderen	BE23
	Netherlands	Zeeland	NL34
	Netherlands	Noord-Brabant	NL41
	United Kingdom	Berkshire, Buckinghamshire and Oxfordshire	UKJ1

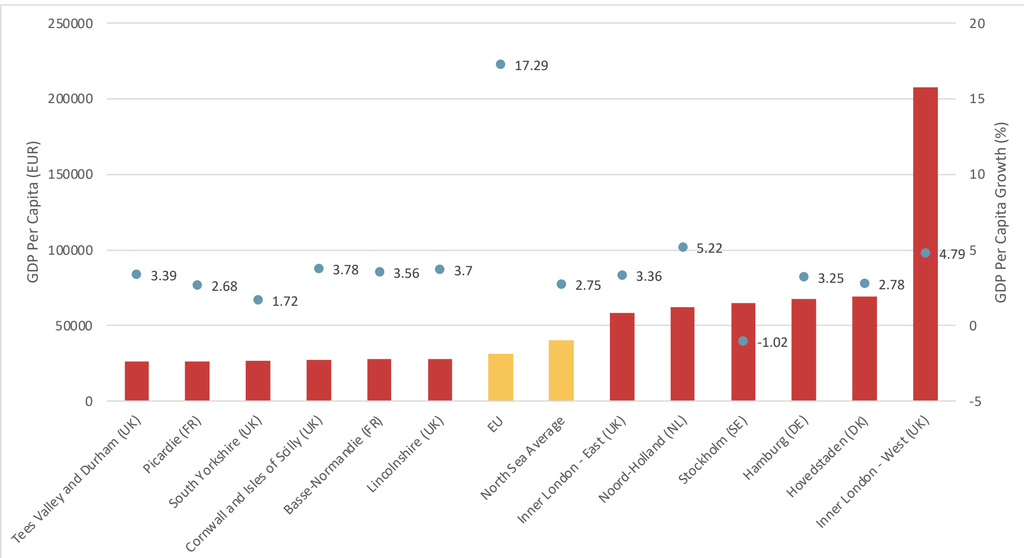
Source: Technopolis Group based on Eurostat

North Sea Region socio-economic performance by indicator

The North Sea region has a much higher average GDP per capita across NUTS 2 regions (40,156 EUR) than the EU average of 31,200 (Calculated by Technopolis Group using Eurostat). The six regions identified with the lowest GDP per capita are from France and UK, with the lowest GDP per capita reaching 26,051 EUR in the Tees Valley and Durham region in UK, well below the North Sea region average. Dutch regions perform slightly above average with (41,869 EUR) on average (Eurostat). UK regions fall around the average on (41,381 EUR), however, they do have the most regions by far, also, the region with the most GDP per capita is Inner – West London 207,590 EUR per capita. It is by far the highest GDP with the next highest being Hovedstaden (69,152 EUR).

Average GDP growth across North Sea is calculated at 2.75% for 2017-2018 with Lincolnshire in the UK experiencing the highest growth at 14.23% (Calculated by Technopolis group using Eurostat). All countries fall around the average GDP growth with the exception on Sweden which is negative.

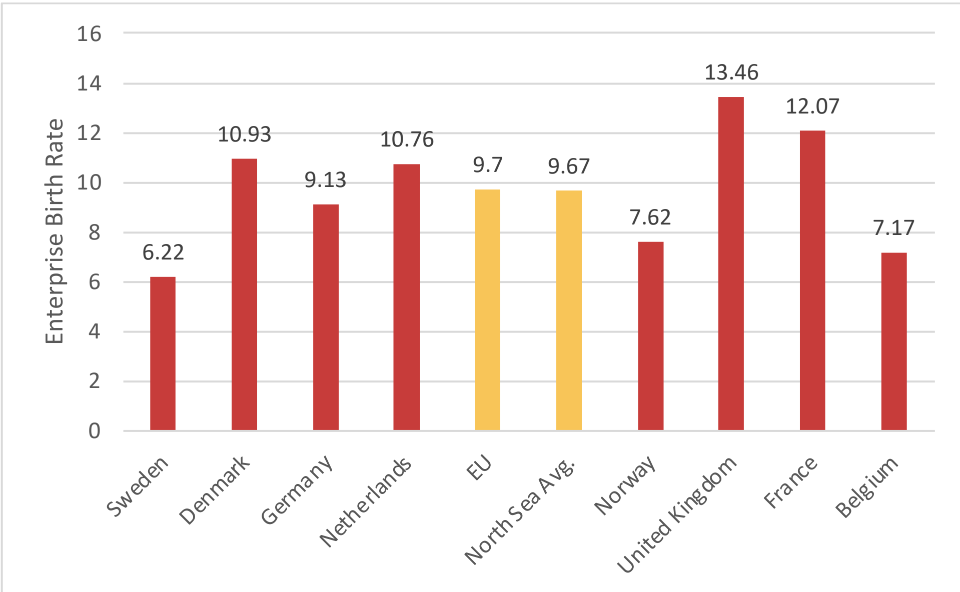
Figure 32 GDP per capita (2019) and GDP growth per capita (2017-2018), (%), North Sea region, Top 6 GDP per capita regions, bottom 6, EU average and North Sea average.



Source: Technopolis Group based on Eurostat

The United Kingdom shows entrepreneurial dynamism with the highest enterprise birth rate of any country. The city of London (6268) has nearly ten times more start-ups than any other city (Crunchbase) (see Figure 34). However, given the size and stature of London as one of the top start-up and financial sector hubs in Europe, this is not surprising. Four of the countries located at the North Sea (Denmark, Netherlands, UK and France) have an enterprise birth rate higher than the EU average (9.7%), while Germany has an enterprise birth rate slightly lower than the EU average. Sweden, Belgium, and Norway have the lowest enterprise birth rates, between 6.22 % and 7.17% respectively.

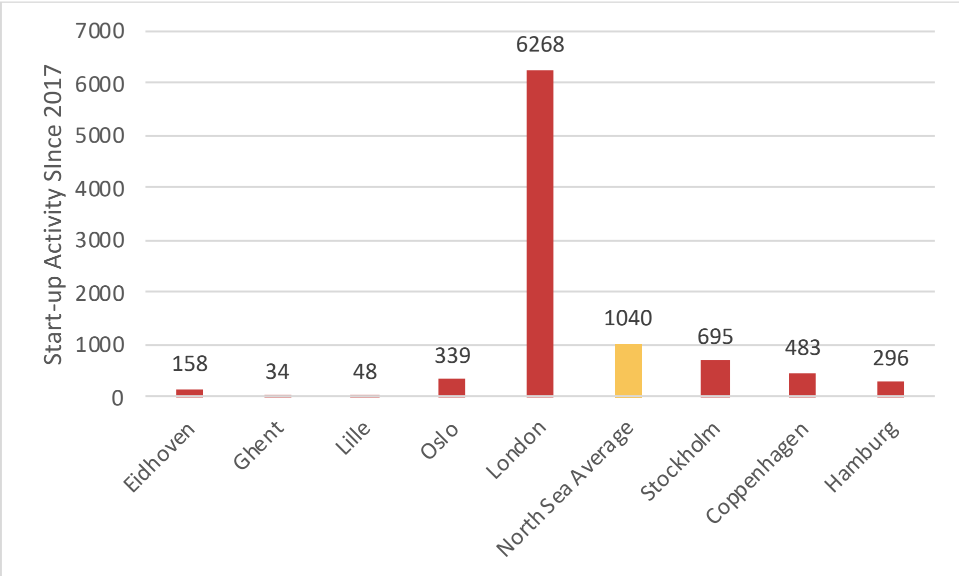
Figure 33 Enterprise Birth Rate (%). North Sea region (2020), Countries, EU average and North Sea average.



Source: Technopolis Group Based on Eurostat

Figure 34 provides an overview of the number of existing innovative start-ups identified in the major cities in the North Sea. London, Stockholm, Copenhagen, Oslo and Hamburg, together with Eindhoven seem to be the cities with the highest numbers of innovative, technology-intense start-ups. The cities of Lille and Ghent have very few start-ups in comparison to the others.

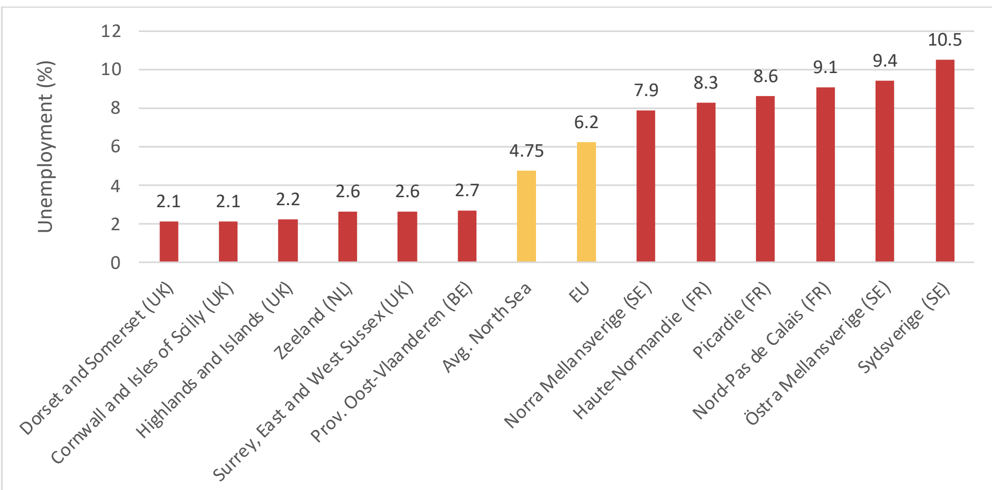
Figure 34 Number of start-ups (2017-2022), North Sea region average, selected Cities and North Sea Average



Source: Technopolis Group based on Crunchbase

Mean unemployment across the North Sea NUTS 2 regions is 4.68% which is lower than the EU average (8.4%). The figures for Belgian regions (3.33%) and the UKs regions (3.53%) are the lowest. The French regions (7.76%) and Swedish (8.06%), however, still fall below the EU average (Calculated by Technopolis group using Eurostat). France has some of the strongest patterns of unemployment with three of its five regions having some of the highest rates of unemployment in the North Sea region.

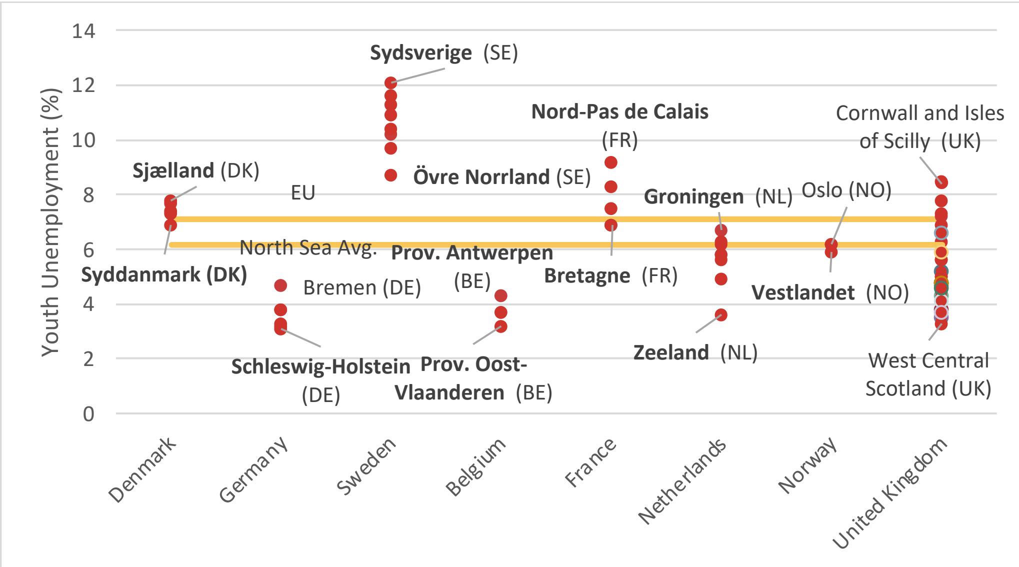
Figure 35 Unemployment Rate (%), North Sea region, top six regions, bottom six, EU average and North Sea average.



Source: Technopolis Group Based on Eurostat; UK 2018

In terms of youth unemployment, Swedish regions (topped by Sydsverige) in the North Sea area have some of the highest rates, along with French regions (topped by Nord-Pas de Calais) (Eurostat). Netherlands and Sweden both show large disparity in youth unemployment, however, the majority of the Dutch regions are below the EU and North Sea average, as seen in Figure 36. Sweden has some of the highest rates along with France (Eurostat). The UK has a wide range of values, however, they do not stay too far above the EU average. Belgian and German regions' youth unemployment levels are well below the EU average.

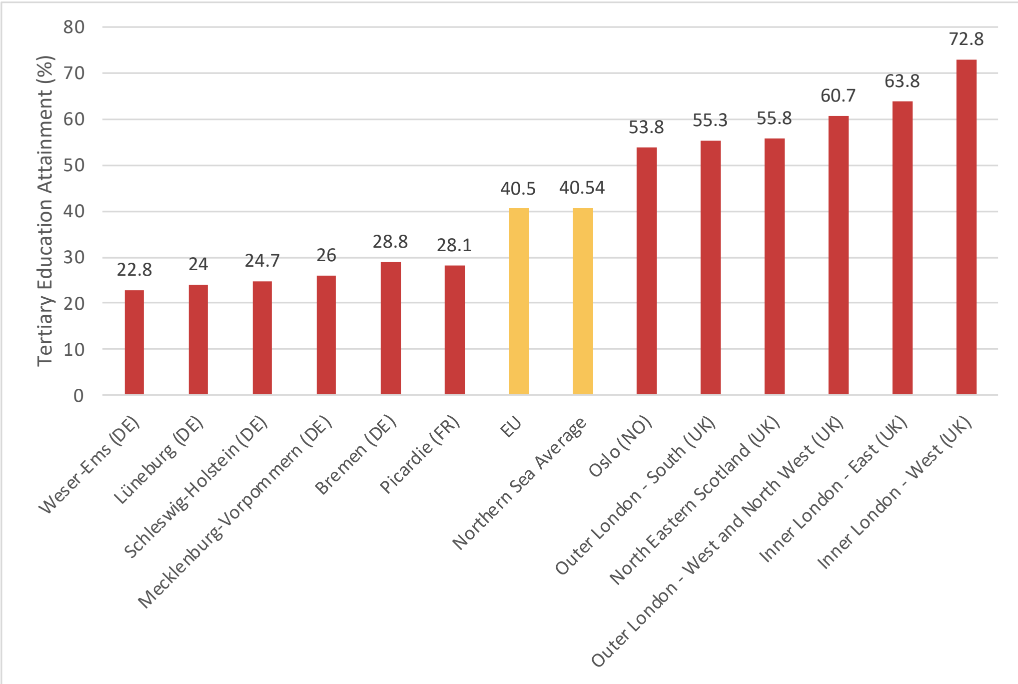
Figure 36 Youth Unemployment Rate (%), (2020) North Sea region, EU average and North Sea average.



Source: Technopolis Group based on Eurostat; UK 2019

Tertiary education attainment works out at 40.5% for the region, the same as the EU average. Inner London West has the highest education attainment (72.8%), Inner London East behind it (63.8%) an– Outer London - West and Northwest third (60.7%) (Eurostat). Although, unsurprising given the affluency and proximity to many third level institutions in London. Norwegian regions have the highest mean for tertiary education attainment with 46% while German (27%) and French have the lowest (27.8%) (Eurostat).

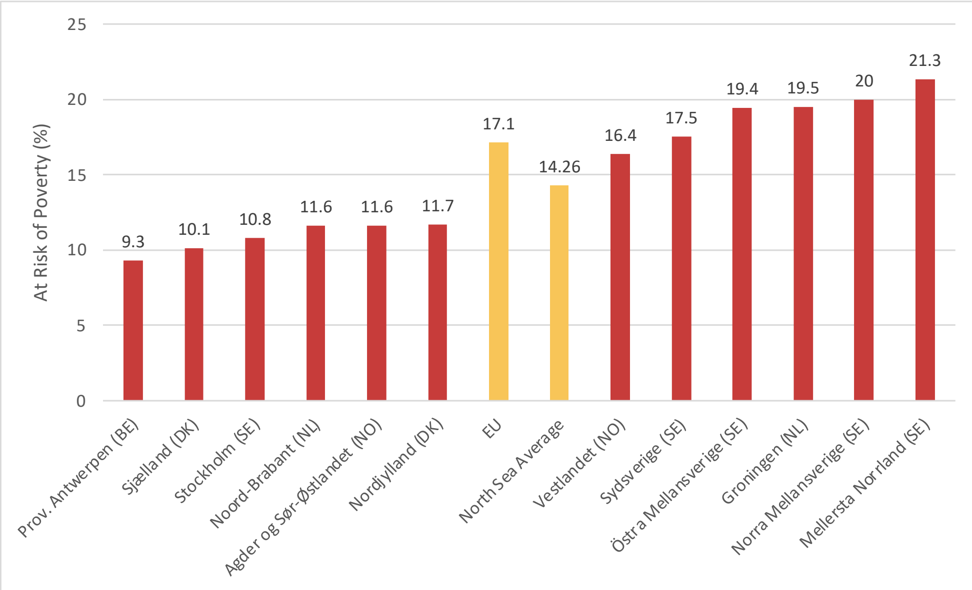
Figure 37 Tertiary Education Attainment (%), North Sea region, Top 6 regions, bottom 6, EU average and North Sea average.



Source: Technopolis Group based on Eurostat

Sweden has some of the highest rates of at-risk of poverty with four regions in the top six. However, they are not far from the EU average. Antwerp (9.3%), Belgium has the lowest at risk poverty rate, while Mellersta Norrland (21.3%) in Sweden shows almost double the amount (Eurostat).

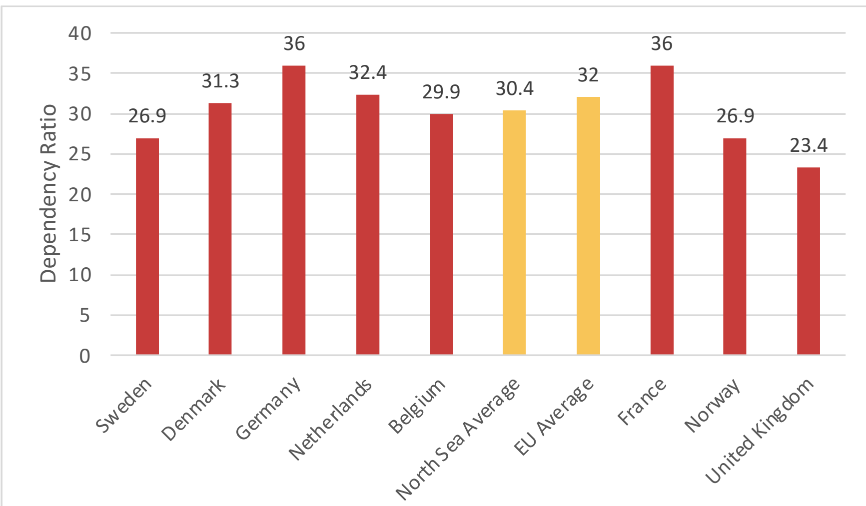
Figure 38 At Risk Poverty Rate (%), 2020 Baltic Sea region, Top 6 GDP per capita regions, bottom 6, EU average and Baltic Sea average.



Source: Technopolis Group based on Eurostat; UK 2018

It is interesting to note that for the regions within the North Sea basin, France and Germany are both slightly above average for material and social deprivation and dependency ratio, which can be seen in Figure 39. However, the majority of the regions show old-age dependency ratios of three employed persons per person aged 65 years or older, with the exception of Sweden, Norway and UK, where the ratio is closer to four employed persons per person aged 65 or older.

Figure 39 Old-age dependency Ratio (%), 2020, North Sea area



Source: Technopolis Group based on Eurostat

5.4.4. R&I landscape &performance in the North Sea Region

Summary R&I performance in the North Sea Region

On the whole, the NUTS2 regions in the North Sea show high levels of R&I intensity and are well above EU average in terms of R&I performance on the EU Regional Innovation Scoreboard (with a score of 143, higher than the Baltic Sea average score of 120). It is interesting to note that over 60% of the North Sea regions show lower inputs into R&I activities than the North Sea average (such as GERD and Human resources in Science and technology), but more than half (55%) have a higher innovation performance than the North Sea average on the RIS Scoreboard. This indicates a relatively significant level of efficiency in the North Sea regions' research and innovation systems.

Table 14 Comparative R&I performance for the Baltic Sea NUTS2 regions

North Sea	Gross R&D expenditure per inhabitant and as % of GDP (GERD)	Human resources in science and technology	Regional Innovation Scoreboard index
Average	1.87	53.62	143.23
% of all North Sea regions above average	39%	40%	55%
% of all North Sea regions below average	61%	60%	45%
Bottom Performers	0.31 to 1.2	42.2 to 48.05	85.14 to 128.62
Disadvantaged Performers	1.2 to 1.65	48.05 to 52	128.62 to 148.64
Above Average (aggregate score in the top 25% to 50%)	1.65 to 2.35	52 to 57.5	148.64 to 165.22
Top Performers	2.35 to 5.47	57.5 to 81	165.22 to 191.62

Source: Techopolis Group based on Eurostat.

Table 15 provides an overview of the level of R&I connectedness of the regions in the North Sea basin, according to the data collected. It confirms earlier findings that there are peak performers or “R&I Hubs”, which are more developed in terms of connectivity to EU networks and internal relational capital, while the majority of the regions show low performance in this sense.

Table 15 Overview of regions' connectedness to EU R&I networks and internal connectedness

	H2020 Projects	Number of patents	Number of publications	Participation in EU R&I networks and structures
Average	254.96	1511.93	17956.55	1.67
% of all North Sea regions above average	25%	33%	34%	33%
% of all North Sea regions below average	75%	67%	66%	67%
Bottom Performers	0 to 32	0 to 337	0 to 1576	0
Disadvantaged Performers	32 to 114	337 to 668	1,576 to 9,735	0
Above Average (aggregate score in the top 25% to 50%)	114 to 225	668 to 2,017	9,735 to 23,384	0 to 2
Top Performers	225 to 2,449	2,017 to 10,399	23,384 to 184,390	2 to 15

Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming).

At the individual regional level there are very diverse patterns of performance in fact, with a diversity of combinations in terms of results for R&I inputs, outputs and connectedness, especially when talking about the R&I disadvantaged areas (see Table 16).

The performers ranked at the bottom by North Sea region standards are those regions who consistently fall in the 0 to 24th percentile for the selected indicators. It consists of five UK regions, four Swedish regions, two from the Netherlands, two from Germany and one from Norway. These regions overall performed better on the innovation scoreboard. However, they consistently performed poorly on H2020 projects and publications in comparison to the other indicators.

Those who are considered disadvantaged consistently scored in the 25th to 49th percentile. It consisted of 11 regions from the UK, three from Denmark, two each from France and the Netherlands and on from Belgium:

- The UK regions performed well in regional innovation scoreboard consistently being in either the top regions or above average therefore being known as an innovative region. However, for GERD they regularly were found to be disadvantaged. For publications, patents and projects there was a mixed performance for all, however, they were never found to be in the top performers for any of the indicators.

- The three Danish and one Belgian region performed similarly. All were above average in terms patents. Three of the four regions were disadvantaged in terms of GERD, however, one Danish region was above average. In HRST the three Danish regions were among the worst performers and the Belgian region was disadvantaged. For H2020 projects two were considered disadvantaged and two were above average.

- The two French and Dutch regions performed similarly in the indicators. Three of the four regions were amongst the top performers in GERD and one was above average. For H2020 projects, patents, and publications the four regions were consistently either in the worst performers or the disadvantaged performers. In terms of regional innovation two of the regions, one from France and the Netherland each, they were among the top performers.

Regions which consistently scored in the 50^{th} to the 74^{th} percentile were considered as preforming above average. This consisted of eight regions from the UK, three from Germany, two from France and Norway each and one each from Denmark and Belgium.

The top performing regions consistently scored in 75^{th} to 100^{th} percentile. They consist of five UK regions, three Swedish, two from the Netherlands, one each from Belgium, France, Denmark and Germany. Out of the indicators, these regions scored relatively lower than for other indicators in terms of gross expenditures of GERD and in HRST and participation in EU R&I structures, while their performance is driven by outputs such as: the Regional Innovation Scoreboard Index, and the number of H2020 projects, patents and publications.

Table 16 Overview of Nort Seas Regions R&I performance.

Performances	Country	NUTS	Region
Bottom Performers	Germany	DE93	Lüneburg
	Netherlands	NL12	Friesland (NL)
	United Kingdom	UKM9	Southern Scotland
	Netherlands	NL34	Zeeland
	Sweden	SE21	Småland med öarna
	United Kingdom	UKE1	East Yorkshire and Northern Lincolnshire
	Germany	DE94	Weser-Ems
	Netherlands	NL13	Drenthe
	Sweden	SE31	Norra Mellansverige
	United Kingdom	UKI5	Outer London - East and North East
	Sweden	SE32	Mellersta Norrland
	Sweden	SE33	Övre Norrland
	United Kingdom	UKK3	Cornwall and Isles of Scilly
	Norway	NO09	NO04 and NO03 (Agder og Sør-Østlandet)
	United Kingdom	UKF3	Lincolnshire
Disadvantaged Performers	Belgium	BE25	Prov. West-Vlaanderen
	Denmark	DK02	Sjælland
	Denmark	DK03	Syddanmark

	France	FRD1	Basse-Normandie
	United Kingdom	UKC1	Tees Valley and Durham
	United Kingdom	UKF1	Derbyshire and Nottinghamshire
	United Kingdom	UKM6	Highlands and Islands
	France	FRE2	Picardie
	Netherlands	NL23	Flevoland
	Netherlands	NL41	Noord-Brabant
	United Kingdom	UKI4	Inner London - East
	United Kingdom	UKI6	Outer London - South
	United Kingdom	UKJ4	Kent
	United Kingdom	UKK2	Dorset and Somerset
	United Kingdom	UKK4	Devon
	Denmark	DK05	Nordjylland
	United Kingdom	UKE2	North Yorkshire
	United Kingdom	UKE4	West Yorkshire
	United Kingdom	UKH3	Essex
Above Average	United Kingdom	UKC2	Northumberland and Tyne and Wear
	France	FRD2	Haute-Normandie
	Germany	DE80	Mecklenburg-Vorpommern
	Germany	DEF0	Schleswig-Holstein
	Norway	NO0A	Vestlandet
	United Kingdom	UKE3	South Yorkshire
	United Kingdom	UKK1	Gloucestershire, Wiltshire and Bristol/Bath area
	United Kingdom	UKM5	North Eastern Scotland
	Germany	DE50	Bremen
	United Kingdom	UKI7	Outer London - West and North West
	Norway	NO08	NO01 (Oslo)
	United Kingdom	UKH1	East Anglia
	Netherlands	NL11	Groningen
	Belgium	BE21	Prov. Antwerpen
	France	FRE1	Nord-Pas de Calais
	Denmark	DK04	Midtjylland
	United Kingdom	UKH2	Bedfordshire and Hertfordshire
	United Kingdom	UKM8	West Central Scotland
Top Performers	United Kingdom	UKJ1	Berkshire, Buckinghamshire and Oxfordshire

	United Kingdom	UKJ2	Surrey, East and West Sussex
	United Kingdom	UKJ3	Hampshire and Isle of Wight
	United Kingdom	UKM7	Eastern Scotland
	Belgium	BE23	Prov. Oost-Vlaanderen
	Denmark	DK01	Hovedstaden
	France	FRH0	Bretagne
	Netherlands	NL33	Zuid-Holland
	Sweden	SE12	Östra Mellansverige
	United Kingdom	UKI3	Inner London - West
	Germany	DE60	Hamburg
	Netherlands	NL32	Noord-Holland
	Sweden	SE11	Stockholm
	Sweden	SE22	Sydsverige
	Sweden	SE23	Västsverige

Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming); Eurostat.

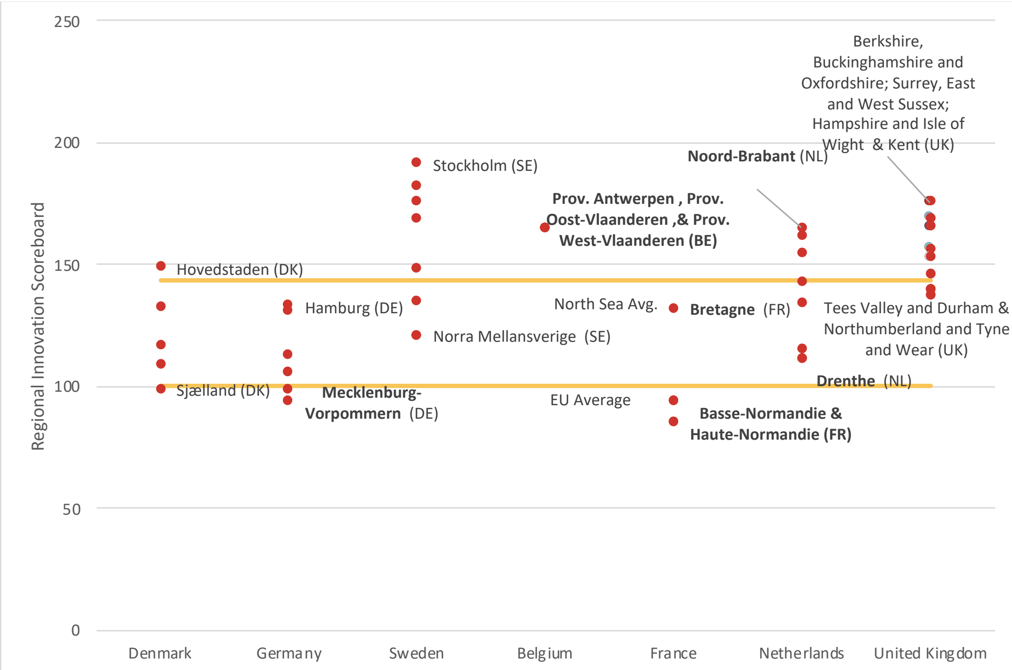
R&I Performance in the North Sea Region by indicator

The North Sea basin average regional innovation scoreboard for the NUTS 2 regions is well above the EU average (100), at 147 (Regional Innovation Scoreboard, 2021). Moreover, the majority of the regions are performing above EU average, with only a few of them obtaining a score below EU average, especially in Germany and France. This shows the high innovation potential in the regions in focus in the North Sea basin.

The United Kingdom's regions average a score of 157, with their individual scores ranging from 138 to 175. All the Belgian regions all have the same score of 165. France only has one region above the EU average, being Bretagne (131). The Netherlands is also a highly innovative country with an average of 137 amongst its regions. Noord Brabant (164) is the most innovative within the country, which contains the city of Eindhoven (Regional Innovation Scoreboard, 2021).

Danish regions all score in-between the EU and basin average and only have one region above the basin average. Germany also has no regions above the average of this basin. However, Sweden still has the most innovative region Stockholm (191) (Regional Innovation Scoreboard, 2021).

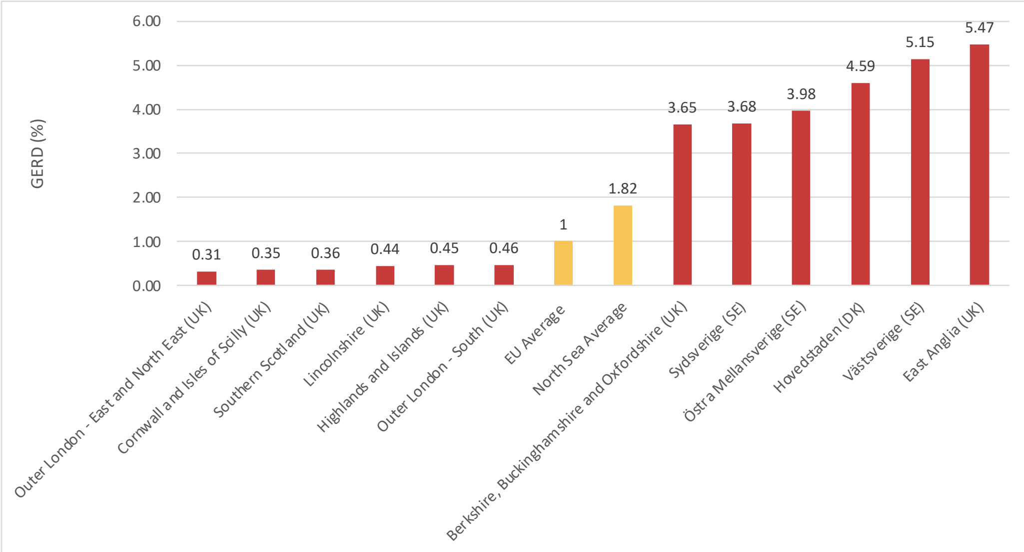
Figure 40 Index for Regional Innovation Scoreboard (2021), North Sea region, EU Average and North Sea average



Source: Technopolis Group based on European Commission, 2021

The North Sea shows high gross R&D expenditures intensity, higher than the EU average. The UK shows an interesting pattern, with two regions holding the top position in terms of Gross R&D expenditures, as the two regions with the highest expenditure in the North Sea stem from the UK and unsurprisingly hold the highly reputable universities of Oxford (Berkshire, Buckinghamshire and Oxfordshire, 3,65%) and Cambridge (East Anglia, 5.47%). However, all bottom six North Sea regions come from the UK and are less than half the EU average in all cases. Other regions with high gross R&D expenditures are Swedish (Vastsverige, Osramediansverige, Sydsverige), and Danish (Hovestaden).

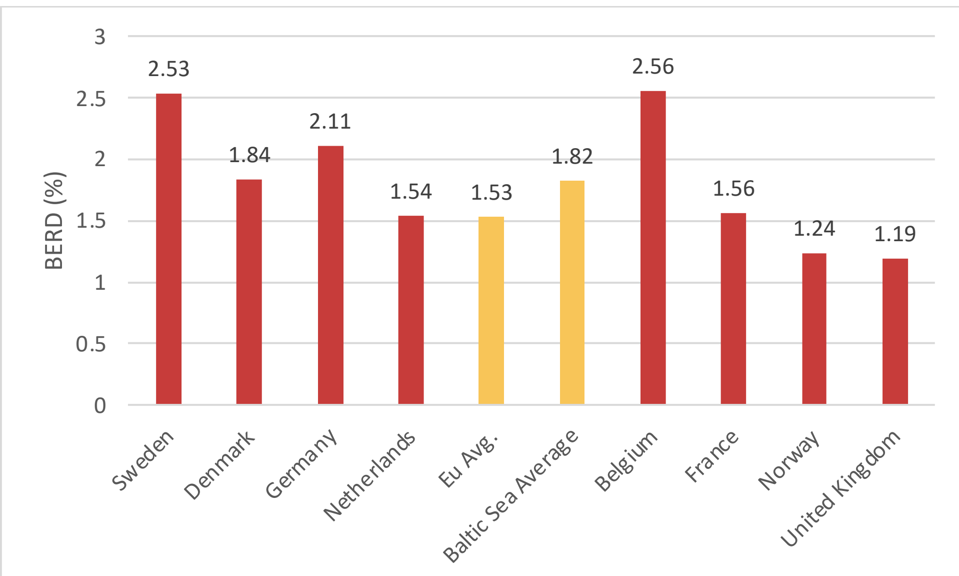
Figure 41 Gross Expenditure on R&I as % of GDP (2019), North Sea region, Top 6 regions, bottom 6, EU average and North Sea average.



Source: Technopolis based on Eurostat

Examining business expenditure at the national level in countries located at the North Sea it appears that these countries' businesses spend a higher proportion on R&I, on average (1.82%), than the rest of the EU (1.53%) (Eurostat). Almost all the countries are above the EU average however, interestingly Norway and the United Kingdom are below the EU average with the UK having the lowest expenditure as share of GDP.

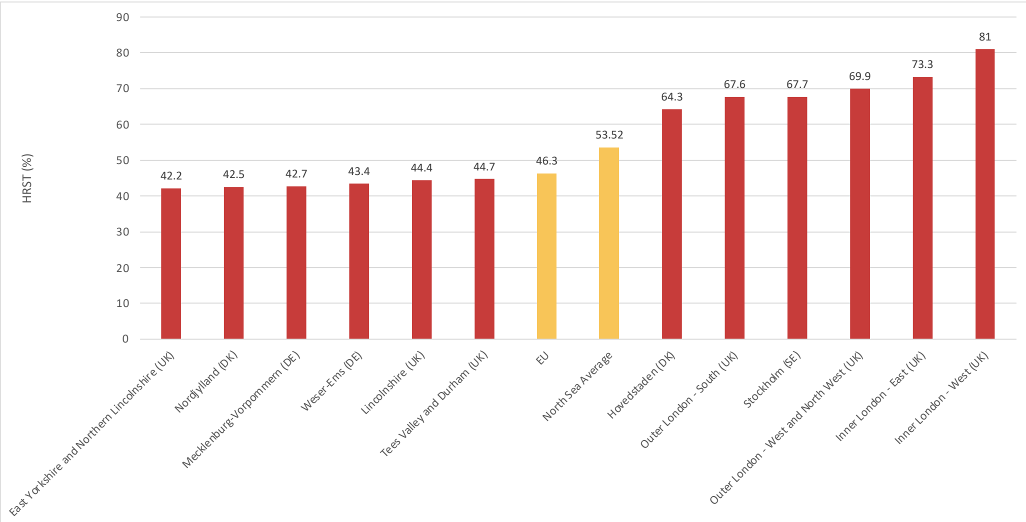
Figure 42 Business Expenditures in R&D as % of GDP, (2020), North Sea region, Countries, EU average and North Sea average.



Source: Technopolis Group by Eurostat

The North Sea (53.3%) has a much higher average than EU (46.3%) for human resources in science and technology (HRST) (Eurostat). As can be seen in Figure 43 the regions that contain cities like London, Stockholm and Copenhagen have much higher rates of HRST in comparison to those which are more rural. Nonetheless, the region with the lowest rates of HRST is still only 4 percentage points lower than EU average.

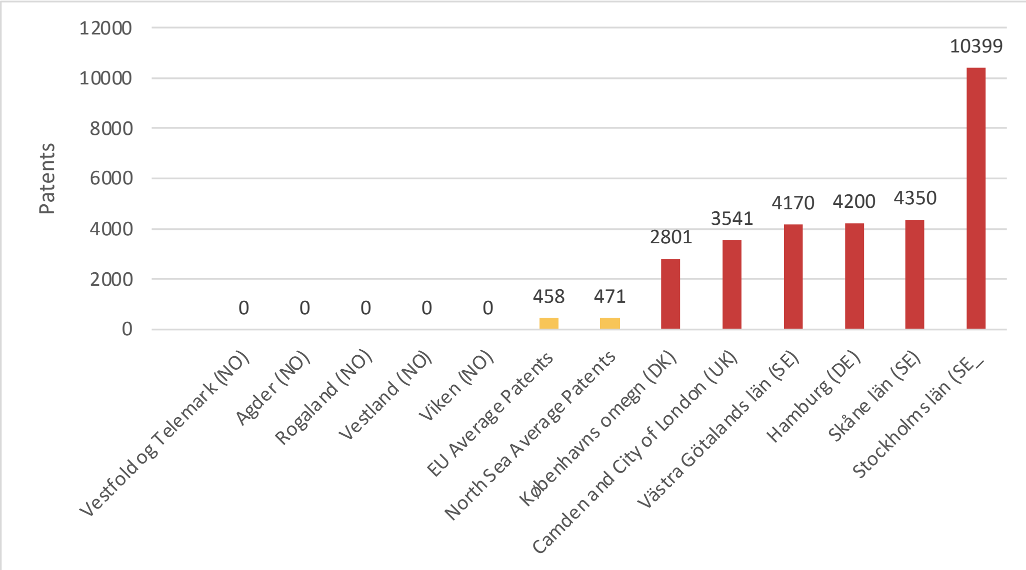
Figure 43 Human resources in science and technology as a % of Population (2019), North Sea region, Top 6 regions, bottom 6, EU average and North Sea average.



Source: Technopolis Group based on Eurostat

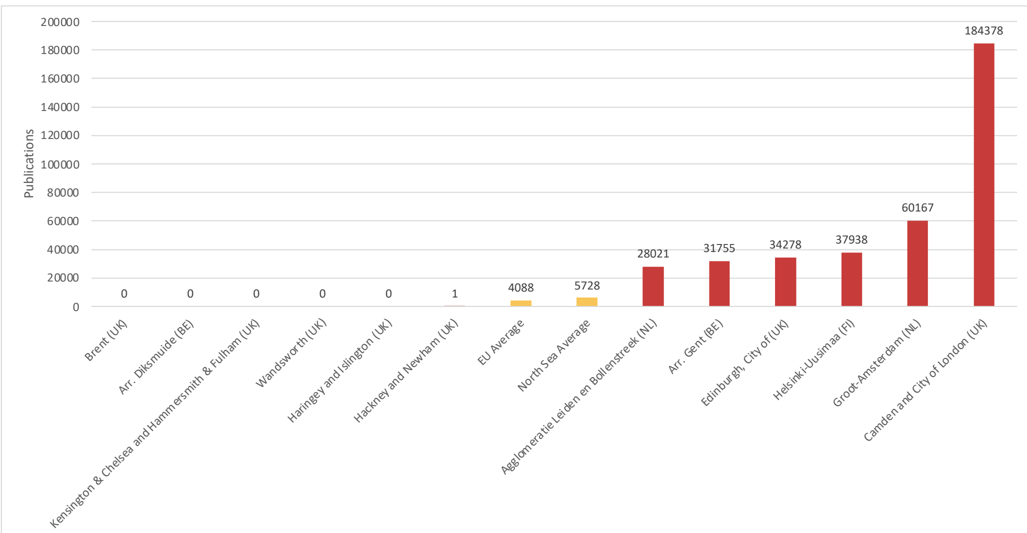
Examining research and innovation results such as patents, H2020 projects and publications, the North Sea basin performs above the EU average on every aspect. However, as it can be seen in the figures below, cities with major universities or industrial strongholds, such as: Stockholm, London, Hamburg, Copenhagen, Skane and Vastra Gotaland consistently dominate these indicators with very high numbers. At the same time, the average North Sea region performs well below these top regions (Technopolis Group based on AIT generated data, Knowledge Ecosystems project for DG RTD) (see figures below).

Figure 44 Patents (2015-2019), North Sea area, Top 6 Regions, Bottom 6 Regions, EU average and North Sea average



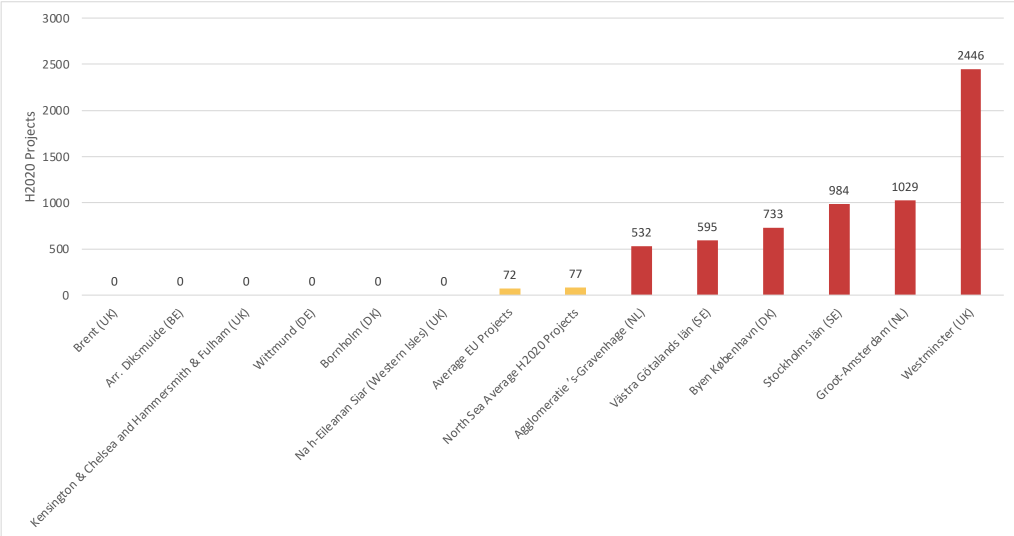
Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming).

Figure 45 Publications (2015-2019), North Sea area, Top 6 Regions, Bottom 6 regions, EU Average and North Sea average



Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming).

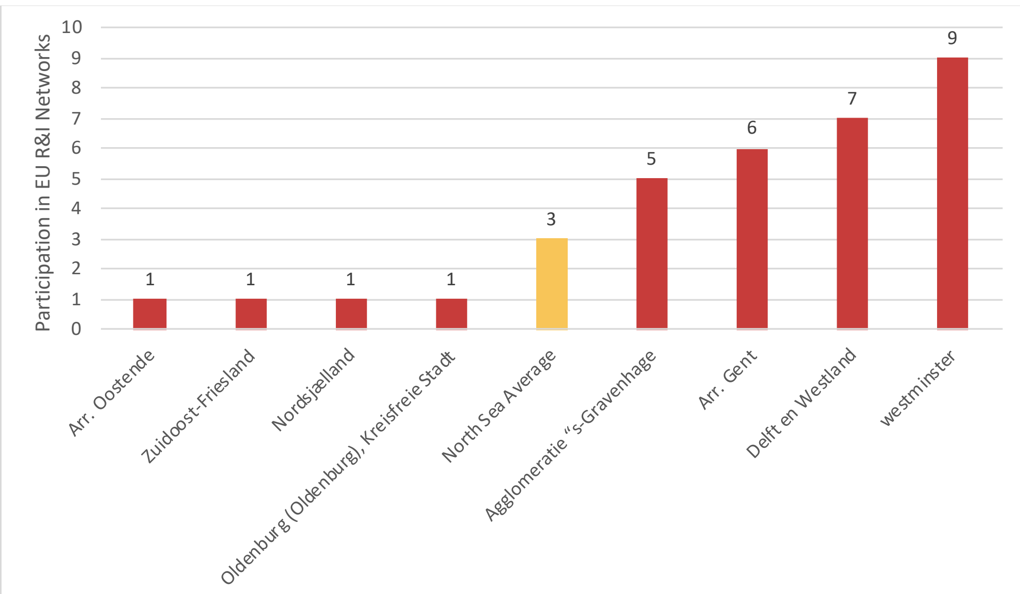
Figure 46 H2020 projects as of 2021 2020, Top 6 Regions, Bottom 6 Regions, EU Average and North Sea average



Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming).

The R&I networks for DIH and collaborative clusters are centred around cities and universities, Kent and Westminster. Similar to the Baltic Sea the North Sea regions seem to be mainly connected to the Digital Innovation Hubs network and the European Cluster Collaboration Platform.

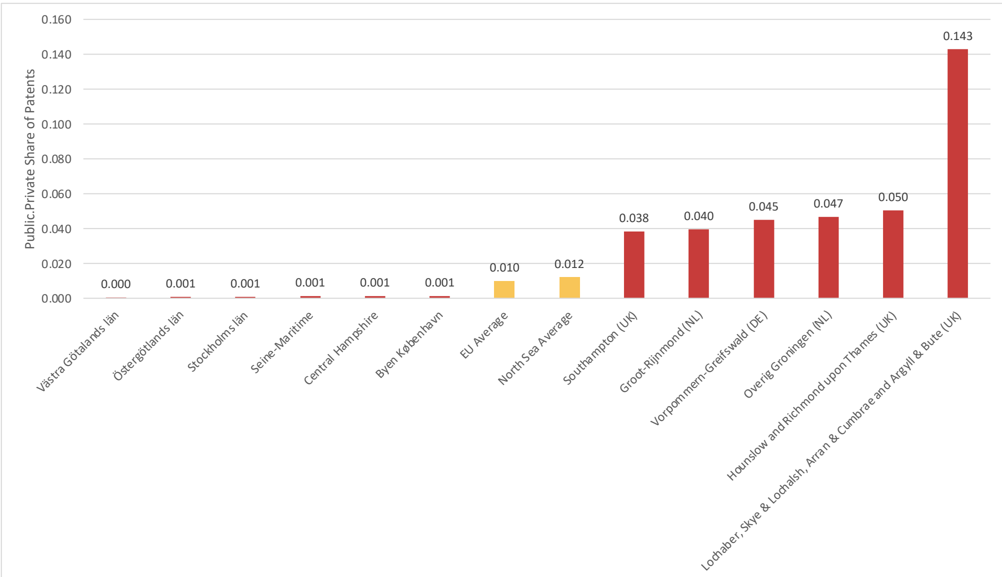
Figure 47 Participation in Cluster Collaborations and DIH, 2020, North Sea area, top 4 regions, bottom 4 regions



Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming).

The figure below shows the top six North Sea regions in terms of public-private cooperation in patenting, which is an indicator for the internal networking within the regions. It appears that four UK NUTS3 regions are the top (e.g. Lochaber, Skye & Lochalsh, Hounslow and Richmond upon Thames, Southampton), together with Dutch regions Overig Groningen and Groot-Rijnmond, and the German region of Vorpommern-Greifswald. Their performance is well above the EU and North Sea average.

Figure 48 Public-Private Share of Patents, (2015-2019), North Sea Region average, EU Average, Top 6 Regions, Bottom 6 Regions



Source: Technopolis Group based on data generated by the Austrian Institute of Technology (AIT) for DG RTD, 2021, Knowledge ecosystems in the New ERA project (publication forthcoming)

6. DEL2: Baseline

6.1. Introduction

This report constitutes the second deliverable of the Baseline study for the implementation of the lighthouse in the Baltic and North Sea basin for the Mission “Restore our ocean and waters by 2030”.

The objective of the baseline study is to comprehensively map the situation in the lighthouse areas with regards to the Mission Objective “Make the sustainable blue economy carbon-neutral and circular”. This mapping includes all relevant stakeholders, networks, governance structures and citizen engagement activities, as well as past, planned and ongoing projects. The aim of this mapping is to provide a basis for the implementation of the Mission lighthouse and the Mission Implementation Charter, which was launched on 30th June 2022.[62] Further, the aim is to establish the baseline situation in 2021 for the relevant Mission objective, against which the progress of Mission implementation can be measured (in 2025 and 2030), as foreseen in the Mission Implementation Plan.

The following six blue economy sectors were analysed to establish the baseline situation of the lighthouse areas:

- Maritime transport (with a focus on ferry transport)
- Maritime ports and facilities
- Offshore renewable energy facilities
- Offshore renewable energy storage facilities
- Multipurpose platforms, and
- Aquaculture.

Based on the data that could be identified and analysed, a set of indicators has been proposed for monitoring the development of the lighthouse areas.

Table 17 below presents how each thematic area relates to the Mission Objective.

Table 17 Relation between the six thematic areas, the underlying objectives, and the targets of the lighthouse areas Baltic Sea and North Sea basin

Mission Objective	Specific Mission target	Mission Objective Outcomes	Thematic area	Area Number

[62] https://research-and-innovation.ec.europa.eu/events/upcoming-events/charter-mission-restore-our-ocean-and-waters-2030-2022-06-30_en

Make the sustainable blue economy carbon-neutral and circular	Eliminate greenhouse gas emissions from maritime economic activities in the EU and sequester those emissions that cannot be avoided (net zero maritime emissions)	Deployment of zero emission (i.e., zero carbon and zero pollution, noise included) marine technologies and solutions	Maritime transport	1
		Deployment of zero emission (i.e., zero carbon and zero pollution, noise included) marine technologies and solutions	Maritime ports & facilities	2
		Battery, hydrogen, or ammonia propelled ferries (calling at ports of seven different countries)	Maritime transport	1
		Emission reduction technological solutions for renewables, ports, and infrastructure	Maritime ports & facilities	2
		Cost-effective solutions for setting up fully circular, zero pollution offshore clean energy facilities	Offshore RE facilities	3
			Offshore RE storage	4
	Develop zero-carbon and low-impact aquaculture, and promote circular, low carbon multi-purpose use of marine and water space.	Applied solutions for multi-use of water space	Multipurpose platforms	5
		Zero-carbon and toxin-free aquaculture/algae production compatible with vulnerable marine ecosystems	Aquaculture	6

For each of the six thematic areas, a summary has been developed of current and past EU funded projects (INTERREG, Horizon, HELCOM, and LIFE) that are relevant to the respective thematic areas.

The summary is complementary to the Excel database of all projects that contribute to the thematic areas in the lighthouse area (Deliverable 3). The database provides key information on project descriptions, -outputs, and -results, geographical focus, project duration, funding amount, and project partners. The relevant projects have been identified through several steps:

The team made use of this database by first screening the project databases of the respective funds using the following keywords:63 "ferry", "ferries", "fuel", "port", "renewable", "wind", "ocean", "tidal", "storage", "offshore", "multi-use", "multiuse", "multi-purpose", "multipurpose", and "aquaculture". This resulted in more than 1,000 projects.

These were then screened in a second step for their relevance to any of the six thematic areas, based on their project title and project description.

Finally, projects that were not directly focused on the seas were excluded. The final list comprises 158 projects in the database.

Based on the baseline situation and the summary of past and current projects, recommendations have been developed for the Baltic Sea and North Sea lighthouses on how funding can be focused to help close existing gaps in each thematic area.

6.1.1. Geographical Delimitations

Before presenting detailed illustration of the baseline situation below, this report first proposes how the lighthouse areas of the Baltic Sea and North Sea could be defined, and provides alternative geographical definitions.

Table 18 and Table 19 below present the geographical extent of both lighthouse areas, which builds on the HELCOM Baltic Sea definition [64] and on the OSPAR Greater North Sea definition[65]. The table below presents the definition of these areas by NUTS 2 regions. Four regions belong to both sea basins: Southern Denmark, Sealand (of Denmark), the capital region of Denmark, and Schleswig Holstein in Germany. Furthermore, one Swedish region is part of the North Sea, while the rest of the country is part of the Baltic Sea basin.

The geographical delineation differs, if one considers the geographical scope of the EU INTERREG B programmes, which are programmes to promote transnational cooperation.[66] Most relevant in this respect are the Baltic Sea and North Sea programmes, which have larger geographical scopes than the lighthouse area definition. In case of the Baltic Sea, all of Norway would be within the lighthouse area, as well as the German regions Berlin and Brandenburg. The North Sea programme has a comparably smaller geographical extent than the lighthouse area, in which limited parts of the Netherlands, Belgium, and the United Kingdom are included. Lastly, the North West Europe programme partially overlaps with the southern regions of the North Sea lighthouse area, i.e. Flevoland (NL), Noord-Holland (NL), Zuid-Holland (NL), Zeeland (NL), Prov. Oost-Vlaanderen (BE), and several regions along the East coast of the UK.

European macroregional strategies (MRS) are strategic fora to address regional development and economic issues on a macroregional level.[67] Currently, there are four

---

[63] INTERREG: https://keep.eu/; HORIZON: https://cordis.europa.eu/; HELCOM: https://helcom.fi/helcom-at-work/projects/; LIFE: https://webgate.ec.europa.eu/life/publicWebsite/index.cfm

[64] https://helcom.fi/about-us/contracting-parties/

[65] https://www.ospar.org/convention/the-north-east-atlantic/ii

[66] https://interreg.eu/list-of-programmes/

[67] https://ec.europa.eu/regional_policy/en/policy/cooperation/macro-regional-strategies

MRS: in the Baltic Sea region, the Alpine space, the Adriatic-Ionian Region, and the Danube region. For the lighthouse areas of the Baltic Sea and North Sea, only the EU Strategy for the Baltic Sea Region (EUSBSR) is relevant. The table below presents the geographical extent of the EUSBSR, which is the same as for the INTERREG Baltic Sea programme excluding non-EU countries.

Table 18 Geographical extent of the lighthouse area by NUTS 2 regions, and their participation in INTERREG B programmes and Macroregional Strategies

Country	NUTS 2 code	NUTS 2 Region	Lighthouse	INTERREG B			Macro-regional Strategy
				North Sea	Baltic Sea	North West Europe	
BE	BE21	Prov. Antwerpen	North				
BE	BE23	Prov. Oost-Vlaanderen	North	x		x	
BE	BE25	Prov. West-Vlaanderen	North				
DE	DE50	Bremen	North	x	x		EUSBSR
DE	DE60	Hamburg	North	x	x		EUSBSR
DE	DE80	Mecklenburg-Vorpommern	Baltic		x		EUSBSR
DE	DE93	Lüneburg	North	x	x		EUSBSR
DE	DE94	Weser-Ems	North	x	x		EUSBSR
DE	DEF0	Schleswig-Holstein	Both	x	x		EUSBSR
DK	DK01	Hovedstaden	Both	x	x		EUSBSR
DK	DK02	Sjælland	Both	x	x		EUSBSR
DK	DK03	Syddanmark	Both	x	x		EUSBSR
DK	DK04	Midtjylland	North	x	x		EUSBSR
DK	DK05	Nordjylland	North	x	x		EUSBSR
EE	EE00	Eesti	Baltic		x		EUSBSR
FI	FI19	Länsi-Suomi	Baltic	x	x		EUSBSR
FI	FI1B	Helsinki-Uusimaa	Baltic	x	x		EUSBSR
FI	FI1C	Etelä-Suomi	Baltic	x	x		EUSBSR
FI	FI1D	Pohjois- ja Itä-Suomi	Baltic	x	x		EUSBSR
FI	FI20	Åland	Baltic		x		EUSBSR
FR	FRD1	Basse-Normandie	North			x	
FR	FRD2	Haute-Normandie	North			x	
FR	FRE1	Nord-Pas de Calais	North			x	
FR	FRE2	Picardie	North			x	
FR	FRH0	Bretagne	North			x	
LT	LT02	Vidurio ir vakarų Lietuvos regionas	Baltic		x		EUSBSR
LV	LV00	Latvija	Baltic		x		EUSBSR
NL	NL11	Groningen	North	x			
NL	NL12	Friesland (NL)	North	x			
NL	NL13	Drenthe	North	x			
NL	NL23	Flevoland	North	x		x	
NL	NL32	Noord-Holland	North	x		x	

NL	NL33	Zuid-Holland	North	x		x	
NL	NL34	Zeeland	North	x		x	
NL	NL41	Noord-Brabant	North			x	
PL	PL42	Zachodniopomorskie	Baltic		x		EUSBSR
PL	PL62	Warmińsko-mazurskie	Baltic		x		EUSBSR
PL	PL63	Pomorskie	Baltic		x		EUSBSR
SE	SE11	Stockholm	Baltic		x		EUSBSR
SE	SE12	Östra Mellansverige	Baltic		x		EUSBSR
SE	SE21	Småland med öarna	Baltic		x		EUSBSR
SE	SE22	Sydsverige	Baltic		x		EUSBSR
SE	SE23	Västsverige	North		x		EUSBSR
SE	SE31	Norra Mellansverige	Baltic		x		EUSBSR
SE	SE32	Mellersta Norrland	Baltic		x		EUSBSR
SE	SE33	Övre Norrland	Baltic		x		EUSBSR
Outside of the EU							
NO	NO08	Oslo og Viken	North	x	x		
NO	NO09	Agder og Sør-Østlandet	North	x	x		
NO	NO0A	Vestlandet	North	x	x		
UK	UKC1	Tees Valley and Durham	North	x		x	
UK	UKC2	Northumberland and Tyne and Wear	North	x		x	
UK	UKE1	East Yorkshire and Northern Lincolnshire	North	x		x	
UK	UKE2	North Yorkshire	North	x		x	
UK	UKE3	South Yorkshire	North	x		x	
UK	UKE4	West Yorkshire	North	x		x	
UK	UKF1	Derbyshire and Nottinghamshire	North	x		x	
UK	UKF3	Lincolnshire	North	x		x	
UK	UKH1	East Anglia	North	x		x	
UK	UKH2	Bedfordshire and Hertfordshire	North			x	
UK	UKH3	Essex	North	x		x	
UK	UKI3	Inner London — West	North			x	
UK	UKI4	Inner London — East	North			x	
UK	UKI5	Outer London — East and North East	North			x	
UK	UKI6	Outer London — South	North			x	
UK	UKI7	Outer London — West and North West	North			x	
UK	UKJ1	Berkshire, Buckinghamshire and Oxfordshire	North			x	
UK	UKJ2	Surrey, East and West Sussex	North			x	
UK	UKJ3	Hampshire and Isle of Wight	North			x	
UK	UKJ4	Kent	North	x		x	
UK	UKK1	Gloucestershire, Wiltshire and Bristol/Bath area	North			x	
UK	UKK2	Dorset and Somerset	North			x	

UK	UKK3	Cornwall and Isles of Scilly	North			x	
UK	UKK4	Devon	North			x	
UK	UKM5	North Eastern Scotland	North	x		x	
UK	UKM6	Highlands and Islands	North	x		x	
UK	UKM7	Eastern Scotland	North	x		x	
UK	UKM8	West Central Scotland	North			x	
UK	UKM9	Southern Scotland	North			x	

Source: HELCOM, OSPAR, INTERREG, DG REGIO, Baltic Sea Region

Table 19 below presents the participation of regions located in the lighthouse areas in other strategic regional fora as well as the status of the adoption of Maritime Spatial Plans. The Conference of Peripheral Maritime Regions (CPMR) is a forum for maritime regions that acts as a think tank and lobby organisation for its member regions.[68] The CPMR is divided into several Commissions based on the EU sea basins: Atlantic Arc Commission, Balkan & Black Sea Commission, Intermediterranean Commission, Islands Commission, Baltic Sea Commission, and North Sea Commission. Only the latter two Commissions fall within the scope of the lighthouse areas. The associated member regions are presented in the table below.

The consortium of the Baltic and North Sea Coordination and Support Action (BANOS CSA) was a research and innovation action for EU Member States and non-EU countries in the Baltic Sea and North Sea, funded under H2020, which officially ended in 2021.[69] The objective of BANOS was to develop EU and national policies and strategies with a particular focus on the Blue Economy. The table below presents the countries that were part of the BANOS consortium, which is similar in scope to the lighthouse areas as defined by HELCOM and OSPAR, with the exception of Finland.[70]

Maritime spatial planning is a key tool in ensuring an efficient, safe, and sustainable management of the European Seas and Oceans.[71] In accordance with the EU Maritime Spatial Planning Directive, all Member States must establish maritime spatial plans by 2021. The table below presents the status of the maritime spatial plans in the lighthouse region, where it can be seen that the adoption of maritime spatial plans is still outstanding in several Member States.[72] Figure 49 and Figure 50, below this table, show the geographical extent of the Maritime Spatial Planning regions and their adoption status.

---

[68] https://cpmr.org/who-we-are/

[69] https://www.banoscsa.org/

[70] Membership was on a national level

[71] https://ec.europa.eu/oceans-and-fisheries/ocean/blue-economy/maritime-spatial-planning_en

[72] https://maritime-spatial-planning.ec.europa.eu/msp-practice/countries

Table 19 Geographical extent of the lighthouse area by NUTS 2 regions, and their participation in the CMPR and BANOS, as well as adoption status of Maritime Spatial Plans on the national level.

Country	NUTS 2 code	NUTS 2 Region	Light house	CPMR	MSP region	BANOS
BE	BE21	Prov. Antwerpen	North	North Sea		
BE	BE23	Prov. Oost-Vlaanderen	North	North Sea	Adopted	x
BE	BE25	Prov. West-Vlaanderen	North	North Sea		
DE	DE50	Bremen	North	North Sea	Adopted	x
DE	DE60	Hamburg	North		Adopted	x
DE	DE80	Mecklenburg-Vorpommern	Baltic	Baltic Sea	Adopted	x
DE	DE93	Lüneburg	North	North Sea	Adopted	x
DE	DE94	Weser-Ems	North	North Sea	Adopted	x
DE	DEF0	Schleswig-Holstein	Both	North Sea	Adopted	x
DK	DK01	Hovedstaden	Both		Forthcoming	x
DK	DK02	Sjælland	Both		Forthcoming	x
DK	DK03	Syddanmark	Both	North Sea	Forthcoming	x
DK	DK04	Midtjylland	North	North Sea	Forthcoming	x
DK	DK05	Nordjylland	North	North Sea	Forthcoming	x
EE	EE00	Eesti	Baltic	Baltic Sea	Regional only, National Plan forthcoming	x
FI	FI19	Länsi-Suomi	Baltic		Regional only, National Plan forthcoming	
FI	FI1B	Helsinki-Uusimaa	Baltic		Regional only, National Plan forthcoming	
FI	FI1C	Etelä-Suomi	Baltic		Regional only, National Plan forthcoming	
FI	FI1D	Pohjois- ja Itä-Suomi	Baltic		Regional only, National Plan forthcoming	
FI	FI20	Åland	Baltic		Regional only, National Plan forthcoming	
FR	FRD1	Basse-Normandie	North		Forthcoming	x
FR	FRD2	Haute-Normandie	North		Forthcoming	x
FR	FRE1	Nord-Pas de Calais	North		Forthcoming	x

FR	FRE2	Picardie	North		Forthcoming	x
FR	FRH0	Bretagne	North		Forthcoming	x
LT	LT02	Vidurio ir vakarų Lietuvos regionas	Baltic		Adopted	x
LV	LV00	Latvija	Baltic		Adopted	x
NL	NL11	Groningen	North	North Sea	Adopted	x
NL	NL12	Friesland (NL)	North		Adopted	x
NL	NL13	Drenthe	North		Adopted	x
NL	NL23	Flevoland	North	North Sea	Adopted	x
NL	NL32	Noord-Holland	North	North Sea	Adopted	x
NL	NL33	Zuid-Holland	North	North Sea	Adopted	x
NL	NL34	Zeeland	North	North Sea	Adopted	x
NL	NL41	Noord-Brabant	North		Adopted	x
PL	PL42	Zachodniopomorskie	Baltic		Forthcoming	x
PL	PL62	Warmińsko-mazurskie	Baltic		Forthcoming	x
PL	PL63	Pomorskie	Baltic		Forthcoming	x
SE	SE11	Stockholm	Baltic	Baltic Sea	Forthcoming	x
SE	SE12	Östra Mellansverige	Baltic		Forthcoming	x
SE	SE21	Småland med öarna	Baltic	Baltic Sea	Forthcoming	x
SE	SE22	Sydsverige	Baltic		Forthcoming	x
SE	SE23	Västsverige	North	North Sea	Forthcoming	x
SE	SE31	Norra Mellansverige	Baltic	Baltic Sea	Forthcoming	x
SE	SE32	Mellersta Norrland	Baltic	Baltic Sea	Forthcoming	x
SE	SE33	Övre Norrland	Baltic	Baltic Sea	Forthcoming	x
Outside of the EU						
NO	NO08	Oslo og Viken	North			x
NO	NO09	Agder og Sør-Østlandet	North	North Sea		x
NO	NO0A	Vestlandet	North	North Sea		x
UK	UKC1	Tees Valley and Durham	North		Adopted	x
UK	UKC2	Northumberland and Tyne and Wear	North		Adopted	x
UK	UKE1	East Yorkshire and Northern Lincolnshire	North		Adopted	x
UK	UKE2	North Yorkshire	North		Adopted	x
UK	UKE3	South Yorkshire	North		Adopted	x
UK	UKE4	West Yorkshire	North		Adopted	x
UK	UKF1	Derbyshire and Nottinghamshire	North		Adopted	x
UK	UKF3	Lincolnshire	North		Adopted	x
UK	UKH1	East Anglia	North		Adopted	x
UK	UKH2	Bedfordshire and Hertfordshire	North		Adopted	x
UK	UKH3	Essex	North		Adopted	x
UK	UKI3	Inner London — West	North		Adopted	x
UK	UKI4	Inner London — East	North		Adopted	x
UK	UKI5	Outer London — East and North East	North		Adopted	x
UK	UKI6	Outer London — South	North		Adopted	x
UK	UKI7	Outer London — West and North West	North		Adopted	x
UK	UKJ1	Berkshire, Buckinghamshire and	North		Adopted	x

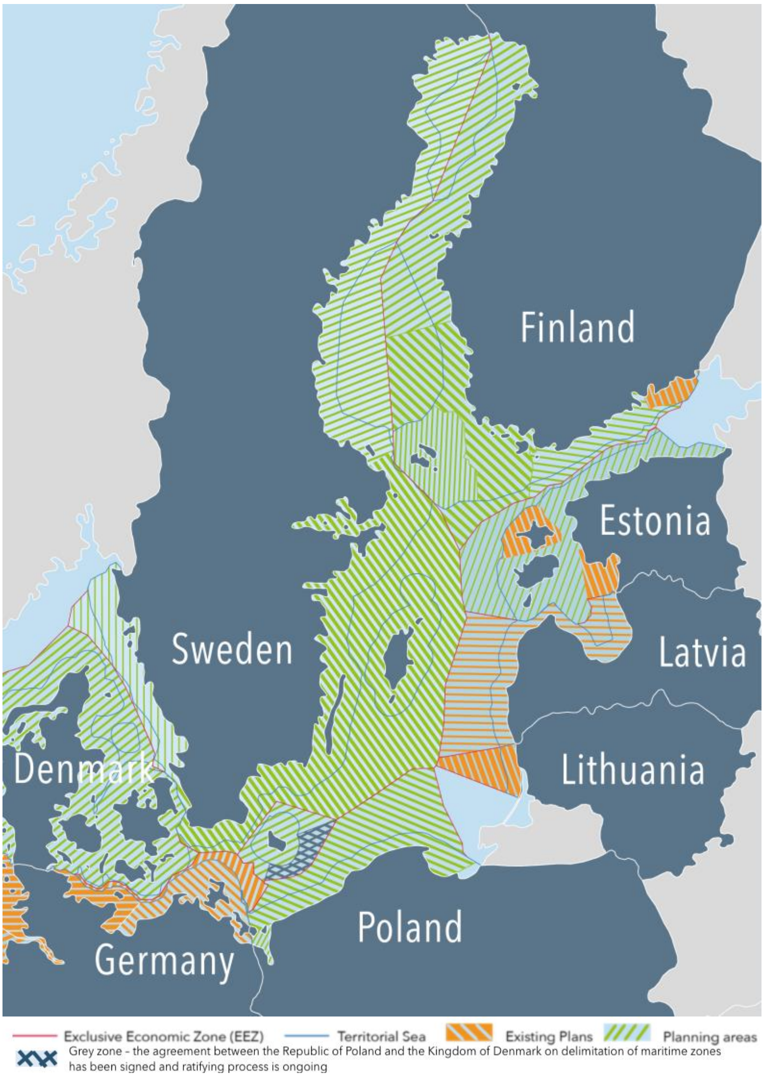
		Oxfordshire				
UK	UKJ2	Surrey, East and West Sussex	North		Adopted	x
UK	UKJ3	Hampshire and Isle of Wight	North		Adopted	x
UK	UKJ4	Kent	North		Adopted	x
UK	UKK1	Gloucestershire, Wiltshire and Bristol/Bath area	North		Adopted	x
UK	UKK2	Dorset and Somerset	North		Adopted	x
UK	UKK3	Cornwall and Isles of Scilly	North		Adopted	x
UK	UKK4	Devon	North		Adopted	x
UK	UKM5	North Eastern Scotland	North	North Sea	Adopted	x
UK	UKM6	Highlands and Islands	North	North Sea	Adopted	x
UK	UKM7	Eastern Scotland	North	North Sea	Adopted	x
UK	UKM8	West Central Scotland	North	North Sea	Adopted	x
UK	UKM9	Southern Scotland	North	North Sea	Adopted	x

Source: HELCOM, OSPAR, CPMR-North Sea, CPMR-Baltic Sea, BANOS CSA

Figure 49 and Figure 50 below each present an overview of Maritime Spatial Planning regions in the Baltic Sea and North Sea, respectively. The figures do not, however, reflect the planning status, as all Maritime Spatial Plans (MSPs) are currently in the process of being adopted. In line with the latest progress report on the implementation of the MSP Directive, all MSPs in both lighthouse areas were expected to be adopted by the end of 2022.[73]

[73] Report from the Commission to the European Parliament and the Council outlining the progress made in implementing Directive 2014/89/EU establishing a framework for maritime spatial planning, COM/2022/185 final

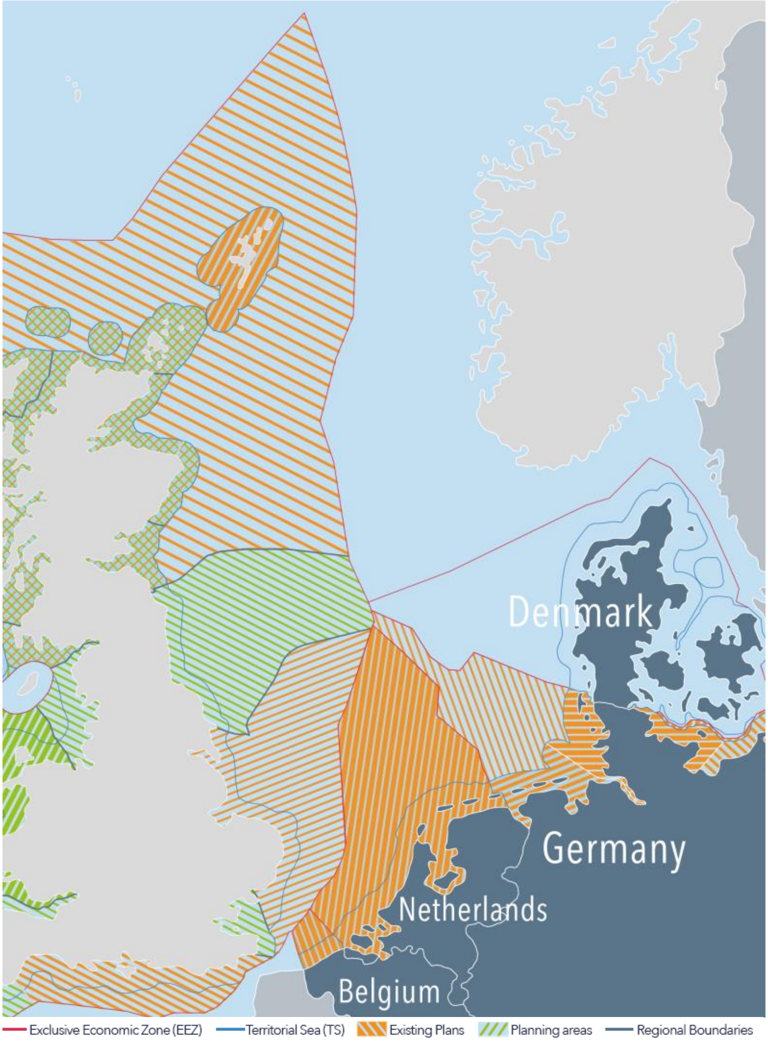
Figure 49: Maritime Spatial Planning regions in the Baltic Sea



Source: European MSP Platform, accessed: 20th June 2022

Figure 50 below presents an overview over Maritime Spatial Planning regions in the North Sea.

Figure 50: Maritime Spatial Planning regions in the North Sea



Source: European MSP Platform, accessed 20th June 2022

The preceding analysis of different typologies to delineate the Baltic Sea and North Sea lighthouse areas has shown that the geographical definitions by HELCOM and OSPAR respectively, provide a scope that largely aligns with the established regional cooperation fora (i.e. HELCOM, OSPAR, INTERREG, BANOS). Furthermore, such a delineation also ensures that non-EU, cooperation countries, which are also key in promoting the Blue Economy, fall within the geographical scope (such as Norway and the United Kingdom). Accordingly, it can be concluded that a delineation of the lighthouse area as per HELCOM and OSPAR is appropriate.

6.2. Thematic Area 1: Maritime Transport

6.2.1. Baseline situation

Introduction

Maritime transport is an important driver for economic growth across the EU, by for instance, connecting islands and peripheral areas with the mainland. Maritime transport is also a significant source of global emissions, corresponding to 2.9%[74] of anthropogenic CO_2. Ships sailing to and from EU ports accounted for approximately 140 Mt CO_2 in 2020.[75] Overall, maritime transport (including inland) accounted for 13.5% of EU transport emissions in 2018.[76] Due to the growth of global trade and, consequently shipping activities, emissions are expected to increase further in the long term. It is estimated that, in a business-as-usual scenario, the global GHG emissions from shipping will increase by 50% until 2050 (compared to 2018).[77] In addition to the GHG emissions, shipping is a source of other harmful pollutants and biological agents, and thus, the reduction of environmental impacts remains an important objective for the sector.[78]

In line with the European Green Deal and the Climate Law, the EU aims to become the first climate neutral continent by 2050. To reach this ambition, all sectors, including maritime transport, will need to contribute. To reduce the emissions from maritime transport, the European Commission (EC) proposed measures alongside the measures agreed upon by the International Maritime Organisation (IMO). These include the inclusion of maritime shipping in the European Emission Trading System (ETS), an initiative to boost the demand for sustainable alternative fuels (FuelEU Maritime), and the revision of existing directives on energy taxation, alternative fuel infrastructures, and renewable energy.

Deployment of zero emissions marine technologies, fuels, and their supporting infrastructure will play a crucial role in decarbonising maritime transport. There are different types of alternative fuels and propulsion systems that can support decarbonisation of the maritime transport, including batteries/electricity, ammonia, methanol, hydrogen, biofuels, and Power to X (PtX).[79] However, many of these fuels are in the early development phase and there is much uncertainty around which fuels will prevail. For example, the FuelEU Maritime initiative examines the market barriers that hamper use of alternative fuels and the

---

74 IMO, 2020, Fourth IMO Greenhouse Gas Study, MEPC 75/7/15, https://docs.imo.org/Shared/Download.aspx?did=125134

75 According to EMSA, ships over 5000 GT emitted 141 Mt GHG in 2020. This figure excludes fishing vessels, offshore support vessels as well as smaller ships, so the total emissions are higher. See: https://mrv.emsa.europa.eu/#public/emission-report

76 EMSA and EEA, 2021, European Maritime Transport Environmental Report, 2021

77 IMO, 2020, Fourth IMO Greenhouse Gas Study, MEPC 75/7/15, https://docs.imo.org/Shared/Download.aspx?did=125134

78 EMSA and EEA, 2021, European Maritime Transport Environmental Report, 2021

79 Power to X (PtX) is a technology that use different renewable energy sources and CO_2 to produce other fuel types such as liquid fuels. For the maritime industry, methane, methanol and ammonia could be PtX fuels.

uncertainty around the market readiness for alternative fuels.[80] Some propulsion systems, such as batteries, are more feasible for specific vessels on short distances. Wind-powered propulsion, such as rotor sails, is an alternative propulsion form which is experiencing growing interest in the sector.[81] This is exemplified by the fact that one of the analysed ferry routes operates an LNG vessel that is supported by a rotor sail.[82]

This chapter analyses the baseline situation in relation to the mission objective: *Make the sustainable blue economy carbon-neutral and circular*, focusing on the maritime transport in the two lighthouse areas: the Baltic Sea and the North Sea. Particularly, the focus is on the state of decarbonisation of ferries in the lighthouse areas. In this context, "ferries" are understood as roll-on/roll-off (Ro-Ro) vessels capable of transporting wheeled cargo and passengers, used for scheduled or regular transport of passengers and cargo and vehicles between ports in the lighthouse area. As ferries are often operated on scheduled routes, with frequent access to ports, and over shorter distances (short-sea shipping), they present higher decarbonisation potential in the medium term compared to deep-sea shipping. This is due to the availability of alternative propulsion systems such as batteries for short-sea shipping.

State of the ferry fleet & the use of alternative fuels

Baltic Sea

According to HELCOM (2018), there were 295,000 visits to ports in the Baltic Sea region in 2015, with almost half of these visits (46%) being passenger ships.[83] This is because of the frequency of ferry transport across the region and relatively short distances between the ports. Similarly, passenger ships (18%) and Ro-Pax[84](41%) made more than half of all port calls in the EU, with 46% of all calls made by vessels engaged exclusively in domestic travel (such as ferries operating between ports in the same country).[85] Most passengers were transported to and from main ports in Denmark, Sweden, and Germany, see

80 European Commission, 2020, CO2 emissions from shipping – encouraging the use of low-carbon fuels. See: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12312-FuelEU-Maritime-

81 https://www.weforum.org/agenda/2020/12/swedish-firm-wind-powered-cargo-ships

82 https://www.vikingline.com/the-group/viking-line/vessels/ms-viking-grace/rotor-sail/

83 HELCOM, 2018, MARITIME ACTIVITIES in the Baltic Sea, BALTIC SEA ENVIRONMENT PROCEEDINGS NO.152

84 Ro-ro ships also referred as roll-on/roll-off ships are designed to carry wheeled cargo, such as automobiles. If they carry more than 12 passengers in addition to vehicles, they are called Ro-Pax vessels. Definition is adopted from the COM SWD on EU Passenger Ship Safety Legislation Fitness Check: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52015SC0197&from=RO

85 EMSA and EEA, 2021, European Maritime Transport Environmental Report, 2021

Table 20.

Table 20 Passengers transported to/from main ports per country (excluding cruise passengers, in thousand)

Countries	2017	2018	2019	2020
EU-27 (from 2020)	211,277	220,106	220,413	120,036
Denmark*	30,532	30,881	31,105	19,109
Sweden	29,635	29,429	29,146	13,229
Germany*	19,944	19,680	20,158	10,530
Finland	18,844	18,564	18,521	7,006
Estonia	12,314	12,255	12,332	6,307
Poland	2,167	2,230	2,279	1,662
Latvia	953	1,017	1,032	435
Lithuania	297	323	343	308

Source: Eurostat (2021)* Denmark & Germany cover both Baltic Sea and North Sea ports.

In terms of the number of ships operating in the Baltic Sea, only 6% (425 vessels) of the IMO registered ships were passenger ships (while 68% were cargo ships) in 2015, as many ferries make multiple trips per day.[86] The main ports in the Baltic Sea, in terms of number of passengers, are: Helsinki (FI), Stockholm (SE), Tallinn (EE), Trelleborg (SE), Aeroskobing (DK), Puttgarden (DE), Ysted (SE), Rostock (DE), Goteborg (SE), Svendborg (DK), Malmo (SE), Gedser (DK), Rodby (DK), Faergehavn (DK), Ronne (DK), Swinoujscie (PL), Turku (FI), Travemunde (DE), Naantali (FI), Mariehamn (FI), Gdynia (PL), Frederikshavn (DK), Karlskrona (SE), and Kappellskar (SE).

The age of the vessels can be an important element in the decarbonisation process, as older vessels tend to be less efficient and exert more pressure on the environment. The information on the age of ferry fleets is only available at the EU level and not per sea basin. Looking at the average age per ship type (registered under EU Member State flag), Ro-Pax ships are among the oldest ships with an average age of 26 years.[87] It is evident however, that several Ro-Pax ships have been retrofitted to extend their lifetime through various retrofitting programmes.

In terms of alternative fuels, **electricity** is the preferred option for increasing numbers of ferries, especially on shorter routes. Electricity is often used in connection with operations in port, while berthing to reduce emissions. Battery powered ferries are used on shorter routes and often in combination with other propellants (marine diesel), i.e., hybrid vessels. In June 2022, there were 427 battery vessels globally, of which slightly less than half (188) were car or passenger ferries. Approximately half of the 427 battery vessels (not limited to ferries) were hybrid vessels.[88]

---

[86] HELCOM, 2018, MARITIME ACTIVITIES in the Baltic Sea, BALTIC SEA ENVIRONMENT PROCEEDINGS NO.152, 2018

[87] EMSA and EEA, 2021, European Maritime Transport Environmental Report, 2021

[88] European Alternative Fuels Observatory, accessed on 31-01-2021, https://www.eafo.eu/shipping-transport/seagoing-vessels/electric-hybrid/electric-hybrids-ships

The battery powered ferries were identified on the following ferries and their routes in the Baltic Sea:

- Fully electric ferry Ellen on Ærø island (DK- with Horizon 2020 support)
- Hybrid ferry Stena Jutlandica on Frederikshavn (DK) - Gothenburg (SE)
- 2 ForSea's hybrid ferries on Helsingør (DK) - Helsingborg (SE)
- 4 hybrid ferries on Rostock (DE) - Gedser (DK)
- Electric ferry within Stockholm (SE)
- FinFerries' Elektra hybrid ferry operating in the Turku Archipelago (FI)
- Tõll hybrid ferry operating on Virtsu-Kuivastu (EE).

Ferries using alternative fuels were identified in Sweden, Denmark, Finland, Germany, and Estonia. No ferries using alternative fuels were operating in Lithuania and Latvia.[89]

Compared to the North Sea area, there are fewer electric ferries operating in the Baltic Sea. This is because of the high share of total electric ferries are operating in Norway, which is a pioneer in electrifying ferry transport (see next section on the North Sea).

In addition to the ferries already in operation, some operators are planning to expand their fleet with electric vessels. For example, Finnlines announced their New building Programme (500 EUR mio), which will add three hybrid Ro-Ro vessels to their fleet in 2022. They will also add two "eco-friendly" Superstar Ro-Pax vessels in 2023 which will employ, among other sustainable technologies, hydrodynamic propulsion, links to alternative onshore energy, as well as use lithium-ion batteries on board.[90] As another example, in a recent green ferry subsidy program, projects for ten Danish full-electric ferries and one hybrid ferry received support.[91] Some electric ferries are supported by wind assisted propulsion technology (such as the Rotor Sail Solution) to further reduce their emissions and improve their energy efficiency. This is the case for two hybrid ferries operating between Rostock (DE) and Gedser (DK).[92] The Viking Line between Turku and Stockholm was the first ship to be fitted with a rotor sail in 2018.

---

[89] In terms of alternative fuels in other countries in the Baltic Sea region, i.e. Poland, the data from national authorities have not yet been received, while the mapping of the main routes did not point to any electric vessels operating in those countries.

[90] Finnlines, accessed on 31-01-2021, https://www.finnlines.com/company/new-vessels

[91] Danish Transport Ministry, 2021, 11 danske indenrigsfærger får tilskud til grøn omstilling, https://www.trm.dk/nyheder/2021/11-danske-indenrigsfaerger-faar-tilskud-til-groen-omstilling

[92] Offshore-Energy, accessed on 31-01-202, https://www.offshore-energy.biz/scandlines-hybrid-ferry-to-get-norsepowers-rotor-sail/ ; https://www.offshore-energy.biz/scandlines-another-hybrid-ferry-to-get-norsepower-rotor-sail/

Another alternative fuel used is **LNG**, which is currently the most common alternative fuel for shipping vessels. Even though LNG is a fossil fuel, it has slightly lower CO_2 emissions than traditional marine diesel oil, albeit with slightly higher methane emissions, making its overall GHG emissions marginally lower.[93] The use of LNG presents further potential for shifting to bio-LNG, which is a renewable and cleaner variant of LNG sourced from biomass. The switch from LNG to bio-LNG requires no further investment in the vessel. LNG also significantly reduces SO_2 emissions, which makes it relevant for many vessels operating in the Baltic and North Sea. Both these areas are Sulphur Emission Control Areas (SECAs) which set limits on SO_x emissions. Despite its obvious benefits in comparison to marine diesel, LNG is one step along the process to widespread use of e-gas, which has long-term scalability.

Despite the aforementioned advantages of LNG, LNG ferries are less common than battery propelled ferries in the EU. In May 2020, there were 225 LNG vessels globally (both new and converted), of which 39 were car or passenger ferries. In Europe (excl. Norway), there were 67 LNG vessels, of which 7 were car or passenger ferries. In Norway, there were 65 LNG vessels, of which 23 were car or passenger ferries.

LNG powered ferries were identified on the following ferry routes in the Baltic Sea:

- LNG powered passenger ferry between Stockholm (SE) and Turku (FI)
- 2 LNG powered MySTAR & Megastar ferries on Helsinki (FI) – Tallinn (EE)
- LNG ferry Nils Holgersen on Lübeck /Travemünde (DE) – Trelleborg (SE)
- LNG and biogas powered Aurora Botnia ferry on Vaasa (FI) – Umeå (SE)
- LNG ferry on Langnas (SE) – Stockholm (SE)
- LNG ferry Prinsesse Isabella on domestic route in DK between the mainland (Jutland) and the island Samsø.

In terms of other alternative fuels such as methanol, ammonia, and hydrogen in the Baltic Sea, only a few vessels that use these fuels are either in operation or in piloting and demonstration phases. For example, a large Ro-Pax ferry, Stena Germanica, was converted to methanol fuel and is currently operating between Gothenburg (Sweden) and Kiel (Germany). Sweden is currently working on the first large scale hydrogen concept vessel for passengers and freight, which is expected to be ordered in 2025.94 Biofuels, another alternative fuel, are currently used as an additive to the main fuel (drop-in) and their usage is limited. Biofuels can be a sustainable alternative, but their potentially adverse environmental impact, their availability at sustainable amounts in the long term, and the

[93] Although LNG's real-world GHG benefits are highly dependent on the rates of methane leakage within the LNG supply chain (fuel production, storage, transportation, bunkering) and "methane slip", literature suggests that NOx emissions are reduced by approximately 80–85% compared to the use of heavy fuel oil (HFO)/marine diesel oil (MDO), SOx emissions, particulate matter (PM) production are almost eliminated, whereas GHG emissions are reduced by 25% (e.g. Spoof-Tuomo and Niemi, Clean Technol. 2020, 2, 34–52; doi:10.3390/cleantechnol2010004)

[94] Hydrogen-Central, accessed on 31-01-2022, https://hydrogen-central.com/gotland-horizon-large-scale-hydrogen-powered-vessel-passengers-freight/

substantially higher costs (particularly more sustainable biofuels), potential competition with food production and use in multiple sectors (i.e. road transport and aviation) generates some concerns in the sector.95

North Sea

The North Sea is the shipping region with the second highest level of traffic in the world with 7,600 ships passing through its main areas annually. The ports of Rotterdam, Antwerp and Hamburg are three of the busiest ports in the world and are located in the North Sea.96

Table 21: All maritime passengers to and from ports in the North Sea (excluding cruise passengers, in thousand).

Country	2017	2018	2019	2020
Norway*	6,242	6,167	6,365	1,893
United Kingdom*	22,354	22,409	21,250	-
Denmark**	30.532	30.881	31.105	19.109
Germany**	19.944	19.680	20.158	10.530
Netherlands	1,928	1,980	2,010	967
France*	21,268	21,697	20,649	8,334
Belgium	316	327	307	40

Source: Eurostat, https://ec.europa.eu/eurostat/databrowser/view/mar_mp_am_cft/default/table?lang=en *The UK, France and Norway do not have differentiated data between the North Sea and the rest bordering another body of water. ** Denmark and Germany cover both the Baltic and North Sea basins.

The North Sea ferry fleet has a relatively high share of green ferries with several LNG-fuelled Ro-Pax ferries operating out of Norway alongside a growing electric ferry market.[97] The Norwegian electric and alternative fuel ferry fleet is quite significant with 49 electric ferries currently in operation, 24 which will become operational in 2022, and 10 that are planned for after 2022. Several of the ferries in operation are hybrid and some are electric and hydrogen fuelled. It is also worth mentioning that the UK government announced that all new ships should be zero-emission capable from 2025 onwards. In Scotland, hybrid ships were found to reduce emissions by 38% in comparison to traditionally-fuelled vehicles of the same size.[98] The first Danish electric ferry in the North Sea basin was put into operation in the fall of 2021. No electric ferries already in operation in the North Sea were

---

[95] Tan, Eric C. D., Kylee Harris, Stephen Tifft, Darlene Steward, and Chris Kinchin. 2021. Adoption of Biofuels for the Marine Shipping Industry: A Long-Term Price and Scalability Assessment. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5100-78237. https://www.nrel.gov/docs/fy21osti/78237.pdf.

[96] Interreg North Sea Region, n.a, Transnational Maritime Spatial Planning in the North Sea: The Shipping Context , https://northsearegion.eu/media/4836/northsee_finalshippingreport.pdf

[97] European Parliament, 2016, Research for TRAN Committee - The EU Maritime Transport System: Focus on Ferries, https://www.europarl.europa.eu/RegData/etudes/STUD/2016/573423/IPOL_STU(2016)573423_EN.pdf

[98] CLEAN ENERGY FOR EU ISLANDS, 2020, Decarbonising maritime transport, Off-grid Scottish Islands, https://www.euislands.eu/sites/default/files/EUIslands_ScottishIslands_DecarbonisingBoats.pdf

identified for Germany, the Netherlands or Belgium, but some plans for electric ferries are underway for 2022.[99]

Key projects related to the decarbonisation of ferries illustrate the ways in which the North Sea is moving towards decarbonisation as well as Blue Growth. These projects are spread out across the lighthouse area and are related to ship conversion to alternative fuels.

Table 22 Overview of key projects on decarbonisation in the North Sea

Project	Country	Technology	Description
H2SHIPS	The Netherlands	Hydrogen	The H2SHIPS project has many objectives that will be delivered jointly by the project partners. A key aim is to develop a hydrogen storage and bunkering system based on solid borohydrides as a hydrogen carrier.
Future of The Fjords	Norway	Hybrid or fully electric	Installing zero-emission sightseeing 'ferries' in the Norwegian fjords.
Ammonia as Fuel	Norway	Ammonia as blended fuel	Pilot in Norway to test whether there is a possibility to utilize ammonia as a blended fuel for a particular vessel in Oslo.
HySeas Project	United Kingdom (Scotland)	Hydrogen from renewable sources	The project is aiming to market the world's first sea-going hydrogen-powered Ro-Pax ferry alongside a business model for European islands
NAVAIS Project	The Netherlands	Efficiency in ships	Studying different ships through a creation of a digital-twin and assessing low impact environmental performance e.g. discharges to air and water, underwater radiated noise and cost-benefit aspects.

Ferry routes & their decarbonization

Baltic Sea

Nowadays, many vessels are equipped with AIS technology which allows for tracking the movements of those vessels. Using AIS technology, it is possible to identify the routes used most frequently by passenger vessels in the Baltic Sea.[100] Figure 51 presents the passenger traffic intensity in the Baltic Sea in 2020, where the most frequently used routes in terms of ship movements are illustrated by the width of the lines. The most used routes include among others:

- Tallin - Helsinki/Espoo, Stockholm – Riga, Stockholm – Mariehamn/Turku, Nynashamn – Ventspils, Klaipeda – Kiel, Klaipeda – Karlshamm, Rostock – Klaipėda;
- Ystad – Rønne, Ystad – Świnoujście, Trelleborg – Świnoujście; Gdynia – Karlskrona, Trelleborg – Rostock, Rostock – Gedser, Lübeck/Travemünde - Trelleborg;

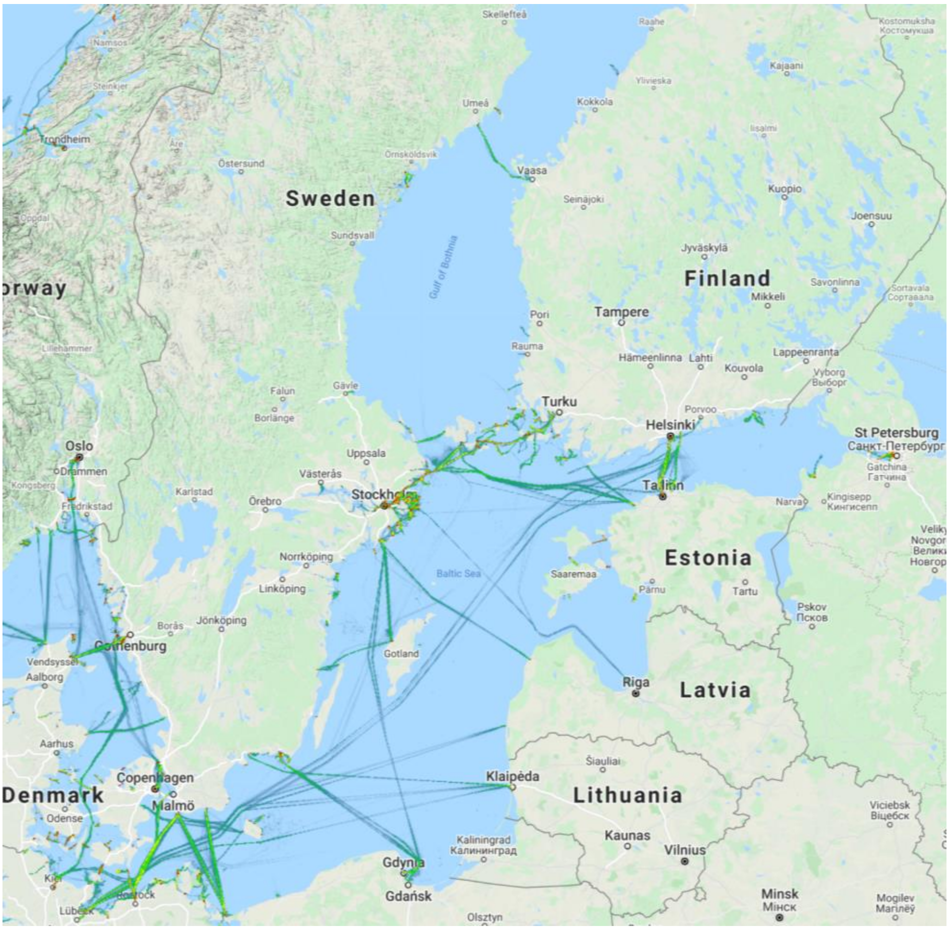
[99] https://www.dnv.com/services/alternative-fuels-insight-128171

[100] In this case, it is not specified whether the passenger vessels only include ferry ships or also cruise and other types of passenger vessels.

- Kiel – Gothenburg, Frederikshavn - Gothenburg;
- Puttgarden – Rødby, Grenaa – Halmstad, Helsingborg – Helsingør, Aarhus - Sjællands Odde.

In addition, there are also a number of domestic routes with high frequency of use, such as Bojden - Fynshav, Svendborg - Aeroskoping and many short distance routes where the ferries run several times per hour. For local ferries and shorter connections, there are data gaps exist as they are often privately owned and the data is not publicly shared by the companies operating the ferries.

Figure 51 Passenger traffic intensity in the Baltic Sea (2020)



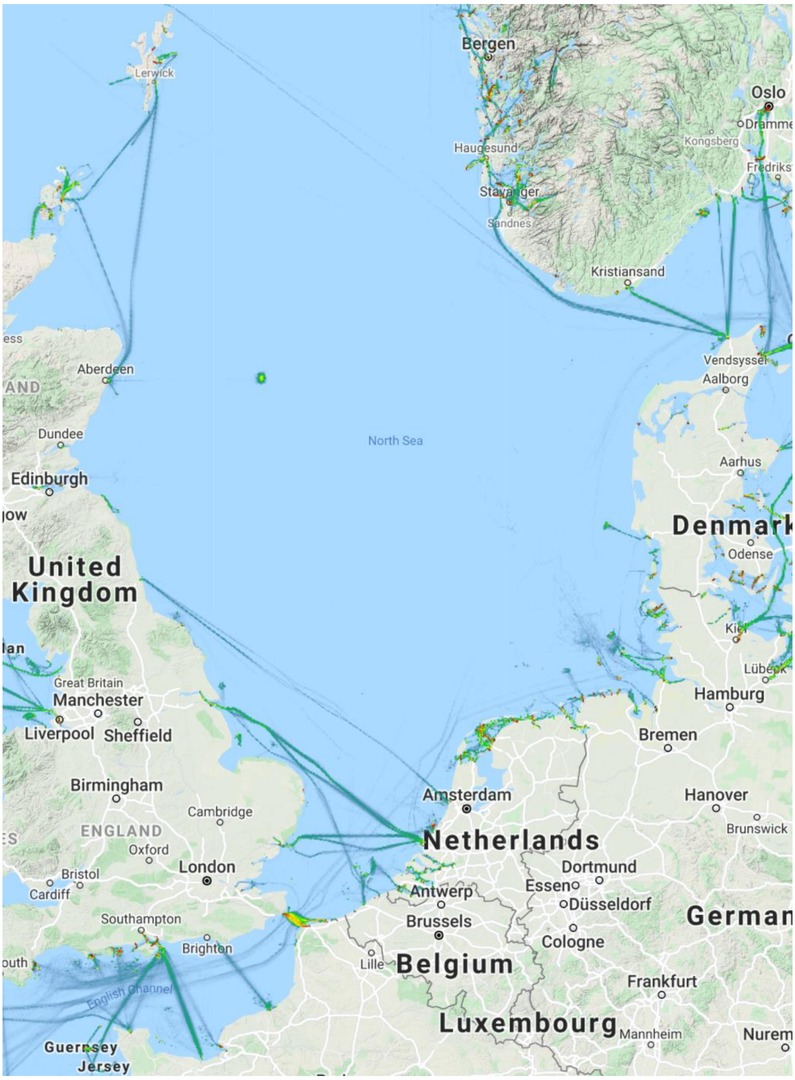
Source: EMODNET, 2020 Passenger AIS Shipping density, available: https://www.emodnet-humanactivities.eu/view-data.php

North Sea

Using the AIS map as well as data from the main ferry operators, it is possible to identify the main long-distance routes in the North Sea. For local ferries and shorter connections, there are some data gaps persist as they are often publicly owned. The routes between the northern part of Denmark to Norway are among the most frequented across international lines, which is consistent with data collected by the ferry companies. Hirsthals in Denmark has routes to Kristiansand, Bergen, Larvik, Stavanger in Norway. From the Netherlands the main international connections are ferries running from Amsterdam, Rotterdam, Ijmuiden, Eemshaven, and Hoek van Holland to Grimsby, Harwich, Hull, Newcastle, and Tyne in the UK. Ferries between the UK and France run between Dover and Calais and Dunkirk. In the UK, there are further connections from Hull and Southampton to Belgium and Finland. In Germany, routes are primarily domestic.[101]

[101] This data is collected via https://www.emodnet-humanactivities.eu/view-data.php, data collected from ferry companies running in the North Sea, i.e. Fjordline, Stena Line, DFDS, P&O Ferries, AGEMS, Color Line, FORSEA, Holland Norway Lines and Adler & Eils GmbH & CO KG., as well as data submitted by the UK Department fro Transport

Figure 52 Shipping density of passenger vessels in the North Sea. 2020



Source: EMODNET, 2020 Passenger AIS Shipping density, available: https://www.emodnet-humanactivities.eu/view-data.php

Case studies

The decarbonisation of ferry routes is linked to the vessels that operate on those routes, providing that these vessels utilise alternative energy for their propulsion. Thus, to identify the routes that are partially or fully decarbonised, a mapping of vessels and their technologies has been carried out. Table 23 presents an overview of the routes and the vessels used on those routes both lighthouse areas. These routes and vessels have been identified as interesting subjects for further investigation through case studies for. For this study, four case studies were selected to further investigate the decarbonisation of routes. The criteria for selecting the case studies were based on geography, the technology used, and publicly available information on quantification of the decarbonisation of the route.

In addition to the routes presented in the table below, the Norwegian electric ferry fleet is quite significant with 49 electric ferries currently in operation, which provide further interesting domestic routes in Norway. The routes selected as case studies are highlighted in italics in Table 23 below.

Table 23 Overview of potential case studies on decarbonisation of ferry routes

Route	Geography	Technology	Interesting aspects
Danish island of Aero - ports of Fynshav to Soby	Baltic Sea	Battery power	• Ellen, World's largest all-electric ferry (2019) • Received EU funding as part of the Horizon 2020 • In operation since August 2019 • Currently making five trips daily
Helsingborg (SE) – Helsingør (DK)	Baltic Sea	Battery power	• Two electric ferries (Ro-Pax), Tycho Braahe and Aurora • The charging infrastructure in the two ports developed
Hjelmeland-Skipavik-Nesvik (NO)	North Sea	Liquid hydrogen	• World’s first liquid hydrogen-powered ferry • The ferry is 82.4 metres long with a capacity of up to 300 passengers & 80 cars • Supply of liquid hydrogen by company Linde from its new 24MW electrolyser at the Leuna Chemical Complex in Germany • Part of the European innovation project Flagships • Scheduled to sail in 2022
Gothenburg (SE) - Kiel (DE)	Baltic Sea	Methanol	• World's second largest Ro-pax ferry (Stena Germanica) • Retrofitting the vessel and the appropriate port infrastructure for the supply of methanol for bunkering developed • Supported through TEN-T programme with EU grant

Stockholm (SE) - Turku (FI)	Baltic Sea	LNG	• World's largest LNG-powered passenger ferry, operated by Viking Lines • Observed emission reductions in CO_2 equivalents are in the order of 23-24%
Puttgarden (DE) - Rødby (DK) & Rostock (DE) - Gedser (DK)	Baltic Sea	Hybrid propulsion (diesel & battery)	• Four passenger ferries converted into hybrid propulsion • Converting the ferries to hybrid ferries allowed to reduce CO2 emissions by up to approx. 15,000 tons per year.

Sources: European Maritime Transport Environmental Report 2021, EMSA and EEA, 2021; Decarbonising Maritime Transport: The Case of Sweden, ITF-OECD, 2018; Elektrek 2019, https://electrek.co/2019/08/21/worlds-largest-electric-ferry/ Offshore Energy 2021, https://www.offshore-energy.biz/worlds-1st-hydrogen-powered-ferry-delivered/; Scandlines, 2021, https://www.scandlines.com/about-us/our-green-agenda/a-fleet-of-hybrid-ferries/

The full case studies are presented in Annex B to this report. The case studies show that the technologies for alternative propulsion are generally mature for deployment. For hydrogen, the case studies show that the technology is at an early stage of entering the market and that further development of LH2 in a sea-going context may be warranted.

More generally, there is still a need to further promote the commercial adoption of alternative fuels and alternative propulsion technologies among ferries. For longer distances, the available combustion technologies are capable of operating on multiple alternative fuels (such as bio-LNG, green methanol, and other renewable (synthetic) liquids and gases). The technology for vessels running on combustion engines is rather well established. According to the information that could be obtained, the technological risks were limited.

The use of a combustion engine can provide flexibility, as both routes, operating on respectively LNG and methanol, are able to run on multiple fuels and are reportedly simple to be fitted to other alternative fuels. Whereas this flexibility leaves the option to operate on oil, it can mitigate the risk for operators of committing to a future alternative fuel with low economic or technical viability compared to other fuels.

The findings of the case studies however, show that sustainable alternative fuels, with the exception of electric propulsion, are not yet sufficiently price-competitive with oil or LNG. This is demonstrated by the fact that none of the investigated vessels use fully decarbonised alternative fuels, i.e. grey hydrogen, recycled carbon methanol, and fossil LNG. The move towards further decarbonisation (such as green hydrogen), is however, in the proverbial pipeline among all operators. The case studies were not able to quantify the degree to which the relevant alternative fuels are more expensive.

Recent research literature suggests that for LH_2, the costs from a well-to-wake perspective are three to seven times higher than for heavy fuel oil, depending on whether the hydrogen is produced from natural gas or renewable energy.[102] In the case of the methanol, the costs

[102] Law et al. (2021), A Comparison of Alternative Fuels for Shipping in Terms of Lifecycle Energy and Cost

are three to seven times higher depending on whether it is sourced from natural gas or renewable energy. The upcoming change to the EU regulatory framework resulting from the Fit-for-55 package as well as the REPowerEU initiative, can be expected to provide a substantial contribution mainstreaming alternative fuels in the maritime transport sector.[103]

Battery propulsion is only suitable for shorter voyages. LH_2 is thus one of few alternatives available if the decarbonisation ambition is to achieve zero-emission waterborne transport on longer voyages. However, the LH_2 technology is still not well established yet. The LH_2 fuelled Hydra MF vessel initiated its operations being 100% propelled by batteries, whereas the LH_2 is yet to be added to the ferry (as of June 2022).

Being a first-mover entails additional risks, but also additional opportunities. In terms of the risks, unforeseen challenges can arise. For example, in the case of the LH_2-fueled Hydra ferry, the developers had to draw on technology that was only available for use on land and had to be refitted for sea use. This led to unforeseen challenges regarding for instance, the fuel delivery to the fuel cell resulting from sea movements during operations.

Furthermore, when using a new technology, regulatory challenges can be substantial: it may be necessary to obtain an extraordinary Non-Class type approval, which can stretch the timeline for implementing new technology and add further complexities and costs to the process. As of June 2022 for example, hydrogen fuelled vessels still require an individual approval process, which create regulatory barriers to the development of further hydrogen-fuelled vessels.[104] It is therefore recommended to promote or incentivise the adoption of Class type approvals or alternatives providing support infrastructures which can help vessel developers to make a non-Class approval processes as efficient as possible.

Simultaneously however, being a first-mover can provide additional avenues of financing through innovation funds, such as Horizon 2020, and possible other funds like the ERDF as well. As also shown above however, these funds may be required for preparatory work prior to the actual procurement of a new vessel. For example, in the cases of the methanol and electric ferry, preparatory work was required for developing the technology and/or evaluating the technology's feasibility on the route.

Nevertheless, the first-mover advantage has provided additional visibility for the operators. This was the case for the Viking Grace vessel on the Turku-Stockholm route, the recycled carbon fuel methanol ferry on the Kiel-Gothenburg route, and the electric ferry on Ærø.

As shown for all the investigated cases, the choice of decarbonising a ferry route also requires investment in supporting infrastructures, which can require commitment by the harbour to provide the relevant bunkering or charging infrastructures. As demonstrated for the case of the LNG vessel however, alternative solutions like mobile bunkering can be a viable alternative.

Data gaps

Data on the ferry fleet and its characteristics in both the Baltic Sea and the North Sea is scattered across different sources and different levels of data granularity exist across

---

[103] https://ec.europa.eu/commission/presscorner/detail/en/QANDA_22_3132

[104] https://www.hylaw.eu/database/#/database/vehicles/boats-ships/design-type-approval

Member States. No one central source on ferry fleet characteristics exists and as such, national authorities responsible for the maritime transport have been contacted and some data has been obtained.[105] However, the level of detail available on ferries differs across Member States.

Data on the use of alternative fuels such as batteries and LNG-powered vessels is available at the EU and global level, but not per sea basin or individual country. To mitigate this, national authorities have been contacted and different literature sources were used to identify the vessels that operate on the routes in the lighthouse areas. For this purpose, the AIS maps which track vessels movements have been used to identify the most frequently used routes. In addition, the major ferry operators in the lighthouse areas have been identified and their webpages were reviewed for any information on the routes, vessels used and the use of alternative fuels. These two sources (AIS maps) and the routes used by major operators have been compared and they appear to correspond. However, some smaller ferry operators or ferries operated by public authorities may not be accounted for.

Conclusion

Ferry transport in the lighthouse areas plays a significant role for connecting passengers across islands and peripheral areas with the mainland. The main alternative fuels currently used are electricity and LNG, namely, battery-powered and LNG-powered propulsion systems. In the North Sea, Norway is pioneering the decarbonisation of ferry transport with a high number of electric and LNG ferries. In both lighthouse areas, the Nordic countries have a higher share of alternative fuels powered vessels. Still, compared to the total number of ferries in the Baltic Sea (425 vessels)[106], the numbers of ferries that use electricity or LNG are low. For example, in Denmark, there are currently 66 domestic ferries that are mainly operated on diesel, and 11 ferries have received public financial subsidies to be transformed to electrification over the coming years.

6.2.2. Proposed Indicators

The following indicators are proposed for assessment of the Mission's progress on Deployment of zero emission (i.e., zero carbon and zero pollution, noise included) marine technologies and solutions:

Output indicators

Number of projects implemented (and total funding provided) that support the development of alternative fuels and alternative propulsion systems for ferries: The indicator provides information on projects in the lighthouse area that concretely support the further development of alternative fuel and -propulsion technologies for potential use by ferries. The indicator can be entirely focused on EU funded projects, but would obtain greater representativeness if the monitoring covered also projects funded by regional and national funds.

Number of projects implemented (and total private and public funding provided) that support the decarbonisation of a specific ferry or ferry route: The indicator provides information on

[105] For example, data for Latvia, Lithuania and the UK have been provided by national authorities.

[106] No data is available on the number of ferries operating the North Sea.

projects in the lighthouse area that concretely support the updating of a ferry or ferry route with alternative fuels or -propulsion technologies. While it could be considered to split this indicator into projects for ferries and ferry routes, it should be kept in mind that each project always contributes to both outputs simultaneously. Compared to the above indicator, this indicator focuses on providing support to a concrete updates of a ferry. The indicator can be specified for EU funds but would obtain greater representativeness if the monitoring covered also regional, national, and even private funds.

Outcome indicators

- Share (%) and number of operational ferries using alternative fuels, by fuel type, out of all ferries operating in the lighthouse area: This indicator directly measures the size of the alternative fuelled fleet and is measured in both absolute and relative values. The overall objective of this specific indicator is to monitor the penetration of alternative fuelled ferries in the market and, hence, to be able to monitor progress towards the mission outcome of deploying of zero emission marine technologies and solutions. A growing number of the indicator would indicate an increasing market maturity for alternative fuelled ferries. Quantification of the indicator would require retrieval of information of the fuel that each ferry uses (e.g., from EU MRV, EMSA, national and port authorities) and its port calls (e.g., EMSA) so as to determine those sailing into the two basins. Access to the data and information for smaller ferries that are not subject to the EU MRV may be limited.

- Share (%) and number (km) of partially or fully decarbonised ferry routes, out of total kilometres of ferry routes in the lighthouse area: This indicator measures the total kilometers of routes where some or even full decarbonization has already occurred. Decarbonization here is meant as a condition where the renewable energy is used by the ferries regularly travelling on the specific routes. It is noted here that the degree of decarbonization of the particular route is not considered in this indicator (as this information is already considered by the indicator above). The focus of this indicator is on the number of kilometres of routes, where an increasing value would indicate a wider use of cleaner technologies or fuels on regular routes in the basins, and thus point to wider market uptake of decarbonization measures. Data related to this indicator are not structurally collected by official authorities and can only be found on a route basis. Quantification of the indicator would require identification of how many ferries are operating and retrieval of information of the fuel that each ferry uses (e.g., from EU MRV, EMSA, national and port authorities).

- Share (%) of renewable energy (i.e. alternative fuels or alternative propulsion) consumption in annual ferry transport energy consumption in MWh: The indicator is defined as the ratio of renewable energy used to the total gross energy consumption in ferry transport and essentially measures the overall progress of the maritime transport sector towards achieving the decarbonization target. To calculate this indicator, information on the type of fuel that each vessel utilizes, as well as information on its fuel consumption per trip leg is needed. Only trip legs occurring in the Baltic and the North Sea should be considered. This type of information should be available as a raw input to the EU MRV Maritime, however, it needs to be clarified whether it would be possible to link this data to the sea basin. Elaboration on this information and its aggregation per annum would lead to the calculation of this indicator. It should be noted however, that information for ferries of less than 5,000 GT (which are also likely to be readily electrified) is not available in the EU MRV and therefore it should be sought from national authorities or relevant economic operators (if available).

Impact indicators

- *Reduction in GHG emissions (Mt) from ferry transport, compared to the baseline of 2021*: The indicator measures the reduction of the total GHG emissions that are due to ferry transport. Implementation of fuel switching (e.g., from diesel to renewables such as hydrogen) would directly reduce the GHG emissions from ferry transport.

For the indicators proposed above, the following data could be collected, based on the available information:

Table 24 Proposed baseline and indicator framework for maritime transport

Indicator type	Indicator	Data/Description
Output	Number of projects implemented (and total funding provided) that support the development of alternative fuels and alternative propulsion systems for ferries	Not available publicly. Data would have to be collected from the economic operators concerned, national authorities and EU funds financing the projects.
Output	Number of projects implemented (and total private and public funding provided) that support the decarbonisation of a specific ferry or ferry route	Not available. As above, the data would have to be collected from the economic operators concerned, national authorities and EU funds financing the projects.
Outcome	Share (%) and number of operational ferries using alternative fuels, by fuel type, out of all ferries operating in the lighthouse area	In the Baltic Sea (2020): Total: 425 passenger vessels of the IMO registered ships in 2015 Electric ferries identified: 11 electric/hybrid ferries LNG ferries identified: 7 In the North Sea (2020): Norway: 49 electric ferries currently in operation, 24 will become operational in 2022 and 10 that are planned for beyond 2022. Norway: 23 LNG car/passenger ferries Data sources are the DNV AFI and EU EAFO databases.
Outcome	Share (%) and number of partially or fully decarbonised ferry routes kilometres, out of total kilometres of ferry routes in the lighthouse area	AIS maps with the most busy routes. Routes with vessels using alternative fuels, i.e. electricity, include: Fully electric ferry Ellen on Ærø island (DK) Hybrid ferry Stena Jutlandica on Frederikshavn (DK) - Gothenburg (SE) 2 ForSea's hybrid ferries on Helsingør (DK) - Helsingborg (SE) 4 hybrid ferries on Rostock (DE) - Gedser (DK) Electric ferry within Stockholm (SE)

		FinFerries' Elektra hybrid ferry operating in the Turku Archipelago (FI) Tõll hybrid ferry operating on Virtsu-Kuivastu (EE) Data sources are EMODNET and ferry operators
Outcome	Share (%) of renewable energy (i.e. alternative fuels or alternative propulsion) consumption of annual ferry transport energy consumption in MWh	Not available. Data could be gathered from the EU-MRV Database, EMSA and national authorities
Impact	Reduction in GHG emissions (Mt) from ferry transport, compared to the baseline of 2021	Not available. Data could be gathered from the EU-MRV Database, EMSA and national authorities

6.2.3. Activities & Projects

The table below presents projects relevant for thematic area 1, which were identified according to the process presented in the introduction above. The table presents the number of projects and funding amounts within different focus areas. This is presented for projects that specifically focus on the Baltic Sea, North Sea, or generally focus on European seas. It should be noted that one project can have multiple focus areas. Furthermore, it should be noted that most of the identified projects occur on a European level, where project partners are found across Europe, but where at least one project partner is from the lighthouse area or where the project's solutions are not specific to a sea basin. Nevertheless, these projects can be regarded as relevant, as the lighthouse area directly benefits from these projects.

It can be seen that the projects focus on establishing more efficient transport corridors within TEN-T, and particularly in the Baltic Sea. There are a further four projects in the Baltic Sea which focus on decarbonising ferries in general. As regards developing specific ferries with alternative fuels or propulsion, most projects focus on fuel cells (i.e. hydrogen). One project in the Baltic Sea focuses on electric ferries and receives a comparably large amount of funding of EUR 15 mio. In the Baltic Sea, two projects also focus on decarbonising ferry transport by making these more efficient (e.g. through lighter construction materials), and one project focuses on the provision of Renewable Natural Gas, which can be used for LNG fuelled ferries.

Table 25 Overview of INTERREG, Horizon, LIFE, and HELCOM projects focusing on maritime ferry transport since 2015

Focus area	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)
	Baltic Sea			North Sea			Focus on seas (excluding projects focused on Baltic & North Seas)		
Transport corridors	8	14	10	1	4	2	1	2	1
Decarbonised ferries	4	12	9	1	4	2	2	47	33
Electric ferries	1	21	15	-	-	-	1	8	7
Fuel cell	-	-	-	3	24	16	1	16	9
LNG fuel	1	0	0	1	7	3	1	2	2
Wind propulsion	-	-	-	1	5	3	-	-	-
Ferries efficiency	2	6	5	-	-	-	2	25	20
RNG	1	0	0	-	-	-	-	-	-

Source: authors' assessment

6.2.4. Recommendations

Data gaps

Based on the data gaps identified above, it is recommended that:

1. Data needs to be consolidated on the funding of related projects, both from EU funds, but also non-EU as well as private funds. The latter of which could be challenging, as vessel operators might regard this information as confidential

2. EU-wide statistics are established on number of ferries operating in both Baltic and North Sea areas, including with data on age of vessels and fuels used (Some national authorities are collecting this data already, another potential source could be EMSA)

3. Data on decarbonisation of ferry routes is linked to the vessels and as such, should be linked to data of ferries;

4. The indicator framework is set-up based on the data that can be collected centrally through EMSA/ national authorities reporting through EMSA

Knowledge/funding gaps

The analysis above shows that there is a tendency to move towards more sustainable ferry transport via both the use of alternative fuels and propulsion systems, and the adoption/application of technological and operational measures that result in fuel savings, energy efficiency and emissions reduction. More ferry operators are announcing their plans for ordering electric ferries, further optimising energy efficiency of existing vessels and /or taking part in different research projects focusing on decarbonisation.

Despite this trend, there is still significant work required to achieve gap to decarbonisation of maritime transport and ferry transport in particular. Very few vessels in the lighthouse areas could be considered zero emissions (fully electric) ferries[107], while hybrid solutions are more common. This is often linked to lack of readily available technologies, their cost, feasibility, and lifetime of vessels, e.g. batteries can be used on shorter distances. The use of other alternative fuels such as hydrogen and ammonia are still in their infancy, with various research and demonstration projects ongoing.

It is therefore recommended to:

- Further support R&I in alternative fuels/propulsion systems for application in the ferry transport, including batteries, hydrogen, ammonia and methanol, in particular demonstration projects operating in real conditions demonstrating both technical and economic feasibility of such solutions

- Support R&I in alternative fuels production, distribution, and storage infrastructure that supports development of the technical and economic feasibility of alternative fuels

[107] This is not accounting for electricity emissions.

- Due to the lifetime of vessels, it is expected that many vessels that are operating today in the lighthouse areas will still be in operation in the medium term (by 2030), thus incentives to further reduce the overall emissions of ferry fleet should be developed, e.g. retrofitting programmes to improve energy efficiency;

- Support projects focused on overall optimisation of maritime traffic like just-in-time operations and Sea Traffic Management (see next section on ports) leading to fuel consumption savings and higher overall efficiency of operations

- Showcase and share the best practices on the use of alternative fuels/propulsion systems as well as operational and technical measures to improve energy efficiency.

6.3. Thematic Area 2: Ports

6.3.1. Baseline situation

The capacity for maritime fleets in the Baltic and the North Sea to transition to greener shipping and transport methods is highly dependent on existing port infrastructure, i.e. LNG refuelling facilities, onshore power supply and the supply of other alternative fuels such as hydrogen, methanol and ammonia. There are also ways to optimise fuel consumption through specific measures implemented at the port level to prevent ships from burning fuel when it is not needed. The European Maritime Transport Environmental Report for 2021 outlines key methods for decarbonisation in ports:

1. *Onshore power supply (OPS), i.e. shore-to-ship* – by connecting to an onshore power source, ships can turn off auxiliary engines and reduce their negative emissions-related impacts while idling in the port to drop off goods or pick up passengers. There are several indicators for shore-to-ship power including the power requirements (peak load), time spent at port; high voltage power supply is required. It is important to note that the decarbonisation of ports, especially in connection to OPS is directly dependent on decarbonisation of the electrical grid through the supply of renewable energy. The attention to grid decarbonisation in relation to renewable energy varies between the countries in the lighthouse area.

2. *LNG Bunkering facilities* – As LNG is the most common way in which ships and shipping companies are transitioning to greener practices, LNG facilities for at least one of a ship's ports of call are necessary to see more uptake and transitioning of ships to LNG. According to the proposed Alternative Fuel Infrastructure Directive (AFID), a core network of refuelling points (terminals, tanks, mobile containers, bunker vessels and barges) for LNG at maritime ports should be available by 2025.[108]LNG facilities can be port-to-ship, ship-to-ship or truck-to-ship, the most common being port-to-ship.

3. *Port Optimisation* – Implementing activities such that ships are adjusting and minimising their in-port stays is vital to decarbonisation, especially if the port does not have infrastructure to allow for turning off of auxiliary engines. Just-in-time is one of the main methods for ships to prevent bottlenecks and reduce time spent in the port and at anchorage. The cornerstone of port-call optimisation is communication capacities of ships and their on-shore counterparts, which further allows ships arriving to port to plan their voyage in real-time and adjust their speed to minimize fuel consumption. Transparent and efficient data sharing is key for this to work as well.

4. *Alternative fuelling* – beyond LNG, alternative fuels such as methanol, ammonia, hydrogen or biofuels also can decarbonise maritime shipping. Data on methanol bunkering facilities in the Baltic and North Sea is not as easily accessible, but

[108] COM, 2021, Proposed Revision of Directive on deployment of the alternative fuel infrastructure , https://ec.europa.eu/info/sites/default/files/revision_of_the_directive_on_deployment_of_the_alternative_fuels_infrastructure_with_annex_0.pdf

there are roughly 100 ports globally with methanol infrastructure.[109] For biofuels, they can be blended with LNG in order to reduce its carbon content. Very low amounts of biofuels are currently used in maritime transport, but the use will potentially grow more as biofuels are gainig more policy attention in the EU. Seaweed will be increasingly used as a source for biofuel as is outlined in more detail under thematic area 5 on aquaculture.[110]

LNG and OPS

The European Alternative Fuel Observatory (EAFO) provides concrete data on both LNG facilities and onshore power supply (OPS) and where they are placed in the lighthouse area. This can help to indicate where are the hotspots for decarbonisation.[111] In addition, different incentive schemes to support port facilities can provide a clear regulatory pathway for expansion. The existing facilities in the lighthouse area are presented below to provide an impression of the current state of ports. It is also important to note that EU standards on alternative fuels requires all ports in the core part of the TEN-T to be equipped with LNG refuelling stations by 2025 and LNG demand is expected to rise from 300,000 to 500,000 tonnes per year.[112] LNG refuelling is classified by the number of facilities that are shore-to-ship (STS), port-to-ship (PTS) or truck-to-ship (TTS). Among the different LNG bunkering types, port-to-ship are the most developed, despite ship-to-ship being the most preferable in some cases.[113]

Across the OPS in the lighthouse area, a much smaller portion are High Voltage facilities, which are necessary to support large ships. Some countries are dedicating significant funding to supporting charging facilities for ships. This includes ports in Southern Denmark, where the project "E-Ferry" has allocated DKK 32 million towards onshore charging facilities on Ærø. In Norway, the ports of Flåm and Gudvangen have charging solutions for specific vessels, including an innovative PowerDock concept, which is a floating charging station with battery packs stored under the deck.[114] More specifically, the PowerDock alleviates the pressure on power grids that are too weak to charge a vessel and can store large amounts of energy.

Baltic Sea

---

[109] FAST Track to Clean and Carbon-Neutral WATERborne Transport, 2021, Deliverable 7.1 Report on methanol supply, bunkering guidelines, and infrastructure. https://www.fastwater.eu/images/fastwater/news/FASTWATER_D71.pdf

[110] Nordic Energy Research, 2020, Navigating Towards Cleaner Maritime Shipping: Lessons from the Nordic Region, https://www.nordicenergy.org/wordpress/wp-content/uploads/2020/11/navigating-cleaner-maritime-shipping.pdf

[111] EAFO, 2021, https://www.eafo.eu/fuel-map

[112] EEA, 2021, European Maritime Transport Environmental Report, https://www.eea.europa.eu/publications/maritime-transport/

[113] Serry, H., 2018, Development of liquefied natural gas facilities in the Baltic Sea ports: a Geographical Perspective, https://hal.archives-ouvertes.fr/hal-01724087/document

[114] Hyen, 2019, Brødrene Aa and The Fjords pioneering with "Future of The Fjords" – offering zero emission fjord cruise, https://mozees.no/wp-content/uploads/2019/05/Article-Future-of-The-Fjords-med-tittelside.pdf

In the Baltic Sea, there are fewer LNG and fewer OPS facilities as compared to the North Sea, mainly due to the fact that Norway has a rather developed alternative fuels infrastructure for ferries and ports. Regardless, LNG facilities dominate with less OPS options available. This aligns with data gathered on the most frequent type of decarbonisation, i.e. LNG is the most common fuel used to "green shipping", as outlined under the maritime transport theme above. Beyond those listed in the tables below, the Baltic area has plans for at least three more LNG facilities in 2023 and beyond. For OPS in the Baltic, roughly 59% of the total facilities are high voltage.

Table 26. Number of onshore power supply facilities in the Baltic Sea and amount of which are high voltage facilities.

Country	Onshore Power Supply	No. of High Voltage
Denmark	3	2
Germany	4	4
Sweden	8	5
Finland	4	3
Estonia	3	0
Latvia	4	3
Lithuania	3	0
Poland	0	0
Total	**29**	**17 (59 %)**

Source: EAFO, accessed on 31-01-2022.

Table 27. LNG refuelling facilities by type and by country in the Baltic Sea. Source: EAFO, accessed on 31-01-2022.

Country	LNG Facilities	Type
Denmark	0	-
Germany	1	1 PTS
Sweden	3	2 STS, 1 PTS
Finland	3	2 PTS, 1 STS
Estonia	1	1 PTS
Latvia	0	-
Lithuania	1	PTS
Poland	0	-
Total	**9**	**6 PTS, 3 STS**

Source: EAFO, accessed on 31-01-2022.

North Sea

In the North Sea, Norway dominates both the total LNG facilities as well as OPS. Of the 46 OPS facilities, 11 are high voltage in Norway, which is more than the total in the rest of the North Sea basin.

Table 28. Onshore power supply by country in the North Sea.

Country	Onshore Power Supply	No. of High Voltage
Norway	46	11
Denmark	6	0
Germany	0	0
Netherlands	2	2
Belgium	2	2
France	3	1
United Kingdom	2	0
Total	**61**	**16 (26%)**

Source: EAFO, accessed on 31-01-2022.

Table 29. LNG refuelling facilities by type and by country in the North Sea.

Country	LNG	Type
Norway	11	2 STS, 9 PTS
Denmark	1	PTS
Germany	4	2 TTS, 1 STS, 1 PTS
Netherlands	7	3 TTS, 1 STS, 3 PTS
Belgium	3	1 PTS, 1 STS, 1 TTS
France	1	STS
United Kingdom	0	-
Total	**27**	**15 PTS, 6 STS, 6 TTS**

Source: EAFO, accessed on 31-01-2022.

Other port infrastructure and projects (optimisation, alternative fuels, incentive schemes)

While LNG and OPS infrastructure standout as leading measures for decarbonisation of ports, port-call measures and alternative fuelling infrastructure are also common in the lighthouse area. Port-call measures such as those developed by the Baltic Sea region include just-in-time operations and the conception of Sea Traffic Management (STM), which were developed as a way to improve on efficiency in ports for both economic and environmental reasons.[115] STM is governed by stringent communication standards and close coordination between ports and the ships. The connection between the different actors in ports and the criteria to communicate between each other is commonly labelled "Port Call Optimization" and ensures that ships are not

[115] Gonzalez, et al., 2021, Digitalization in Just-In-Time Approach as a Sustainable Solution for Maritime Logistics in the Baltic Sea Region, https://www.mdpi.com/2071-1050/13/3/1173

wasting time at the port. Specifically, green steaming is one such approach enabling ships to reduce their speed and arrive in the ports at a predefined time of arrival.

For alternative fuels other than LNG, the infrastructure is less advanced, but some ports support methanol and hydrogen facilities. Methanol, while still a fossil fuel, emits 90% less sulphur (SOx) and 60% less nitrogen (NO_X), which makes it an attractive choice for "green shipping", in particular if synthetic (or sustainable bio-) methanol were used. Including the well-to-tank emissions for methanol, the GHG emissions from the production of methanol are half of those for conventional fuels. That being said, the environmental benefits of methanol are directly dependent on raw materials used to produce it.[116]

Baltic Sea

Green steaming has notably been studied in Sweden and Denmark. As an example, the Port of Gothenburg found that optimisation of time arrival saved 4.1% of emissions and fuel.[117] For alternative fuels in the Baltic, the Stena Germanica ferry servicing the line from Kiel to Gothenburg is the first ship to run on marine methanol fuel. In combination with the two ports and methanol producer Methanex Corporation, the capacity of the ship to run on methanol required close coordination between several parties. The two ports are capable of supporting alternative fuels such as methanol and it is expected more ports will follow.[118]

The Nordic countries are leaders in OPS facilities and are front-runners in providing incentives for ships to adapt to greener port facilities. For example, Sweden had already established on-shore power in the 1980s and 1990s for the port of Stockholm and the port of Gothenburg. In Finland, shore power facilities were installed in the 2000s. Incentive schemes for ports also push shipping companies to equip their vessels with alternative fuels or the use of electric power while berthed in ports. There are also ongoing research projects on ports, which bilaterally incentivise action in transitioning ports to greener solutions. Some incentive schemes include:

- The Port of Stockholm provides grants of SEK 1 million to shipping companies that will equip vessels with connections for shore-power. Sweden as a whole, provides tax reductions for port infrastructure of this type.[119]

- Nordic Energy Research, Nordic Maritime Transport and Energy Research Programme will support testing the use of ammonia and hydrogen as fuel for maritime vessels.[120]

---

[116] International Maritime Organization (IMO). 2016. Methanol as a marine fuel: Environmental benefits, technology readiness, and economic feasibility. https://www.methanol.org/wp-content/uploads/2020/04/IMO-Methanol-Marine-Fuel-21.01.2016.pdf

[117] Watson et al., 2015, Green Steaming: A methodology for estimating carbon emissions avoided

[118] European Commission, 2014, Methanol: the marine fuel of the futurehttps://ec.europa.eu/inea/sites/default/files/download/project_fiches/multi_country/fichenew_2012eu21017s_final_1.pdf

[119] International Transport Forum, 2018, Decarbonising Maritime Transport, https://www.itf-oecd.org/sites/default/files/docs/decarbonising-maritime-transport-sweden.pdf

- EcoPorts (SDM and PERS), having a low temperature in port authority offices, avoiding standby mode on electronics.[121]

North Sea

In the North Sea, there are examples of port-call optimisation as well as transitions towards alternative fuels. A Just-In-Time trial was conducted in the Port of Rotterdam as well and revealed the clear potential and benefit of adding more updates to the ships arriving to the port in order for ships to adjust their speed. In comparing two scenarios in the trial, 23% less fuel was consumed.[122]

In the UK, there is a mobile hydrogen refuelling station operating in a pilot phase for the Pure Energy Centre for which the electrolyser is expected to produce hydrogen at 30 bars.[123] In Groningen, offshore wind is used to generate hydrogen and has large-scale storage facilities making it favourable for use in green hydrogen for shipping. The port of Den Helder has offshore gas transport infrastructure and proximity to offshore wind locations making it favourable for blue and green hydrogen activities. The port of Amsterdam has potential as a major importer of hydrogen and fuel conversion making it a point of focus for the coming years in bunkering for green ships.[124] In addition, the Port of Tallinn is establishing a Green Hydrogen Strategy which is expected to impact the maritime sector in the basin. The PORTHOS project in the Port of Rotterdam plans to capture and store carbon underneath the North Sea. It will capture emissions from the industry near the Port of Rotterdam and be stored via a pipeline 3 km beneath the North Sea in empty gas fields. While related to decarbonisation of industry, as opposed to emissions from ships, the project realtes to decarbonisation of port areas and investment into carbon capture technology, which is in its foundering phase globally. The projectt is expected to result in a reduction of 10% of emissions from the Port of Rotterdam and will be operational in 2024.[125]

Concerning incentive schemes and funding in research and innovation, the North Sea has numerous ongoing projects :

---

[120] Nordic Energy Research, 2021, Nordic Maritime Transport and Energy Research Programme, https://www.nordicenergy.org/project/nordic-maritime-transport-and-energy-research-programme/

[121] ESPO, 2021, A Manual for European Ports Towards a Green Future, https://www.espo.be/media/ESPO%20Green%20Guide%202021%20-%20FINAL.pdf

[122] Port of Rotterdam, 2019, Desktop Just-In-Time trial yields positive results in cutting emissions, https://www.portofrotterdam.com/en/news-and-press-releases/desktop-just-time-trial-yields-positive-results-cutting-emissions

[123] Interreg, Zero Emission Ports North Sea, https://northsearegion.eu/zem-ports-ns#

[124] TNO, Northern Dutch Ports: Future Energy Hun in Northwest Europe, https://www.tno.nl/en/focus-areas/energy-transition/roadmaps/system-transition/towards-a-reliable-affordable-and-fair-energy-system/energy-conversion-and-storage/dutch-ports-future-energy-hub-in-northwest-europe/

[125] PORTHOS Project, https://www.porthosco2.nl/en/project/

- Norway provides funding for electrification of ships as well as for the onshore electricity in ports.[126]

- Green port fees for ships that are not equipped with environmentally friendly technology are a key measure outlined in the Green Cruise Port project. In addition, the environmental ship index (ESI) has a bonus scheme for seagoing vessels that use low sulphur fuels as well as a green port incentive that has been implemented in both Rotterdam and Antwerp.[127,128]

- The Wind Assisted Ship Propulsion (WASP) programme, funded by Interreg WASP Project, provides thrust to ships generated by high altitude winds which can also be used to navigate into ports.[129]

- The project sMArt Green Ports as Integrated Efficient multimodal hubs (MAGPIE) has a budget of over EUR 30m.Tthe project is ongoing until 2026 and has plans to conduct 12 pilots on alternative energy sources and smart technologies to increase transport efficiency. The port of Rotterdam and the Haropa port in France are included in the study. A number of renewable fuels and energy carriers are currently being further developed, including green hydrogen, large electric batteries, ammonia, and bio-LNG. Examples of actions to be undertaken within the project include bunkering ammonia as a transport fuel, or electrical power from shore for ships moored offshore to a mooring buoy.[130]

- A Horizon 2020 project, PORTable Innovation Open Network for Efficiency and Emissions Reduction Solutions (PIONEERS) is running until 2026 and will develop solutions to transform ports into green infrastructure by 2050.[131] It includes the ports of Antwerp and Venlo.

---

[126] Nordic Energy Research, 2020, Navigating Towards Cleaner Maritime Shipping: Lessons from the Nordic Region, https://www.nordicenergy.org/wordpress/wp-content/uploads/2020/11/navigating-cleaner-maritime-shipping.pdf

[127] Interreg, 2019, Green Cruise Port Action Plan 2030, http://www.greencruiseport.eu/files/public/download/events/final_conference/Green%20Cruise%20Port%20Action%20Plan%202030_Final%20Report.pdf

[128] Lawer, et al., 2019, Selective Adoption: How Port Authorities in Europe and West Africa Engage with the Globalizing 'Green Port' Idea

[129] Interreg, Welcome to the project website of WASP: Wind Assisted Ship Propulsion, funded by the Interreg North Sea Region Programme, https://vb.northsearegion.eu/public/files/repository/20210111083115_WASP-WP4.D5B-NewWPTALiteratureReviewofRecentAdoptions-Final.pdf

[130] CORDIS, 2021, sMArt Green Ports as Integrated Efficient multimodal hubs, https://cordis.europa.eu/project/id/101036594

[131] CORDIS, 2021, PORTable Innovation Open Network for Efficiency and Emissions Reduction Solutions, https://cordis.europa.eu/project/id/101037564

Data gaps

Data on the LNG and OPS infrastructure is available per sea basin through the EAFO. Limited data (often on project basis) is available on supporting infrastructure for hydrogen, methanol, ammonia, which is also linked to limited use of these fuels in the lighthouse area.

In terms of data on the state of decarbonisation of port facilities and incentive schemes for promoting green shipping, this is not centrally collected at the EU level. This information has been identified through combining different sources such as reports, studies, and websites of individual ports.

Conclusion

LNG and OPS infrastructure standout as leading measures for decarbonisation of ports and vessels in both lighthouse areas. In the North Sea area, Norway dominates in terms of number of both OPS and LNG fuelling facilities. In the Baltic Sea, there are fewer LNG and OPS facilities as compared to the North Sea, with higher number of facilities in Sweden. Other measures to support decarbonisation include port calls optimisation, such as just-in-time operations, and the conception of Sea Traffic Management (STM). There are also individual port initiatives for ships across the lighthouse areas to adapt to support greener shipping, for instance, through reduction of port fees, funding, and research.

6.3.2. Proposed Indicators

The following indicators are proposed for the assessment of the Mission's progress on *Deployment of zero emission (i.e. zero carbon and zero pollution, noise included) marine technologies and solutions:*

Output indicators

- *Number of projects implemented (and total funding provided) supporting the infrastructure for alternative fuel bunkering at port facilities*: The indicator provides information on the funding provided to support the provision of alternative fuels for maritime transport, such as refuelling stations for hydrogen or LNG, the establishment of renewable fuel bunkers, and the provision of onshore power. The indicator can be specified for EU funds but would generate greater value if it also encompassed regional and national funds.

- *Number of projects implemented (and total funding provided) supporting the decarbonisation of port facilities*: The indicator provides information on the number of projects and funding provided to support the decarbonisation of port facilities and their operations, such as renewable energy provision for facilities or the electrification of transport equipment. The indicator can be specified for EU funds but would provide greater representativeness if it also encompassed regional and national funds.

Outcome indicators

- *Share (%) and Number of ports offering renewable energy supply for maritime transport, per type of alternative fuel*: This indicator measures the absolute number of ports that offer bunkering of renewable and alternative maritime fuels.

- *Share (%) and Number of ports offering onshore power for maritime transport, out of all ports in the lighthouse area*: This indicator measures the relative number of ports that offer onshore power facilities (low or high voltage). EAFO publishes a list of onshore power infrastructure facilities in ports in Europe.[132]

- *Share (%) and Number of ports offering LNG refuelling for maritime transport, out of all ports in the lighthouse area*: This indicator measures the relative number of ports that feature LNG refuelling facilities and can therefore offer LNG as a marine fuel. EAFO publishes a list of LNG bunkering facilities for LNG fuelled vessels in Europe.[133].

- *Share (%) of annual renewable energy bunkering in ports in MWh*: this indicator is defined as the ratio of renewable energy to the total energy bunkering in ports. Data collected directly from the port authorities could be utilised to quantify this indicator.

- *Share (%) of annual renewable energy consumption in port facilities in MWh*: this indicator is defined as the ratio of renewable energy to the total energy consumed in port facilities. It measures the degree of decarbonisation of the energy used by ports. Data to support the development of this indicator can be sought from each port through the energy bills (incl. electricity, heat, natural gas, oil products, etc.), and potentially the sustainability reports published by the port operators. However, there is currently no standardised procedure to facilitate this process, as the information is scattered and as not all ports may be collecting or publishing that data.

Impact indicators

- *Reduction in GHG emissions (Mt) from ports operations, compared to the baseline of 2021* (as defined by the scope 1 and scope 2 emissions of the GHG protocol): The indicator measures the total GHG emissions that are due to the ports' operations. Implementation of fuel switching (e.g. from fossil fuels such as diesel to renewables such as biofuels) and/or energy efficiency measures would directly reduce the GHG emissions of ports. Other organisational measures could also result in a reduction of the environmental footprint of ports. Port emissions are currently not reported in a structured and organised way, which would be necessary in future to have available data to measure this indicator.

For the indicators proposed above, the following data could be collected, based on the available information:

[132] https://www.eafo.eu/shipping-transport/port-infrastructure/ops/data

[133] https://www.eafo.eu/shipping-transport/port-infrastructure/lng/bunkering-for-ships

Table 30 Baseline indicator framework for ports

Indicator type	Indicator	Data/Description
Output	Number of projects implemented (and total funding provided) supporting the provision of alternative fuels for maritime transport	Not available publicly. Data would have to be collected from the port operators concerned, national authorities and EU funds financing the projects.
Output	Number of projects implemented (and total funding provided) supporting the decarbonisation of port facilities	Not available publicly. Data would have to be collected from the port operators concerned, national authorities and EU funds financing the projects.
Outcome	Share (%) and number of ports offering renewable energy supply for maritime transport	In the Baltic Sea: OPS: 29, of which 17 HV LNG facilities: 9, of which 6 PTS & 3 STS In the North Sea OPS: 61, of which 16 HV LNG facilities: 27, of which 15 PTS, 6 STS and 6 TTS
Outcome	Share (%) and Number of ports offering onshore power for maritime transport	
Outcome	Share (%) and Number of ports offering LNG refuelling for maritime transport	
Outcome	Share (%) of annual renewable energy bunkering in ports in MWh	Data could be derived from the EAFO database. The available data can however not be aggregated (as it is in the form of screenshots on the website)
Outcome	Share (%) of annual renewable energy consumption in port facilities in MWh	Not available publicly. Data would have to be collected from the port operators concerned, national authorities and EU funds financing the projects.
Impact	Reduction in GHG emissions (Mt) from ports operations, compared to the baseline of 2021	Not available publicly. Data would have to be derived from the above indicators, or be collected from the port operators directly.

6.3.3. Activities & Projects

The table below presents projects identified as relevant for thematic area 2. The table presents the number of projects and funding amounts within different focus areas. This is presented for projects that focus specifically on the Baltic Sea, North Sea, or generally focus on European seas. It should be noted that one project can have multiple focus areas.

Most projects in the lighthouse area (eight in total) focus on cross-cutting themes on decarbonising ports through various means, such as the increased use of renewable energy. Of these eight projects, two projects in the lighthouse area include a focus on energy efficiency, and one on the electrification of facilities. Furthermore, one project focuses on offering LNG fuel supply in the Baltic Sea and North Sea, respectively. In the North Sea, that same project (ZEM Ports NS) also focuses on offering hydrogen supply for fuel cells.

Table 31 Overview of INTERREG, Horizon, LIFE, and HELCOM projects focusing on ports since 2015

Focus area	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)
	Baltic Sea			North Sea			Focus on seas (excluding projects focused on Baltic & North Seas)		
Decarbonised ports	5	12	7	3	16	9	5	75	56
Energy efficiency	1	2	2	2	11	6	3	72	54
RE generation	-	-	-	1	3	2	2	64	50
Alternative fuels operations	-	-	-	-	-	-	2	64	50
LNG fuel supply	1	3	2	1	4	2	1	31	25
Fuel cell supply	-	-	-	1	4	2	1	31	25
Electrification	1	5	2	-	-	-	-	-	-

Source: authors' assessmen

6.3.4. Recommendations

Data gaps

Based on the data gaps identified above, it is recommended that:

Data collection on the decarbonisation of port facilities and existing incentive schemes in line with the indicators proposed above by national authorities and reporting along these indicators on an annual basis.

Knowledge/funding gaps

The capacity for maritime fleets to transition to greener shipping is highly dependent on existing port infrastructure, i.e. LNG refuelling facilities, OPS and supply of other alternative fuels such as hydrogen, methanol, and ammonia. The analysis above shows that the increasing number of both LNG and OPS facilities are being developed in the lighthouse areas. Despite this, there is limited infrastructure available to support other alternative fuels, which contribute to limited use of those fuels in maritime transport (e.g. hydrogen and ammonia).

It is therefore recommended to:

- Together with development of vessels using alternative fuels/propulsion systems (see section on maritime transport), support development of enabling infrastructure for those vessels;

- Further promote R&I on decarbonisation of port facilities, e.g. through projects like DocksTheFuture that focuses on developing the methodology for a coordinated approach to the clustering, monitoring and evaluation of results of actions under the Ports of the Future topic;

- Promote the introduction of green initiatives for ports to facilitate both decarbonisation of vessels and ports;

- Support projects focused on overall optimisation of maritime traffic like just-in-time operations and Sea Traffic Management.

6.4. Thematic Area 3: Offshore RE facilties

6.4.1. Baseline situation

Introduction

Offshore waters are likely to be a particular focus of Blue Economy expansion over the next decades.[134] This is because massive upscaling of offshore RE, especially offshore wind power and ocean energy technologies (wave and tidal), is critical to achieving global and national goals to decarbonise the electricity supply. This is also demonstrated by the EU's climate ambition expressed in the 2021 Fit-for-55 package of regulatory proposals and the more recent REPowerEU initiative, where RE technologies play a key role. Other offshore RE technologies such as algal biofuels (biodiesel, biogas, and bioethanol), and floating photovoltaic are still in early stages of development but could be promising for the future.[135]

The Baltic and North seas have a high natural potential for offshore wind energy and some localised potential for wave and tidal energy. In 2020, the European Commission estimated the installed offshore wind capacity to be 12 GW (EU-27), while ocean energy (wave and tidal) accounted for 34 MW.[136] Regarding offshore wind capacity, higher figures were reported by WindEurope, who estimated the installed offshore wind capacity to be about 15 GW (EU-27), and 26 GW including the UK.[137] Moreover, according to WindEurope, the number of turbines installed in 2020 was 5,566 across 120 wind farms. In 2020, offshore wind energy production covered 3% of total electricity demand in Europe.[138]

Wind farms are becoming more and more efficient at capturing energy from the wind and turning it into electricity. In 2020, the average capacity factor[139] for offshore wind was 42%. This number, however, is relatively low as it also includes old installations; new offshore wind farms will operate at up to 60%.[140] [141] For comparison, solar energy is within the range

---

[134] Novaglio, C., Bax, N., Boschetti, F., Emad, G. R., Frusher, S., Fullbrook, L., ... & Fulton, E. A., 2021. Deep aspirations: towards a sustainable offshore Blue Economy. Reviews in fish biology and fisheries, 1-22.

[135] An EU Strategy to harness the potential of offshore renewable energy for a climate neutral future. SWD(2020) 273 final. https://ec.europa.eu/energy/sites/ener/files/offshore_renewable_energy_strategy.pdf

[136] COM/2020/741 final. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. An EU Strategy to harness the potential of offshore renewable energy for a climate neutral future.

[137] WindEurope, 2021. European Offshore Wind Farms Map Public. https://windeurope.org/intelligence-platform/product/european-offshore-wind-farms-map-public/

[138] WindEurope, 2021. Wind energy in Europe 2020 Statistics and the outlook for 2021-2025. https://windeurope.org/intelligence-platform/product/wind-energy-in-europe-in-2020-trends-and-statistics/

[139] ´Capacity Factor is a measure of how much power a turbine is producing compared to its rated capacity. Generally, this is reported over a period of time for a wind farm, so is a measure of how well the farm is producing on average compared to its rated capacity.´ Sparta, 2020. Portfolio Review 2019/20. https://ore.catapult.org.uk/wp-content/uploads/2021/02/SPARTA-Review-2020.pdf

[140] WindEurope, 2021. Wind energy in Europe 2020 Statistics and the outlook for 2021-2025. https://windeurope.org/intelligence-platform/product/wind-energy-in-europe-in-2020-trends-and-statistics/

of 10-25% while tidal/wave energy has a capacity factor of around 50%.[142] Production Based Availability, or PBA, is a measure of how well a turbine is using the available wind resources. Unlike the “capacity factor”, PBA does not penalise for low winds, as it measures how well the turbine is performing compared to its power curve, given the wind speeds that occur at that site.[143]

Despite the progress in RE offshore in the last years, there remains significant untapped potential. The Commission estimates that the objective to have an installed capacity of at least 60 GW of offshore wind and at least 1 GW of ocean energy by 2030, with a view of reaching respectively 300 GW and 40 GW of installed capacity by 2050, is realistic and achievable.[144]

The largest networks of wind and ocean energy professionals, have even greater hopes for the offshore RE development. For example, WindEurope forecasts an installed capacity of about 111 GW of offshore wind by 2030. This development would mainly be driven by the UK which has pledged to building 40 GW of offshore wind by 2030, Germany that with an amendment to the Offshore Wind Energy Act (WindSeeG) raised the country’s offshore ambitions from 15 GW to 20 GW by 2030, 40 GW by 2035, and 70 GW by 2045. The Netherlands has also increased its offshore wind capacity towards 2030 (22.2 GW) and Denmark has identified areas of up to 12.4 GW offshore capacity to be auctioned in the coming decade.[145]

By 2050, WindEurope expects 450 GW of offshore wind to be implemented; the report concludes that 212 GW should be deployed in the North Sea, 93 GW in the Baltic Sea, 85 GW in the Atlantic, and 70 GW in the Mediterranean and other Southern European waters.[146] A slightly more conservative figure (408 GW by 2050) was reported by ENTSOG and ENTSO-E.[147]

With respect to ocean energy, Ocean Energy Europe expects deployments of installed tidal stream capacity to be in the range of 1,324 MW (low growth scenario) and 2,388 MW (high

---

141 IRENA, 2019. Future of Wind. Deployment, investment, technology, grid integration and socio-economic aspects.

142 Coles, D., Angeloudis, A., Goss, Z., & Miles, J. (2021). Tidal Stream vs. Wind Energy: The Value of Cyclic Power When Combined with Short-Term Storage in Hybrid Systems. Energies, 14(4), 1106.

143 Sparta, 2020. Portfolio Review 2019/20. https://ore.catapult.org.uk/wp-content/uploads/2021/02/SPARTA-Review-2020.pdf

144 COM/2020/741 final. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. An EU Strategy to harness the potential of offshore renewable energy for a climate neutral future.

145 WindEurope, 2020. Offshore Wind in Europe Key trends and statistics 2020. https://windeurope.org/intelligence-platform/product/offshore-wind-in-europe-key-trends-and-statistics-2020/

146 WindEurope, 2019. Our energy, our future. How offshore wind will help Europe go carbon-neutral. https://windeurope.org/about-wind/reports/our-energy-our-future/

147 ENTSOG and ENTSO-E, 2021. TYNDP 2022. Draft Scenario report. https://2022.entsos-tyndp-scenarios.eu/wp-content/uploads/2021/09/2021-10-TYNDP_2022_Draft_Scenario_Report.pdf

growth scenario) by 2030, and wave energy in the range of 178 MW and 494 MW. By 2050, Ocean Energy Europe expects 100 GW of ocean energy to be deployed, equivalent to 10% of Europe's electricity consumption.[148]

The North Sea is the most established sea basin in Europe with almost 79% of all offshore wind capacity in Europe, while the Baltic Sea represents about 9% of the total installed capacity. The Irish Sea (12%) and the Atlantic Ocean (about 1%) make up the rest[149]. Moreover, the North Sea basin drives the ocean energy activity[150].

Caution is needed when interpreting the data. Denmark, Germany, and Sweden cover both the North Sea and Baltic Sea region, while the majority of the offshore RE data are available at country level (and not at regional level). Moreover, the UK lies between the North Sea and the Atlantic Ocean. Therefore, a clear-cut distinction between North Sea and Baltic Sea in terms of installed and planned offshore RE is not directly available. When data at regional level are not available, maps displaying the geographical distribution of offshore wind energy facilities such as those provided by WindEurope and EMODnet help the distinction between installation in the North Sea and Baltic Sea. However, when data are extracted from the database, the information are mostly aggregated at country level.

North Sea

At the global level, the United Kingdom leads in terms of total offshore wind deployment, with 32%, followed by Germany (23%), China (22%), the Netherlands (8%), Belgium (7%), and Denmark (5%).[151] Scotland, Ireland, and England accounted for about 41.8% of the installed offshore wind capacity in Europe, followed by Germany (29%), the Netherlands (10.4%), Denmark (8.7%), and Belgium (8.6%). In 2020, the UK registered the highest average production-based availability in Europe.

The UK is also the country where the bulk of the ocean energy activities take place. The majority of wave and tidal projects, however, are located in the Atlantic Ocean (Figure 3-2).

Tidal stream and wave energy projects are also being implemented or tested in France and Denmark.[152] For example, in France the tidal energy company SIMEC Atlantis Energy plans to develop a 12 MW tidal power project in Raz Blanchard from Engie to Normandie

148 Ocean Energy Europe, 2020. 2030 Ocean Energy Vision Industry analysis of future deployments, costs and supply chains. https://www.oceanenergy-europe.eu/wp-content/uploads/2020/10/OEE_2030_Ocean_Energy_Vision.pdf

149 WindEurope, 2020. Offshore Wind in Europe Key trends and statistics 2020. https://windeurope.org/intelligence-platform/product/offshore-wind-in-europe-key-trends-and-statistics-2020/

150 Ocean Energy Europe, 2021. Ocean Energy Key trends and statistics 2020. https://www.oceanenergy-europe.eu/wp-content/uploads/2021/03/OEE-Stats-Trends-2020.pdf

151 NREL, 2021. Offshore Wind Market Report: 2021 Edition. https://www.energy.gov/sites/default/files/2021-08/Offshore%20Wind%20Market%20Report%202021%20Edition_Final.pdf

152 Ocean Energy Europe, 2018. Ocean Energy Key trends and statistics 2018. https://www.oceanenergy-europe.eu/wp-content/uploads/2019/04/Ocean-Energy-Europe-Key-trends-and-statistics-2018_web.pdf

Hydroliennes[153], while the Seabased (Swedish wave energy company) plans to install a 10 MW commercial wave energy park in France's Brittany region.[154] Hydroquest, a company based in Normandy is also running three different projects with capacity of 17.5 MW, 8 MW and 3.5 MW.

Baltic Sea

In the Baltic Sea, Sweden accounts for about 0.7% of the installed offshore wind capacity followed by Finland (0.3%). No active offshore wind energy facilities in Estonia, Poland, Lithuania and Latvia were reported by WindEurope and 4Coffshore.[155] Instead, a relatively large amount of offshore wind energy facilities in Estonia, Poland, Lithuania, (in addition to Sweden and Finland), are either "under permitting procedure" or "planned"[156]. In Poland and Lithuania the governments have recently worked on creating a regulatory framework allowing for better conditions for the development of offshore wind energy.[157] [158] Moreover, the representatives of the Ministries are currently discussing the possibility of cooperation between Poland and Lithuania in the area of offshore wind energy.[159]

Concerning wave energy, the theoretical wave power resource of the Baltic Sea was estimated to be 1 GW. However, there seems to be very little concentration of demonstration projects in the Baltic Sea.[160]

Opportunities and challenges for the uptake of offshore RE

Identifying the area needed to install an additional capacity of offshore RE

According to WindEurope, the total area of the North Seas needed for 380 GW of offshore wind would be 76,000 km2, an area just below the size of the island of Ireland. It represents only 2.8% of the total area of the North Sea. However, because of "exclusion zones"[161] in at least 60% of the North Sea, it is not possible to build offshore wind farms everywhere. This

---

153 https://www.oedigital.com/news/479524-simec-atlantis-gets-hold-of-12mw-tidal-power-project-lease-in-france

154 https://www.renewablesnow.com/news/seabased-to-install-10-mw-wave-energy-park-in-france-743015/

155 https://www.4coffshore.com/

156 Data were extracted from European Offshore Wind Farms Map https://windeurope.org/intelligence-platform/product/european-offshore-wind-farms-map/ A subscription is required.

157https://cleanenergynews.ihsmarkit.com/research-analysis/poland-takes-first-steps-to-offshore-wind-target-passes-key-le.html;

158 https://www.offshorewind.biz/2021/08/04/lithuanian-government-adopts-offshore-wind-rules/

159 https://balticwind.eu/polish-lithuanian-summit-talks-on-development-of-offshore-wind-energy/

160 Baltic Lines, 2019. 2030 and 2050 Baltic Sea Energy Scenarios – Ocean Energy. https://vasab.org/wp-content/uploads/2019/05/Baltic-LINes-2030-and-2050-Baltic-Sea-Energy-Scenarios-Ocean-Energy.pdf

161 Exclusion zones are zones around seabased events or operations where sea traffic is forbidden from entering for safety reasons. These refer to a blanket 500m zone around above-surface oil and gas installations.

means that at least three quarters of the future offshore wind power capacity cannot be built at a very low levelised cost of energy (LCOE)[162] in the North Sea[163], which would otherwise be possible in the absence of exclusion zones.

Long-term development should be planned in advance by public authorities. To this end, the Maritime Spatial Planning Directive[164] requires all coastal Member States to submit national maritime spatial plans to the European Commission by 31 March 2021. Maritime spatial planning is an essential and well-established tool to anticipate change, prevent and mitigate conflicts between policy priorities while also creating synergies between economic sectors[165]. The uptake of this practice is increasing in EU Member States[166] [167]. Synergies between economic sectors, such as combinations between offshore wind farms and tourism and aquaculture, are already taking place in several locations. For example, in Sweden, Denmark, Belgium, the Netherlands, United Kingdom and Germany, boat tours and information centres on land are quite common outreach strategy of the offshore wind sector for obtaining social acceptance,and improving their corporate social responsibility[168]. Moreover, several pilot projects such as, among others, Edulis (Belgium)[169] and UNITED (Germany, Denmark, the Netherlands, Belgium, and Greece),[170] examined the multi-use of offshore wind farms and low trophic aquaculture.

Addressing legal and regulatory barriers hindering offshore RE deployment, especially on market design

According to WindEurope, the main barrier to offshore wind energy deployment is not related to technology, financing, or costs, but to permitting. In some cases, rules to get permits for new and repowered wind farms in Europe can be complex, procedures are slow, and permitting authorities are not adequately staffed. Nevertheless, some national maritime spatial plans are increasingly incorporating offshore wind as a key industry, paving the way for its further development. In response to the aforementioned barrier, the European Commission has adopted guidelines and a proposal for an amendment of the Recast

162 Levelized cost of energy, or levelized cost of electricity (LCOE), measures the average net present cost of electricity generation for an offshore wind turbine over its lifetime and is based on wind speed, distance to shore and water depth.

163 WindEurope, 2019. Our energy, our future. How offshore wind will help Europe go carbon-neutral. https://windeurope.org/about-wind/reports/our-energy-our-future/

164 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0089

165 COM/2020/741 final. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. An EU Strategy to harness the potential of offshore renewable energy for a climate neutral future.

166 https://maritime-spatial-planning.ec.europa.eu/sea-basins/north-sea-0

167 https://maritime-spatial-planning.ec.europa.eu/sea-basins/baltic-sea-0

168 United Nation Global Compact, 2021. Roadmap to Integrate Clean Offshore Renewable Energy into Climate-smart Marine Spatial Planning. https://www.unglobalcompact.org/library/5977

169 http://bluegent.ugent.be/edulis

170 https://www.h2020united.eu/pilots

Renewable Energy Directive in May 2022 to improve permit-granting procedures and facilitating Power Purchase Agreements (PPAs).[171, 172] As is also presented above, the rise in renewable energy ambitions at the EU level, (resulting from the measures of the REPowerEU initiative), will provide an additional boost to (offshore) RE deployment.

Similar to offshore wind energy deployment, a recent study has found that the consenting process appears to be a major source of barriers for ocean energy technologies.[173] This includes, among others, lengthy procedures, multiple consenting agencies, and a lack of a streamlined process. However, there are significant differences in approaches among countries. For example, in Denmark the processing time ranges from 1 month to several years, while in France range from 1 to 4 years. In Norway, there is only one licensing authority, while in England (the UK) there are four licencing authorities. In the Northern Ireland (the UK) the number of consents needed is nine on average, while in Sweden five are needed on average.

Supporting schemes for procurement

Revenue stabilisation and risk mitigation are among the benefits of a well-designed and robust support scheme for offshore wind. This is due to offshore wind's relatively larger time and capital investment requirements compared to other renewable energy technologies. This sharpens the focus on bankability conditions, as well as significant dependencies on enabling infrastructure such as grids, ports, manufacturing, and workforce capacity.[174] Markets like Germany and the Netherlands began with Feed-in-Tariffs (FiTs) to minimise risk to developers and investors. Once sufficient volume was underway, they eventually moved to competitive schemes or procurement frameworks with greater price exposure to wholesale markets. Denmark initially financed RE projects through the PSO (Public Service Obligation) tariff, while the UK did so through Renewables Obligation (a subsidy scheme). Both Denmark and the UK then employed a Contract for Difference (CFD) to facilitate cost reductions in offshore wind.

Making components (e.g., wind turbine blades) fully circular

Decommissioning practices are starting to emerge in those countries with a mature market. Wind turbines already have a recyclability rate of 85% to 90%. Most components of a wind turbine – the foundation, tower, components of the gear box and generator – are recyclable and are treated as such. However, wind turbine blades are challenging to recycle due to the bonds of the thermoset plastic in the composite materials used in their production. While various technologies exist to recycle glass fibre and carbon fibre from wind turbine blades, these solutions have yet to become widely available at an industrial scale and to be cost-competitive. To accelerate circularity, the wind industry calls for a Europe-wide landfill ban

171 https://energy.ec.europa.eu/topics/renewable-energy/enabling-framework-renewables_en

172 Directive (EU) 2018/2001

173 Apolonia, M., Fofack-Garcia, R., Noble, D. R., Hodges, J., & Correia da Fonseca, F. X., 2021. Legal and Political Barriers and Enablers to the Deployment of Marine Renewable Energy. Energies, 14(16), 4896.

174 Global Wind Energy Council, 2021. Global offshore wind report 2021. https://gwec.net/global-offshore-wind-report-2021/

on decommissioned wind turbine blades by 2025, meaning that the industry commits to re-use, recycle, or recover 100% of decommissioned blades.[175]

Data gaps

Following the growth of offshore wind farms in the North and Baltic seas, data are becoming more and more available. In contrast, data on ocean energy technologies are limited, reflecting the early stage of their development.

Main performance indicators for offshore wind farms (e.g., average capacity factors and capacity density), and data tracking current and future capacity is available. However, there is a lack of a harmonised practice for the collection, processing, and publication of data, which also leads to different levels of data quality. Moreover, most of the publicly available data lack a sufficient level of detail that would enable to assess the current status and performance of offshore wind farms, including – but not limited to – environmental conditions (e.g., wind speed), operational ability (share of the time when the system is operating compared to the total time), reliability (the number of failures per turbine and/or per component), age of installation, etc.

Conclusion

Wind energy is the largest source of offshore RE in Europe. Offshore wind energy in the Baltic Sea, and, especially in the North Sea has experienced rapid growth in recent years. Thehe annual cumulative installed capacity is expected to increase significantly in coming years. Untapping such potentials, while preventing degradation of the environment, will require addressing regulatory and legal barriers (e.g., complex permitting rules), strategic maritime and spatial planning, government support, and decommissioning practices. The recent REPowerEU initiative, which was introduced as a measure to reduce gas dependency from Russia, will provide further boost the deployment of RE in Europe, and is complemented by the recent permitting guidelines, which seek to accelerate the permitting procedures and reduce administrative obstacles. The EU has thus already introduced measures to overcome the primary obstacles to further offshore RE deployment.

6.4.2. Proposed Indicators

The following indicators are proposed for the assessment of the Mission's outcome on *Cost-effective solutions for setting up fully circular, zero pollution offshore clean energy facilities*:

Output indicators

- *Number of projects implemented (and total funding provided) supporting the development of offshore renewable energy facilities that aim to be fully circular and/or create zero pollution*: The indicator provides information on the number of projects and total funding that fund/implement offshore renewable energy solutions that are fully

175 WindEurope, 2020. How to build a circular economy for wind turbine blades through policy and partnership. https://windeurope.org/wp-content/uploads/files/policy/position-papers/WindEurope-position-paper-how-to-build-a-circular-economy.pdf

circular and/or lead to zero pollution. The indicator can be specified for EU funds but would offer greater value if it also encompassed regional and national funds.

Outcome indicators

- *Installed offshore renewable energy capacity, by type of source* (in MW): the indicator describes the installed maximum generation capacity.

- *Planned offshore renewable energy capacity by type of source (in MW):* the indicator describes the planned maximum generation capacity, and thus what can be expected to be produced by 2025 and by 2030.

- *Capacity density (in MW/km^2):* The indicator refers to the amount of energy that is produced per km^2, and thus describes how much (and how well) the existing sea space is utilised.

- *Recycling rate of renewable energy facilities (annual, in %):* This indicator describes the percentage of recyclable materials that is actually being recycled at the end of the operational lifetime of a facility.

- *Average capacity factor (annual, in %):* The indicator is defined as the average power that is being generated, divided by the maximum power rating, and describes the extent to which energy is being generated at the maximum capacity.

- *Average permitting time for new and repowered wind farms (in months):* This indicator describes the average time per country and per sea basin for the whole permitting process.

- *Share of offshore renewable energy capacity that is aligned with the EU taxonomy's DNSH criteria for wind energy (in %):* The indicator identifies the level of RE capacity that does no significant harm to climate adaptation, water resources, the circular economy, pollution prevention, and biodiversity & ecosystems.

Impact indicators

- *Share (%) of the growth in renewable energy capacity in the lighthouse area originating from offshore renewable energy, against the baseline of 2021*: The indicator provides information on the extent to which the growth in renewable energy capacity in the lighthouse area can be attributed to offshore renewable energy.

For the indicators proposed above, the following data could be collected, based on the available information (see

Table 32 below):

Table 32: Baseline indicator framework for offshore renewable energy facilities

Indicator type	Indicator	Data/Description
Output	Number of projects implemented (and total funding provided) supporting the development of offshore renewable energy facilities that aim to be fully circular and/or create zero pollution	Not available. Data would have to be collected from project investors, but also national authorities and EU funds that finance projects.
Outcome	Installed offshore RE capacity Offshore wind energy[176] Wave[177] Tidal	*The installed maximum net generating capacity* United Kingdom: MW 11,069 Germany: MW 7,689 Netherlands: MW 2,986 Denmark: MW 2,308 Belgium: MW 2,261 Sweden: MW 192 Finland: MW 171 Europe: MW 12 Europe: MW 27.9
Outcome	Planned offshore RE capacity Offshore wind energy[178] Wave[179] Tidal	*The planned maximum net generation capacity* Belgium: MW 3,500 Denmark: MW 19,974 Estonia: MW 12,590 Finland: MW 3,374 France: MW 10,004 Germany: MW 20,255 Latvia: MW 500 Lithuania: MW 700 Netherlands: MW 147,600 Norway: MW 5,006 Poland: MW 10,027 Sweden: MW 34,510 United Kingdom: MW 54,237 Europe: MW 3.1 Europe: MW 2.9

176 https://windeurope.org/intelligence-platform/product/european-offshore-wind-farms-map-public/

177 Ocean Energy Europe, 2021. Ocean Energy Key trends and statistics 2020. https://www.oceanenergy-europe.eu/wp-content/uploads/2021/03/OEE-Stats-Trends-2020.pdf

178 Data were extracted from European Offshore Wind Farms Map https://windeurope.org/intelligence-platform/product/european-offshore-wind-farms-map/ A subscription is required.

179 Ocean Energy Europe, 2021. Ocean Energy Key trends and statistics 2020. https://www.oceanenergy-europe.eu/wp-content/uploads/2021/03/OEE-Stats-Trends-2020.pdf

Outcome	Capacity density Offshore wind energy[180] [181]	*The capacity density indicates the amount of energy that is produced per km²* North Sea region: 6.0 MW/km² Baltic Sea region: 5.5 MW/km² Europe: 6.4 MW/km² Poland[182]: 7.1 MW/km²
Outcome	Recycling rate Offshore wind turbines[183]	*The recycling rate is the percentage of recyclable materials actually recycled* 85%-90%
Outcome	Average capacity factor Offshore wind turbines[184] Wave[185] Tidal[186]	*The capacity factor, or load factor, is the average power generated, divided by the rated peak power* Europe: 42%[187] North Sea: 25-32% Europe: 20%-37%

180 Borrman, R., Rehfeldt, K., Wallash, A., Lüers, S., 2018. Capacity densities of European offshore wind farms. https://vasab.org/wp-content/uploads/2018/06/BalticLINes_CapacityDensityStudy_June2018-1.pdf

181 Enevoldsen, P., & Jacobson, M. Z., 2021. Data investigation of installed and output power densities of onshore and offshore wind turbines worldwide. Energy for Sustainable Development, 60, 40-51.

182 The figure refers to the average planned capacity of seven project (Baltica 2, Baltica 3, Baltic Power, BC Wind, FEW Baltic II, MFW Bałtyk II, MFW Bałtyk III). Information were provided by the Ministry of Climate and Environment, Poland.

183 WindEurope, 2020. Accelerating Wind Turbine Blade Circularity. https://windeurope.org/intelligence-platform/product/accelerating-wind-turbine-blade-circularity/

184 WindEurope, 2021. Wind energy in Europe 2020 Statistics and the outlook for 2021-2025. https://windeurope.org/intelligence-platform/product/wind-energy-in-europe-in-2020-trends-and-statistics/

185 Lavidas, G., 2020. Selection index for Wave Energy Deployments (SIWED): A near-deterministic index for wave energy converters. Energy, 196, 117131.

186 Magagna, D., 2019. Ocean Energy Technology Development Report 2018, EUR 29907 EN, European Commission, Luxembourg, ISBN 978-92-76-12428-3, doi:10.2760/158132, JRC118296.

187 Poland: 45.7% - information provide by the Ministry of Climate and Environment, Poland.

Outcome	Average permitting time for new and repowered wind farms (in months)	This indicator would need to be collected through primary data collection, such as surveys to authorities, industry associations, and permit applicants.
Outcome	RE capacity (GW) that is aligned with the EU taxonomy	There is no aggregated indicator available. The data can however be gathered from investors who are subject to the EU Sustainable Finance Disclosures Regulation (SFDR). Under the EU SFDR, investors have to use Regulatory Technical Standards to disclose how investors make sustainable investments.
Impact	Share (%) of the growth in renewable energy capacity in the lighthouse area originating from offshore renewable energy, against the baseline of 2021	The data can be collected through the above indicator on 'Installed offshore RE capacity', which can be combined with RE indicators from Eurostat.

6.4.3. Activities & Projects

The table below presents projects identified as relevant for thematic area 3. The table presents the number of projects and funding amounts within different focus areas. This is presented for projects that focus specifically on the Baltic Sea, North Sea, or generally focus on European seas. It should be noted that one project can have multiple focus areas.

Offshore wind energy is by far the most covered focus area, both in terms of the number of projects and amount of funding. Compared across the lighthouse area, there are more projects found that focus on the North Sea. There are further projects found that focus on the wider area of ocean energy, or even more specifically on tidal energy (utilising the currents of tides), or wave energy (utilising wave movements).

Table 33 Overview of INTERREG, Horizon, LIFE, and HELCOM projects focusing on offshore RE facilities since 2010

Keywords	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)
	Baltic Sea			North Sea			Focus on seas (excluding projects focused on Baltic & North Seas)		
Wind energy	3	9	7	6	108	78	17	109	74
Airborne wind energy	1	3	2	-	-	-	3	7	6
Ocean energy	-	-	-	2	17	9	6	58	41
Tidal energy	-	-	-	3	18	11	8	80	49
Wave energy	1	5	5	-	-	-	6	25	23
Offshore renewable energy	-	-	-	-	-	-	2	23	19

Source: authors' assessment

6.4.4. Recommendations

Data gaps

The data collection has shown that there is no harmonised practice and that the available high-level data lacks a sound definition of offshore RE and other relevant indicators. It is therefore recommended to:

- Establish a more centralised collection (e.g. Eurostat) of information for indicators which enable an isolated assessment of offshore RE performance to ensure consistent data quality and avoid the fragmentation of data across national statistics and/or private stakeholders

- Establish more comprehensive data sets on the performance of offshore RE facilities, such as environmental conditions, operational ability, reliability, and recyclability as well as environmental impact performance. This can be done by obtaining and merging for example meteorological data and data from project developers, operators, and owners of offshore RE facilities.

Knowledge/Funding gaps

The analysis above shows that offshore RE is already a considerably, economically competitive technology, and that strong growth is expected for the coming decades in this area. However, spatial constraints and other policy-related barriers limit the full potential of offshore RE. As regards to policy-related barriers however, the EU has recently introduced action (i.e. the REPowerEU initiative and permitting guidelines), which seeks to reduce these barriers. It is recommended to focus on the following:

1. Support projects and activities that promote knowledge exchange among maritime spatial planners on how to enable a better uptake of offshore RE in MSPs;

2. Support projects and activities that increase the uptake of multi-use offshore RE projects, such as in combinations with marine aquaculture or recreational purposes;

3. In the context of the REPowerEU initiative and the permitting guidelines, projects and activities can be supported which focus on exchange on effective practices that (i) remove barriers that are not addressed by the above, (ii) implement the above initiatives, and (iii) promote multi-use approaches to offshore RE;

4. Support R&I projects that introduce new approaches to achieving full circularity of offshore RE facilities, focusing particularly on materials that are currently not recyclable or difficult to recycle or reuse (e.g. wind turbine blades) and environmental impacts.

6.5. Thematic Area 4: Offshore RE storage facilities

6.5.1. Baseline situation

Introduction

The opportunities (and potential) for the integrated implementation of various offshore RE and for storage systems, are vast, but at an early stage of development. There are a number of low-carbon energy solutions that are currently considered to be options for enabling a cost-efficient energy transition.[188] The identified opportunities mainly relate to the North Sea region due to its high share of installed capacity of offshore RE.

Energy storage using offshore assets

One of the possible applications for offering flexibility to the energy system and to stabilise prices is through storage. This may be done on a small scale in batteries on existing platforms but also in the form of gas storage (hydrogen) in small tanks, caverns, or gas fields. This could be placed on or unlocked via platforms or islands. Both batteries and integrated power-to-hydrogen solutions offer flexibility to the electrical system. The most significant advantages of power-to-hydrogen are its potential integration into the gas system and access to the considerable flexibility of that system. In contrast, battery storage technologies have generally higher roundtrip efficiencies.

The REPowerEU initiative recognises the importance of storage systems to an accelerated transition. Therefore, the initiative introduces a number of activities that seek to support the development and deployment of the storage facilities. The European Commission will promote a European market for hydrogen, incl. storage facilities, as part of the “Hydrogen Accelerator”, by further developing the regulatory framework, ensuring that the infrastructure is compatible across the border, mobilising more funding through the CEF, Cohesion Funds, and the RRF, and facilitating cooperation (e.g. on joint purchasing of hydrogen under the EU Energy Platform.[189]

North Sea

The possibility of combining offshore wind farms and battery storage has been explored by the Danish group Ørsted, who is the largest offshore wind developer. In 2017, Ørsted added a 2 MW battery energy storage system to the Burbo Bank offshore wind farm in the UK to stabilize its delivery frequency to the grid. The 90 MW Burko Bank project is located in Liverpool (the UK) and has been in operation since 2007.[190]

---

[188] North Sea Energy, 2020. Unlocking potential of the North Sea. Interim Program Findings June 2020. https://north-sea-energy.eu/static/3e19bcb9aa57735fe1bbc423ca22d5e7/FINAL-North-Sea-Energy-Unlocking-potential-of-the-North-Sea-program-findings-2020.pdf

[189] European Commision, COM (2022) 230 final on the REPower EU Plan, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A230%3AFIN&qid=1653033742483

[190] Orsted, 2019. Burbo Bank Offshore Wind Farm https://orstedcdn.azureedge.net/-/media/www/docs/corp/uk/updated-project-summaries-06-19/190514_ps_burbo-bank-web_aw.ashx?la=en&rev=fb2686e48e004d12b0e04a14dfc82696&hash=DD9E2352B14CC817CA78895DC2FCE013

In 2021, Tractebel and partner companies have developed what they describe as the world's first offshore infrastructure and processing facilities concept for the storage of hydrogen in offshore caverns. The plant complex developed by Tractebel has initially been dimensioned to convert 2,000 MW of offshore wind power into hydrogen. Underground salt caverns will be used as storage and buffer space for the hydrogen produced offshore, before the gas is transported via the pipeline network to the onshore grid, and finally to consumers and customers. Such a facility could store up to 1.2 million cubic metres of hydrogen on the high seas in the future.

The North Sea is considered to be well suited for the solution due to its geological conditions and underground rock salt formations.[191] This is because caverns can be excavated in these formations to create large volumes of storage.

Integration of various RE source: Power-to-X (PtX) e.g., power-to-hydrogen, power-to-methanol, and power-to-ammonia, on offshore platforms and energy islands

The primary source of electricity is foreseen to be offshore wind but could in the future also include offshore solar or other power sources. Besides power-to-hydrogen, renewable electricity can also be converted into other gasses or liquids with existing markets and market value. For example, methanol requires CO_2 in the production process, sourced from a CO_2 infrastructure. Ammonia synthesis requires nitrogen production from ambient air. The production of Power-to-X (PtX) on an offshore location requires a substructure, either platform or island, that will be able to offer a multitude of functionalities. However, an important limiting factor is the space available on platforms to reach economies of scale.

North Sea

There are a number of countries that are currently developing PtX projects.[192] A clear regional focus has been established in the North Sea with Germany, Denmark, France, and the Netherlands being the leading countries. The majority of the PtX project, however, are still in the pre-commercialisation phase.[193] In Germany, for example, the AquaVentus initiative comprises numerous sub-projects along the value chain, from the production of hydrogen in the North Sea, to transport to customers on the mainland.[194] AquaVentus aims to provide 10 GW of generation capacity by 2035.

Denmark is considered a frontrunner in PtX. The Danish Government has recently released a proposal for a new strategy to promote and navigate the future development of PtX projects in Denmark.[195] The PtX strategy focuses on four key points: supporting the cost-

191 https://tractebel-engie.com/en/news/2021/world-s-first-offshore-hydrogen-storage-concept-developed-by-tractebel-and-partners

192 Global Wind Energy Council, 2021. Global offshore wind report 2021. https://gwec.net/global-offshore-wind-report-2021/

193 Wulf, C., Zapp, P., & Schreiber, A., 2020. Review of power-to-X demonstration projects in Europe. Frontiers in Energy Research, 191.

194 https://www.aquaventus.org/presse/flagship-project-for-green-hydrogen/

195 https://investindk.com/insights/denmark-announces-new-power-to-x-strategy

effective CO_2 reductions and the aim of the Danish Climate Act; providing the framework for a general expansion of PtX in Denmark; strengthening the interaction between PtX and the energy system; and supporting the export potential for PtX products and technology. More than 6 GW PtX projects have already been announced in Denmark. Under the "HyBalance" project, excess wind power is used to produce hydrogen by electrolysis for grid balance purposes. The produced hydrogen is then used in the transport and industrial sectors in the city "Hobro" in Denmark[196]. Moreover, on the 4th of February 2021, Denmark committed to building the first energy island in the North Seas. The plan envisages the establishment of an artificial island in the North Sea about 60-80 kilometres from the town Thorsminde (peninsula Jutland), which will serve as a hub for offshore wind farms supplying 3 GW of energy (around 200 wind turbines), with a long-term expansion potential of 10 GW. The first phase, which comprises establishing the island and wind farms with a capacity of 3 GW, is planned to be completed in 2030, while the final phase, which comprises additional wind farms with a capacity of 7 GW, is planned to be completed by 2050. The energy island in the North Sea is expected to have a total area of at least 120,000 square meters.[197]

Baltic Sea

With the agreement of 4 February 2021, Denmark also decided to establish another offshore wind energy island and hub in the Baltic Sea. The energy island in the Baltic Sea will be Bornholm, where electrotechnical facilities on the island will serve as a hub for offshore wind farms off the coast supplying 2 GW of energy (about 133 wind turbines).[198] [199] The energy island in the Baltic Sea will have nearby wind farms, which will be located in offshore areas about 20 kilometres from the city Rønne.

Energy system integration: *Carbon capture and storage using offshore power infrastructure, and electrification of oil & gas platforms*

Carbon capture and storage (CCS) is an important form of system integration because the existing gas infrastructure can be (partially) used to transport and store CO_2. Furthermore, electricity is highly beneficial on platforms for compressing, conditioning, and monitoring CO_2, even though offshore CO_2 transport and storage power requirements are lower than the power required for natural gas production. Synergy can thus be achieved by electrifying oil & gas platforms and using them for CCS.[200]

---

[196] IRENA, 2019. Future of Wind. Deployment, investment, technology, grid integration and socio-economic aspects. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Oct/IRENA_Future_of_wind_2019.pdf

[197] DLA PIPER DENMARK, 2021. Denmark has decided to establish two energy islands and wind farms in the North Sea and the Baltic Sea. https://denmark.dlapiper.com/sites/default/files/node/field_download/Denmark%20will%20establish%20two%20energy%20islands%20and%20windfarms.pdf

[198] https://ens.dk/en/our-responsibilities/wind-power/energy-islands/denmarks-energy-islands

[199] DLA PIPER DENMARK, 2021. Denmark has decided to establish two energy islands and wind farms in the North Sea and the Baltic Sea. https://denmark.dlapiper.com/sites/default/files/node/field_download/Denmark%20will%20establish%20two%20energy%20islands%20and%20windfarms.pdf

[200] Preliminary findings show that the electrification of platforms provides a significant degree of flexibility, as this electricity can be used for multiple applications and results in high cost and emissions reduction for

CCS is also essential in producing blue hydrogen, which is produced by reforming natural gas to hydrogen and CO_2. Finally, CCS could also contribute to the net removal of CO_2 from the atmosphere, for example, by applying CCS in combination with bioenergy or direct capture of CO_2 from the air. Currently, there are very few operational CCS facilities in Europe.

North Sea

In the Netherlands, Belgium, Sweden, and the UK some CCS facilities are at an advanced stage of development.[201] In Denmark, the Project Greensand for CCS has recently received the largest single grant ever awarded in the country (26 EUR mio).[202] The project's goal is to establish an entire value chain for CCS in Denmark by 2025. The project focuses on offshore transportation and storage, and collaborates with partners who focus on onshore capture, transportation, and port bunkering. All offshore transportation of CO_2 will be handled by ship and injected via the offshore well head platform. The CO_2 will be stored in depleted oil and gas sandstone reservoirs 1500 m beneath the seabed and existing infrastructure will be repurposed from oil and gas production to CO_2 injection, and hereby get a second life in the energy transition.

Baltic Sea

According to the Global CCS Institute, none of the countries in the Baltic Sea region is planning to develop CCS using offshore power infrastructure.

Data gaps

The projects related to the integrated implementation of various offshore RE and storage systems are at an early stage of development. Data gaps are significant. Information about planned storage capacity, amount of financial support, and location of the project can be found (though not easily). The number of different types of options and technologies make comparisons difficult.

Conclusion

Unlocking the low-carbon energy potential of the North Sea and Baltic Sea requires integrated system thinking and interlinked changes in the system rather than merely individual technology improvements. The opportunities for collaboration and synergy between sectors are vast. Several options are currently being considered and developed. The majority of these initiatives are taking place in the North Sea region due to its higher share of offshore wind capacity as compared to the Baltic Sea region. Compared to the

---

energy supply. McKenna, R., D'Andrea, M., & González, M. G., 2021. Analysing long-term opportunities for offshore energy system integration in the Danish North Sea. Advances in Applied Energy, 4, 100067.

[201] Global CCS institute, 2021. Global Status of CCS in 2021. https://www.globalccsinstitute.com/resources/global-status-report/

[202] https://projectgreensand.com/the-project/

other countries in the lighthouse area, Denmark appears to be a frontrunner in the integrated implementation of various offshore RE and for storage systems.

6.5.2. Proposed Indicators

Thematic area 4 falls within the Mission Objective Outcome *cost-effective solutions for setting up fully circular, zero pollution offshore clean energy facilities.* Given the above-mentioned limitations in data collection, no indicators are directly available to measure the performance in the lighthouse areas. A future indicator framework could be composed of the following indicators:

Output indicators

- *Number of projects implemented (and total funding provided) supporting the development of offshore storage facilities for offshore RE production*: The indicator provides information on the number of projects that fund offshore storage facilities for offshore renewable energy production. The indicator can be specified for EU funds but would offer greater representativeness if it also encompassed regional and national funds.

Outcome indicators

- *Installed storage capacity for offshore RE production (by type, in MW)*: The total installed amount of energy that can be stored or discharged by the battery storage system.

- *Planned storage capacity for offshore RE production (by type, in MW)*: The total planned amount of energy that can be stored or discharged by the battery storage system.

- *Storage system efficiency (annual average, in %)*: The percentage of energy delivered by the storage system compared to the energy initially supplied to the storage system.

- *Energy conversion efficiency (annual average, in %)*: The ratio between the useful energy output and the energy input (e.g., offshore wind energy-to-hydrogen).

Impact indicators

- *Share (%) of the growth in energy storage capacity in the lighthouse area originating from offshore energy storage, against the baseline of 2021*: The indicator provides information on the extent to which the growth in energy storage capacity in the lighthouse area can be attributed to offshore energy storage.

For the indicators proposed above, the following data could be collected, based on the available information:

Table 34: Baseline indicator framework for offshore renewable energy storage facilities

Indicator type	Indicator	Data/Description
Output	Number of projects implemented (and total funding provided) supporting the development of offshore storage facilities for offshore RE production	Not available. Data would have to be collected from project investors, but also national authorities and EU funds that finance projects.
Outcome	Installed storage capacity for offshore RE production (by type, in MW) Battery energy storage offshore wind farm	The total installed amount of energy that can be stored or discharged by the battery storage system The UK: 2 MW
Outcome	Planned storage capacity for offshore RE production (by type, in MW) Offshore wind power-to-hydrogen Energy island Offshore wind power-to-hydrogen Offshore wind power-to-hydrogen Energy island	The total planned amount of energy that can be stored or discharged by the battery storage system North Sea (Tractbel project – North Sea) Denmark: 10,000 MW Denmark: 6,000 MW Germany: 10,000 MW Baltic sea Denmark: 2,000 MW
Outcome	Storage system efficiency (annual average, in %)	The percentage of energy delivered by the storage system compared to the energy initially supplied to the storage system Not available, but can be established from data provided by national authorities (e.g. as part of 'raw' data provided to EU energy statistics, or the Transmission

		system operators (TSOs) in the lighthouse areas.
Outcome	Energy conversion efficiency (annual average, in %)	The ratio between the useful energy output and the energy input (e.g., offshore wind energy-to-hydrogen) Not available but can be established as also presented above.
Impact	Share (%) of the growth in energy storage capacity in the lighthouse area originating from offshore energy storage, against the baseline of 2021	The data is directly available. It can be collected through the above indicator on 'Installed storage capacity for offshore RE production', which can be combined with data on total installed storage capacity in the lighthouse area (which must be collected from project developers, industry publications, and potentially national authorities)

6.5.3. Activities & Projects

The table below summarises the EU projects that focus on the offshore RE storage (thematic area 4). The table shows that there is, one project in the Baltic Sea and North Sea that focuses on energy storage in general. Finally, two projects in the North Sea study hydrogen energy storage.

However, at the EU level funding is provided for projects on storage solutions like batteries and PtX. These do however not focus on offshore deployment and are therefore not presented in the table below. Hydrogen energy storage is widely researched and studied. Methanol, which is an alternative energy storage form to hydrogen, is in turn addressed by only two projects. Two other energy storage forms which projects focus on are batteries (for e.g. port operations), and thermal energy storage (e.g. for heating and cooling of port facilities). The storage forms have, however, a less significant storage potential than hydrogen due either to their comparably limited storage capacity or their limited application range.

Table 35 Overview of INTERREG, Horizon, LIFE, and HELCOM projects focusing on offshore RE storage since 2015

Keywords	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)
	Baltic Sea			North Sea			Focus on seas (excluding projects focused on Baltic & North Seas)		
General energy storage	1	2	1	1	4	2	-	-	-
Hydrogen energy storage	-	-	-	2	28	8	1	7	5

Source: authors' assessment

6.5.4. Recommendations

Data gaps

The low number of operational offshore RE energy storage facilities currently make it of limited relevance to ensuring the provision of centrally stored data, as the resources required for the collection may not be proportionate. In the initial phase, it can therefore be worthwhile to conduct ad-hoc data collection. However, as more offshore RE storage facilities become operational, it is recommended to ensure that the data underlying the indicators proposed above are centrally collected, either by national authorities or the European Commission, to ensure harmonised data of sufficient quality.

Knowledge/Funding gaps

The development of energy storage technologies is still in a pre-commercial stage, but as the analysis above shows, there are many projects that investigate energy storage solutions (particularly hydrogen). However, further knowledge is needed on how to optimally integrate energy storage on offshore RE facilities and/or multipurpose platforms (MPP). Furthermore, since championing countries in energy storage are found in the lighthouse area, it is recommended to:

1. Promote projects and activities that demonstrate the economic and technical feasibility to establish energy storage facilities on MPPs;

2. Promote projects and activities that investigate offshore energy storage on existing facilities, and particularly geological storage in the North Sea;

3. Promote knowledge exchanges, where championing regions within offshore energy storage (incl. PtX) can share their insights and experiences in the lighthouse area;

4. Support early niche applications with promising commercial potential, including scalability of technology, manageable technology risk, and wider societal acceptance.

6.6. Thematic Area 5: Multipurpose platforms

6.6.1. Baseline situation

Introduction

One of the challenges facing the lighthouse area regarding its ability to support infrastructure for decarbonisation, is the lack of sufficient offshore space. Combining different uses of marine areas into one can help to alleviate some of the concerns for expansion of, for instance, aquaculture into areas with heavy maritime transport traffic, recreational areas, or protected areas. Multipurpose platforms (MPPs) have become increasingly popular as possible options for reducing competition for functional marine space. MPPs can also be used as a means to support growth and rehabilitation of biodiversity through creation of and protection of habitats. Through the supply of energy, food, and jobs, MPPs can also support rural and remote island or coastal communities.[203]

The benefits of MPPs are numerous and the number of research projects that have already been completed or are ongoing demonstrates it as a key point of interest for the EU and the future of its marine areas. Governance of these areas along with marine technology will be vital to the sector's growth and capacity to support the EU's Sustainable Blue Economy. Of the projects in the EU, combining wind energy alng with wave energy is the most feasible, yet still faces many barriers in terms of technology and access to sites. Multiple pilots such as MERMAID, MUSES, A Rich North Sea and H2OCEAN looked at how to best combine use-types through MPPs to maximize efficiency and ease implementation challenges. [204]

Despite the benefits outlined above, MPPs are firmly in their inception phase, or even their pre-inception phase in the EU and even more so in the Baltic and North Sea. Pilot studies and projects (e.g. EU-SCORES, which seeks to deliver the world's first bankable hybrid marine energy parks), are ongoing but have yet to produce any significant results or data that can signal a potential upscaling. This lack of data allows for a hypothetical analysis where potentials are used as indicators and several conclusions can be drawn about the barriers to implementation of such projects which exist on a wider scale.

It should, however, be noted that the EU has further projects in the pipeline, as the Horizon Europe Work Programme for 2021-2022 foresees dedicated calls for the European Missions.[205] One Horizon Europe call dedicated to aquaculture and multi-purpose of marine space in the Baltic and North Sea lighthouses was concluded in April 2022.[206] Accordingly, further demonstration projects can be expected in the coming years.

---

[203] Abhinav, K. A., et al., 2020, Offshore multi-purpose platforms for a Blue Growth: A technological, environmental and socio-economic review.

[204] MERMAID: https://cordis.europa.eu/project/id/288710; MUSES: https://cordis.europa.eu/project/id/727451; A Rich North Sea: https://www.derijkenoordzee.nl/en; H2OCEAN: https://cordis.europa.eu/project/id/288145

[205] https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2021-2022/wp-12-missions_horizon-2021-2022_en.pdf#page=143&zoom=100,91,774

[206] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-miss-2021-ocean-04-01

Overview of MPPs

Of the countries in the lighthouse area, Denmark, Germany, Belgium, and the Netherlands are front-runners for concrete implementation and pilot studies of MPPs with already ongoing activities which combine use areas. Denmark is a leader in offshore wind farms with some of the largest wind farms in the EU. Off the coast of Copenhagen, there are wind farms that are already being used for both energy as well as for recreation. While not providing multiple forms of production, i.e. wind and wave energy or wind energy and aquaculture production, tourist activity can also generate support for MPPs and build a base of knowledge for the future of the sector. For Germany, Belgium, and the Netherlands, the projects are less concrete in the sense that they have only just finalised the conclusions from their pilots. In the tables below, the ongoing projects in the lighthouse area are presented alongside the scale of capacity and use value. The tables below show the areas from the main pilots and ongoing implementation activities, which indicates that there is currently a small uptake for MPPs in the lighthouse area.

Baltic Sea

Table 36. Overview of MPPs in the Baltic.

Project title and country	Types of uses	Scale / Use value	Expansion
Kiel Mussel Farms, Baltic Sea, Germany	Mussels, Offshore seaweed	Mussels and seaweed production, no concrete values	Improved technology and operations, expected results by 2023
Kriegers Flak, Baltic Sea, Denmark	Offshore wind, aquaculture (Salmon or trout)	Energy and fish production	Potential for seaweed in same site

North Sea

Table 37. Overview of MPPs in the Baltic.

Project title and country	Types of uses	Scale / Use value	Expansion
Middelgrunden, North Sea, Denmark	Offshore wind, recreation	40 MW capacity, 90 kWh annually / Educational	Wave energy of 24 MW and seaweed production
North Sea, Belgium	Oysters, offshore wind, seaweed, reef restoration	Ecosystem services, oyster and seaweed production, energy production	Continued research needed to expand or implement

North Wadden Sea, North Sea, Netherlands	Offshore wind, mussels, seaweed	600 MW, 2,600 GWh; 48 kton WW mussels, 480 kton WW seaweed	N/A

Future Expansion

The expansion of MPPs in the lighthouse area and into the rest of the EU is dependent on feasibility and accessibility, as well as on the results of the pilot studies already taking place. The investment needs and returns are not entirely realised, making entry into the sector costly. In addition, the challenges presented from the pilots show that regulatory barriers exist and a complicated licensing and permitting process makes the entire uptake for MPPs difficult. These barriers will be explored further on in the section on challenges. In many cases, the benefits for dual use of offshore wind platforms are not quantified in the sense that they provide ecosystem services, such as water filtration, protection and restoration of biodiversity, and education. While these services can improve the visibility and attitude towards MPPs, they do not provide any direct financial benefits, unless payments for these services are part of the legal framework.

The basis for a MPP framework in the lighthouse area comes from several EU funded studies in different geographies and across different use-types. These studies give a clear picture of the sector and indicate key areas for expansion in the lighthouse area. These studies include MERMAID, MUSES, EU SCORES and A Rich North Sea.The MERMAID project looked at four potential MPP sites, including two in the lighthouse area focusing the business, technical, spatial socio-economic planning, and environmental dimensions. The first site which is relevant to the lighthouse area is in the Danish Baltic Sea area, the Kriegers Flak and the other in the Netherlands in the North Wadden Sea. The offshore wind sector in Denmark is already robust and the Baltic Sea has high potential for MPP as it is shallow, allowing for easy technological access. Combining offshore wind, fish farming as well as seaweed production, the pilot found that turbine foundations can provide a habitat for filter feeders that could sequester waste lost from fish farms creating a semi-closed loop for nutrient runoff. The Dutch site also found that shallow waters and low wave activity make it an ideal site in terms of stability, although high temperature peaks make it a difficult environment for certain species beyond shellfish and seaweed. The conclusions from the study give guidelines for project owners to establish MPPs and on how to avoid some of the main barriers that are presented in the study.[207]

MUSES undertook an in-depth analysis for European basins and the Blue Growth potential of MPPs including a broad mapping of the most attractive sites. The project also looked athow these sites can provide some insights into environmental, societal, technological, and political goals, and presented some concrete courses of action. The project covered both the Baltic and the North Sea. Among other conclusions, it examined uses beyond the traditional standard for MPPs, such as use in shipping terminals and for the generation of green energy and in desalination/hydrogen for renewable energy.[208]

207 CORDIS, 2021, Innovative Multi-purpose off-shore platforms: planning, Design and operation, https://cordis.europa.eu/project/id/288710

208 MUSES Project, https://muses-project.com/

EU SCORES, under Horizon 2020, combines offshore wind with wave and offshore solar PV energy. The site is set to be installed 2 km off the Belgian coast and will focus on demonstrating complementary production profiles to wind parks, the electrical integration with existing infrastructure, and the long-term endurance of an offshore multipurpose platform on. The project is in its preparatory phase including permitting, technical design and impact analysis. The study should be concluded in October 2022.[209]

The project A Rich North Sea looked at the possibilities for enhancement of biodiversity in offshore wind farms. The study also provided insight in the Netherlands, on using the base of turbines in offshore wind farms as a way to increase the number of reefs and growth of oysters, thereby enriching the North Sea biodiversity. By establishing reef-building species such as the flat oyster, the blue mussel and tubeworms, a soft seabed can be transformed into a hard and long-term seabed with increased endo and epi-benthic communities, which in turn provides habitats for species such as cod and sea bass. The study looked at actual and planned offshore wind farms comprising 12 different specific farms in the north and south part of the Dutch North Sea. The study identified three key aspects for establishing reefs in offshore wind farms: identifying and protecting existing biodiversity, introducing and restoring reefs with reef building species, and constructing artificial reefs at offshore wind farms in order to optimise reef structures. With costs in the middle-range and objectives of promoting biodiversity, the feasibility of reef restoration is high in the Baltic and the North Sea.[210]

The data gaps in the MPPs lie in their general uncertainty as they are still in the pilot phase, especially for the lighthouse area. The main data issues are therefore based on the the fact that the data does not yet exist. However, data on both maritime aquaculture and offshore wind farms can be used tentatively for the potential of future MPPs.

The challenges for expansion of MPPs are related to the existing challenges for offshore wind, i.e. energy transfer to shore, permitting, energy storage, and capacity to withstand extremes. On top of this, the design of the systems met with barriers related accounting for environmental impact on marine space, such as the impact on native species and the encroachment on potentially protected marine space. In addition, maintenance requirements, as well as costs of installation depending on depth add complexity. Generally, the capacity for MPPs is highly dependent on power grid development, the need for interdisciplinary technical skills (i.e., wind power and aquaculture production), as well as the need for close collaboration between different interest groups for which a regulatory framework does not exist yet.

209 https://euscores.eu/#solar-wind

210 Bureau Waardenburg, 2020, Options for biodiversity enhancement in offshore wind farms, https://www.buwa.nl/fileadmin/buwa_upload/Bureau_Waardenburg_rapporten/2020/18-0660_The_Rich_North_Sea-_options_for_biodiversity_enhancement_in_OWFs_07022020-reduced.pdf

6.6.2. Proposed Indicators

The following indicators are proposed for assessment of the Mission's progress on *Applied solutions for multi-use of water space:*

Output indicators

- *Number of projects implemented (and total funding provided) supporting the development of offshore platforms with multiple uses of water space*: The indicator provides information on the number of projects that fund multi-purpose or multi-use platforms in the lighthouse area. The indicator can be specified for EU funds but would generate greater value if it also encompassed regional and national funds.

Outcome indicators

- *Number of operational platforms that combine at least two uses of water space (multipurpose or multi-use) that are aligned with the objectives of the Blue Economy, by types of use:* The indicator measures the number of platforms that contribute to the objectives of the Blue Economy: i) climate neutrality and zero pollution, ii) circularity and prevention of waste, iii) biodiversity conservation and protection, iv) coastal resilience, and v) responsible food systems.[211]

- *Capacity of renewable energy production from multi-use spaces or multipurpose platforms (in MW)*: The indicator describes the amount of offshore renewable energy production that is associated with a multi-use of space.

- *Total aquaculture production from multi-use spaces or multipurpose platforms (annual, in tonnes):* The indicator describes the amount of aquaculture production that is associated with a multi-use of space or multipurpose platform.

- *Total carbon sequestration capacity of multi-use spaces or multipurpose platforms (in kt CO2 equivalent per year):* The indicator describes the carbon sink capacity, which is relevant for some types of use spaces, such as the production of mussels which have a high carbon sequestration capacity.

- *Total area (in ha) of multi-use and multipurpose platforms dedicated to biodiversity and nature conservation and protection:* The indicator describes the extent to which multi-use areas or multipurpose platforms *are* being dedicated to promoting biodiversity.

Impact indicators

- *Gross value added from activities associated with multi-use spaces or multipurpose platforms (in EUR)*: This indicator measures the economic significance of associated platforms. Given that the platforms can have multiple uses with very different types of results that are not directly comparable, gross value added can put different activities into a *common* denominator. Simultaneously, this indicator establishes the significance of multi-use spaces or multipurpose platforms for the Blue Economy.

---

[211] European Commission, 2021, Communication on a new approach for a sustainable blue economy in the EU Transforming the EU's Blue Economy for a Sustainable Future, COM, 2021, 240 final

For the indicators proposed above, the following data could be collected, based on the available information:

Table 38 Baseline indicator framework for multipurpose platforms

Indicator type	Indicator	Data/Description
Output	Number of projects implemented (and total funding provided) supporting the development of offshore platforms with multiple uses of water space, by types of use	Not available centrally. Data would have to be collected from primarily projects that received funding on a regional, national, and EU level. The dedicated call for Horizon Europe is one specific source for this data.
Outcome	Number of operational platforms that combine at least two uses of water space (multipurpose or multi-use) that are aligned with the objectives of the Blue Economy	Middelgrunden, North Sea, Denmark North Wadden Sea, North Sea, Netherlands Total: 2[212]
Outcome	Capacity of renewable energy production from multi-use spaces or multipurpose platforms (in MW)	Middelgrunden, North Sea, Denmark: 40 MW capacity North Wadden Sea, North Sea, Netherlands: 600 MW Total: 640 MWh
Outcome	Total aquaculture production from multi-use spaces or multipurpose platforms (annual, in tonnes)	North Wadden Sea, North Sea, Netherlands: 48 kton WW mussels, 480 kton WW seaweed Total: 528 kton
Outcome	Total carbon sequestration capacity of multi-use spaces or multipurpose platforms (in kt CO_2 equivalent per year)	Not available. The performance would need to be assessed based on the information available by funded projects that have an objective of carbon sequestration.
Outcome	Total area (in ha) of multi-use and multipurpose platforms dedicated to biodiversity and nature conservation and protection	Not available. The area would need to be assessed based on the information available by funded projects that have an objective of conservation and protection. However, the MSPs in the lighthouse area could also provide such information.
Impact	Gross value added from activities associated with multi-use spaces or multipurpose platforms (in EUR)	Not directly available. The basic information on the relevant sectors (e.g. RE or aquaculture) could be available by national statistical authorities that gather macroeconomic statistics (e.g. data per NACE codes). The data would however need to be further synthesised to identify, which activities could qualify as multi-use.

[212] These platforms are not operational in the sense that they are currently producing any additional uses beyond wind energy. These are the only two that have potential values.

6.6.3. Activities & Projects

The table below presents an overview of EU projects focusing on multipurpose platforms (thematic area 5). In this respect, the identified projects are split between multipurpose platforms, which are constructed platforms for use and multi-use of space, which is the combined use of space (e.g. offshore wind and aquaculture).

The table shows that no projects have been identified that have a dedicated focus on the Baltic Sea. For the North Sea, projects have been found with a focus on multipurpose, multi-use, offshore wind, ocean energy, and aquaculture. As also mentioned under thematic area 1 above, many projects have a general focus on European seas and/or include project partners from the lighthouse area, which directly benefits the Baltic Sea and/or North Sea.

Table 39 Overview of INTERREG, Horizon, LIFE, and HELCOM projects focusing on multipurpose platforms since 2012

Keywords	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)
	Baltic Sea			North Sea			Focus on seas (excluding projects focused on Baltic & North Seas)		
Multipurpose	-	-	-	1	8	7	3	29	24
Multi-use	-	-	-	1	-	-	5	27	22
Energy island	-	-	-	-	-	-	1	7	5
Wind	-	-	-	2	8	7	2	16	14
Ocean energy	-	-	-	1	8	7	-	-	-
Wave energy	-	-	-	-	-	-	2	16	14
Photovoltaic	-	-	-	-	-	-	1	10	9
Aquaculture	-	-	-	1	-	-	2	13	9

6.6.4. Recommendations

Data gaps

Due to the low number of operational MPPs and the overall infancy of the sector, it is currently of limited relevance to ensure the provision of centrally stored data. However, once the number of operational MPPs start growing, it is recommended to ensure that the data underlying the indicators proposed above are systematically collected.

Knowledge/funding gaps

The analysis above shows that pilot studies and projects are ongoing have yet to produce significant results or data that can signal a potential upscaling. It is therefore relevant to gather and disseminate more experiences with MPPs to learn about enabling factors and barriers, notably in terms of permitting and licensing.

It is recommended to:

1. Conduct knowledge dissemination activities on recent and on-going projects piloting the use of MPPs in the lighthouse area.

2. Support activities and projects that support maritime spatial planners on how multipurpose platforms (and multi-use of marine space) can be further integrated into MSPs.

6.7. Thematic Area 6: Aquaculture

6.7.1. Baseline situation

Introduction

The aquaculture industry in the Baltic and the North Sea is characterised by a high potential, yet slow growth due to different challenges. These include the ecological effect on wild fish, nutrient overload, competing interests, as well as lack of regulatory guidance or consistency. In Europe, aquaculture is a fast-growing industry with an annual expansion rate of 8% over the last thirty years.213 Nevertheless, in comparison to the global expansion rate, the EU share of production has decreased over time and is only 3.5% of the global production.214 Aquaculture has the potential to reduce the pressure on fish populations that have been declining due to commercial fishing. Seaweed aquaculture can also be combined with fish farming by absorbing dissolved nutrients that lead to eutrophication and can also capture and store CO_2. Line-grown mussels are also becoming increasingly popular due to their low impact and water filtration capabilities. The industry, as it grows, has potential as well to pioneer new environmentally friendly production standards and spur research in the bioeconomy.

Developing zero-carbon and low-impact aquaculture and promoting circular marine and water space use is the centre-point of the Mission's intervention logic.215 The analysis here provides key statistics from the lighthouse areas. In other words, the aquaculture industry is a key focus area within the EU which has the potential to be developed in such a way that it is sustainable and environmentally sound. Many countries have increasingly strict environmental standards for the aquaculture industry (e.g. Denmark). In the lighthouse area, Norway has the largest marine aquaculture industry, followed by the United Kingdom, the Netherlands, Denmark, France, Finland, and Sweden. A few of the lighthouse area countries have very small industries that are either decreasing in size or in their pilot phases.

Organic aquaculture in Europe is also growing, yet it is difficult to establish certifications for producers and has yet to yield a strong economic performance. However, for major species such as salmon and seabass/seabream there was 25% increase in organic aquaculture over the period of 2012-2015.216 Generally, statistics for organic aquaculture are difficult to access and present a problem in tracking the indicators related to the industry as a whole, as they are not separated by marine and freshwater bodies, or by area. Nevertheless, the organic component of the industry is important for the overall outlook for the sector as it continues to expand.

[213] Aqua-Lit, How can the aquaculture sector contribute to reducing marine litter in the North Sea? https://aqua-lit.eu/assets/content/State%20of%20Play%20-%20North%20Sea.pdf

[214] FAO, 2020, The State of World Fisheries and Aquaculture (SOFIA), https://www.fao.org/documents/card/en/c/ca9229en

[215] European Commision, 2021, European Missions – Restore our Ocean and WQaters by 2030, Implementation Plan, https://ec.europa.eu/info/sites/default/files/research_and_innovation/funding/documents/ocean_and_waters_implementation_plan_for_publication.pdf

[216] EUMOFA, 2017, EU Organic Aquaculture, https://www.eumofa.eu/documents/20178/84590/Study+report_organic+aquaculture.pdf

Production and location of aquaculture across lighthouse area

In collecting data on the production and scale of the lighthouse area's marine aquaculture, the main sources used were the FAO database for aquaculture as well as EMODnet. In many cases, data on marine and land aquaculture is not differentiated, and this is reflected in the tables below for the Baltic and the North Sea individually (Denmark and Germany are classified into the Baltic area). In order to create a comparison across the countries, the most recent year was used for which the countries had data. Trends in the industry and whether the industry is growing or not will be discussed in the next section.

Baltic Sea

The Baltic Sea plays a relatively minor role in aquaculture production in Europe in comparison to warmer climates, yet Scandinavian aquaculture traditions are consistent and mostly stable. Marine aquaculture has been prevalent in Denmark for example, for over 50 years and is pioneering line-grown mussels also as a means for nutrient filtration. Estonia has a minimal marine aquaculture industry (a fraction of the Finnish or Danish industry). Poland, Latvia, and Lithuania have no marine aquaculture. The Finnish industry is focussed on research and development, in particular to improve the sustainability of its production. For Germany, only data on mussels could be located.

The table below presents marine production data for the Baltic from a variety of sources, though not differentiated between offshore and onshore production.

Table 40 Most recent production values of marine aquaculture in the Baltic Sea.

Country	Marine production in tonnes (most recent)	Main species
Denmark	19,167 tonnes (5,110 tonnes organic production)[217]	Rainbow trout, European flat oyster, blue mussel, European eel, seaweed
Estonia	1,062 tonnes (2019)[218] 100,00-150,000 tonnes algae	Shellfish, red algae[219]
Finland	11,914 tonnes[220]	Rainbow trout, European whitefish
Germany	22,264 tonnes[221]	Mussels
Latvia	-	-

---

[217] Data received from the Danish Ministry of Food, Agriculture, and Fisheries for 2021.
[218] Fisheries Information Centre, 2020, Estonian Fishery 2019, http://www.kalateave.ee/images/pdf/Estonian_Fishery_2019_web.pdf
[219] Red algae comes from wild harvesting and is not cultivated, so these estimates are a bit outside of the scope for aquaculture.
[220] Luke Statistics, Finland, 2018, http://statdb.luke.fi/
[221] EUMOFA, 2019, Fresh Mussel in the EU, https://www.eumofa.eu/documents/20178/151118/PTAT+Fresh+Mussel_EN.pdf

Lithuania	-	-
Poland	-	-
Sweden	4,856 tonnes[222]	Mussels, rainbow trout

North Sea

The North Sea aquaculture industry is dominated by Norway, which has a higher production level than the entire EU combined. The majority of the farming in Norway is of Atlantic Salmon and Norway is developing its industry to grow even further.[223] The values presented for Norway also include the areas outside of the North Sea and have not been split by region. For France, an estimate of the small portion from the North Sea section of the country was calculated based on the figures presented in the 2019 report, *The fisheries and aquaculture sector in France*.[224]

Table 41 Most recent production values of marine aquaculture in the North Sea.

Country	Marine production in tonnes (most recent)	Main species
Belgium	75 tonnes[225]	Rainbow trout
France*	4,830 tonnes[226]	Seabream, seabass, mussels, oysters
Netherlands	46,350 tonnes[227]	Blue mussel, Pacific cupped oyster,
Norway	1,400,000 tonnes[228]	Atlantic salmon, rainbow trout
United Kingdom	184,932 tonnes[229]	Atlantic salmon, mussels and rainbow trout

[222] SCB, 2018, Aquaculture in Sweden, https://www.scb.se/contentassets/cef2fb103630496bb532e76c98f747e6/jo1201_2018a01_sm_jo60sm1901.pdf
[223] Bailey, J. L., & Eggereide, S. S., 2020, Mapping actors and arguments in the Norwegian aquaculture debate
[224] FranceAgriMer, 2019, The fisheries and aquaculture sector in France, https://www.franceagrimer.fr/fam/content/download/61053/document/a4-CC%20p%C3%AAche%202019%20eng-CORRIGE.pdf?version=8
[225] FAO, 2017, Fisheries and Aquaculture Belgium, https://www.fao.org/fishery/en/facp/255/en
[226] FranceAgriMer, 2019, The fisheries and aquaculture sector in France, https://www.franceagrimer.fr/fam/content/download/61053/document/a4-CC%20p%C3%AAche%202019%20eng-CORRIGE.pdf?version=8
[227] FAO, 2019, Fisheries and Aquaculture Netherlands, https://www.fao.org/fishery/en/facp/150/en
[228] Directorate of Fisheries, 2020, Key figures from the Norwegian Aquaculture Industry, https://www.fiskeridir.no/English/Aquaculture/Statistics/Booklets
[229] FAO, 2018, Fisheries and Aquaculture UK, https://www.fao.org/fishery/en/facp/229/en

Planned Extensions

It is clear from the desk review that the trends for aquaculture in the lighthouse area are moving towards more sustainable practices, increased stringency in environmental regulations, as well as increases in seaweed and algae production. There is also an indication that marine aquaculture, while still viable, is not experiencing the same growth rates as land-based aquaculture, i.e. in ponds or estuaries. As aquaculture is one of the key pillars for the Blue Growth Strategy in the EU, offshore aquaculture has a high potential. As demand for fish in Europe continues to increase, the sector itself will need to grow to meet this demand. Demand for sustainable seafood is growing across much of Europe, particularly in the Nordic countries and North-western Europe. The Aquaculture Stewardship Council (ASC) is the clear standard for providing certified, farmed products to consumers and in 2019, the amount of ASC-certified products was 27% more than in 2020.[230]

As aquaculture in marine areas involves interactions between many differing elements, such as health, biodiversity, animal welfare, nutrient runoff, etc. regulating it will require key attention from Member States (MS) that are involved in the sector. The EU coordinates many of these aspects for MS and their waters, including through the “Strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021-2030" (COM(2021)236 final). The EU regulations for organic production also require compliance from aquaculture through ingredients in feed and medicine for farmed fish. Nevertheless, a robust aquaculture sector is governed by individual MS and the way the MS manage the funding from the EU will determine the future of the sector.

One of the standout measures and possibilities for an even more sustainable aquaculture industry is the practice of integrated multi-trophic aquaculture (IMTA). This is the synergy between the cultivation of different species at different trophic levels. An example is combining the farming of finfish alongside seaweed cultivation as a means to harvest organisms at the bottom of the food chain.

Baltic Sea

In order to spur growth, many countries in the lighthouse area have implemented compensation principles to encourage sustainable and environmentally sound aquaculture measures. In the Baltic Sea area for example, Sweden, Estonia, and Finland employ compensation measures as a way to incentivise aquaculture farms that are actively mitigating nutrient runoff. For Finland, compensation only applies to measures based on scientific knowledge and only those that clearly lead to an improvement in water quality.[231]

One of the main challenges facing the Baltic Sea is eutrophication and nutrient overload in coastal waters. Nutrient emissions from uneaten feed and excretions in fish farming have an effect on water bodies, especially as many of the farms are open to the sea around them so that closed solutions have become more attractive to prevent nutrient runoff. In Denmark, there is an increasing use of recirculating aquaculture systems (RAS) in land-based systems. RAS is not used as much in marine aquaculture as it is difficult to create

[230] CBI, 2021, What is the demand for fish and seafood on the European market? https://www.cbi.eu/market-information/fish-seafood/what-demand

[231] Interreg, 2020, Legislation of Aquaculture Status and Perspectives in the Baltic Sea and Nordic countries Position Paper, https://www.submariner-network.eu/images/20200525_SUBM_Position_Paper_Baltic_Aquaculture_Legislation.pdf

closed systems where the water can be circulated due to issues of water chemistry, fish production, and health.232

Beyond the development of innovative solutions to address environmental issues, many countries are also taking measures to ensure growth in the long-term. In the Baltic Sea mussel industry, specifically Denmark, Sweden, and Germany, the introduction of tubes and nets on top of conventional longline systems are planned in order to reach a potential production output of 130 tonnes per ha.233 A pilot study on mussel farms across the three countries also showed that more lines per farm have significant growth potential without expanding majorly into sea areas already crowded by other use. The study also found that in order to achieve expansion, there must be better protection against storms and waves as a means to protect mussels that are lost due to mechanical damage or buoys being ripped off. In one standout case in Estonia, the buoys from a mussel line were stolen and the entire line dropped to the sea floor, ruining the harvest.234

The Baltic Blue Growth mussel project examined several mussel farms across five different countries to understand how mussel farming can lead to filtration of nutrient overloaded waters, as well as how they can be cultivated in a low impact manner. Using farmers' logs and both pre- and post-harvest results, the study provided insight into the pros and cons of mussel farming. Due to various technical challenges, including loss of mussels due to predators, extreme weather Conditions, and lack of proper equipment only two of the original studied farms produced a harvest. In addition, investment and operational costs were estimated in 2019, with investment costs ranging from approximately EUR 7,000 – 45,000 per 100 meter farm unit and operational costs ranging from about EUR 2,000 – 4,400 per growth cycle and 100 metre farm unit. The project also outlined the key aspects to consider when developing a mussel farm and where and how there is capacity for mussel farming either for consumption or for nutrient filtration.235 The above considerations show that mussel farming has a high potential in contributing to sustainable aquaculture in both the Baltic and the North Sea.

North Sea

Aquaculture in Norway is regulated separately from the EU and represents an industry that is much larger than the entire EU combined, particularly in Atlantic salmon. The Aquaculture Act governs inland and marine aquaculture and has standards for environmental monitoring. In the Netherlands, aquaculture is subject to the requirements of the Fisheries Act but does not require a formal Environmental Impact Assessment, while for Germany impact assessments and other regulatory measures set the standard for aquaculture.236

The marine litter study done in the North Sea examined how the aquaculture sector, as a newer sector, could spur a reduction in litter through new policies or regulations. The main suggestion from the study was to include aquaculture in smaller industries, including in

[232] Holan, A. B., et a., 2020, Health management in recirculating aquaculture systems (RAS).
[233] Petersen, J.K., 2020, Policy guidelines for implementation of mussel cultivation as a mitigation measure for coastal eutrophication in the Western Balkan Sea, https://backend.orbit.dtu.dk/ws/portalfiles/portal/210255337/optimus_policy_dtuaqua.pdf
[234] Minnhagen, S., et al., 2019, Results from Baltic Blue Growth project's mussel farms and way forward for mussel farming in the Baltic Sea, https://www.submariner-network.eu/images/GoA_3_2_Results_from_the_BBG_mussel_farms_corrected_version_190820.pdf
[235] Ibid.
[236] Jansen, H. M., et al., 2016, The feasibility of offshore aquaculture and its potential for multi-use in the North Sea.

fishing so that larger amounts of waste can be collected and standards for collection can be systematized. Starting with a stringent line of waste collection in aquaculture can encourage circularity through alternatives to plastics, for example.[237]

More specific to decarbonisation, though, and more prevalent in the North Sea than the Baltic, is the ongoing development of the seaweed industry in the Netherlands. By combining research alongside implementation, the goal is to grow and process seaweed in an economically viable way, which can contribute significantly to the sustainable energy plan for 2050. In connection with the need to account for harvesting times for example, a farm west of Amsterdam found that seaweed can in fact be grown year-round. MacroFuels, an EU initiative with 11 organisations across the EU, is also dedicated to testing and implementing projects related to the biofuel production processes of different seaweeds. The expansion in the Netherlands as well as the knowledge sharing that is occurring from the various organisations doing research can catapult the rest of the EU into a more robust seaweed industry.

The bio-industry in aquaculture is becoming one of the key measures to support circularity. The potential for circularity works in two directions: using food, plant, and animal waste as bio-protein for fish feed and cultivating seaweed or collecting waste from fish farming as biofuel. One standout regulation for seaweed cultivation and its use in bio-products is the North Sea Agreement developed by the Government of the Netherlands, which proposes the authorisation of every new offshore wind farm is contingent on combining the area with other sustainable ocean activities such as seaweed farms.

Future trends and barriers

One of the major trends for aquaculture is a growing seaweed industry, either through collection or growing. Seaweed has a range of applications including for the biofuel industry as well is in pharmaceuticals, cosmetics, food, and ecosystem services (nutrient uptake and CO_2 absorption). The North and Baltic Seas have good conditions for seaweed growth as they are nutrient rich and cold, but there is still a lack of production growth compared to the global market or land-based market. Nevertheless by 2030 it has been estimated that the seaweed industry could play a meaningful role in removing nitrogen and phosphorous from coastal waters. The potential for removal is between 6,000-20,000 tonnes of nitrogen and 600-2,000 tonnes of phosphorous from European waters annually.

In many countries, innovative solutions to aquaculture are being developed to meet demand and account for special issues in marine areas. For the EU as a whole, the space used for marine aquaculture represents a small portion of the actual coastline. It is a growing concern that there is not sufficient space for aquaculture as there are numerous competing activities that can interfere with fish farming including commercial fishing, recreation, maritime transport, and offshore wind. Maritime spatial plans are mandatory for all marine areas bordering EU MS since 2021, yet aquaculture has yet to be a key player as a potential user for sea space. As can be seen in the maritime transport section of this report, creating synergies and involving multiple stakeholders in decision-making on space-use as well as through financial incentives, solutions can be found to improving marine aquaculture. These solutions include integrated multi-trophic aquaculture (IMTA) as well as multi-use platforms (though as can be seen in section 5 this is still in the pilot phases).

[237] Aqua-Lit, How can the aquaculture sector contribute to reducing marine litter in the North Sea? https://aqua-lit.eu/assets/content/State%20of%20Play%20-%20North%20Sea.pdf

Some barriers are still standing in the way of the aquaculture sector's expansion especially with regard to newer industries like seaweed and biofuel production. These challenges can be treated as key areas for improvement.

Table 42 Main barriers facing the future of the aquaculture sector across both the Baltic and the North Sea.

Challenge	Explanation
Lack of capability to cultivate aquaculture further offshore	Lack of space in marine areas has led to the option to move aquaculture to areas that are further off the coast, but high waves can lead to damage of aquaculture systems and contamination of surrounding water.
Complexity of using certain technology	New technology using polyethylene tubes with nets require no buoyancy but require complicated and expensive harvest machinery.
Lack of R&D in bioeconomy	Seaweed has low methane potential and must be mixed with other organic materials. Commercial capacity is low due to lack of knowledge.
Habitat and biodiversity protection	Preserving and encroaching on protected areas as well as mixing of species with wild species can lead to die out of wild species.
Nutrient runoff	High levels of N and P has led to eutrophication of coastal waters.
Low impact and organic	Lack of data on organic aquaculture as well as lack of certifying bodies and available standards for low impact or organic production.
Species weakness	In some cases in France, the reliance on farming the Japanese oyster shows high risk for changes in water quality. 238
High start-up costs	For more sustainable practices or complex technologies, start-up costs can be prohibitive.
No framework for multi-purpose use	Rather limited regulatory field for establishing aquaculture next to or with other marine space uses such as offshore wind or through IMTA.

Data gaps

The data gaps for aquaculture are significant as it is still a budding sector in comparison to other maritime activities such as shipping and transport or offshore wind. There is data from countries that are participating in aquaculture and national statistics, yet marine data is still lacking as the land-based sector is slightly more developed. In the future, using a new regulatory framework to ensure stringency in the sector and even provide incentives for farmers who are active in implementing sustainable procedures for aquaculture production. Ongoing pilot studies in technology and innovative solutions for aquaculture will help the lighthouse area to expand the reach and production of the sector in such a way that it actively contributes to mitigation in the overall sector.

Conclusion

The sector is rapidly growing in globally, but in the lighthouse area, the competition for space has made expansion difficult. In Denmark, marine aquaculture has been halted due to environmental degradation of existing farms. Land-based aquaculture represents most of the industry for Belgium and Poland without official plans for expansion into marine areas. In other cases, like Norway, aquaculture is an important industry with significant growth plans, despite having severe cases of disease and threats to wild populations. Nevertheless, the sector can contribute to decarbonisation through the contribution to production of biofuels, (such as the seaweed industry), or to the implementation of circular

[238] https://www.fao.org/fishery/en/countrysector/naso_france

feed practices. Combining uses of both aquaculture and offshore wind for example through IMTA or MPPs will help the Baltic and North Seas to account for spatial issues that arise from large fish farms. MPPs and IMTA have yet to see significant uptake and will require regulatory support. Finally, using mussels or oysters to filter nutrients out of coastal waters can lead to an improved acceptance of the sector by environmentalists.

6.7.2. Proposed Indicators

The following indicators are proposed for assessment of the Mission's outcome on *Zero-carbon and toxin-free aquaculture/algae production compatible with vulnerable marine ecosystems*:

Output indicators

- *Number of projects implemented (and total funding provided) supporting the development of zero-carbon and toxin-free marine aquaculture or algae production (excluding feed production)*: The indicator provides information on the number of projects that implement or fund aquaculture and algae production. The indicator can be specified for EU funds but *would* offer greater representativeness if it also encompassed regional and national funds.

- *Number of projects implemented (and total funding provided) supporting the development of zero-carbon and toxin-free marine aquaculture feed*: The indicator provides information on projects that fund carbon neutral aquaculture feed. The indicator can be specified for EU funds but would offer greater representativeness if it also encompassed regional *and* national funds.

Outcome indicators

- *Total marine aquaculture production, aggregated and per type (annual, in tonnes)*: The indicator isolates the marine- from land-based aquaculture production.

- *Total aquaculture production of low trophic species (e.g. molluscs and algae), per type of species (annual, in tonnes & % out of total aquaculture production)*: The indicator provides information on the extent of marine aquaculture production that is associated with a neutral to positive impact on the environment.

- *Total marine aquaculture production that contributes to nature conservation or restoration (annual, in tonnes & % out of total aquaculture production)*: The indicator provides information on the extent of the use of marine aquaculture in vulnerable marine ecosystems for nature conservation or restoration. For example, Integrated Multi-Trophic Aquaculture in a Natura 2000 area. The indicator covers all types of production that contributes to the nature conservation or restoration, such as aquaculture that filtrates excessive nutrients, but also reef building species, to the extent these are connected with aquaculture production.

- *Total organic marine aquaculture production, by species group (annual, in tonnes & % out of total aquaculture production)*: The indicator provides information on the extent of organic marine aquaculture production, which is relevant in the context of the Blue Economy.

- *Share of (%) aquaculture feed consumed for marine aquaculture production that is carbon-neutral in terms of its scope 1-3 emissions of the GHG protocol:* The indicator provides information on the share of carbon neutral aquaculture feed.

Impact indicators

- *Reduction in the GHG emissions intensity (Mt CO_2eq/EUR million Gross-Value Added) from marine aquaculture production, compared to the baseline of 2021 (as defined by the scope 1-3 emissions of the GHG protocol):* The indicator follows the trajectory of the GHG intensity of marine aquaculture production. Given that marine aquaculture production is expected to increase in volume, the total GHG emissions can also be expected to do so. It is therefore appropriate to measure the GHG intensity.

For the indicators proposed above, the following data could be collected, based on the available information:

Table 43 Baseline indicator framework for aquaculture

Indicator type	Indicator	Data/Description
Output	Number of projects implemented (and total funding provided) supporting the development of zero-carbon and toxin-free marine aquaculture or algae production (excluding feed production)	Not centrally available. Data would have to be collected from national authorities and EU funds that finance projects. Furthermore, a common definition would need to be determined for zero-carbon and toxin-free.
Output	Number of projects implemented (and total funding provided) supporting the development of zero-carbon and toxin-free marine aquaculture feed	Not centrally available. Data would have to be collected from national authorities and EU funds that finance projects. As above, a common definition would be needed.
Outcome	Total marine aquaculture production, aggregate and per type (annual, in tonnes)	Denmark: 19,167 tonnes Estonia: 1,062 Finland: 11,914 Germany: 22,264 Sweden: 12,954 Baltic Sea total: 67,361 Belgium: 75 France: 4,830 Netherlands: 46,350 Norway: 1,400,000 United Kingdom: 184,932 North Sea total: 1,636,187
Outcome	Total marine aquaculture production that contributes to nature conservation or restoration (annual, in tonnes & % out of total	Not centrally available. Data would have to be collected from national authorities and EU funds that finance

	aquaculture production)	
Outcome	Total organic marine aquaculture production (annual, in tonnes & % out of total aquaculture production)	Denmark: 5,110 (26.6 %) Finland: 0 Belgium: 0
Outcome	Share of (%) aquaculture feed consumed for marine aquaculture production that is carbon-neutral in terms of its scope 1-3 emissions of the GHG protocol	Not centrally available. Data would have to be collected from national authorities
Impact	Reduction in the GHG intensity emissions (Mt CO2eq/EUR million Gross-Value Added) from marine aquaculture production, compared to the baseline of 2021 (as defined by the scope 1-3 emissions of the GHG protocol)	Not available publicly. Data would have to be derived from the above indicators, assuming an average emission factor, or be collected from aquaculture operators directly (e.g. as part of potential sustainability reporting, if applicable).

6.7.3. Activities & Projects

The table below presents an overview of EU projects focusing on aquaculture (thematic area 6). Most projects have a general focus on seas or not specifically focused on the Baltic- or North Sea. A common feature among most projects is that they seek to improve, among others, the overall sustainability of aquaculture, with some even aiming to promote fully circular aquaculture. Furthermore, a number of projects focus on providing more sustainable fish feed (from e.g. fungi or the wood processing industry), or animal feed (e.g. from algae and molluscs). Two such projects are found in the Baltic Sea. Aquaculture monitoring, such as through remote sensing and tidal current observations, is also studied by projects, one of which focuses on the North Sea.

Looking more closely at the types of aquaculture, the production of algae, such as seaweed, is receiving most attention, as algae have a variety of potentials within e.g. photovoltaic energy, biofuels, and feed production.

Table 44 Overview of INTERREG, Horizon, LIFE, and HELCOM projects focusing on aquaculture since 2010

Keywords	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)	Number of projects	Total budget (EUR mio.)	EU funding (EUR mio.)
	Baltic Sea			North Sea			Focus on seas (excluding projects focused on Baltic & North Seas)		
sustainable aquaculture	1	4	3	-	-	-	22	99	92
aquaculture monitoring	-	-	-	1	12	12	7	54	49
fish feed	2	7	5	-	-	-	5	24	21
animal feed	2	7	5	-	-	-	2	27	23
molluscs	2	5	4	-	-	-	3	15	12
crustaceans	-	-	-	-	-	-	3	21	19
finfish	-	-	-	-	-	-	1	7	6
algae	3	7	5	1	3	2	9	56	49
bio-based products	1	2	2	-	-	-	1	16	13

Source: authors' assessment

6.7.4. Recommendations

Data gaps

Based on the data gaps identified above, it is recommended that:

- EU-wide statistics are established which further enable the separation of marine aquaculture from land-based aquaculture;
- EU-wide statistics are established which enable the quantification of sub-types of marine aquaculture production, i.e. 'low impact', organic, and biofuels.

Knowledge/funding gaps

The analysis above shows that there is a trend towards sustainable marine aquaculture, as is also shown by the number of projects that focus on improved sustainability. The competition of marine aquaculture with other marine activities, such as transport, fishing, and offshore RE, which often take precedence over aquaculture, calls for a more efficient use of aquaculture space and the establishment of a more supportive permitting framework for marine aquaculture.

Marine aquaculture faces, particularly in the Baltic Sea, the challenge of nutrient pollution, where a further development of sustainable production technologies is needed.

Finally, the marine aquaculture production for advanced applications, such as animal feed and energy feedstocks, is still in its infancy, but also bears a lot of potentials in creating more sustainable aquaculture production.

It is therefore recommended to:

1. Support activities & projects that promote and further mature the use of IMTA to support more space-efficient marine aquaculture;
2. Support activities & projects that further develop multi-use concepts that make marine aquaculture an attractive addition to other offshore activities, such as offshore wind;
3. Support activities & projects that provide knowledge exchanges among stakeholders on how permitting for the use of marine space can help promote the integration of marine aquaculture with other uses of marine space;
4. Use research funding, e.g. Horizon Europe, to increase the competitiveness and energy efficiency of recirculating aquaculture systems (RAS) for marine production, with a focus on the Baltic Sea;
5. Support activities & projects that promote alternative approaches to mitigating eutrophication and nitrogen overloads in the Baltic Sea (e.g. IMTA and more intensified mussel production);
6. Support activities & projects that develop the production technologies and establish offtake markets for feed production (e.g. mussels for feed production), energy feedstocks (e.g. algae for biofuels), and other bio-based products from marine aquaculture.

7. DEL4: Governance in the Lighthouse Area

7.1. Introduction

The Baltic/North Sea area faces a number of environmental challenges and threats, such as pollution, overexploited fisheries, and climate change, that require collaboration among different stakeholders and a structured approach in dealing with them. Diverse national interests and priorities, political and regulatory systems at times create a barrier for macroregional and international collaboration. However, transboundary natural environments, cumulative impacts on marine environments and common stressors call for integrated environmental management and a more holistic approach to ocean/maritime governance.[239]

The governance of marine environments in the Lighthouse area is complex. It consists of legal/regulatory, policy and institutional frameworks at different levels: international/global, (macro)regional, national and sub-national. In addition, the governance of marine and coastal areas in many countries and in international waters is primarily sectoral. This implies that each marine-related sector (e.g., fisheries, offshore energy, maritime safety and security, environmental, shipping, trade) has separate governance structures. These structures are interlinked, given cross-sectoral nature of marine-related issues and challenges. Nevertheless, a greater coordination of regulations, strategies and policies is needed, as well as a clearer framework of cross-institutional collaboration.

The aim of this report is to provide an overview of governance structures in the Baltic/North Sea area. It is the third Deliverable, following Deliverable 1 'Description of the Lighthouse areas' and Deliverable 2 "Baseline for the Baltic and North Sea basin Lighthouse", within the Baseline study for the implementation of the lighthouse in the Baltic and North Sea basins for the Mission "Restore our ocean and waters by 2030".

The current report presents the analysis of institutional and legal frameworks, highlighting major international, EU, macroregional (Baltic/North Sea area) and national stakeholders involved in decision-making and regulations or policies that govern activities in the area. In addition, it describes mechanisms of monitoring, evaluation and control in the Lighthouse area, and points to key stakeholders that support policy design and implementation in the area. The latter includes a diverse set of organisations that provide advisory or technical support, influence policy agendas, provide data or research findings to inform policymakers, contribute to the development and growth of blue sectors, represent societal groups that call for action in a specific marine-related area, finance activities in line with blue strategies or stimulate a political dialogue between Member States in the Lighthouse area. In general, the different categories of stakeholders (e.g., industry, research, civil society, finance) in each sector determine their role and functions towards governance structures. Thus, key stakeholders that support policy design and implementation will be clustered according to the sector in which they operate.

Given the complexity of governance structures, this report presents an overview of regulatory and institutional frameworks at the international, EU, macroregional, national and sub-national in six thematic areas that are in the focus of this study:

[239] https://www.sciencedirect.com/science/article/pii/S0048969720360939

- Maritime transport,
- Maritime ports & facilities,
- Offshore renewable energy (RE) facilities,
- Offshore renewable energy (RE) storage facilities,
- Multipurpose platforms,
- Aquaculture.

The governance in the area of maritime transport will be discussed together with maritime ports & facilities, due to their strong interlinkage. Similarly, the governance structures of offshore renewable energy facilities and of offshore storage facilities will be presented in one chapter. To facilitate the analysis of regulatory and institutional frameworks in each thematic area, discussion is organized at the different levels - international, EU, macroregional and national.

Due to similar patterns of monitoring, evaluation and control mechanisms across thematic areas, as well as presence of same stakeholders that are involved in them, these mechanisms will be discussed together. However, some specifications per thematic area will be provided when relevant.

Thus, this report is structured in the following way:

Chapter 7.2 Institutional and regulatory frameworks of the Lighthouse area

Chapter 7.3 Mechanisms of monitoring, evaluation and control in the Lighthouse area

Chapter 7.4 Key stakeholders supporting policy design and implementation in the Lighthouse area

Chapter 7.5 Conclusions

Chapter 7.6 Efficiency of governance and recommendations.

In Annex C: DEL4, an overview of the following topics can be found:

- Governance structures in the area of maritime transport and maritime infrastructure
- Governance structures in the area of renewable energy, its offshore facilities and offshore renewable energy storage facilities
- Governance structures in the area of multipurpose structures
- Governance structures in the area of aquaculture.

7.2. Institutional and regulatory frameworks of the Lighthouse area

7.2.1. Institutional framework at the international level

The United Nations (UN) is the main institution that governs oceans/seas at an international level. The global marine governance and ocean management are framed within a broader cooperation in the environmental arena. The UN General Assembly provides guidance to its Member States through its subsidiary institution - UN's Environment Programme (UNEP). This entity was established in 1972 as a follow-up to the first UN Conference on Human Environment (UNCHE) to meet the urgent need for a permanent institutional arrangement within the United Nations system for the protection and improvement of the environment.[240] Since then, UNEP became the first major UN environmental institution that has acted as a coordinator of activities and programmes within the UN system and as a major catalyst for the international environmental cooperation and law-making.

One of the most important achievements of UNEP was the Regional Seas Programme (RSP), which is an action-oriented programme that implements region-specific activities for conservation of the marine and coastal environment, bringing together regional stakeholders, seas conventions and Action Plans. Thus, the RSP embraces the ecosystem approach to managing marine resources and promotes regional oceans/seas governance. Currently, the RSP consists of three types of Regional Seas Conventions and Action Plans (RSCAPs), across 18 different regions (Box 1). The Baltic Sea and the North Sea are covered under the so-called independent Plans (i.e., Baltic Sea and North-East Atlantic Region), meaning that the RSCAPs have not been established by UNEP, but cooperation is organised through the Regional Seas Programmes (HELCOM and OSPAR, please see more details about these organisations in chapter 7.2.4).

Box 1 Three types of Regional Seas Conventions and Action Plans (RSCAPs)

UNEP-administered – These RSCAPs have been established and are directly administered by UNEP who provides Secretariat functions, managing of finances and technical assistance. UNEP administers 5 regional seas conventions and 2 action plans. These are: Caribbean Region, East Asian Seas, Eastern Africa Region, Mediterranean Region, North-West Pacific Region, Western Africa Region. The Regional Office for Europe administers the Tehran Convention (Caspian Sea).

Non-UNEP administered – These RSCAPs have been established under the auspices of UNEP, but another regional body provides the Secretariat and administrative functions. These are: Black Sea Region, North-East Pacific Region, Red Sea and Gulf of Aden, ROPME Sea Area, South Asian Seas, South-East Pacific Region, Pacific Region.

Independent – These RSCAPs have not been established by UNEP but cooperate with the Regional Seas Programme and attend regular meetings. These are: Arctic Region, Antarctic Region, Baltic Sea, North-East Atlantic Region.

Source: UN Environment Programme, 2022[241]

[240] https://www.iucn.org/sites/dev/files/import/downloads/cel_op_desai3.pdf

[241] https://www.unep.org/explore-topics/oceans-seas/what-we-do/regional-seas-programme

Besides UNEP, several UN bodies have been created to stimulate international cooperation in specific marine-related areas. Among them are; Food and Agriculture Organisation (FAO), with its subsidiary body Committee on Fisheries (COFI), Intergovernmental Oceanographic Commission (IOC) of United Nations Educational, Scientific and Cultural Organisation (UNESCO), International Seabed Authority (ISBA), International Labour Organisation (ILO), United Nations Conference on Trade and Development (UNCTAD), World Bank (IBRD), World Health Organisation (WHO), World Meteorological Organisation (WMO), International Maritime Organisation (IMO), and International Atomic Energy Agency (IAEA).[242] Their aims and focus areas are described in Table 45.

Table 45 List of key UN agencies that govern marine-related areas

UN agencies	Focus area with respect to maritime affairs	Aims
UNEP/Regional Seas programme	Protection and development of oceans and coastal areas	Sets the environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system and serves as an authoritative advocate for the global environment
United Nations Educational, Scientific and Cultural Organisation (UNESCO)/ Intergovernmental Oceanographic Commission (IOC)	Marine scientific investigations	Responsible for supporting global ocean science and services, supporting all its Member States to build their scientific and institutional capacity for achieving the SDGs
International Maritime Organization (IMO)	Shipping and pollution from ships	Regulates safety and security of shipping and the prevention of marine and atmospheric pollution by ships, and decarbonisation
International Seabed Authority (ISA)	Mineral resources of the seabed	Organizes, regulates and controls all mineral-related activities in the international seabed area; ensures the effective protection of the marine environment from harmful effects that may arise from deep-seabed related activities
Food and Agriculture Organization (FAO)/ Committee on Fisheries	Fish stocks/fishery activities,	Reviews the programmes of work of FAO in the field of fisheries and aquaculture and their implementation; conducts periodic general reviews of fishery and

242 https://link.springer.com/article/10.1007/s13280-016-0847-9

	aquaculture	aquaculture problems and appraise such problems and their possible solutions
World Meteorological Organisation (WMO)	Global climate	Promotes international cooperation and coordination on the state and behaviour of the Earth's atmosphere, its interaction with the land and oceans, the weather and climate it produces, and the resulting distribution of water resources. It monitors Earth System to provide vital weather and climate information worldwide
International Labour Organisation (ILO)	Occupational health and safety of workers in the maritime sector	Sets labour standards to protect the rights of workers, including in the shipping and fishing sectors (decent on-boarding working and living conditions, employment agreements of fishermen, protection against occupational hazards etc)
United Nations Conference on Trade and Development (UNCTAD)	Maritime trade and transport, technology transfer	Stimulates trade and development, focuses on interrelated issues in the areas of finance, technology, investment and sustainable development. It assists developing countries, especially the least developed countries, and countries with economies in transition, to integrate beneficially into the global economy
International Bank for Reconstruction and Development (IBRD) and the World Bank (WB)	Investment in sustainable development of blue economy	Provides financial products and policy advice to help countries reduce poverty and extend the benefits of sustainable growth to all of their people
World Health Organisation (WHO)	Protection of health through marine environmental protection	Promotes health, well-being and safety, directs and coordinate the world's response to health emergencies
International Atomic Energy Agency (IAEA)	Marine pollution, monitoring of hazardous contaminants and biotoxins in seafood	Stimulates cooperation in the nuclear field, promotes the safe, secure and peaceful use of nuclear technologies, helps Member States monitor pollution, minimise the impact of incidents and mitigate their effect on local populations

Source: own production, 2022

Overall, the UN bodies are focused on promoting cooperation in a specific area among Member States, stimulating formulation of legally binding agreements and standards, settling legal disputes, providing advisory, scientific and technical support. The UN system of marine environmental governance is very complex, as different autonomous UN organisations have a limited, sector-focused mandate. Each UN agency pursues its own objectives and programmes, preventing the formulation of a holistic ecosystem management of the marine environments. This, at times, results in conflicts of interests between stakeholders that a specific agency protects and difficulties in coordination of efforts. In the conservation field, such tensions can be found between, for instance, UNEP/RSPs and FAO/Regional Fishery Organizations on environmental impact of fisheries and marine protected areas, and between UNEP/RSPs and IMO on environmental effects of shipping.[243]

Despite these shortcomings, the UN system is expected to continue playing a central role in the global environmental protection and management of resources, activities of the oceans and seas. The need for an international environmental cooperation has been recognised by almost all countries around the world, therefore the UN has been successful in getting support for the global environmental policies and initiatives, such as the Convention on Biological Diversity, UN Framework Convention on Climate Change that built the basis for the Paris Climate Agreement, UN Sustainable Development Goals (SDGs), UN Decade of Ocean Science for Sustainable Development and Ocean Panel (Box 2).

Box 2 Key global environmental policies

CONVENTION ON BIOLOGICAL DIVERSITY

The Convention on Biological Diversity (CBD) is a multilateral treaty that entered into force in 1993. It is now one of the most widely ratified international treaties on environmental issues, with 194 member countries. The CBD has three main objectives:

- Conservation of biological diversity
- Sustainable use of the components of biological diversity
- Fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.

PARIS CLIMATE AGREEMENT

The Paris Climate Agreement (PCA), signed in November 2016, builds on the United Nations Framework Convention on Climate Change (UNFCC) and Kyoto Protocol. The Agreement has been signed by 197 countries and ratified by 185 as of January 2019. The central aim of the Agreement is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius when compared to pre-industrial levels and to pursue efforts to limit the temperature increase even more, to 1.5 degrees Celsius.

UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

The Sustainable Development Goals (SDGs) form the heart of the UN 2030 Agenda for

[243] Redpath, Stephen Mark; Bhatia, Saloni; Young, Juliette. 2015. Tilting at wildlife: reconsidering human-wildlife conflict. Oryx, 49 (2). 222-225. 10.1017/S0030605314000799

Sustainable Development adopted by all UN Member States in 2015. A 15-year plan has been set to achieve the Goals. In total, 17 Sustainable Development Goals have been adopted to demonstrate an urgent call for action by all countries – developed and developing – in a global partnership to tackle growing inequalities, empower women and girls, and address the climate emergency. They are the universal call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere.

UNITED NATIONS DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT

The United Nations proclaimed the UN Decade of Ocean Science for Sustainable Development for 2021 to 2030 (Ocean Decade) in December 2017. It aims to deliver science that is focused on providing the right topics in order to provide a common framework of ocean science, which can support countries' actions to sustainably manage the ocean, seas and coasts. The Ocean Decade recognises that the science-informed mitigation and adaptation policies to global climate change are urgently needed, but neither science nor policymakers can accomplish that alone. As such, the Ocean Decade bolsters inclusive approaches of designing and conducting scientific marine research, which also supports the development of a sustainable blue economy.

Source: BANOS : The Baltic and North Sea Strategic Research and Innovation Agenda Banos SRIA, 2021[244]

Overall, the UN and other regional/international platforms have gained more prominence in the last two decades. Nevertheless, it is worth noting that the UN cannot enforce compliance with international legal agreements. The ultimate decision-making power belongs to the national governments that collectively drive the global environmental agenda through the UN and other organisations and are responsible for signing and implementation of international laws and regulations.

Besides the UN bodies, there are many international and intergovernmental organisations that play important roles in supporting the UN and in promoting global and regional marine-related research and management. These organisations are discussed in the next sub-chapter 7.2.2.

7.2.2. Regulatory framework at the international level

The above-listed UN organisations are mandated to support efforts of Member States in a specific area (i.e. safe management of the deep seabed area, monitoring of marine environments, marine scientific research) in line with the international conventions, agreements and treaties. As a rule, international law stands above the EU and national laws, regardless of the area (e.g., maritime transport, offshore energy activities). The United Nations Convention on the Law of the Sea (UNCLOS), adopted in 1982, lays down a comprehensive legal regime in the world's oceans and seas, establishing rules governing most uses of the oceans and its resources. There are a number of international agreements on specific issues, such as those related to management of fisheries resources, safety of maritime traffic, pollution control, protection and conservation of biodiversity, response to expected climate change, and to regional agreements aiming at protection and development of regional seas.

[244] https://www.banoscsa.org/files/7273/Banos_2021_SRIA_web_FINAL.pdf

Box 3 United Nations Convention on the Law of the Sea (UNCLOS)

UNCLOS divides the sea into several maritime zones (e.g., territorial sea, Exclusive Economic Zone (EEZ), continental shelf (CS), and high seas). UNCLOS regulates the regime of these zones, but the distinction in their regime predates the UNCLOS. As such, there are specifies rules, authorities, rights and regulations in each zone for different activities and stakeholders, such as merchant ships, submarines, nuclear-powered ships. The territorial sea, EEZ and CS zones are relevant for the Baltic and North Sea areas. In the territorial sea, which is up to 12 nautical miles from the coastline, countries have full jurisdictional power and can exercise sovereignty to regulate activities.[245] With regards to the EEZs and the CS sea territories, these often overlap in the Lighthouse area. In such cases, delimitation agreements have been drafted.[246] The difference between the two is that a CS zone includes the seabed and subsoil beyond the territorial sea and an EEZ includes the water column (i.e. a column of water from the surface of the sea to the bottom).[247] Furthermore, an EEZ needs to be explicitly proclaimed by a coastal state.

Beyond the territorial sea, states have more limited rights; the so-called 'functional jurisdiction' (i.e., jurisdiction only for the purpose of regulating these particular activities/function[248]). Furthermore, states also have the right to construct and regulate artificial islands, installations and structures with economic purposes).[249] In an EEZ, coastal states also have the right to explore, exploite, conserve and manage natural (living and non-living) resources and carry out other activities for the economic exploitation and exploration of the zone, which includes the production of energy using water's currents and wind.[250]

In addition, UNCLOS identifies three categories of states:

- Flag states – states where ships are registered
- Port states – states that have the right to institute inspections on vessels in their ports
- Coastal states – states that have jurisdiction on vessels sailing within the territorial waters of a country.

Thus, only the national governments of coastal states have the legal right and responsibility to issue licenses and permissions connected with the use and protection of the seas under

[245] Article 2 and 3 the UNCLOS

[246] https://www.un.org/depts/los/nippon/unnff_programme_home/fellows_pages/fellows_papers/dundua_0607_georgia.pdf

247 Article 57 of the UNCLOS.

[248] Articles 56 and Article 77 of the UNCLOS.

[249] Article 60, 77(1), 80 of the UNCLOS

[250] Article 56(1)(a) of the UNCLOS

national sovereignty and jurisdiction.

Source: UNCLOS, 1982

Besides UNCLOS, there are many other international conventions, regulations related to the maritime sector that have been formulated under the auspices of different UN and other bodies.

Table **46** provides a selection of main international agreements that are currently in force. They relate to the following areas: environmental standards for marine protection, maritime transport, marine trade, fisheries and labour rights of workers occupied in the marine/fisheries sectors.

The list of legal agreements that regulate maritime transport, fisheries and seek to address pollution from shipping is quite extensive, as these areas have been the focus of policymakers for many years. IMO and FAO have been very active in promoting international collaboration in these areas. In contrast, regulation in novel marine-related areas, such as multi-purpose platforms or aquaculture, is scarce. FAO's Code of Conduct for Responsible Fisheries (1995) includes principles for sustainable aquaculture, while the regulation framework of multi-purpose platforms is not fixed and embraces a wide variety of general laws and agreements for the seas and oceans, as presented in Table 2. In the area of labour law and occupational health and safety, the generic ILO laws apply to workers involved in the maritime sectors, such as Freedom of Association and Protection of the Right to Organisation Convention (1946), Forced Labour Convention (1930), Abolition of Forced Labour Convention (1957), Discrimination (Employment and Occupation) Convention (1958). However, the ILO developed several conventions specifically related to fishermen.

The area of international trade is also regulated by commercial laws and treaties. Under the auspices of UNCTAD several international conventions have been formulated specifically for the transportation and trade of goods by sea. Cooperation in the scientific/research domain of the maritime sector has not been formalised in legally binding agreements. Instead, countries and their researchers join bilateral, multilateral research/scientific partnerships and collaborate with international organisations, including previously mentioned UN bodies - IOC, UNESCO, WMO.

The ecosystem approach to marine governance, as well as global environmental challenges, such as climate change, have been increasingly drawing attention of policymakers towards environmental protection and sustainable management of marine resources. All international legal agreements take account of the impact on environment. However, a number of international conventions are specifically focused on these areas.

Table 46 International legal agreements in the maritime sector that are in force

Name of the legal document	Purpose	Focus area	Entry into force	EU /Lighthouse country membership
United Nations Convention on the Law of the Sea	To set up a comprehensive new legal regime for the sea and oceans and, as far as environmental provisions are concerned; to establish material rules concerning environmental standards as well as enforcement provisions dealing with pollution of the marine environment.	Management of marine resources, environmental standards for marine protection	1994	yes
United Nations Framework Convention on Climate Change	To achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.		1994	yes
Convention on Fishing and Conservation of the Living Resources of the high Seas	Through international co-operation, to solve the problems involved in the conservation of the living resources of the high seas, considering that through the development of modern techniques some of these resources are in danger of being over-exploited.		1966	Belgium, Denmark, Finland, France, Netherlands, Portugal, Spain
International Convention for the Safety of Life at Sea (SOLAS)	To promote safety at sea by establishing a common agreement, uniform principles and rules. The first version was brought out in 1914 the second entered into force in 1933 and the third in 1952. The fourth version of SOLAS entered into force in 1965 and the current SOLAS was adopted in 1974. The various reflect changes in the various chapters of SOLAS.		1974	yes
International Convention on Maritime Search and Rescue	To establish an international maritime search and rescue (SAR) plan covering the needs for ship reporting systems, SAR services and the	Maritime transport, marine pollution	1979	yes

	rescue of person in distress at sea.			
Convention on International Regulations for Preventing Collisions at Sea (COLREG)	To establish principles and rules concerning lights and shapes to be displayed by ships.		1972	yes
International Convention on Standards of Training, Certification and Watchkeeping for Seafarers	To promote safety of life and property at sea and the protection of the marine environment by establishing in common agreement international standards of training, certification and watchkeeping for seafarers.		1984	yes
International Convention on the Control of Harmful Anti-fouling Systems on Ships	To prohibit the use of harmful organotins in anti-fouling paints used on ships and to establish a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems.		2001	Yes
Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter (London Convention)	To control pollution of the sea by dumping, and to encourage regional agreements supplementary to the Convention.		1972	All Lighthouse countries except Estonia, Latvia, Lithuania
International Convention for the Prevention of Pollution from Ships (MARPOL)	To preserve the marine environment by achieving the complete elimination of pollution by oil and other harmful substances and the minimisation of accidental discharge of such substances.		1973	Yes
International Convention Relating to Intervention on the High Seas in Cases of Marine Pollution by Substances other than Oil	To enable States to take action on the high seas in cases of maritime casualties resulting in grave and imminent danger of pollution to their coastline or related interests by substances other than oil.		1969	unknown
International Convention for the Control and Management of Ships' Ballast Water and Sediments	To prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and		2004/2017[251]	All Lighthouse countries except the United Kingdom

[251] In 2017, the entry into force of the Convention was trigged.

	control of ships' ballast water and sediments			
The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships	To ensure that ships, when being recycled after reaching the end of their operational lives, do not pose any unnecessary risk to human health and safety or to the environment.		2009	Belgium, Denmark, Estonia, France, Germany, Netherlands, Norway
Torremolinos International Convention on the Safety of Fishing Vessels	To provide uniform principles and rules concerning construction, equipment, stability, radio communications and other safety aspects of fishing vessels.		1977	Yes
United Nations Convention on Conditions for Registration of Ships	To ensure or strengthen the genuine link between a State and ships flying its flag, and in order to exercise effectively its jurisdiction and control over such ships with regard to identification and accountability of shipowners and operators as well as with regard to administrative, technical, economic and social matters		1986	Poland, Russian Federation
Convention for Safe Containers	To maintain a high level of safety of human life in the transport and handling of containers, and to facilitate the international transport of containers by providing uniform international safety regulations		1972	unknown
Convention on the Suppression of Unlawful Acts Against the Safety of Maritime Navigation	To improve security and reduce the risk to passengers and crews on board ships.		1988	Yes
Nairobi convention for removal of wrecks	To remove, or have removed, shipwrecks that may have the potential to affect adversely the safety of lives, goods and property at sea, as well as the marine environment.		2015	Yes

United Nations Convention on a Code of Conduct for Liner Conferences	To improve the linear conference system and to facilitate the orderly expansion of world sea-borne trade, establishing a universally acceptable code of conduct for linear conferences	Marine trade, maritime transport	1974	Belgium, Denmark, Finland, France, Germany, Netherlands, Norway, Russian Federation, Sweden and the United Kingdom
Convention on International Trade in Endangered Species of Wild **Fauna and Flora**	To ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species.		1975	Yes
Agreement on Straddling and Highly Migratory Fish Stocks	To provide the framework for the conservation and management of straddling and highly migratory fish stocks in high seas areas regulated by Regional Fisheries Management Organizations (RFMOs).	Fisheries	2001	Yes
Fish Stocks Agreement	To enhance the cooperative management of fisheries resources that span wide areas, and are of economic and environmental concern to a number of nations.		2001	Yes
Code of Conduct for Responsible Fisheries	To provide international principles and standards of behavior to ensure effective conservation, management, and development of both marine and freshwater living aquatic resources. It accounts for the impact of fishing on ecosystems, the impact of ecosystems on fisheries, and the need to conserve biodiversity.		1995	unknown
Convention for the International Council for The	To provide a new constitution for the International Council for the		1964	All lighthouse countries

Exploration of the Sea	Exploration of the Sea established in Copenhagen in 1902.			
Convention on Biological Diversity	To develop national strategies for the conservation and sustainable use of biological diversity. The Convention affirms that conservation of biodiversity are common concerns of humankind and reaffirms that nations have sovereign rights over their own biological resources.		1993	Yes

Source: own production, 2022

7.2.3. Regulatory framework at the EU level

EU laws and regulations are coherent with the international framework. The EU has been introducing complementary legislation in several cases: if international agreements have gaps, if collective action at the EU level is needed, or when the EU seeks to establish stricter rules or higher standards, building on EU policies and strategies. The EU encourages the UN bodies to apply higher standards or rules, following the EU practice. In contrast to international treaties, the EU often provides stronger and clearer enforcement obligations, thereby stimulating achievement of similar results across Member States in terms of marine safety and environmental protection.

The EU has more than 200 laws and acts related to environmental policy areas, such as climate change, waste management, water quality, noise, nature protection, industrial pollution control, chemicals.[252]

Among the main EU directives and policies related to the sustainable blue economy and maritime affairs in general are; the Sustainable Blue Economy (formerly, Blue Growth Strategy), Water Framework Directive, Biodiversity Strategy, Circular Economy Action Plan, and the Common Fisheries Policy (Box 4). To reduce policy fragmentation, the EU adopted several instruments that ensure a comprehensive and integrated approach to the protection of all European coasts and marine waters. These instruments include the Marine Strategy Framework Directive, Maritime Spatial Planning Directives, Integrated Coastal Management, Integrated Maritime Policy (Box 4). Due to a lack of a single policy or a set of policies to manage the marine environment, there is a complex web of interacting and overlapping policies that leave significant problems unresolved.

It is important to note that Integrated Maritime Policy (IMP), adopted in 2007, seeks integration between sectors at the EU level. It covers 5 cross-cutting policies - blue growth, marine data and knowledge, maritime spatial planning, integrated maritime surveillance, and sea basin strategies. As a result, other above-listed regulations - the Maritime Spatial

[252] https://www.euneighbours.eu/sites/default/files/publications/2021-09/EMTER_Report_TH-AL-21-004-EN-N.pdf

Planning and Marine Strategy Framework Directive (MSFD) - were developed based on the IMP.[253]

In recent years, the EU focused on coherence between different policies, therefore various EU maritime-related policies seek to contribute to broader EU strategies and policies, such as the EU Green Deal, Europe 2020 Strategy for smart, sustainable and inclusive growth, Recovery Plan for Europe, and 2050 Long-term strategy. In 2021, the European Commission published a paper "Putting the Blue into the Green", highlighting connection between these areas and stressing that a sustainable blue economy will help to deliver both the European recovery and the European Green Deal.[254] As such, the sustainable blue economy will complement other initiatives on biodiversity, food, mobility, security, data and more.

Box 4 Key EU Policies and Directives relevant for maritime affairs

European Green Deal.[255] Set in 2020, the cross-sectoral European Green Deal (EGD) aims to make the EU's economy sustainable by turning climate and environmental challenges into opportunities. The policy is targeted towards everyone, from policymakers to industry to citizens with an emphasises on joint action to achieve the goals.

Communication on EU Biodiversity Strategy for 2030 represents a 2020 update of Biodiversity Strategy (BdS)[256], adopted in 2011. It consists of an ambitious strategy including six targets and twenty actions to halt the loss of biodiversity and ecosystem services in the EU, as well as to help stop the global biodiversity loss by 2020. The mid-term review of the strategy indicated progress in many areas but highlighted the need for much greater effort.

Long-term 2050 Strategy.[257] EU's target to reduce its greenhouse gas emissions progressively by 2050 (Long-term 2050 strategy): this long-term strategic vision for a prosperous, modern, competitive and climate-neutral economy by 2050 was set by the Commission in 2018. The strategy shows how Europe can lead the way to climate neutrality by investing into realistic technological solutions, empowering citizens, and aligning action in key areas such as industrial policy, finance, or research – while ensuring social fairness for a just transition.

Communication on Sustainable Blue Economy (SBE)[258] represents a 2021 update of the Blue Growth Strategy (BGS), established in 2012, which is a long-term strategy to support

[253] https://ec.europa.eu/info/research-and-innovation/research-area/environment/oceans-and-seas/integrated-maritime-policy_en

[254] https://ec.europa.eu/oceans-and-fisheries/ocean/blue-economy/sustainable-blue-economy_en

[255] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

[256] https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en

[257] https://ec.europa.eu/clima/eu-action/climate-strategies-targets/2050-long-term-strategy_en

[258] https://ec.europa.eu/info/news/european-commission-adopts-new-communication-sustainable-blue-economy-2021-may-17_en

the sustainable growth in the marine and maritime sectors. It emphasizes the role of the seas and the ocean as the drivers for the future European economy, including the potential for innovation and growth. In the wider policy context, SBE and BGS are the maritime contribution of the Europe 2020 strategy for smart, sustainable and inclusive growth, the European Green Deal and the Recovery Plan for Europe.

It identifies concrete transformations in the different sectors of the Blue Economy that could guide public and private initiatives. This novel approach aims to provide coherence across the blue economy sectors, facilitate their coexistence and look for synergies in the use of maritime space, without damaging the environment. This innovative approach seeks also to increase coordination and cooperation between different policy areas, across sectors and between international, national, regional and local decision makers. It also underlines the need for investment in research, skills and innovation.

Integrated Maritime Policy[259] has been in place since 2007. It seeks to provide a holistic, enhanced cross-coordination between different national maritime policies. Higher returns from seas and the ocean with less impact on the environment are envisaged. There are 5 cross-cutting policies in the Integrated Maritime Policy, where research and innovation plays an important role - blue growth, marine data and knowledge, maritime spatial planning, integrated maritime surveillance, and sea basin strategies.

Common Fisheries Policy (CFP)[260] stipulates that between 2015 and 2020 the fish catch limits should be set at sustainable limits and overfishing should be halted to ensure the long-term viability of the fish stocks. In practical terms, the CFP set rules for managing European fishing fleets and for conserving fish stocks. Designed to manage a common resource, it gives all European fishing fleets equal access to EU waters and fishing grounds and allows fishermen to compete fairly.

CFP is based on three main pillars:[261]

- The new CFP (Regulation (EU) No 1380/2013);
- The common organisation of the markets in fishery and aquaculture products (Regulation (EU) No 1379/2013);
- The new European Maritime and Fisheries Fund (Regulation (EU) No 508/2014).

In 2018, the European Commission proposed a number of changes to the control regulation, as well as targeted amendments to the regulation on illegal, unregulated and unreported fishing (IUU regulation) and to the EFCA founding regulation.

[259] https://ec.europa.eu/info/research-and-innovation/research-area/environment/oceans-and-seas/integrated-maritime-policy_en

[260] https://ec.europa.eu/oceans-and-fisheries/policy/common-fisheries-policy-cfp_en

[261] https://www.europarl.europa.eu/factsheets/en/sheet/114/the-common-fisheries-policy-origins-and-development

Circular Economy Action Plan (CEAP)[262] was adopted in 2015. The CEAP includes measures to help stimulate Europe's transition towards a circular economy, boost global competitiveness, foster sustainable economic growth and generate new jobs. It entails the complete production cycle: from production and consumption to waste management and the market for secondary raw materials and a revised legislative proposal on waste.

In March 2020, the European Commission adopted the new Circular Economy Action Plan.[263] It is one of the main building blocks of the European Green Deal. The new action plan announces initiatives along the entire life cycle of products. It targets how products are designed, promotes circular economy processes, encourages sustainable consumption, and aims to ensure that waste is prevented and the resources used are kept in the EU economy for as long as possible.

Integrated Coastal Management[264] aims for the coordinated application of the different policies affecting the coastal zone and related to activities such as nature protection, aquaculture, fisheries, agriculture, industry, offshore wind energy, shipping, tourism, development of infrastructure and mitigation and adaptation to climate change. It will contribute to sustainable development of coastal zones by the application of 'ecosystem-based approach' approach that respects the limits of natural resources and ecosystems.

Maritime Spatial Planning (MSP) Directive.[265] MSP is a process by which the relevant EU Member State's authorities analyse and organise human activities in marine areas to achieve ecological, economic and social objectives. MSP can result in plans, permits and other administrative decisions comprising the spatial and temporal distribution of existing and future activities and uses in the marine waters.[266]

Marine Strategy Framework Directive (MSFD)[267] is the main European legal instrument for protecting and conserving the marine environment and ecosystems. The Directive enshrines ecosystem approach to the management of human activities. To support the MSFD, the Commission developed several other environment-oriented laws and launched programmes that enable monitoring of progress in specific areas (i.e., water pollution from shipping, underwater noise). In addition, Member States were asked to put in place programmes that help to achieve goals of the MSFD, as well as, to monitor and report their progress to the European Commission. The European Commission and the EU Member States work together in specific technical groups to support the MSFD's implementation.

[262] https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en

[263] https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en

[264] https://ec.europa.eu/environment/iczm/index_en.htm

[265] https://ec.europa.eu/oceans-and-fisheries/ocean/blue-economy/maritime-spatial-planning_en

[266] https://seaplanspace.eu/msp/

[267] https://ec.europa.eu/info/research-and-innovation/research-area/environment/oceans-and-seas/eu-marine-strategy-framework-directive_en

These include the technical groups on marine litter (D10), underwater noise (D11) and integrity of the seabed (D6).[268]

Water Framework Directive (WFD)[269] focuses on addressing pollution from urban wastewater and on water management. It primarily aims at the implementation of the environmental policy's protection principles with respect to the waters concerned, i.e. to preserve and enhance the status of aquatic ecosystems, with certain nuances depending on their respective categories. The WFD also has a wider and longer-term perspective by promoting "sustainable water use based on a long-term protection of available water resources". The EU Member States are obliged to develop river basin management plans, outlining measures that can address water-related challenges and contribute to good water quality. The port areas should be in a particular focus of such plans.

WFD has undergone a fitness check, which concluded that the Directive is overall fit for purpose, with some room for enhanced effectiveness. The results of the evaluation, published in 2019, showed that the Directive has been successful in setting up a governance framework for integrated water management for the more than 110,000 water bodies in the EU, slowing down the deterioration of water status and reducing chemical pollution. However, the Directive's implementation has been significantly delayed.[270]

European Climate Law[271] writes into law the goal set out in the European Green Deal for Europe's economy and society to become climate-neutral by 2050. The law also sets the intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. In addition, it aims to ensure that all EU policies contribute to this goal and that all sectors of the economy and society play their part.

Source: The Baltic and North Sea Strategic Research and Innovation Agenda BANOS SRIA, 2021[272]

In addition to development of policies in thematic areas, the EU designed regional policies, including in the Baltic and North Sea region, including: the European Union Strategy for the Baltic Sea Region (EUSBSR)[273], (last update in 2017), and the North Sea Region Programme[274], (last update is expected in summer 2022).

---

[268] https://www.euneighbours.eu/sites/default/files/publications/2021-09/EMTER_Report_TH-AL-21-004-EN-N.pdf

[269] https://ec.europa.eu/environment/water/water-framework/index_en.html

[270] https://ec.europa.eu/info/news/evaluation-eu-water-legislation-concludes-it-broadly-fit-purpose-implementation-needs-speed-2019-dec-12_en#:~:text=On%20the%20one%20hand%2C%20the,status%20and%20reducing%20chemical%20pollution.

[271] https://ec.europa.eu/clima/eu-action/european-green-deal/european-climate-law_en

[272] https://www.banoscsa.org/files/7273/Banos_2021_SRIA_web_FINAL.pdf

[273] https://www.balticsea-region-strategy.eu/about/about

[274] https://ec.europa.eu/regional_policy/EN/atlas/programmes/2014-2020/europe/2014tc16rftn005

These programmes have been implemented through Interreg[275] – one of key instruments of the European Union supporting cooperation across borders through project funding. Both macroregional programmes focus on tacking major marine/environmental challenges, stimulating economic growth, promoting green transport and mobility, and fostering shared solutions. More information on these strategies can be found in Box 5 and 6. Among key benefits that these Programmes have generated is an active engagement of diverse stakeholders in the Regions. This has been stimulating new partnerships and collaborative initiatives in the Baltic and North Sea Regions, in the maritime sector and beyond.

Box 5 EU Strategy for the Baltic Sea Region (based on DEL1, Task 1.2)

The European Union Strategy for the Baltic Sea Region (EUSBSR) is the first macro-regional strategy in Europe. The Strategy was approved by the European Council in 2009 following a communication from the European Commission.

The Strategy constitutes an integrated framework to address common challenges, i.e. the urgent environmental challenges related to the Baltic Sea, and to contribute to the economic success of the region and to its social and territorial cohesion, as well as to the competitiveness of the EU.

Four key challenges have been identified as requiring urgent attention:[276]

- To enable a sustainable environment,
- To enhance the region's prosperity,
- To increase accessibility and attractiveness,
- To ensure safety and security in the region.

Addressing the environmental problems and adaptation to climate change are in line with the Mission objectives. Thus, synergies should be sought. Moreover, the EUSBSR aims to tackle wide disparities in research, increase productive innovation and improve networks, eliminating the energy isolation of parts of the region, and ensure the sustainability of transport modes. These could significantly support implementation of the Mission through developed capacities and networks.

The key EUSBRS achievement was to bring together stakeholders across countries, sectors and levels. New networks and projects of macro-regional relevance have been created across policy areas and existing ones intensified. Examples of these can be found on the EUSBSR website.[277] The Strategy has also contributed to policy shaping and development (e.g. in the fields of energy, navigation, environment and climate change), to a better implementation of existing legislation and to the further development of synergies

[275] https://interreg.eu/

[276] EN (europa.eu)

[277] https://www.balticsea-region-strategy.eu/

and complementarities between existing cooperation frameworks in the region. Some concrete examples include[278]:

- The nutrient inflows to the Baltic Sea are being reduced through the implementation of projects such as PRESTO and Interactive water management (IWAMA);
- Business development and integration are being stimulated in the Baltic Sea region thanks to closer cooperation between companies and students which is being promoted through projects like the Baltic Training Programme;
- Maritime safety and accident prevention in the Baltic Sea is being improved by carrying out projects like Efficient, Safe and Sustainable Traffic at Sea (EfficienSea) and its follow up EfficienSea which focus on developing and testing infrastructure and services for e-Navigation.

Interreg Baltic Sea Region 2021-2027 continues mobilising stakeholders from around the region to help develop solutions and transfer knowledge to advance policy processes of the Strategy. The Programme funds projects that implement the EUSBSR action plan. It also supports macro-regional governance and coordination. The three objectives of the Strategy are formulated as: Save the Sea, Connect the Region and Increase Prosperity.

The EUSBSR Action Plan has been revised several times over the years. The last revision took place in March 2017. The updated Action Plan included a number of technical updates and corrections, a revised Policy Area Transport chapter and the inclusion of a new action on the integration of refugees in Policy Area Education. In addition, a new section on the procedure to follow in the case of change of thematic coordinators was included in the governance chapter.[279]

Source: own production, 2022, based on DEL 1, Task 1.2

Box 6 EU North Sea Region Programme

The overall objective of the EU North Sea Region Programme was to support development and foster sustained economic growth across the North Sea Region. The programme aimed to help enterprises, institutions, public administrations, NGOs and others to pool their expertise, share their experience and cooperate to develop realistic solutions to problems shared by organisations across the region. The North Sea Region Programme has been active between 2014 and 2020.The Programme had four main priorities:

- Priority 1: Thinking Growth – Supporting growth in the North Sea Region economies by promoting business investment in research and innovation, and developing links and synergies between enterprises, research and development centres and the higher education sector.
- Priority 2: Eco-innovation – Stimulating the green economy by supporting industrial transition towards a resource efficient economy, promoting green growth, eco-

[278] EC, 2022

[279] https://www.balticsea-region-strategy.eu/ap-2015-general-overview

innovation and environmental performance management in the public and private sectors.

- Priority 3: Sustainable North Sea Region – Protecting against climate change and preserving the environment by supporting investment for adaptation to climate change, including ecosystem-based approaches and protecting and restoring biodiversity and soil and promoting ecosystem services.

- Priority 4: Promoting green transport and mobility by developing and improving environmentally-friendly (including low noise) and low-carbon transport systems, including inland waterways and maritime transport, ports, multimodal links and airport infrastructure in order to promote sustainable regional and local mobility.

These priorities are in line with the Mission objectives. The Programme is expected to generate the impacts that will contribute to the Mission implementation:

- Develop new or improved knowledge partnerships between businesses, knowledge institutions, public administrations and end users with a view to long-term cooperation on developing products and services. Enhance regional innovation support capacity to increase long-term innovation levels and support smart specialization strategies. Stimulate the public sector to generate innovation demand and innovative solutions for improving public service delivery.

- Promote the development and adoption of products, services and processes to accelerate greening of the North Sea Region economy. Stimulate the adoption of new products, services and processes to reduce the environmental footprint of regions around the North Sea.

- Demonstrate new and/ or improved methods for improving the climate resilience of target sites. Develop new methods for the long-term sustainable management of North Sea ecosystems.

- Develop demonstrations of innovative and/or improved transport and logistics solutions with potential to move large volumes of freight away from long-distance road transportation. Stimulate the take-up and application of green transport solutions for regional freight and personal transport.

In the 2014-2020 period, the Programme funded 73 projects in the North Sea Region with approximately 177 EUR mio. One of the main achievements of the Programme was that it stimulated collaboration between stakeholders in industry, academic, public and NGO sectors. Many networks and partnerships continue working together long after the project has been completed. The new Programme (2021-2027) is expected to be officially approved during the summer of 2022. Following that, the European Commission will launch two rounds of calls for projects during summer and September of 2022.[280]

Source: EC: North Sea Interreg, 2022[281]

[280] https://northsearegion.eu/new-programme/process-and-timeline/

[281] https://ec.europa.eu/regional_policy/EN/atlas/programmes/2014-2020/europe/2014tc16rftn005

7.2.4. Institutional framework at the EU level

In terms of the institutional framework that governs the maritime sector in the EU, the regular EU decision-making process is applicable.

Within the European Commission, the key organisation responsible for the development of regulations in the blue sector is the European Commission Directorate-General for Maritime Affairs and Fisheries (DG MARE). It promotes maritime policies, ocean governance at international level, stimulates a sustainable blue economy, as well as works to ensure that the ocean resources are used sustainably and that coastal communities and the fishing sector have a prosperous future.[282] DG MARE has five directorates that focus on specific areas (Box 7).

Box 7 Directorates within DG MARE

Directorate A: Maritime Policy and Blue Economy (Acting Director: Mr Christos Economou)

Directorate B: International Ocean Governance and Sustainable Fisheries (Acting Director: Mr Andres Jessen)

Directorate C: Fisheries Policy - Atlantic, North Sea, Baltic and Outermost Regions (Acting Director: Mr Fabrizio Donatella)

Directorate D: Fisheries Policy – Mediterranean and Black Sea (Acting Director: Ms Lena Andersson Pench)

Directorate E: General Affairs and Resources (Acting Director: Mr Andrew Mathison)

Source: European Commission. Directorate-General for Maritime Affairs and Fisheries.[283]

Given a cross-sectoral nature of topics related to the maritime affairs and governance structures within the European Commission, DG MARE collaborates with other DGs of the European Commission. Among them are listed:

- Directorate-General for Environment (DG ENV)
- Directorate-General for Mobility and Transport (DG MOVE)
- Directorate-General for Climate Action (DG CLIMA)
- Directorate-General for Communications Networks, Content and Technology (DG CNECT)
- Directorate-General for Research and Innovation (DG RTD)

---

[282] https://ec.europa.eu/info/departments/maritime-affairs-and-fisheries_en

[283] https://ec.europa.eu/info/sites/default/files/organisation_charts/organisation-chart-dg-mare_en.pdf

- Directorate-General for Energy (DG ENER)

In addition, DG MARE closely cooperates with the European Research Executive Agency and the European Climate, Infrastructure and Environment Executive Agency (CINEA), delegating a number of actions to CINEA under Horizon Europe, LIFE programme, and the work programme (Management Plan 2021) in the following areas:

- Maritime Policy, in areas such as marine knowledge, maritime spatial planning, maritime surveillance, monitoring trends in the blue economy, ocean governance, and support for investment for jobs and sustainable economic development in innovative and emerging maritime sectors (18 actions);

- Scientific advice and projects necessary for the development and the implementation of the Common Fisheries Policy (16 actions).[284]

Other organisations that provide advisory or technical support to the EU policymakers are discussed in chapter 5.2.3.

7.2.5. Institutional and regulatory frameworks of the Lighthouse area at the macroregional level

7.2.5.1. Baltic Sea

The Convention on the Protection of the Marine Environment of the Baltic Sea Area (the 'Helsinki Convention') seeks to protect the Baltic Sea from all sources of pollution from land, air and sea, as well as to preserve biological diversity and to promote the sustainable use of marine resources. It also commits the signatories to take measures on conserving habitats and biological diversity and for the sustainable use of marine resources. Since 1992, the Convention includes ten Contracting Parties - Denmark, Estonia, the European Union, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden.[285] The Baltic Marine Environment Protection Commission (HELCOM) is the regional platform for environmental policy-making set up by the Helsinki Convention.

HELCOM has eight groups that handle specific topics related to the Baltic Sea's environment or maritime activities (

[284] https://ec.europa.eu/info/system/files/management-plan-mare-2021_en_0.pdf

[285] https://helcom.fi/about-us/convention/

Table **47**). The groups gather scientific and technical expertise and translate their findings into policies, strategies or recommendations. In addition, HELCOM also has expert groups and networks, comprised by experts in specific areas and Member State representatives.

Table 47 HELCOM Working Groups

Name of the Working Group	Short description of its activities
Gear: Group on the Implementation of the Ecosystem Approach	The ecosystem approach is the key ingredient of the HELCOM Baltic Sea Action Plan and a driving principle in the EU Marine Strategy Framework Directive (MFSD). The Gear Group works towards region-wide co-operation on all elements of national marine strategies. The group builds on HELCOM's coordinated monitoring programmes, core indicators with good environmental status boundaries, thematic and integrated assessment reports including assessment of pressures on the marine environment, as well as commonly agreed measures. The HELCOM expert network on economic and social analyses (EN ESA) enhances regional collaboration to produce comparable information on the economic and social aspects of the Baltic Sea marine environment.286
Maritime: Maritime Working Group	The Maritime Working Group works to prevent any pollution from ships – including deliberate operational discharges as well as accidental pollution. The group works to ensure that adopted regulations are observed and enforced effectively and uniformly through close international co-operation, and to identify and promote actions to limit sea-based pollution while ensuring safe navigation. The group works closely together with other international bodies such as the International Maritime Organization (IMO) to ensure that international measures are properly applied and implemented in the Baltic or the Regional Seas Programme (RSP) and the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA) under UNEP to address the problem of marine litter both at regional as well as global level.287 Within this Group are four expert/sub-groups: Expert Working Group on Mutual Exchange and Deliveries of Automatic Identification System data (AIS EWG), Sub-group on Green Technology and Alternative Fuels for Shipping (GREEN team), Group of Experts on Safety of Navigation (Safe NAV), The Joint HELCOM/OSPAR Task Group on Ballast Water Management Convention (BWMC) and Biofouling (JTG BALLAST & BIOFOULING).
Pressure: Working Group on the Reduction of Pressures from the Baltic Sea Catchment Area	The Working Group on the Reduction of Pressures from the Baltic Sea Catchment Area (Pressure WG) provides the necessary technical basis to the work on inputs of nutrients and hazardous substances from both diffuse and point sources on land, including follow-up of the implementation of the HELCOM nutrient reduction scheme. Within the Pressure Group are five expert/sub-groups : EG Marine Litter, EG on Underwater Noise (EG Noise), EG on Dredging/depositing Operations at Sea (EG DREDS), Reduction Scheme Core Drafting Group (REDCORE DG), The HELCOM Correspondence Group on Pharmaceuticals (hereafter CG PHARMA).288
Response: Response Working Group	Response WG ensures swift national and international response to maritime pollution incidents, as well as, to ensure that in case of an

[286] https://helcom.fi/helcom-at-work/groups/gear/helcom-esa-network/

[287] https://helcom.fi/helcom-at-work/groups/maritime/

[288] https://helcom.fi/helcom-at-work/groups/pressure/

	accident the right equipment is available and routines are in place to respond immediately in co-operation with neighbouring states. The EG analyses developments in maritime transportation around the Baltic and investigates possible impacts on international cooperation with regard to pollution response. In addition, it coordinates the aerial surveillance of maritime shipping routes to provide a complete picture of sea-based pollution around the Baltic, and to help identify suspected polluters. The group works closely with other relevant international bodies including BONN Agreement, and the International Maritime Organisation (IMO), to ensure international measures are suitably applied and implemented in the Baltic. The Response WG has four expert/sub-groups: The HELCOM Expert Group on Oiled Response (EG WILDLIFE), Informal Working Group on Aerial Surveillance (IWGAS), Expert Coordination Network on Response on the Shore (SHORE Network), Expert Group on Environmental Risks of Submerged Objects (EG SUBMERGED).289
State and Conservation: Working Group on the State of the Environment and Nature Conservation	The State and Conservation Working Group covers monitoring and assessment functions as well as issues related to nature conservation and biodiversity protection in HELCOM. A major aim of the State & Conservation group is to work across the monitoring-indicators-assessment chain in order to provide a stronger basis for coordinated development of the HELCOM thematic assessment tools and a coherent holistic assessment of the ecosystems health, including Baltic Sea Pressure Index and Impact Index. This Group has nine expert/sub-groups: Expert Group on Marine Mammals (EG MAMA), Expert Group on Sturgeon Remediation (EG STUR), Expert Group on Hazardous Substances (EG HAZ), Expert Network on Benthic Habitats and Biotopes (EN BENTHIC), Joint HELCOM/Baltic Earth Expert Network on Climate Change (EN CLIME), Intersessional network on eutrophication (IN Eutrophication), OSPAR/HELCOM Joint Expert Group on Non-Indigenous Species (JEG NIS), HELCOM-OSPAR-ICES Joint Working Group on seabirds (JWG Bird), Expert group on monitoring of radioactive substances in the Baltic Sea (MORS).[290]
Agri: Group on sustainable agricultural practices	The Agri Group enhances dialogue between agricultural and environmental national authorities on the development and application of sustainable agricultural practices with the least environmental impact on the Baltic Sea. Agricultural practices for reduced nutrient leakage are key focus areas for the Agri Group, bearing in mind that the agricultural sector is a main source of land-based nutrient pollution of the Baltic Sea.[291]
Fish: Group on Ecosystem-based sustainable fisheries (Fish Group)	The Fish Group deals with fisheries in relation to the implementation of the ecosystem approach. Moreover, the group works on finding solutions about how the fisheries sector could further contribute to reaching Good Environmental Status of the Baltic Sea. The Fish Group involves representatives from fisheries and environment authorities of the Baltic Sea countries, as well as EU, and HELCOM Observers and others as appropriate Fish Group has two expert/sub-groups: Correspondence Group concerning a draft document on Best Available Technology/Best Environmental Practices (BAT/BEP) descriptions for sustainable

289 https://helcom.fi/helcom-at-work/groups/response/

290 https://helcom.fi/helcom-at-work/groups/state-and-conservation/

291 https://helcom.fi/helcom-at-work/groups/agri-group/

	aquaculture in the Baltic Sea region (CG Aquaculture), and Task Force on migratory fish species (FISH-M).[292]
HELCOM-VASAB MSP: Joint HELCOM-VASAB Maritime Spatial Planning Working Group	The Joint HELCOM-VASAB Maritime Spatial Planning Working Group (HELCOM-VASAB MSP WG) was launched in October 2010 by HELCOM and the Vision and Strategies around the Baltic Sea (VASAB) Committee on Spatial Planning and Development of the Baltic Sea Region (CSPD/BSR). The Working Group was established to ensure cooperation among the Baltic Sea Region countries for coherent regional Maritime Spatial Planning (MSP) processes in the Baltic Sea. HELCOM-VASAB MSP WG is assisted by the MSP Data Expert sub-group that provides data, information and evidence exchange for MSP processes with regard to cross-border/transboundary planning issues.[293]

Source: HELCOM: Groups[294]

7.2.5.2. North Sea

In the North Sea, the OSPAR Commission implements the Convention for the Protection of the Marine Environment of the North-East Atlantic ('OSPAR Convention'). The OSPAR Convention requires Contracting Parties to take all possible steps to prevent and eliminate pollution and to take the necessary measures to protect the maritime area against the adverse effects of human activities so as to safeguard human health and to conserve marine ecosystems and, when practicable, restore marine areas which have been adversely affected. The OSPAR Commission identifies threats to the marine environment in the North-East Atlantic area and puts in place programmes and measures to ensure effective collective and national action to combat them. As a result, OSPAR is helping governments to cooperate, monitors and assesses the environmental status of the seas and set internationally agreed goals. The Contracting Parties of the OSPAR Convention are Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom, together with the European Union.

The OSPAR Commission is supported by five committees, some of which are in turn supported by working groups (

[292] https://helcom.fi/helcom-at-work/groups/fish-group/

[293] https://helcom.fi/helcom-at-work/groups/helcom-vasab-maritime-spatial-planning-working-group/

[294] https://helcom.fi/helcom-at-work/groups/

Table **48**). In addition, the Heads of the Delegations of the Contracting Parties meet regularly to prepare the meetings of the Commission, to advise on management and to oversee the development and implementation of the agreements made by the Commission.

Table 48 OSPAR main Committees

Name of the Committee	Short description of its activities
HASEC: Hazardous Substances and Eutrophication Committee	This Committee focuses on the following areas: hazardous substances and eutrophication. The working groups within HASEC include: Monitoring & on Trends and Effects of Substances in the Marine Environment (MIME); Inputs to the Marine Environment (INPUT); Intersessional Correspondence Group on Eutrophication (ICG Eut); Intersessional Correspondence Group on Eutrophication Modelling (ICG EMO).
OIC: Offshore Industry Committee	This Committee focuses on the following areas: offshore installations, discharges, carbon capture and storage, offshore chemicals. The working groups within OIC include: REACH Harmonisation (ICG-REACH), OIC deliverables to the Quality Status Report (OIC-ICG-QSR).
RSC: Radioactive Substances Committee	This Committee focuses on the following areas: periodic evaluation, discharges from nuclear and non-nuclear installations, best available techniques and best environmental practice. The working groups within RSC include: Delivering the Fifth Periodic Evaluation (ICG 5PE); Close to Zero (ICG CTZ); Environmental Assessment Criteria (ICG EAC); MODelling of additional concentrations of NORM in seawater from discharges of produced water from the offshore oil and gas sector (ICG MOD).
BDC: Biodiversity Committee	This Committee focuses on the following areas: species & habitat, marine protected areas, biodiversity monitoring & assessment. The working groups within BDC include: Coordination of Biodiversity Assessment and Monitoring (ICG COBAM); Protection & Conservation of Species and Habitats (ICG POSH); Marine Protected Areas (ICG MPA).
EIHA: Environmental Impact of Human Activities Committee	This Committee focuses on the following areas: marine litter, underwater noise, offshore renewables, shipping and ballast water, dredging & dumping, dumped chemical & conventional munitions, fisheries and mariculture, other human activities. The working groups within EIHA include: Underwater Noise (ICG Noise); Marine Litter (ICG ML); Cumulative Effects (ICG EcoC); Protection of Species & Habitats (ICG POSH); Economic & Social Analysis (ICG ESA).

Source: OSPAR Commission, 2022[295]

7.2.5.3. Two main organisations with similarities

HELCOM and OSPAR have many common areas of thematic focus and activities, given similarities of their mandates and of issues that require macroregional governance in the Baltic and North Sea area. Both organisations serve as a mechanism for collaboration between Member States on marine-related issues, develop environmental objectives and actions, often supplementing UN laws, and ensure that standards and rules are being implemented throughout the basin. HELCOM and OSPAR developed environmental plans/strategies for their respective regions (Box 8).

[295] https://www.ospar.org/work-areas

Given that HELCOM and OSPAR contracting parties include non-EU Member States, namely Norway, Switzerland, Iceland, United Kingdom and Russia, the macroregional organisations serve as a useful channel for intra-regional collaboration on seas. HELCOM and OSPAR also count with the particular role of some countries (Denmark, Finland, Germany and Sweden) that are members of both Conventions and have, from that position, contributed towards the enhancement of common knowledge and experiences.

HELCOM, OSPAR and their Contracting Parties support the work of the International Maritime Organisation to achieve effective protection of the marine environment at an international level. In addition, both macroregional bodies are collaborating with the International Council for the Exploration of the Sea (ICES), the International Atomic Energy Agency (IAEA) and other EU and UN bodies described earlier. As bodies that are predominantly operating in the EU, HELCOM and OSPAR assist their Member States to deliver on commitments under the EU Marine Strategy Framework Directive (MSFD). Apart from focusing on macroregional challenges, HELCOM and OSPAR are engaged in the global processes of fulfilling the UN Sustainable Development Goals (SDGs), especially Goal 14: "Conserve and sustainably use the oceans, seas and marine resources for sustainable development".

HELCOM and OSPAR have a common vision of an ecosystem approach to managing human activities impacting on the marine environment. Since 2003, these organisations have been actively collaborating in a number of fields, such as biodiversity, underwater noise, invasive species, marine litter, climate change, pollution and contamination by pharmaceuticals.[296] This is reflected in a declaration of the First Joint Ministering meeting of their Commissions[297] and in a Joint HELCOM/OSPAR Work Programme on Marine Protected Areas[298] that aims to ensure coherence in approaches towards protection of marine areas. In some areas collaboration has been particularly strong, resulting in creation of joint group, such as a Joint ICES/OSPAR/HELCOM Working Group on Seabirds. HELCOM and OSPAR continue exploring potential synergies and improving cross-regional coherence to support knowledge exchange, monitoring and evaluation of activities and programmes in the basin.

Despite a prominent coordination and monitoring role of HELCOM and OSPAR, the Member States in the Baltic and North Sea area hold the ultimate decision-making power over maritime affairs and do not tend to form stronger regional/macroregional governance structures. As a result, the institutional and regulatory frameworks at the EU and international levels have a greater influence on the developments in the basin.[299]

---

[296] https://portal.helcom.fi/meetings/MARITIME%2018-2018-503/MeetingDocuments/2-6%20HELCOM-OSPAR%20cooperation.pdf

[297] https://helcom.fi/wp-content/uploads/2019/10/First-Joint-Ministerial-Meeting-of-the-Helsinki-and-OSPAR-Commissions.pdf

[298] http://archive.iwlearn.net/helcom.fi/stc/files/BremenDocs/Joint_MPA_Work_Programme.pdf

[299] https://www.researchgate.net/publication/274388081_Marine_Governance_in_Europe_problems_and_opportunities

Box 8 HELCOM and OSPAR key policy documents

HELCOM Baltic Sea Action Plan

In 2007, HELCOM Contracting parties adopted the Baltic Sea Action Plan, which was updated in 2021. The Plan is HELCOM's strategic programme of measures and actions for achieving good environmental status of the sea, ultimately leading to a Baltic Sea in a healthy state.

BSAP is divided into four segments with specific goals:

- Biodiversity, with its goal of a "Baltic Sea ecosystem is healthy and resilient",
- Eutrophication, with its goal of a "Baltic Sea unaffected by eutrophication"
- Hazardous substances and litter, with its goal of a "Baltic Sea unaffected by hazardous substances and litter", and
- Sea-based activities, with its goal of "Environmentally sustainable sea-based activities".

OSPAR North-East Atlantic Environment Strategy (NEAES) 2030

The North-East Atlantic Environment Strategy (NEAES) 2030 was adopted on 1 October 2021 in Cascais, Portugal. This was supported by a high-level review of OSPAR's previous strategy for the decade 2010-2030.

The Strategy outlines objectives with respect to tackling eutrophication, preventing pollution by hazardous and radioactive substances, as well as, preventing inputs of and significantly reducing marine litter.

Source: HELCOM Baltic Sea Action Plan[300]; OSPAR North-East Atlantic Environment Strategy (NEAES) 2030[301]

7.2.5.4. Additional macroregional organisations

Apart from HELCOM and OSPAR, Vision and Strategies Around the Baltic Sea (VASAB) is an intergovernmental multilateral co-operation of the Baltic Sea Region in spatial planning and development, guided by the Conference of Ministers responsible for spatial planning and development. It is steered by the Committee on Spatial Planning and Development of the Baltic Sea Region (CSPD/BSR), composed of representatives of respective ministries and regional authorities (Germany, Russia).[302] VASAB prepares policy options for the territorial development of the Baltic Sea Region and provides a forum for exchange of know-how on spatial planning and development between the Baltic Sea countries.

---

300 https://helcom.fi/baltic-sea-action-plan/

301 https://www.ospar.org/documents?v=46337

302 https://vasab.org/home/about/

HELCOM and VASAB have been actively collaborating on maritime spatial planning. This resulted in creation of the Joint HELCOM-VASAB Maritime Spatial Planning Working Group. The description of this group was presented in

Table **47**.

Beyond the maritime sector, there are several macroregional organisations that have a broad policy agenda, yet their activities also stimulate development of the blue economy in the Lighthouse area. In the North Sea, the Nordic Council and its Council of Ministers are prominent organisations.[303] The Nordic Council aims to ensure that the Nordic region will become the most sustainable and integrated region in the world in 2030. This is elaborated in the Action Plan “Our Vision 2030”.[304] Its members are Denmark, Finland, Norway, and Sweden. Their national representatives are members of the national parliaments and are nominated by the party groups. The Nordic Council of Ministers is the official body for inter-governmental co-operation in the Nordic Region. The Nordic Council of Ministers consists of one or more members of each country’s government with the rotating system of presidency. The Council cooperates in the following relevant policy areas: environment and climate, sustainable development and energy.

The Council of Baltic Sea States (CBSS) is an inter-governmental political forum for cooperation in the Baltic Sea Region. The CBSS supports a global perspective on regional problems, translating the UN Sustainable Development Goals, the Paris Climate Agreement, the Sendai Framework on Disaster Risk Reduction, the Palermo Protocol and the UN Convention on the Rights of the Child, into regional actions on the ground. The CBSS functions as a coordinator of a multitude of regional actors in the areas of its three long-term priorities: Regional Identity, Sustainable & Prosperous Region, and Safe & Secure Region.[305] The CBSS focuses on several themes that are relevant for the Mission, such as sustainability, research and innovation.

The Conference of Peripheral Maritime Regions of Europe (CRPM) is a forum that brings together **more than 150 Regions from 24 States from the European Union and beyond.** The CPMR is sub-divided into six Geographical Commissions, corresponding to Europe’s maritime basins.[306] The CPMR Baltic Sea Commission is an international, independent organisation of Regional Authorities across the Baltic Sea Region. It serves as a forum for policy-oriented cooperation and lobbying amongst Regional Authorities. Each Member Region is represented by leading elected politicians. For example, the President of the CPMR Baltic Sea Commission is Jari Nahkanen from the Council of Oulu Region (Finland), while the president of North Sea Commission is Kerstin Brunnström, who is a regional councillor at Västra Götaland (Sweden).[307]

The CPMR Baltic Sea Commission promotes the specific interests of Baltic Sea regions towards EU institutions and fosters regional cooperation to address common challenges. The organisation supports the main goals of the EU Strategy for the Baltic Sea Region and works for a stronger involvement of regional stakeholders in the governance and implementation of the EU Strategy of the Baltic Sea Region. CPMR BSC long-term

[303] https://www.norden.org/en/organisation/nordic-co-operation

[304] https://www.norden.org/en/our-vision-2030

[305] https://cbss.org/organisation/about-us/

[306] https://cpmr.org/

[307] https://cpmr-northsea.org/who-we-are/

thematic Working Groups cover the policy areas of: Accessibility and Transport, Maritime Affairs, Energy and Climate.

The CPMR North Sea Commission pursues similar objectives as the CPMR Baltic Sea Commission, namely:

- To promote and create awareness of the North Sea region as a major economic entity within Europe
- To be a platform for developing and obtaining funding for joint development initiatives
- To lobby for a better North Sea region.

The CPMR North Sea Commission has been quite productive. It has developed a North Sea Region 2020 strategy, followed by the adoption of the North Sea Region 2030 Strategy. More information about the strategies can found in Box 9. In addition, the North Sea Commission, through its Fisheries group, set up the North Sea Commission Fisheries Partnership (North Sea Regional Advisory Council) which brought together scientists and fishermen from all the countries around the North Sea including Norway. The Commission has also succeeded in sourcing funding for interregional cooperation and development of joint projects through Interreg programmes and other EU, national and regional instruments.

Box 9 The North Sea Region strategy for 2020 and 2030

The North Sea Region 2020 strategy was adopted in 2016 for the period until 2020. The thematic scope of the North Sea Region 2020 Strategy was based around four priority areas[308], which reflect shared regional development concerns in line with the Europe 2020 Strategy, and relevant national policy priorities, and have the scope to benefit from joint/collaborative actions:

- tapping into “blue” resources
- promoting a more environmentally friendly and efficient transport sector
- addressing energy and climate issues facing the region
- promoting local businesses and partnerships in order to help create vibrant local communities.

In pursuing these aims the Strategy promotes innovation and seeks to support a skilled and relevant workforce for the future.

The North Sea Region 2020 strategy was revised in 2016. During the Annual Business Meeting in 2018 it was decided to begin the process of developing a North Sea Region post 2020 Strategy. The process led to the adoption of the North Sea Region 2030 Strategy. In the Strategy, regional authorities across the North Sea have jointly defined the most

[308] North Sea Region Strategy 2020 – CPMR North Sea Commission (cpmr-northsea.org)

pressing issues and topics where there is an added value in transnational cooperation and action. It is also a priority list, where the North Sea Commission believe that the North Sea Region, and the EU, can take the lead in the transition towards the green economy and delivering on the European Green Deal and the Paris Agreement, and contributing to the UN Sustainable Development Goals.

The four new priority areas[309] for cooperation are:

- a productive and sustainable North Sea
- a climate neutral North Sea
- a connected North Sea region
- a smart North Sea region

Source: CPMR North Sea Commission, 2022[310]

It is important to note that the CPMR Baltic and North Sea Commissions predominantly consist of representatives of local governments (i.e., county mayors, regional councillors, regional ministers). Among other prominent macroregional initiatives that involve the local governments, is listed KIMO (Local Authorities International Environmental Organisation). It is an international local government network representing more than five million citizens in eight northern European countries: Denmark, the Netherlands, Belgium, Norway, Sweden, the United Kingdom, Germany and Lithuania. They unite local governments to prevent pollution and protect, preserve and enhance the seas and coastal waters of the North-East Atlantic and Baltic regions.[311]

Some macroregional cooperation in the Baltic and North Sea basin is focused on specific territories. For example, the Wadden Sea World Heritage supports, facilitates and coordinates cooperation between Denmark, Germany and the Netherlands that focuses on ensuring environmental protection of the Wadden Sea (an intertidal zone in the southeastern part of the North Sea).[312] The cooperation is targeting three areas - conservation, sustainable development and environmental education. Similarly, the International Scheldt Commission (ISC), an intergovernmental institution for better coordination of the monitoring of surface and groundwater quality and quantity at the scale of the International Scheldt District, with a view to sustainable and harmonised management. The International Scheldt District covers some areas of France, Kingdom of Belgium, Walloon Region, Flemish Region, Brussels Capital Region, the Netherlands.[313]

[309] North Sea Region 2030 Strategy – CPMR North Sea Commission (cpmr-northsea.org)

[310] https://cpmr-northsea.org/

[311] https://www.kimointernational.org/about-us/mission/

[312] https://www.waddensea-worldheritage.org/common-wadden-sea-secretariat

[313] https://www.isc-cie.org/en/about/

7.2.6. Institutional and regulatory frameworks of the Lighthouse area at the national level

At the national level, the institutional and regulatory framework of governance in the maritime sector is sub-divided according to thematic areas (e.g., energy, transport, fisheries/food). Annex C provides a deeper look into the institutional and regulatory frameworks for the areas in focus per country, while this chapter presents major national institutions that are primarily responsible for the maritime sector as a whole and for maritime spatial planning. Additionally, it lists key policy documents (i.e., strategies, acts, plans) that are focused on the management of the maritime sector in a country.

In general, all national ministries are involved in the governance of the maritime sector, given diversity of areas that are encompassed in the sector. For example, the Ministries of Foreign Affairs represent their countries in the political forums organised in the Baltic and North Sea region, such as regional strategy forums (e.g., EU Strategy for the Baltic Sea Region), infrastructure, border management and security forums (e.g., Three Seas Initiative). The ministries of transport, energy, economic affairs are typically covering maritime transport, offshore (renewable) energy and marine trade respectively.

Table 49 presents the list of national organisations that have a generic or a broader coverage of areas in the maritime sector. Most of them are ministries of environment. These Ministries also represent the contracting parties at HELCOM and OSPAR.

Table 49 National organisations with the focus on the maritime sector

Country	National organisation(s) with the focus on the maritime sector	Key policy, legislative and regulatory documents in the maritime sector
Belgium	Federal Public Service Health, Food Chain Safety and Environment	Royal decree MSP-2020-2026; Marine Environment Act
Denmark	Danish Ministry of Environment	Danish Maritime Spatial Plan (Havplan); Maritime Spatial Planning Act; Danish Marine Strategy
Estonia	Ministry of the Environment	Estonian maritime spatial plan (official final plan yet to be published); Water Act of Estonia
Finland	Ministry of the Environment	Maritime spatial plan for Finland 2030; Land Use and Building Act; Government Decree on Maritime Spatial Planning
France	Ministry of Europe and Foreign Affairs, Ministry of Ecological Transition, The General Secretariat for the Sea (SGMer)	National Strategy for the Sea and Coast (SNML); North Sea Basin Strategy (Documents Stratégiques de Façade (DSF))
Germany	Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection	Maritime Spatial Plan 2021, Site Development Plan, the Ordinance on Maritime Spatial Planning in the German exclusive economic zone in the North Sea and the Baltic Sea (*AWZROV*); Federal Spatial Planning Act
Latvia	Ministry of	The Maritime Spatial Plan for Internal

	Environmental Protection and Regional Development of the Republic of Latvia	Waters, Territorial Waters and Exclusive Economic Zone of the Republic of Latvia (MSP 2030); Marine Environment Protection and Management Law
Lithuania	Ministry of Environment of the Republic of Lithuania	Second Comprehensive Plan exists for the Republic of Lithuania (including a section on “Maritime territories“); Republic of Lithuania’s Government Decree, No. 1597, Law on Territorial Planning
Netherlands	Ministry of Infrastructure and Water Management	North Sea Program 2022-2027 (to be published in March 2022); Water Act; Spatial Planning Act; National Water Plan; Dutch Maritime Strategy; Environment Act (to replace parts of the Spatial Planning Act)
Norway	**Ministry of Climate and Environment**	Updated ocean strategy Blue Opportunities; Norway’s integrated ocean management plans; Marine Resource Act; Planning and Building Act; Water Management Regulations
Poland	Ministry of Infrastructure	MSPs for: Polish Sea Areas in scale of 1:200 000; Szczeciński Lagoon and Kamieński Lagoon; Vistula Lagoon; Port area waters; Detailed plans for selected areas covered by the Maritime Spatial Plan for Polish Sea Areas in scale of 1:200 000; Act on Sea Areas of Poland and Maritime Administration of March 21st 1991; Ministerial regulation concerning maritime spatial plans of Polish sea area
Russia	Ministry of Natural Resources and the Environment of the Russian Federation, Federal Environmental, Industrial and Nuclear Supervision Service under the Russian Government	The Federal target Program "World Ocean", Program GOF-2014
Sweden	Ministry of the Environment	Swedish maritime plan (havsplaner314); Swedish Environmental Code (EC, 1998:808); the Plan and Building Act (2010:900)
United Kingdom	Department for Environment, Food and Rural Affairs, Marine Environment Division	UK Marine Policy Statement; various Regional Marine Plans; Marine and Coastal Access Act,; Marine (Scotland) Act 2010; Maritime 2050 – Navigating the Future strategy

Source: own production, 2022

To ensure a better governance of the territorial waters and marine resources by national authorities the European Commission introduced a Directive on maritime spatial planning (MSP)[315] that led to an obligation for the 22 coastal Member States to establish and develop MSPs. In the development of these plans participate key stakeholders that are involved in the management of maritime affairs in the national territories.

[314] https://www.havochvatten.se/arkiv/aktuellt/2022-02-15-regeringen-fattar-beslut-om-sveriges-forsta-havsplaner.html not yet translated in English

[315] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0089

Table **50** provides a list of key institutional stakeholders and legislative documents governing marine affairs at the national level.

The governance over administrative territories within countries determines the number and type of governing authorities in the maritime sector. This is reflected in

Table **50**, which indicates a competent authority for a specific area. For example, in the UK, the preparation of the MSP is the responsibility of the respective governments within the UK, reflecting the devolution of powers to Scotland, Wales and Northern Ireland. In Germany, the federal government has control over the exclusive economic zones, while the states that have coasts (Mecklenburg-Vorpommern and Schleswig-Holstein) have significant decision-making power over maritime affairs in the territorial waters surrounding these states.

As a result, the MSP is developed and implemented in pre-determined spatial boundaries, either at marine sub-basin level (regional level) or national administrative boundaries. Each marine country establishes its own spatial planning framework, corresponding procedures and mechanisms for development, implementation and monitoring, including stakeholder engagement – based on the given planning culture and legislative framework.

The progress of the MSP development differs across countries, as some plans are in preparation, adoption or a review phase. There are however differences across the two Lighthouse areas - while most of MSPs in the North Sea are in place, many national MSPs in the Baltic Sea are still not ready (detailed overview about status of the MSP in the two lighthouse areas is provided in DEL2). Hence, the formulation of the common maritime spatial planning on a macroregional scale remains a complicated task.

In spite of the fact that Norway is not part of the EU and is not obliged to develop an MSP, the national authorities decided to develop a management plan for the three seas that Norway borders: the Barents Sea, the Norwegian Sea and the North Sea.[316] Similarly, Russia has started to work on the development of the MSP that will cover the Russian part of the Gulf of Finland (Baltic Sea region) and Barents Sea.[317] However, the development of the MSP for the Kaliningrad region is not envisaged at the moment, possibly due to the strategic position of the region for Russia's security.

Recently, the European Commission launched a project "Emerging ecosystem-based Maritime Spatial Planning topics in North and Baltic Seas Region (eMSP NBSR)". The aim of the eMSP NBSR project is to enable Maritime Spatial Planners of managing authorities and policymakers from the North and Baltic Sea Regions to reflect on current MSP practices, to learn effectively from each other, and to collectively identify problems and solutions.[318] The project is expected to provide new knowledge and information to national governments and the European Commission on implementation, development and research actions, and managerial approaches that can or should be taken to deal with future challenges and opportunities afforded by the sea in a coherent way and with involvement of industry, academia and non-governmental organisations. It will run between 2021 and 2024 and is funded from EMFF.

[316] https://www.regjeringen.no/en/dokumenter/meld.-st.-20-20192020/id2699370/?ch=2

[317] https://vasab.org/wp-content/uploads/2020/03/Country-fiche_RU_MSP_March_2020.pdf

[318] https://maritime-spatial-planning.ec.europa.eu/node/3231

Table 50 Key institutional stakeholders at a national level

Country	Level and area covered	Competent authority for the MSP	Supporting key institutional stakeholders
Belgium	Federal: all marine waters, EEZ	Belgian Minister for the North Sea	Marine Environment Service, Ministry of Economy, Ministry of Defence, Ministry of the interior, Ministry of Energy, Ministry for Science Policy, Federal Council for Sustainable Development
	Regional: Flemish territorial waters	Government of Flanders, Agency for Maritime Services and Coast	Government of Flanders, Department of Mobility and Public Works, Maritime Access Division; Government of Flanders, Agriculture and Fisheries Department
Denmark	National: all marine waters	Danish Maritime Authority, Ministry of Business and Growth	Ministry of Environment and Food of Denmark, the Danish Agricultural Agency, the Danish Veterinary and Food Administration, The Danish Fisheries Agency. The Danish Coastal Authority is the official coastal government agency and an adviser to the Ministry of Environment and Food of Denmark.
Estonia	National: all marine waters	Ministry of Finance	The Ministry of Environment manages protected areas, including Natura 2000 sites; The Ministry of Agriculture manages and organises fishing; The Ministry of Defence organises defence activities and uses sea space for military purposes; The Ministry of Culture manages cultural heritage.
	Regional: Hiiu county's territorial waters	Hiiu County Board	
	Regional: Parnu county's territorial waters	Parnu County Board	
Finland	Regional: Northern Bothnian Sea, Quark, Bothnian Bay – all marine waters	Coastal Regional councils (Regional Council of Ostrobothnia, Regional Council of Central Ostrobothnia, Council of Oulu Region and Regional Council of Lapland, Regional Council of Southwest Finland and Regional Council of Satakunta, Helsinki-Uusimaa Regional Council and Regional Council of Kymenlaakso)	Prime Minister's Office, Finnish Ministry of the Environment, Ministry of Agriculture and Forestry, Ministry of Transport and Communications, Ministry of Economic Affairs.
	Regional: Archipelago Sea; Southern Bothnian Sea - all marine waters		
	Regional: Gulf of Finland - all marine waters		
	Regional: territorial	8 Coastal Regional	

	waters	Councils	
	Local: territorial waters	60 coastal municipalities	
France	National: all marine waters	French Ministry for the Sea	French Environmental Authority, National Committee for the Sea and Shorelines
	Regional: East Channel-North Sea	Maritime Council of Hauts-de-France and Normandy	Inter-regional Directorates for the Sea
Germany	Federal: EEZ	Federal Ministry of the Interior, Building and Community (BMI)	Federal Maritime and Hydrographic Agency
	State, Mecklenburg-Vorpommern: territorial and internal waters	Ministry of Energy, Infrastructure, Digitalisation MV	Ministry of Agriculture and Environment
	State, Schleswig-Holstein: territorial and internal waters	Ministry of the Interior, Rural Areas and Integration of the State Schleswig-Holstein	Ministry of Energy, Agriculture, the Environment, Nature and Digitalization; Ministry of Economic Affairs, Transport, Employment, Technology and Tourism
Latvia	National: all marine waters	Ministry of Environmental protection and Regional Development	Ministry of Agriculture, Ministry of Education and Science, Ministry of Transport
	Local: 2 km wide coastline zone, coastal waters	11 Coastal municipalities	
Lithuania	National: all marine waters and terrestrial areas of Lithuania	Ministry of Environment (Construction and Territorial Planning Policy Group, and Strategic Environmental Assessment Pollution Prevention Policy Group)	Ministry of Agriculture, Lithuanian Transport Safety Administration, *Ministry* of Energy
Netherlands	National: all marine waters	Interdepartmental Directors' Consultative Body North Sea (IDON) led by the Ministry of Infrastructure and Water Management	Ministry of Agriculture, Nature and Food Quality; Ministries of Economic Affairs, Defence, Finance, Education, Culture and Science
Norway	National: all marine waters	Ministry of Climate and Environment	Ministry of Petroleum and Energy, Ministry of Trade, Industry and Fisheries, Ministry of Local Government and Modernisation, Ministry of Transport, Ministry of Foreign Affairs, Norwegian Environmental Agency
Poland	National: all marine waters	Maritime Offices in Gdynia; Szczecin; Ministry of Infrastructure - Maritime Economy Department	Ministry of Climate and Environment, Ministry of Education and Science, Ministry of State Affairs
	Local: Szczeciński Lagoon	Maritime Office Szczecin	
	Local: Kamieński Lagoon	Maritime Office Szczecin	

	Local: Gdansk Bay	Maritime Office Gdynia	
	Local: Vistula Lagoon	Maritime Office Gdynia	
	Local: for several port area waters	Maritime Offices	
Russia	National: all marine waters	Ministry of Natural Resources and Environment of the Russian Federation	Ministry of Economic Development, Ministry of Natural Resources
Sweden	National, Gulf of Bothnia: from 1 nautical mile from the baseline till border of EEZ	Swedish Agency for Marine and Water Management, and Ministry of Environment	Swedish Marine Administration, Swedish Association of Local Authorities and Regions, Swedish Board of Agriculture, Swedish National Board of Housing, Building and Planning (Boverket), Swedish Environmental Protection Agency (EPA), Swedish National Heritage Board, Geological Survey of Sweden (SGU), Swedish Energy Agency, Swedish Transport Administration, Swedish Armed Forces and the Swedish Civil Contingencies Agency
	National, Baltic Sea: from 1 nautical mile from the baseline till border of EEZ		
	National, Western Waters and Skagerrak / Kattegat: from 1 nautical mile from the baseline till border of EEZ		
	Municipal comprehensive plans and regional plans: internal and territorial waters	65 Coastal municipalities 2 out of 21 regions have planning responsibilities	
United Kingdom	National, England: territorial waters of England	Department for Environment, Food & Rural Affairs (DEFRA), Marine Management Organisation (MMO)	Department for Transport, Department for Business, Energy & Industrial Strategy, Maritime and Coastguard Agency
	National, Scotland: territorial waters of Scotland	Marine Scotland	
	National, Wales: territorial waters of Wales	Welsh Government	
	National, Northern Ireland: territorial waters of Northern Ireland	Department of Agriculture, Environment and Rural Affairs (DAERA)	

Source: own production, 2022

7.3. Mechanisms of monitoring, evaluation and control in the Lighthouse area

The monitoring and evaluation of sea-related data and activities has many purposes, including risk and progress assessment, avoiding or mitigating accidents at sea, reducing negative impacts of human activities on marine environments, trade facilitation, enforcement and control in the fields of customs, sea border control, health etc. The monitoring and evaluation of marine environments and activities are conducted at different levels (i.e., international, EU, macroregional, national), leading to a complex network of organisations and processes that are, at times, insufficiently aligned. Control and decision-making power primarily belongs to the national governments, although control by non-national authorities may apply when examining fulfilment of obligations in line with international/EU/macroregional laws and regulations.

Overall, there is no coordinated and comprehensive framework for data monitoring, evaluation and control in the maritime sector. These activities are conducted by multiple organisations for specific marine-related areas, including by institutions that are issuing policies and strategies. Nevertheless, the characteristics of the mechanisms are similar. The system of monitoring, evaluation and control is built bottom-up, as national authorities provide data and information to the macroregional, EU and international authorities.

This chapter presents an overview of key organisations, policies, data platforms and mechanisms that are involved in monitoring, evaluation and control in the maritime affairs in the Lighthouse area.

7.3.1. International level

At the international level, the UN agencies are actively involved in monitoring and evaluation. In general, two types of organisations can be distinguished conducting these activities. The first group represents organisations that are examining compliance with specific laws and regulations that were adopted under their auspices, while the second group of organisations consists of bodies that focus on research activities, checking current status and progress in reaching specific targets (i.e., reduction of greenhouse gas emission, mitigation of climate change).

7.3.1.1. Key organisations that monitor and evaluate compliance with regulations, and their data systems

The IMO belongs to the first group of organisations, as under its auspices have been adopted a large number of international conventions related to maritime transport and pollution from shipping. Hence, we will use it to illustrate the mechanism of monitoring and evaluation for the first group of UN bodies.

The IMO Maritime Safety Committee and Marine Environment Protection Committee conduct an assessment, monitoring and review of the current level of implementation of IMO instruments by countries.[319] Moreover, the IMO inspection promotes and assists Member States to improve their capabilities to implement adopted directives/regulations, predominantly through technical assistance (i.e. provision of guidelines, training) and examination of the port state control procedures. Similarly, in the area of fisheries and

[319] https://www.imo.org/fr/OurWork/IIIS/Pages/Default.aspx

aquaculture, FAO seeks to improve knowledge, mechanisms, procedures of data collection and reporting requirements through guidance documents and strategies on monitoring and evaluation. Assessment/evaluation of aquaculture production occurs through international certification schemes, like the Aquaculture Stewardship Council.[320] ASC is the world's leading certification scheme for farmed seafood and through application of its criteria[321] combines the independent assessment of farms with environmental and social responsibility.

All Member States that signed international conventions related to maritime transport are requested to supply marine-related data to the IMO. The data is stored and displayed at Global Integrated Shipping Information System (GISIS)[322] – an online data source system. The system has three levels of data accessibility: for the public, for IMO Member States, for IMO Secretariat. The system provides databases on different topics/modules, such as port reception facilities, maritime security, national maritime legislation, ballast water management, test laboratories and halon facilities, recognized organisations, pollution prevention equipment and anti-fouling systems and others. Displayed data can be updated only by the respective Member States.

In addition to provision of data for GISIS, IMO Contracting Parties are obliged to submit reports and other data under relevant Conventions. For example, Parties to International Convention for the Prevention of Pollution from Ships (MARPOL) are obliged to annually report information on pollution incidents under the Convention.

Apart from GISIS, the IMO adopted a mandatory data collection system (DCS) to monitor greenhouse gas emission. The system is developed for ships above 5000 gross tonnes to report consumption data for fuel oil, hours under way and distance travelled.[323] The EU also instituted a monitoring, reporting and verification (MRV) system of CO_2 emissions from maritime transport (Regulation 2015/757) that also targets ships above 5000 gross tonnes.[324] As a result, data on greenhouse gas emissions calling at ports in the European Economic Area (EEA) must be reported in two separate, but largely overlapping systems. This points to a lack of integrity and to complexities that generate inefficiencies.

Additional monitoring is conducted by the European Environment Agency (EEA) to inform national and EU policymakers on use of available measures for reducing CO_2 emissions within the EEA ports and to raise awareness of these emissions. The key differences between the EU MRV system and the IMO DCS are presented in Box 10.

[320] https://www.asc-aqua.org/what-we-do/about-us/about-the-asc/

[321] The criteria and standards for certification include requirements covering the potential impacts of aquaculture – including water quality, responsible sourcing of feed, disease prevention, animal welfare, the fair treatment and pay of workers and maintaining positive relationships with neighbouring communities.

[322] https://gisis.imo.org/Public/Default.aspx

[323] Monitoring, reporting and verification of CO2 emissions from maritime transport (europa.eu)

[324] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R0757&from=EL

Box 10 Key differences between the EU MRV system and the IMO DCS

The IMO DCS comprises any activity carried out by ships in the marine environment, while the EU MRV covers only transport of goods and persons.

The IMO DCS applies to all international voyages, while the EU MRV applies only to voyages to and from EEA ports, including domestic voyages.

Emissions in EEA ports are reported separately in the EU MRV system.

The IMO DCS requires annual aggregated data, while the EU MRV uses data per voyage.

The IMO DCS requires data on the deadweight tonnage (the carrying capacity of the ship), while the EU MRV requires data related to transport work (weight of actual cargo carried or number of passengers).

The IMO DCS requires publication of aggregated data, while the EU publishes data on the performance of individual ships.

Source: European Parliament, 2020[325]

7.3.1.2. Key monitoring and evaluation research-focused organisations and their data systems

The second group of UN bodies that collect, monitor and assess marine-related data from Member States is headed by the Intergovernmental Oceanographic Commission (IOC).[326] The IOC launches global programmes devoted to specific UN initiatives or conventions in different marine or environment-related areas (e.g., UN Framework Convention on Climate Change, UN Environment Programme), involving a variety of stakeholders, including Member States, research organisations, marine/ocean and coastal management agencies. Each programme launches projects to implement specific actions and reach objectives of the programmes. These projects are also implemented with diverse international partners. Such approach enables the IOC to coordinate marine scientific research programmes for its 150 Member States, collaborate with different UN and external partners in areas of common interest, to provide ocean/marine services and needed capacity development activities.

Box 11 Intergovernmental Oceanographic Commission

IOC is a body with functional autonomy within UNESCO. Its purpose is to promote international cooperation and to coordinate programmes in research, services and capacity-building in order to learn more about the nature and resources of the ocean and coastal areas and to apply that knowledge for the improvement of management, sustainable development, the protection of the marine environment, and the decision-making processes of its Member States. Thus, IOC focuses on three broad areas:

[325] https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/642224/EPRS_BRI(2019)642224_EN.pdf

[326] https://ioc.unesco.org/node/2

- strengthening scientific knowledge of the ocean and human impact on it,
- applying that knowledge for societal benefit,
- building institutional capacities for sound management and governance.

At the national level, IOC works with the relevant marine, ocean and coastal management agencies to ensure that policymakers have access to the best possible ocean science and services.

IOC is recognized through the United Nations Convention on the Law of the Sea (UNCLOS) as the competent international organization in the fields of Marine Scientific Research (Part XIII) and Transfer of Marine Technology (Part XIV).

Source: IOC Medium-term Strategy, 2014-2021[327]

The key data collection and monitoring programmes of the IOC are the Global Ocean Observing System (GOOS), the Global Sea Level Observing System (GLOSS), the General Bathymetric Chart of the Oceans (GEBCO), the Joint Centre for Oceanographic and Marine Meteorological Observing Programme Support (JCOMMOPS), the International Oceanographic Data and Information Exchange (IODE) and Ocean Biodiversity Information System (OBIS). More information on them can be found in Table 51.

Apart from data collection and monitoring, the IOC evaluates the workforce, infrastructures, equipment, funding, investments, publications, blue patents, data flow and exchange policies, as well as national strategies in the blue sector, and reports it in the global ocean science reports. Based on these evaluations, the IOC is helping Member States to improve global management of the world's shared marine ecosystems and oceanic resources through maritime spatial planning, formulation of marine policy and support in building the marine ecosystem approach.

Table 51 Key monitoring programmes of the IOC

Name of the monitoring programme	Short description of the programme	Key partners
Global Ocean Observing System (GOOS)	The Global Ocean Observing System (GOOS) provides countries and end-users with critical information on physical, chemical, and biological essential ocean variables, aimed at delivery for climate, operational services, and ocean health. The GOOS mission is to lead the ocean observing community and create the partnerships to grow an integrated, responsive and sustained observing system.	The World Meteorological Organization (WMO), the United Nations Environment Programme (UNEP) and the International Science Council (ISC)
Global Sea Level	The Global Sea Level Observing System	Joint Centre for

[327] https://unesdoc.unesco.org/ark:/48223/pf0000228221

Observing System (GLOSS)	(GLOSS) uses a network of 290 sea level stations located around the world to measure global sea levels. GLOSS has been used to collect real-time measurements of sea levels since the 2004 Indian Ocean tsunami, and this information is used to support long-term climate change studies.	Oceanographic and Marine Meteorological Observing Programme Support (JCOMMOPS) of the Intergovernmental Oceanographic Commission (IOC) and the World Meteorological Organisation (WMO).
General Bathymetric Chart of the Oceans (GEBCO)	The General Bathymetric Chart of the Oceans (GEBCO) is working to map the floor of the global ocean. The oceans cover over two-thirds of our planet but it's often said that we know more about the shape of the surface of Mars than we do about the bottom of our own ocean.	International Hydrographic Organization (IHO)
Joint Centre for Oceanographic and Marine Meteorological Observing Programme Support (JCOMMOPS)	The Joint Centre for Oceanographic and Marine Meteorological Observing Programme Support (JCOMMOPS) is a collaboration between the IOC and the World Meteorological Organization (WMO) which internationally coordinates about 10,000 in situ ocean observing instruments for the continuous monitoring of the global ocean and the atmosphere above it.	World Meteorological Organization (WMO)
International Oceanographic Data and Information Exchange (IODE)	IODE's purpose is to enhance marine research, exploitation and development, by facilitating the exchange of oceanographic data and information between participating Member States, and by meeting the needs of users for data and information products.	More than 100 National Oceanographic Data Centres (NODCs), Associate Data Units (ADUs) and Associate Information Units (AIUs).
Ocean Biodiversity Information System (OBIS)	OBIS is a global data platform that integrates, quality controls and provides access to over 60 million occurrence records of 135,000 different marine species and that number is growing by millions every year. OBIS is built by the contribution of thousands of scientists who collaborate with data managers to make scientific data available for research, management and public awareness.	Predominantly national and international R&D&I organisations

Source: UNESCO IOC, 2022[328]

7.3.1.3. Other relevant research and sector-focused monitoring and evaluation organisations

The key partners in the above-listed programmes of the IOC are research organisations, particularly those that collect meteorological, environmental, marine/ocean or climate data. It is worth to highlight among them the World Meteorological Organization (WMO), International Science Council (ISC) and International Hydrographic Organization (IHO) that play an important role in global monitoring and evaluation for the maritime sector. More information on them is provided in Box 12-14.

[328] https://ioc.unesco.org/index.php/our-work

In addition to above-listed organisations, different UN bodies form partnerships and collect marine-related data to monitor and analyse state of the art, effectiveness of public/private interventions and design new policy tools. For example, the UN Environment Programme collects marine water quality statistics from national reporting agencies, marine information systems for Europe and regional organisations to trace progress in achieving the SDGs.[329] The strong focus of the UN on the SDGs resulted in the establishment of the Regular Process for Global Reporting and assessment of the State of the Marine Environment, including Socioeconomic Aspects (Regular Process). This is an intergovernmental process guided by international law, including the United Nations Convention on the Law of the Sea and other applicable international instruments, that results in a global integrated assessment of the world's ocean. This process is guided by international experts to support national policymaking and to make informed decisions surrounding ocean issues in alignment with "The 2030 agenda for Sustainable Development".[330]

Lastly, there are some sector-focused monitoring and evaluation organisations at the international level. For example, the International Renewable Energy Agency (IRENA) is involved in monitoring and evaluation of renewable energy policies and deployment. IRENA provides data on statistics such as renewable energy capacity and renewable energy power generation. Similarly, the International Energy Agency (IEA) also collects data to inform policymakers and provide a long-term perspective to the energy sector through dedicated statistics. These energy statistics includes energy balances, key energy-related indicators, including energy prices, public Research, Development & Deployment (RD&D) and measures of energy efficiency.

Box 12 Overview of activities of the World Meteorological Organization (WMO)

The WMO originated from the International Meteorological Organization (IMO). The WMO is the specialised agency of the United Nations for meteorology (weather and climate), operational hydrology and related geophysical sciences. The WMO facilitates and promotes:

- the establishment of an integrated Earth System observation network to provide weather, climate and water-related data,
- the establishment and maintenance of data management centres and telecommunication systems for the provision and rapid exchange of weather, climate and water-related data,
- the creation of standards for observation and monitoring to ensure adequate uniformity in the practices and procedures employed worldwide and, thereby, ascertain the homogeneity of data and statistics,
- the provision of weather, climate and water-related services to reduce disaster risks and contribute to climate change adaptation, as well as for sectors such as transport (aviation, maritime and land-based), water resource management, agriculture, health,

[329] Marine Water Quality Statistics, Session 1_6UNEP Marine Water Quality Statistics.pdf

[330] Division for Ocean Affairs and the Law of the Sea | (un.org)

energy and other areas,

- activities in operational hydrology as well as closer cooperation between National Meteorological and Hydrological Services in states and territories where they are separate,
- the coordination of research and training in meteorology and related fields.

Source: WMO, 2022[331]

Box 13 Overview of activities of the International Science Council (ISC)

The ISC is a non-governmental organization with a unique global membership that brings together over 200 international scientific unions and associations as well as national and regional scientific organizations including academies and research councils.

The ISC's activities focus on three principal areas of work:

- Science-for-policy to stimulate and support international scientific research and scholarship, and to communicate science that is relevant to international policy issues;
- Policy-for-science to promote developments that enable science to contribute more effectively to major issues in the international public domain; and
- Scientific freedom and responsibility to defend the free and responsible practice of science.

The ISC's monitoring and observation programmes facilitate data collection and foster the development of international standards and methodologies that support universal equitable access.

Source: International Science Council, 2022[332]

[331] https://public.wmo.int/en/our-mandate/what-we-do

[332] https://council.science/about-us/

Box 14 Overview of activities of the International Hydrographic Organization (IHO)

The International Hydrographic Organization (IHO) is an intergovernmental organization that works to ensure all the world's seas, oceans and navigable waters are surveyed and charted. Established in 1921, it coordinates the activities of national hydrographic offices and promotes uniformity in nautical charts and documents. It issues survey best practices, provides guidelines to maximize the use of hydrographic survey data and develops hydrographic capabilities in Member States.

Hydrography is a fundamental basis for all activities involving the sea:

- Safety of navigation
- Protection and management of the marine environment
- Use of marine resources: minerals, oil & gas, renewable energy
- Maritime trade
- Coastal zone management
- Fishing, aquaculture and mariculture
- Maritime defence and security
- Tourism
- Search and rescue
- Maritime boundaries and policing
- Marine science
- Marine spatial data infrastructure
- Recreational boating
- Tsunami flood and inundation modelling

Source: IHO, 2022[333]

[333] https://iho.int/en/about-the-iho

7.3.2. European level

The monitoring, evaluation and control at the European level is also sector-oriented, although the unifying EU policy programmes in the blue sector create connections between a network of organisations that are involved in these activities.

7.3.2.1. EU regulations/policies that require monitoring

At the European level, the EU Marine Strategy Framework Directive (MSFD) states that each Member State should prepare a framework for marine monitoring operations for informed policymaking, followed by the establishment of monitoring programmes for ongoing assessment of the environmental status and marine-related activities. To ensure coherence of monitoring and assessment systems and to meet set environmental targets across the EU, the European Commission lays down criteria and methodological standards to be used by the Member States for monitoring and assessment.[334] For example, the Commission Decision 2010/477/EU on criteria and methodological standards on good environmental status of marine waters lists 29 criteria and 56 indicators.[335]

Apart from the MSFD, there are many other EU directives and programmes that require data collection and reporting for monitoring purposes. Among them are listed the Water Framework Directive (WFD), the Environmental Quality Standards Directive (EQS), the Habitats Directive (HD), the Birds Directive (BD), the Data Collection Framework Regulation for the Common Fisheries Policy (CFP). Despite that the Joint Research Centre (JRC) provides technical guidance on monitoring, a greater comparability of assessment approaches, interoperability of monitoring data and better coordination of monitoring programmes in the marine environment is needed.[336] Typically, national and regional monitoring practices and methodologies differ, thereby inhibiting collaboration.

The EU legislation includes the requirement on Member States to develop and maintain the necessary technical interfaces for electronic data transmission to increase efficiency in collecting and sharing information between policymakers at different levels (i.e., national, EU). For example, the monitoring, surveillance, positioning and observation of vessel traffic and enabling information system exchange is based on the EU Directive 2002/59/EC and its update Directive 2014/100/EU.[337]

7.3.2.2. EU data platforms and mechanisms of monitoring and reporting

Among the most prominent European organisations that collect and analyse data on the environment is the European Environment Agency, together with its European environment information and observation network – Eionet. This network gathers data and produces assessments on a wide range of topics related to the environment, including water and marine environment, renewable energy, air pollution and sources, climate change adaptation, greenhouse gas emissions, contamination, waste management and

---

[334] https://eur-lex.europa.eu/eli/dir/2008/56/oj

[335] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32010D0477%2801%29

[336] https://mcc.jrc.ec.europa.eu/documents/201702065840.pdf

[337] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0100

prevention.[338] The EEA collects data from national focal points, typically national environment agencies or environment ministries.

To monitor and share sea-related data between national and EU authorities, the EU established the Maritime Information and Exchange System (SafeSeaNet). The system is composed of a network of national systems in the Member States and a central system acting as a nodal point, hosted and operated by the European Maritime Safety Agency (EMSA). Apart from enhancing maritime safety, port and maritime security, environmental protection and pollution preparedness, the system allows for the exchange and sharing of additional information facilitating efficient maritime traffic and maritime transport.[339] Data stored at SafeSeaNet is being effectively used by other EU Agencies, such as the European Border and Coast Guard Agency (FRONTEX), the European Fisheries Control Agency (EFCA), the EU Naval Force (EU-NAVFOR), the Maritime Analysis and Operation Centre – Narcotics (MAOC-N), which provide operational services in the areas of anti-piracy, criminal intelligence and coordinate law enforcement action on the high seas, fisheries campaign monitoring and border control. The services are also offered to all EU/EEA states, allowing them to make full use of the system and can be tailor-made for specific national purposes such as coastal radar or patrol assets.[340]

In addition to SafeSeaNet platform, the EU funded a number of important marine data initiatives for connecting data services, research infrastructures and e-infrastructures (Box 15). Among most prominent ones is the European Marine Observation and Data Network (EMODnet). This Network was established due to a group of organisations, supported by the EU's integrated maritime policy, that share marine observation data. The data originates within the Member States and is aggregated by EMODnet for publication on the EMODnet Central Portal as a centralised hub for European marine data.[341]

There are other EU platforms that focused on monitoring in a specific maritime sector. For example, EUMOFA - the European Market Observatory for fisheries and aquaculture, is a market intelligence tool on the European Union fisheries and aquaculture sector, developed by the European Commission. It aims to increase market transparency and efficiency, analyses EU markets dynamics, and supports business decisions and policy-making. EUMOFA monitors directly volumes, values and prices of fisheries and aquaculture products, from the first sale to retail stage, including imports and exports.

The ocean modelling data is provided through Copernicus Marine Service – the marine component of the Copernicus Programme of the European Union. This Programme offers information services based on satellite Earth Observation, in situ (non-space) data and numerical models. It is implemented in partnership with the Member States, the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological

[338] European Environment Agency's home page — European Environment Agency (europa.eu)

[339] https://transport.ec.europa.eu/transport-modes/maritime/eu-wide-digital-maritime-system-and-services/union-maritime-information-and-exchange-system-safeseanet_en

[340] https://transport.ec.europa.eu/transport-modes/maritime/eu-wide-digital-maritime-system-and-services/union-maritime-information-and-exchange-system-safeseanet_en

[341] https://emodnet.ec.europa.eu/en/emod-pace/about

Satellites (Mercator), the European Centre for Medium-Range Weather Forecasts (ECMWF), EU Agencies and Mercator Ocean International.[342]

Box 15 List of main European data management infrastructures and networks on ocean and marine data

- EU Copernicus Marine Service (CMEMS)
- EU Copernicus Climate Change Service (C3S)
- EMODNet - The European Marine Observation and Data Network
- Blue-Cloud – Piloting innovative services for Marine Research & the Blue Economy
- Copernicus DIAS - Data and Information Access Services
- EuroArgo Data Centres & International Argo Data System
- EurOBIS – European Ocean Biodiversity Information System
- ICOS Ocean Thematic Centre – Data Portal
- SeaDataNet – Pan-European Infrastructure for Ocean & Marine Data Management
- SafeSeaNet - European Union's Maritime Information and Exchange System
- ODIP - Ocean Data Interoperability Platform
- Eionet - European Environment Information and Observation Network

Source: EU4Oceanobs, 2022[343]

7.3.2.3. Examples of different monitoring and evaluation mechanisms: policy-driven, funding-related, private sector and sector-specific

There are different mechanisms on how data is being monitored and evaluated. In most cases, collected data is analysed and used to inform policymaking for different DGs of the European Commission, as well as, by national governments. Similarly to the UN bodies, different DGs within the European Commission (e.g., DG MARE, DG ENV, DG RTD) monitor specific marine-related areas that are in the focus of their programmes, policies and

[342] https://marine.copernicus.eu/about

[343] https://iho.int/en/about-the-iho

regulations, and launch projects to collect, monitor, analyse, evaluate developments in a specific area. For example, in 2013 the European Commission launched the project COMMON SENSE that will support implementation of the European Union marine policies such as MSFD and the Common Fisheries Policy (CFP). This marine monitoring project has been designed to directly respond to requests for integrated and effective data acquisition systems by developing innovative sensors that will contribute to our understanding of how the marine environment functions.[344] As in the case of monitoring and evaluation at the international level, the research and scientific organisations are enabling entities for monitoring and evaluation of maritime affairs in the EU.

The EU R&I programmes and funding instruments, such as Horizon Europe[345], LIFE programme[346] and the European Maritime and Fisheries Fund (EMFF)[347], are also monitored and evaluated through projects, initiatives, activities that they have invested in. Such assessments also contribute to the analysis and evaluation of different maritime sectors. In case of EMFF, the Fisheries and aquaculture monitoring and evaluation (FAME) was established to assist in monitoring and evaluating the implementation of the EMFF and to build capacity across EU countries and in the Commission on evaluation and monitoring methodologies, indicators and good practice.[348]

Besides publicly funded initiatives and organisations that collect and analyse marine data, there are several industry platforms composed of private sector stakeholders. For example, in the energy sector, WindEurope collects data from its members from across the whole value chain of wind energy: wind turbine manufacturers, component suppliers, power utilities and wind farm developers, financial institutions, research institutes and national wind energy associations. Collected data is used for coordination of international policy**, c**ommunications, research and analysis.[349]

Lastly, there are sector-specific mechanisms for monitoring and evaluation. Below is the illustration in the energy sector. According to the Regulation on the governance of the energy union and climate action, EU countries are obliged to report climate information to Reportnet 3.0, an online reporting system that is managed by the European Environment Agency. From 2023 onwards, all EU Member Countries should report to the European Commission on the progress of the implementation of the National Energy and Climate Plans (NECP). According to the regulation that was predecessor of the Regulation on the governance of the energy union and climate action, the Climate Monitoring Mechanism, EU Member Countries already had to report on an annual basis on climate change progress, measures to counter climate change and other relevant information. Among other relevant stakeholders in the energy sector are the Council of European Energy Regulators (CEER),

[344] Home (commonsenseproject.eu)

[345] https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en

[346] https://www.lifeis30.eu/

[347] https://ec.europa.eu/oceans-and-fisheries/funding/european-maritime-and-fisheries-fund-emff_en#:~:text=The%20EMFF%20is%20the%20fund,and%20growth%20in%20the%20EU.

[348] https://ec.europa.eu/oceans-and-fisheries/funding/fisheries-and-aquaculture-monitoring-and-evaluation-fame_en#ecl-inpage-235%20s.

[349] https://windeurope.org/about-us/

which reports on status of renewable energy (integration) in Europe, and the Agency for the Cooperation of Energy Regulators (ACER), which is a European Union Agency formed for the cooperation of energy regulators.

7.3.2.4. Mechanisms of control at the EU level

With respect to control, specific EU agencies are responsible for inspection and control on compliance with set regulations. For example, the European Fisheries Control Agency (EFCA)[350] promotes the highest common standards for control, inspection and surveillance under the Common Fisheries Policy. The European Maritime Safety Agency (EMSA)[351] conducts many different kinds of **technical** inspection, including checking that ships calling at EU ports are adequately inspected and that national vessel traffic monitoring systems are working effectively.[352] The European Border and Coast Guard Agency (FRONTEX) monitors what is going on at the EU external border, ensures effective border control and migration management.[353]

In addition, some EU Member States participate in joint actions, initiatives to improve control and inspection over maritime affairs. For example, the EU SHIPSAN ACT Joint Action, funded by the European Commission under the Health Programme (2008-2013), involved 33 partners from 24 European countries. The EU SHIPSAN ACT Joint Action focused on the inspection of health threats due to biological, chemical and radiological agents, including communicable diseases that affect passengers on maritime transport.[354] It is important to note that the modern digital, satellite and sensor technologies play an important role in assisting authorities to control and monitor activities in the seas.

7.3.3. Macroregional level

HELCOM and OSPAR pursue their obligations to monitor and assess the status of the marine environment. They are in charge for the overall coordination of monitoring in the Baltic Sea and the north-east Atlantic and the North Sea, respectively.[355] On the basis of collected data, HELCOM and OSPAR produce analyses that are shared with their members. Nevertheless, both organisations do not have a mandate to control affairs in the basins.

7.3.3.1. Main monitoring and evaluation mechanism in the Baltic Sea

Currently, there are 12 agreed HELCOM monitoring programmes covering sources and inputs of human pressures and various variables reflecting the state of the environment in the Baltic Sea. HELCOM offers a platform for the Contracting Parties to jointly plan,

---

[350] https://www.efca.europa.eu/en

[351] https://www.emsa.europa.eu/

[352] https://european-union.europa.eu/institutions-law-budget/institutions-and-bodies/institutions-and-bodies-profiles/emsa_en

[353] https://frontex.europa.eu/about-frontex/who-we-are/foreword/

[354] https://www.shipsan.eu/

[355] https://www.eea.europa.eu/publications/92-9167-001-4/page024.html

coordinate monitoring and assessment activities, to share resources for cost-efficiency and better quality of data, as well as, to fine-tune and optimise the activities to match national and international needs and obligations.

To ensure good coordination of monitoring and evaluation between and within Member States, HELCOM developed a Joint Coordinated Monitoring System, Data and Information Strategy and Assessment System.[356] In addition, HELCOM subdivided the Baltic Sea into 17 sub-basins to ensure efficiency and alignment of data collection efforts among Member States. Data and information are gathered through joint monitoring activities with national authorities to produce joint assessments. Shared monitoring stations and activities, information and data are instrumental in this. Research agencies and institutes of Contracting Parties and observer organizations with research interests, that are not a regular part of HELCOM work, are also involved in a scientific-research cooperation to build synergies.

The collection of data is based on agreed standards, guidelines and procedures to ensure comparability across the Baltic Sea Region. Collected data can be used to fulfil other international requirements, in particular by those Contracting Parties that are also EU Member States in relation to MSFD, WFD, EU Strategy for the Baltic Sea Region. The Strategy also facilitates collaboration with other organizations in the field of environmental monitoring and assessment, e.g. the International Council for the Exploration of the Sea (ICES), the European Environment Agency (EEA), the Barcelona Convention, OSPAR and Black Sea Commission, the Arctic Monitoring and Assessment Programme (AMAP), the European Air Pollution Monitoring Programme (EMEP) and UNEP Regular Process for Global Reporting and Assessment of the State of the Marine Environment.

In addition to monitoring, HELCOM regularly carries out thematic and holistic assessments to evaluate progress towards the goals and objectives set for the Baltic Sea environment. For effective evaluation of collected data, HELCOM developed an assessment system that specifies methodologies and tools.[357] Assessments take place at different levels, ranging from data on the measured parameter and indicator to thematic (e.g. MSFD descriptors, WFD quality elements) and holistic assessments, involving increasingly complex assessment and aggregation procedures.[358]

7.3.3.2. Main monitoring and evaluation mechanism in the North Sea

In the North Sea, OSPAR performs similar activities with respect to monitoring and evaluation as HELCOM in the Baltic Sea. OSPAR developed a Coordinated Environmental Monitoring Programme (CEMP) that aims to deliver comparable data from across the OSPAR Maritime Area, which can be used in assessments to address the specific questions raised in OSPAR's Joint Assessment and Monitoring Programme (JAMP). The CEMP focuses on six thematic areas for monitoring:

---

356 Draft HELCOM Monitoring and Assessment Strategy

357 http://stateofthebalticsea.helcom.fi/about-helcom-and-the-assessment/

358 https://helcom.fi/media/publications/Monitoring-and-assessment-strategy.pdf

- Theme A - Cross-Cutting Components
- Theme B - Biodiversity and Ecosystems
- Theme E - Eutrophication
- Theme H - Hazardous Substances
- Theme O - Offshore Oil and Gas Industry
- Theme R - Radioactive Substances

Similar to HELCOM, OSPAR ensures coordination of regional monitoring activities and seeks to build synergies between the activities of OSPAR and of the MSFD and other EU Directives. For example, in 2014 OSPAR revised its CEMP Appendices to align with the European Commission's (EC) MSFD Art.11 monitoring programmes reporting tables, to assist Contracting Parties that are Member States in their MSFD reporting commitments.[359] In addition, OSPAR builds collaboration with other marine-focused organisations, such as the Barcelona Convention (UNEP-MAP), the Arctic Council (e.g., Protection of the Arctic Marine Environment, Arctic Monitoring and Assessment Programme) and the regional fisheries organisations in the North-East Atlantic (e.g., North East Atlantic Fisheries Commission, North Atlantic Salmon Conservation Organisation) as well as of global bodies dealing with marine environmental questions (e.g., IMO, ISA).[360]

An illustrative example of international collaboration with a macroregional body is the collaboration between OSPAR and the International Council for the Exploration of the Sea (ICES). ICES is an intergovernmental marine science organization that has several thematic working groups. In the case of aquaculture - the Working Group on Risk Assessment of Environmental Interactions of Aquaculture (WGREIA) and the Working Group on Social and Economic Dimensions of Aquaculture (WGSEDA). These Working Groups collect data from a network of 6000 scientists from over 700 marine institutes in 20 member countries and provide an analysis for a specific sea. At the moment, ICES has a partnership with organisations in the North Sea, such as OSPAR and local research organisations, therefore it has recently published the first Aquaculture Overview for Norwegian Sea Ecoregion, which includes the most recent understanding on the potential environmental, economic, and social interactions to aid aquaculture planning. 361

To facilitate monitoring and evaluation, OSPAR developed the OSPAR Data and Information Management System (ODIMS), outlined methodologies, guidelines and tools for data collection, provided assessment sheets and indicator frameworks for evaluation. Collected and analysed information result in joint reporting.

Similar to HELCOM, OSPAR divided the Maritime Area into five regions: Arctic Waters, Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast and Wider Atlantic. Each

---

[359] Background - OSPAR-OAP (Prod)

[360] Outline thematic parts of the JAMP (ospar.org)

[361] https://doi.org/10.17895/ices.advice.9585

Contracting Party conducts monitoring and assessment in its own waters and later shares data with OSPAR and other relevant EU/international authorities.

7.3.3.3. Other organisations that conduct monitoring and evaluation at a macroregional level

Apart from data repositories and resource catalogues available at HELCOM and OSPAR websites, the collection and monitoring of data at the macroregional level is also conducted by Copernicus Marine Environmental Monitoring Service (CMEMS), the Baltic Monitoring Forecasting Centre and the Arctic Monitoring Forecasting Centre, the Baltic Operational Oceanographic System (BOOS), Federal Maritime and Hydrographic Agency (BSH) and many other research organisations and national public organisations. In addition, EMODnet provides information about the North and Baltic Seas.

7.3.4. National and sub-national level

As mentioned earlier, each government in the Baltic and North Sea is required to develop its own marine monitoring programme under the EU MSFD. Following IMO and EU requirements, states have to conduct a port state control – an inspection of foreign-flagged ships in national ports to verify that the condition of the ship and its equipment comply with the requirements of international, EU and national regulations and that the ship is manned and operated in compliance with these rules. Thus, each country has a maritime inspectorate. In addition, each country may have additional national laws and regulations pertaining to monitoring, evaluation and control of maritime affairs.

Some countries develop national monitoring, evaluation and control programmes that specify how specific marine areas are being monitored and what control mechanisms are available. Besides complying with international and EU regulations, some Member States also set additional requirements, which are then translated into specific monitoring. For example, in Denmark there is a national monitoring and assessment programme for the aquatic and terrestrial environments[362]; in France, there is a national marine monitoring programme, as well as seashore microbiological and phytoplankton monitoring programmes; in Greece, there is a bathing water monitoring programme.[363]

As outlined in Section 2.2.1, typically, national and regional monitoring practices and methodologies differ, thus hampering collaboration and exchange. Especially at the regional level, responsibilities vary considerably. For example, in Germany the significant administrative and legal border is not between land and sea, but between the 12 nautical mile zone of the territorial waters and Exclusive Economic Zone (EEZ). The 12 nautical mile zones of the German sea area are within the competence of the coastal states (Bundesländer). The rest of the German EEZ is under responsibility of the Federal government (Ministry of Transport, Building and Urban Affairs). The Government and the Coastal States work together within the framework of the Federal/State Working Group on the North Sea and Baltic Sea (BLANO) and its structures.[364]

---

[362] https://www2.dmu.dk/1_viden/2_Publikationer/3_fagrapporter/rapporter/FR537.PDF

[363] 4.5. Monitoring of marine waters — European Environment Agency (europa.eu)

[364] Bund/Länder-Arbeitsgemeinschaft Nord- und Ostsee - Umsetzung EU-MSRL in Deutschland (meeresschutz.info)

In the context of renewable energy, all countries have their own Energy Regulators. Often these Energy Regulators report to the EEA or Eoinet in order to comply with European data requests or reporting duties for the UN Framework Convention on Climate Change.

In general, national monitoring programmes are carried out by specialized institutes, or a cluster of them, and involve other parties – regional environmental authorities, border guards, non-profit organizations (as example, in Finland, see example below), which have necessary infrastructure (including designated research vessels and data storing/management systems).

Box 16 Finland's marine monitoring system

The Finland's monitoring programme compiles information from several different research institutions (the Finnish Environment Institute (SYKE), the Finnish Meteorological Institute (FMI), the Natural Resources Institute Finland (Luke), the Finnish National Supervisory Authority for Welfare and Health, the Finnish Food Authority, the Geological Survey of Finland (GTK), Radiation and Nuclear Safety Authority (STUK), and other parties, such as regional environmental authorities, the Finnish Border Guard, the Finnish Museum of Natural History, Metsähallitus and non-profit organisations. The work is coordinated by the SYKE Marine Research Centre.

Observations from the entire Baltic Sea area are compiled by the SYKE research vessel Aranda in cooperation with the Swedish Meteorological and Hydrological Institute (SMHI), among other parties. Automatic monitoring equipment installed on trade vessels (Alg@line) also helps to monitor the surface temperature and salinity of waters and algae concentrations in real-time. On the Finnish coast, Centres for Economic Development, Transport and the Environment (ELY Centres) also gather information about the state of coastal waters. The status assessments also utilise information produced through satellite imaging.

Source: Finland's Ministry of the Environment, 2022[365]

The main marine monitoring and control organizations in lighthouse area (per country) are shown in the table below.

[365] https://www.ymparisto.fi/en-US/Sea/Monitoring_the_state_of_the_Baltic_Sea

Table 52 National Marine Monitoring and control organisations in the Lighthouse area (non-exhaustive list)

Country	Major monitoring and evaluation organisations	Major control organisations
Belgium	Royal Belgian Institute of Natural Science,s Flanders Marine Data Centre of VLIZ	Marine Environment Service
Denmark	Aarhus University, Danish Centre for Environment and Energy (DCE)	The Danish Environmental Protection Agency
Estonia	Estonian Marine Institute at University of Tartu (the leading marine research and education institution in Estonia) EMI is responsible for marine monitoring program in Estonia.	Estonian Environment Agency
Finland	The Finlands monitoring programme is coordinated by the SYKE Marine Research Centre. It compiles information from several different research institutions (the Finnish Meteorological Institute (FMI), the Natural Resouces Institute Finland (Luke), The Finnish National Supervisory Authority for Welfare and Health, the Finnish Food Authority, the Geological Survey of Finland (GTK), Radiation and Nuclear Safety Authority (STUK), and other parties, such as regional environmental authorities, the Finnish Border Guard, the Finnish Museum of Natural History, Metsähallitus and non-profit organisations)	Environmental Protection Department (MoE)
France	Ifremer, the French Research Institute for Exploitation of the Sea, SGmer (Prime Minister associated body)	Maritime prefect Metropolitan France (Channel/North Sea, Atlantic, Mediterranean), SGmer (Prime Minister associated body)
Germany	Federal Maritime and Hydrographic Agency (BSH) Leibniz Institute for Baltic Sea Research Warnemuende (IOW)	Federal Environmental Agency
Latvia	Latvian Institute of Aquatic Ecology (LIAE) (responsible for national marine environmental monitoring programme)	State Environmental Inspectorate, State Marine Board
Lithuania	Marine research institute (Klaipeda University) Environmental Protection Agency (under MoE) Marine research institute (Klaipeda University)	Environmental Protection Agency (under MoE)
Netherlands	The Marine Information and Data Centre (IHM) (collaborative venture between Rijkswaterstaat Ministry of Infrastructure and Water Management, the Ministry of Agriculture, Nature and Food Quality and the Ministry of Defence (The Hydrographic Service of the Royal Netherlands Navy))	Human Environment and Transport Inpectorate, Authority Consumers & Markets
Norway	The Institute of Marine Research (IMR)	The Norwegian Environment Agency
Poland	Department of Environment Monitoring, Institute of Meteorology and Water Management	Chief Inspectorate Of Environmental

	(National Research Institute)	Protection
Russia	Roshydromet (a federal executive body under the jurisdiction of the Ministry of Natural Resources and Ecology of the Russian Federation). Roshydromet includes 17 Federal research institutions.	The Federal Supervisory Natural Resources Management Service (under MoE)
Sweden	National Oceanographic Data Centre of Sweden, Swedish Meteorological and Hydrological Institute Statistics Sweden	The Swedish Environmental Protection Agency
United Kingdom	Centre for Environment, Fisheries and Aquaculture Science (CEFAS)	United Kingdom government Department for Environment, Food and Rural Affairs (DEFRA)

Source: own production, 2022

7.4. Key stakeholders supporting policy design and implementation in the Lighthouse area

This chapter presents key stakeholders that are supporting policy design and implementation in the Lighthouse area. Their role in the governance structures is determined by their mandate/aim, which is typically associated with the sector in which they operate – research, development and innovation (R&D&I), industry and business, civil society/NGO or finance. Thus, the R&D&I organisations are expected to provide data for evidence-based policymaking and evaluation, NGOs are expected to raise important community/national issues related to maritime sector, while finance organisations are expected to invest in activities that have been prioritised through policies and strategies in the maritime sector.

Some of the listed stakeholders contribute to work of different governance actors in the maritime sector, being active in multiple areas and geographic locations. Thus, it is not possible to indicate their main contribution to the governance system of the maritime sector and to highlight their degree of influence on specific policymakers. Overall, in the governance of regional seas such as the Baltic Sea and North Sea, collaboration fostering initiatives by nongovernmental and subnational organisations, as well as transnational stakeholder networks, have been found to be influential in many environmental governance contexts.

The organisations that are presented below have been identified through an extensive literature review of publicly available sources. For example, searches have been performed of the webpages of key governance stakeholders. As a result, this chapter does not present an exhaustive list of all relevant stakeholders, but rather it provides an overview of the key stakeholders that have been primarily detected through the desk study and are relevant to the scope of the study. Thus, the assumption on their relevance is linked to direct mention in the literature of governance structures in the maritime sector and/or to their association with the policymakers. In the sections below, it is noted that stakeholders acting at international, macroregional and national levels are presented under each category.

7.4.1. R&D&I organisations

An adequate level of R&D&I will be a critical lever in achieving the objectives of the European Mission ‘Restore our ocean and waters by 2030’. Especially in the context of achieving carbon neutrality and circularity in the lighthouse area research and innovation is of utmost importance. Initiatives, institutes, research centres and other stakeholders involved in Research & Development & Innovation can play an important role in supporting policy design and implementation, especially when it comes to providing data or research that support the policy process. Likewise, important research findings for the Blue Economy or the maritime environment can be disseminated to the public and influence the policy agenda. The applications of R&D&I to the lighthouse area ranges from ferries that use alternative fuels to the development of a 'green' hydrogen industry. The R&D&I organisations can provide a wide range of services to support the policy design or implementation with an advisory role, technical support, data provision or through elaboration of recommendations on the basis of research findings.

At the international level, due to the broad scope of the Blue Economy, many different stakeholders are involved in R&D&I activities. For instance, several initiatives, such as Mission Innovation, have the goal to promote research into themes like zero-emission shipping, clean hydrogen and renewable energies.[366] Mission Innovation 2.0 is an initiative that has the objective to promote action and investments in R&D&I to make clean energy affordable, attractive and accessible to all in the next decade. The same holds for the IEA Committee on Energy Research and Technology (CERT) and the IRENA Innovation and Technology Centre (IITC), which are both two initiatives affiliated with intergovernmental energy organisations. Both initiatives aim to promote research into offshore renewable energy and emerging technologies. Additionally, there are many intergovernmental and non-governmental organisations that play a key role in marine research and management. Among them are listed the International Council of Scientific Unions (ICSU) that promotes international cooperation in the advancement of science, the International Council for the Exploration of the Sea (ICES) concerned with marine and fisheries sciences, and scientific advice on marine and fisheries management to regulatory commissions, the International Union for Conservation of Nature (IUCN) that provides a forum for governments and NGOs to discuss global and regional conservation issues.[367] Similarly, the International Water Association (IWA) is an international network of water (management) professionals that aims to develop research and projects focused on solutions for water management.[368] Likewise, the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping is a not-for-profit R&D centre specifically aimed to create a zero carbon shipping industry.

Considering that the EU policies and regulations are based on evidence and consultation with experts or public, the research-oriented bodies of the European Commission play a critical role. The Joint Research Centre (JRC), the European Research Executive Agency (REA) and the European Research Council Executive Agency (ERCEA) are actively supporting the decision-making in the maritime affairs. Likewise, the European Environment Agency provides independently environmental data to support policy design, monitoring and implementation. Similarly, Knowledge4Policy (K4P) is the EU Commission's platform for **evidence-based policymaking**. The platform's knowledge centres include biodiversity and earth observation. In order to keep the ocean monitoring and forecasting activities of the Copernicus Marine Service (CMEMS) of excellent qualities, it recently published the document *Copernicus Marine Service Evolution Strategy: R&D priorities*. The evolution of the technological capabilities of the CMEMS will provide it the ability to keep informing

[366] http://mission-innovation.net/about-mi/overview/

[367] https://link.springer.com/article/10.1007/s13280-016-0847-9

[368] https://iwa-network.org/about-us/

public and private users and supporting policies through its services and data. Other European R&D&I organisations include the European Marine Board and the European Marine Research Network (EuroMarine).

Several ESFRI (European Strategy Forum on Research Infrastructures) Projects and ESFRI Landmarks also contribute to research that is relevant to the Blue Economy.[369] According to the 2020 ESFRI White Paper, European research infrastructures should be seen as strategic investments into knowledge hubs that contribute to European strategic agendas and enabling European research and innovation to address pressing and complex societal challenges.[370] Hence, the role of research infrastructures in supporting policy through excellence research, data provision or merely advisory roles can be seen as vital for the future. Currently, the water-related research infrastructures include the European Marine Biological Resource Centre (EMBRC-ERIC), LifeWatch ERIC, ICOS ERIC, MARINERG-i, EMSO ERIC, EURO-ARGO ERIC, JERICO-RI. Other interesting initiatives include the Clean Energy Transition SET Plan, multiple European Technology and Innovation Platforms and European Technology Platforms and the MARINET2 network. Additionally, there are other stakeholders that have a thematic focus, such as the Association of European Renewable Energy Research Centres (EUREC) and Ocean Energy Europe, which is a network of ocean energy professionals and has the objective to promote the ocean energy industry.

At a macroregional level, the Baltic and North Sea Coordination and Support Action (BANOS CSA) represented the leading research and innovation funders of 12 EU Member States and associated states surrounding the Baltic Sea and the North Sea whose representatives from both the highest decision-making body, the BANOS CSA Steering Committee, as well as the 'tasks' oriented Forum of Programme Managers. The BANOS Secretariat office closed on 31 December 2021. The BANOS CSA consortium was coordinated by BONUS EEIG (European Economic Interest Grouping) and funded by the European Union’s Horizon 2020 Research and Innovation Programme. This is the dedicated implementing structure of BONUS, the joint Baltic Sea research and development programme.[371] BONUS Art. 185 ran in 2010-2020, having five competitive calls and funding 48 projects. The programme enhanced the research capacity in the region and contributed to several EU policy objectives, including governance aspects, policy for climate change challenges and sustainable aquaculture in the Baltic Sea area.[372]

Other macroregional organisations involved in research activities include Nordregio, an international research centre for regional development and planning, Nordregio is linked to the platform for Scandinavian coordination – the Nordic Council of Ministers. The Baltic Sea Hydrographic Commission is a regional hydrographic commission that is tasked to coordinate hydrographic activity and cooperation in the Baltic Sea. The Baltic Sea Hydrographic Commission provides data that can support policymakers in the policy design, monitoring or implementation.

[369] European Strategy Forum on Research Infrastructures (ESFRI) is a strategic instrument to develop the scientific integration of Europe and to strengthen its international outreach.

[370] ESFRI, (2020), Making Science Happen, A new ambition for Research Infrastructures in the European Research Area

[371] https://www.banoscsa.org/banos_csa/about_us

[372] http://bonusportal.org/files/7212/BONUS_projects_update_2021.pdf

The key R&D&I stakeholders supporting policy design and implementation at the national level are sometimes publicly funded and other times private institutions. Table 53 gives an overview of the major maritime R&D&I organisations in the lighthouse area.

Table 53 Major maritime R&D&I organisations at the national level

Country	Major marine research, development and innovation organisations
Belgium	Belgian Science Policy Office (BELSPO), National Fund for Scientific Research, Research Foundation – Flanders, Royal Belgian Institute of Natural Sciences - OD Nature, Ghent University, Flanders Marine Institute (VLIZ), Hasselt University (Universiteit Hasselt), Katholieke Universiteit Leuven (KU Leuven), Royal Belgian Institute of Natural Sciences (RBINS), Flanders Research Institute for Agriculture, Fisheries and Food (ILVO), EMBRC Belgium, Belgian Marine Data Centre
Denmark	National Institute for Aquatic Resources, Aarhus University, University of Southern Denmark, AlgeCenter Danmark, Danish Knowledge Center for Seaweed, WSP, Agri-Aqua Innovation Denmark, Centre for Blue Governance, DTU Aqua, National Environmental Research Institute, Southern Denmark University, Algecenter Denmark, Danish Knowledge center for Algae, DTU Aqua - Danish Shellfish Centre, AquaCircle
Estonia	Estonian Academy of Sciences, University of Tartu - Estonian Marine Institute, Baltic Environmental Forum Estonia, Stockholm Environment Institute Tallinn, Tallinn University of Technology, Tallinn University, Estonian University of Life Sciences, Fisheries Information Centre
Finland	University of Helsinki - Tvärminne Zoological Station, Finnish Environment Institute (SYKE), LUKE - Natural Resources Institute Finland, VTT Technical Research Centre of Finland Ltd, Aalto University, University of Helsinki, University of Turku, University of Oulu, LUT University, JAMK University of Applied Sciences
France	National Centre for Scientific Research, French Research Institute for Exploitation of the Sea, Marine Universities of France, European Marine Biological Resource Centre, Sorbonne University, French National Research Institute for Sustainable Development, Universites Marines, University of Western Brittany, Station Biologique de Roscoff, Campus Mondial de la Mer, La Rochelle Universite, IFREMER, Institut Carnot MERS
Germany	German Marine Research Consortium, GEOMAR Helmholtz Centre for Ocean Research Kiel, Helmholtz centre for polar and marine research the Alfred Wegener Institute (AWI), Leibniz Institute for Baltic Sea Research (IOW), Centre for Marine Environmental Sciences (MARUM), *Kiel Marine Science, Deutsches Zentrum für Marine Biodiversitätsforschung DZMB, Universität Rostock, Universität Greifswald, Fraunhofer-Einrichtung für Marine Biotechnologie und Zelltechnik, Thünen-Institut für Seefischerei, Universitätsklinikum Schleswig-Holstein, Gesellschaft für Marine Aquakultur GmbH (GMA), Fachhochschule Flensburg, Alfred-Wegener-Institut, BioMedTec Wissenschaftscampus Lübeck, Centrul Industrielle Biotechnologie, Fachhochschule Lübeck Forschungs-GmbH, Max-Planck-Institut für Marine Mikrobiologie, Thünen-Institut für Fischereiökologie, Institut für Weltwirtschaft (IfW), Universität Bremen (Zentrum für Marine Umweltwissenschaften) (MARUM)*; German Advisory Council on Global Change (WBGU); Renewable Energies Research Network – FVEE; Institut für Klimaschutz, Energie und Mobilität e.V. (IKEM)
Latvia	Latvian Institute of Aquatic Ecology, University of Latvia, Riga Technical University, Liepaja University, Daugavpils University, Latvia University of Life Sciences and Technologies, Institute of Food Safety, Animal Health and Environment "BIOR", Aquaculture research and education centre of fish farm "Tome", Institute of Agricultural Resources and Economics
Lithuania	Klaipeda University, Environmental Research Centre of Vilnius University; Coastal Research and Planning Institute
Netherlands	Royal Netherlands Institute for Sea Research, DELTARES, University of

	Groningen - Groningen Institute for Evolutionary Life Sciences, Wageningen Marine Research, Netherlands Organisation for applied scientific research (TNO), North Sea Centre, TU Delft
Norway	Institute of Marine Research (IMR), The Research Council of Norway (RCN), Norwegian Marine University Consortium, University of Bergen, Nofima, Norwegian Institute for Water Research, Norwegian University of Science and Technology, The Arctic University of Norway - Tromsø Aquaculture Research Station, University of Oslo, NORD University, Nordic Energy Research, The Fram Centre, Fridtjof Nansen Institute (FNI), LowEmissions Centre, Norwegian Centre for Energy Transition Strategies, Norwegian Institute of Fisheries and Aquaculture, National Competence Center for Aquaculture
Poland	Institute of Oceanology, Polish Academy of Sciences, Gdynia Maritime University, University of Gdansk, National Fisheries Research Institute; Maritime Institute in Gdansk (MIG)
Russia	Kaliningrad State Technical University, Shirshov Institute of Oceanology of Russian Academy of Science, Saint Petersburg State University, Research Institute of Maritime Spatial Planning Ermak NorthWes
Sweden	University of Gothenburg, Stockholm University, KTH Royal Institute of Technology, SLU Aquaculture, Swedish Mariculture research Centre, Baltic Sea Science Centre
United Kingdom	Marine Alliance for Science and Technology Scotland (MASTS), Natural Environment Research Council (NERC), National Oceanography Centre (NOC), Marine Biological Association, Marine Scotland Science, Scottish Ocean Institute - University of St. Andrews, The Centre for Environment, Fisheries & Aquaculture Science, Scottish Association for Marine Science, Scottish Association for Marine Sciences, CEFAS, Stirling University Institute of Aquaculture

Source: own production, 2022

7.4.2. Industry and business organisations

The industry and business organisations in the maritime sector play an important role in the governance structures. Through industry, trade or business network associations these stakeholders have been influencing policymakers, particularly in the fisheries and shipping sectors. The climate change agenda, together with increasing concerns of environmental pollution, has been demanding a different business approach that focuses on sustainability and accountability. This led to tensions and increasing lobbying by industry and business organisations in the maritime sector. It is important to note that some of these organisations have characteristics of a civil society/NGO organisations, as they highlight a broad spectrum of societal, environmental and other challenges associated with specific business groups. Thus, some of them may be presented in both categories. Nevertheless, in this chapter we aim to present organisations that mostly focus on defending their own business, profit-oriented interest.

At the international level, there is a large number of industry and business organisations in the shipping sector. Among them are Interferry – a shipping association representing the ferry industry worldwide, World Shipping Council - industry trade association representing the international liner shipping industry, INTERTANKO (International Association of Independent Tanker Owners) - a trade association that has served as the voice for independent tanker owners, International Chamber of Shipping (ICS) - the principal international trade association for merchant shipowners and operators, representing all sectors and trades, International Association of Dry Cargo Shipowners (INTERCARGO), Cruise Lines International Association (CLIA), the International Windship Association, the Global Maritime Forum, International Association of Ports and Harbours and many others. However, in the offshore renewable energy sector and in fisheries and aquaculture the number of relevant organisations is smaller. It is worth mentioning the Global Wind Energy Council (GWEC) - the global wind industry trade association, the World Bioenergy

Association (WBA) - the global organization dedicated to supporting and representing the wide range of actors in the bioenergy sector, Hydrogen Council – a global CEO-led initiative of 92 leading energy, transport, industry and investment companies with a united and long-term vision to develop the hydrogen economy. In the fisheries and aquaculture sector, the World Aquaculture Society and SafeSeaweed Coalition are the lead organizations.

At the European level, there is a large number of relevant organisations. Some of them have a broad scope and stimulate entrepreneurship, including in the maritime sector, such as EUROCHAMBRES - The Association of European Chambers of Commerce, but others are strongly linked to a specific sector. In the offshore renewable energy sector are active the following organisations - Wind Europe; Ocean Energy Europe; AW (Airborne Wind) Europe; EASE (European Association for Energy Storage); Waterborne Technology Platform; Fuels Europe; Eurobat (Association of European Automotive and Industrial Battery Manufacturers). In addition, it is worth to mention the European Wind Industrial Initiative (EWII) and EERA Joint Programme on Wind energy, European Technology and Innovation Platform on Wind Energy (ETIPWind) driven by the European wind energy industry and coordinated by the European Wind Energy Association.

In the aquaculture sector – Eurofish (an international organisation part of global network FISH INFOnetwork); FEAP (Federation of European Aquaculture Producers); European Aquaculture Technology and Innovation Platform (EATIP); RECIRCFISK PO (The Recirculating Aquacultures Sweden Economic Association Producer Organisation); European Fisheries and Aquaculture Research Organisations (EFARO); AquaMaof (aquaculture technology company). In the shipping, ESPO-European Seaports Organisation, ECSA (European Community Shipowners' Associations); MIDC (Maritime Industry Decarbonisation Council).

At the macroregional level, a few relevant initiatives can be highlighted. The Baltic Innovative Research and Technology Infrastructure (BIRTI) unites and coordinates cooperation between universities, scientific institutes and entrepreneurs. The aim of BIRTI is to create favourable conditions for the innovation process, scientists, engineers, designers and contractors, working together on a competitive knowledge-based world-class product development and manufacturing.[373] The North Sea Wind Power Hub consortium (hereafter: ‘NSWPH’ or ‘the consortium’), consisting of TenneT Netherlands and Germany, the Port of Rotterdam, Gasunie and Energinet, is an example of a consortium that stimulates large-scale offshore wind on the North Sea through hybrid offshore wind projects. The North Sea Advisory Council (NSAC) is an interdisciplinary stakeholder-led organisation that takes a regional approach to provide the European Commission and EU countries (North Sea Member States) with recommendations on the management of North Sea fish stocks on behalf of the fisheries sector, environmental and other stakeholders.[374]

Among prominent business tech hubs (business incubator and accelerator) are listed:

- Maritime ClimAccelerator, supported by EIT Climate-KIC, through its vast network of collaborators. It offers participating start-ups funding, training, peer to peer coaching and theme-specific mentoring (both virtually and in-person).

---

[373] http://www.birti.eu/lv/par-birti/struktura/item/79-about-birti

[374] https://www.nsrac.org/

- The Atlantic Smart Ports Blue Acceleration Network (AspBAN) is a project that has been awarded funding by the European Union. Focused on developing a dynamic acceleration platform, AspBAN helps EU Atlantic ports work as blue economy hubs.

- Blue Growth Piraeus is an initiative to support start-ups and sustainable entrepreneurship on the maritime economy.

Table 54 Major marine industry and business organisations at the national level

Country	Major marine industry and business organisations
Belgium	Blaue Cluster, BLUEGent, Royal Belgian Shipowners' Association
Denmark	Wind Denmark, Dansk Akvakultur; Danish Maritime; MARLOG; Danish Shipping; Danish Ferry Association; DH (Danish Ports), Danish Aquaculture, Business Lolland-Falster, **BioInnovation Institute Foundation,** Danish Wind Industry Association, Danish Energy Association, Danish Seaweed, Bioeconomy Hotspot at Guldborgsund Municipality, INCUBA
Estonia	Tartu Biotechnology Park, Tuuleenergia; Estonian Fish Farmers' Association (Kalakasvatajad), Cleantech ForEst
Finland	FWPA (Finish Windpower Association); Finnish Fish Farmers Association (Kalankasvatus); Finnish shipowners' association; Finnish Maritime Cluster Organisation; FPA (Finnish Port Association), Metsähallitus
France	Armateurs France, Incubateur Descartes, Le Village by CA, Emerging Valley, Accelerateur M, France Energie Eolienne, Comité National Des Peches Maritimes et des Elevages Marins
Germany	BWE (German Wind Energy Association); BWO (Federal association of Wind Farm Operators Offshore); BVES (Federal German Association for Energy Storage Systems); Stiftung Offshore Windenergie (German Offshsore Wind Energy Foundation); WAB e.V. (German Wind Energy Network); German Aquaculture Association (Bundesverband Aquakultur); German Maritime Center (DMZ); VDR (German shipowners association); ZDS (Central Association of German Seaports), German Tech Entrepreneurship Center (GTEC), Sharkbite Innovation, SpinLab – The HHL Accelerator, WAZIUP e.V; Federal Association of Energy and Water Management – BDEW; Federal Association of Industry – BDI; Federal Association of Renewable Energies – BEE; Association of Municipal Enterprises –VKU; Deutsche WindGuard
Latvia	Association of the Latvian Chemical and Pharmaceutical Industry (LAKIFA), Labs of Latvia, LWEA (Latvian wind energy association), Clean Tech Latvia
Lithuania	Lithuanian Wind Power Association, Lithuanian Shipowners' Association, Civitta UAB, Startup Division Lithuania
Netherlands	Dutch Seaweed Group, Rockstart, StartLife / Wageningen University & Research, WorldStartup Collective
Norway	Sea Front Logistics, Norwegian Seafood Council, National Federation of Fish and Aquaculture Industries, The Norwegian Fish Farmers Association, Katapult Accelerator
Poland	PTMWE (Polish Offshore Wind Energy Society); PWEA (Polish Wind Energy Association); Polish Shipowners' Association, Polish Maritime Technology Forum (pftm.pl) ; Westpomeranian Maritime Cluster Zachodniopomorski Klaster Morski ; BSSC.PL – Baltic Sea & Space Cluster
Russia	RAWI (Russian Association of Wind Power Industry); RS-COM (Russian Shipowners' Community), Association of employers in fisheries and aquaculture
Sweden	SWEA (Swedish Wind Energy Association); Swedish Wind Power; RECIRCFISK PO (The Recirculating Aquacultures Sweden Economic Association Producer Organisation); Transportföretagen, SSPA, Swedish Aquaculture and Seafood Economic Association, SSE Business Lab
United Kingdom	RenewableUK, Offshore Wind Industry Council, IFCA, Associated British Ports, Scottish Salmon Producers' Organization, Shellfish Association of Great Britain,

	SeaFood Scotland, Imperial College London incubator, Coventry University International Centre for Transformational Entrepreneurship (ICTE), Innohub

Source: own production, 2022

7.4.3. Civil society, NGOs and cross-sectoral network organisations

This chapter presents key civil society, non-governmental organisations and cross-sectoral network organisations in the maritime sector. These organisations typically have a broad scope of work and collectively create a mixed group, focused on representation of issues related to environmental protection, information, training or advisory support, organisations that perform supporting functions. Nevertheless, most of identified organisations in this group are involved in driving and contributing to environmental sustainability agenda.

At the international level, apart from world renowned organisations such as Greenpeace and World Wildlife Fund that are also active in the maritime sector, it is worth to highlight the following organisations:

Global Seafood Alliance advances responsible seafood practices worldwide through education, advocacy and demonstration. GSA convenes seafood industry leaders, academia and NGOs to collaborate on cross-cutting issues like environmental and social responsibility, animal health and welfare, food safety and more.

Climate Action Network (CAN) is a worldwide network of over 1100 Non-Governmental Organizations (NGOs) in more than 120 countries, working to promote government and individual action to limit human-induced climate change to ecologically sustainable levels.

The WCRE is the global voice for Renewable Energy. It operates independently and free of the vested interests of the present global energy system. As a non-profit and non-governmental globally working organisation it is focused on developing policies and strategies for Renewable Energy.

At the European level, many aquaculture-related organisations and initiatives are detected. Among them are listed the AAC (Aquaculture Advisory Council), EU4Ocean Platform (an initiative within the EU4Ocean Coalition, AquaTT (European Network for Training and Technology Transfer in Aquaculture), European Aquaculture Technology and Information Platform, European Aquaculture Society and Seas at Risk. The latter is an association of environmental organisations from across Europe, working together to ensure that life in our seas and oceans is abundant, diverse, climate resilient, and not threatened by human activities.

In the maritime transport and offshore renewable energy sectors, only a few relevant NGOs were identified. The EcoPorts - the environmental initiative of the European port sector, and the European Academy of Wind Energy - an international community that promotes and supports the development of wind energy science to exploit wind energy to its full potential for the benefit of the world. However, at the macroregional level there is a large number of relevant organisations in the Baltic Sea. These are presented below:

SUBMARINER Network EEIG is a network of various stakeholders – academic institutions, entrepreneurs, clusters and NGOs - involved in most of the activities related to, inter alia, marine aquaculture in the Baltic Sea region. The network promotes innovative approaches to the sustainable use of marine resources and offers a cooperation platform to related actors and initiatives in the Baltic Sea Region.

Coalition Clean Baltic (CCB) – environmental non-governmental organizations (ENGO's) from the countries of the Baltic Sea Region united to co-operate in activities concerning the Baltic Sea environment. The main goal of CCB is to promote the protection and improvement of the environment and natural resources of the Baltic Sea Area. CCB working areas, *inter alia*, include Eutrophication with a task to promote the implementation of EU Circular Economy package. Race For The Baltic is a non-profit organisation with a mission to ensure a healthy Baltic Sea. t. The supported projects include e.g. reduction of fertiliser leakage at Baltic Sea ports, creation of market for locally caught fish products for human consumption, recycling of nutrients.

Baltic Sea Conservation Foundation (BaltCF) is a private civil law foundation registered in Germany as International Baltic Sea Foundation for Nature Conservation. BaltCF aims at addressing the most urgent environmental problems faced by the countries of the sea's catchment area. BaltCF funds projects and supports the non-profit organisations which address the environmental challenges of the Baltic. Circularity and sustainability are criteria for funding and projects include recycling of captured ghost fishing nets, recycling of organic waste from water streams. .

Wadden Sea Forum - an independent platform for various actors from Denmark, Germany and the Netherlands and contributes through numerous trilateral activities to a sustainable and future-oriented Wadden Sea Region. The Forum currently works on development of Green Coastal Deal to implement the European Green Deal in the area, it has a goal of becoming carbon neutral area in 2030, is active in surface water management policy and in developing safe shipping at the region.

John Nurminen Foundation – Clean Baltic Sea has two key areas of operation: cultural activities focusing on maritime history, and the environmental work in its Clean Baltic Sea Projects. The objective of the Foundation's Clean Baltic Sea projects is to reduce the eutrophication of the Baltic Sea and increase environmental awareness of its condition. Reduction of nutrient loads and nutrient recycling has been addressed widely in the funded projects, e.g., via mussel cultivation, sustainable biogas production and innovative use of coastal reed. The Baltic Sea Action Group (BSAG), (officially "Foundation for a Living Baltic Sea") is an independent non-profit foundation (2008) based in Finland. BSAG works to find solutions and right actors to restore the good ecological balance of the Baltic Sea. As the emphasis of activities is on the reduction of eutrophication, then efforts are devoted to nutrient binding and recycling from the Baltic Sea. Nutrient Cycling ecosystem is a network of companies related to nutrient recycling and aiming to have sustainable and competitive business models in nutrient management.

The Baltic Environmental Forum (BEF) was founded in 1995 by the Baltic Ministries of Environment, Germany and the European Commission as a technical assistance project to strengthen the co-operation among the Baltic environmental authorities. .[375] Since 2003 it has been transformed into four independent NGOs in the Baltic States and Germany as the BEF group.[376] Activities of the NGOs include promotion of various natural resource management policies, including water, developments of concepts and methodologies for MSP, information campaigns on hazardous substances, biodiversity and climate change.

[375] https://climate-adapt.eea.europa.eu/metadata/organisations/baltic-environmental-forum

1. [376] www.bef-de.org

Process of MSP has been addressed in the aspects of sustainability and planning for successful blue economies.

Table 55 Major maritime civil society, NGOs and cross-sectoral organisations at the national level

Country	Major civil society, NGOs and cross-sectoral organisations
Belgium	Sea Shepherd Belgium, , Belgian Offshore Cluster
Denmark	Tang Netværk, AquaCircle, Havhost, Innovation Network for Bioresources, Danish Society for Marine Biology (DSFMB), VedvarendeEnergi, Landsforeningen Levende Hav
Estonia	Estonian Green Movement**,** Estonian Fund for Nature
Finland	John Nurminen Foundation – Clean Baltic Sea
France	Atlan Pole, Robin Des Bois, The French Aquaculture Federation, Professional Union of Aquaculture Feed Producers, Surfrider Foundation Europe
Germany	Oclean, EUCC-D, One Earth - One Ocean, Coastal Union Germany; German Offshore Wind Energy Foundation
Latvia	Latvian Fund for Nature, association “Baltic Coasts”, WWF Latvia, Fund for Environmental Education, Latvian Maritime association, Latvian Environment Protection Club
Lithuania	ECAT-Lithuania (Environmental Center for Administration and Technology); LFN (Lithuanian Fund for Nature); Media and Environment Projects (MADPRO), Lithuanian Seafarers’ Union,
Netherlands	Urgenda, Stichting De Noordzee (North Sea Foundation), Natuur & Milieu, Sea Shepherds Netherlands,
Norway	AlaskaNoR, BarentsWatch, NOSCA Clean Oceans
Poland	Instytut Balticum, BISER, Fundacja Balteus/Foundation Balteu EKO-UNIA**,** Federation of Greens Association "GAJA"
Russia	BFN (Baltic Fund for Nature), Friends of the Baltic
Sweden	Fisheries Secretariat, Swedish Society for Nature Conservation, East Regional Aquaculture Centre
United Kingdom	Maritime Foundation, Marine Conservation Society, Great British Oceans

Source: own production, 2022

7.4.4. Financial organisations

In this chapter we present key organisations or programmes that finance initiative in the maritime sectors (Blue economy).

The Environment Fund is the core financial fund of the UN Environment Programme (UNEP). As the main source of unrestricted funds, provided by Member States, it enables strategic and effective delivery of results, while allowing for flexibility to respond to emerging environmental challenges. The Fund is supporting countries to deliver on the environmental dimensions of the 2030 Agenda. The conventions of regional seas - OSPAR and HELCOM collaborate with UNEP and its Regional Seas Programme to provide sustainable mechanisms for enhancing cooperation and collaboration on joint programmes, projects and activities, helping governments implement SDG 14 to help make the 2030 Agenda a reality. International organizations that offer funding were mostly established by states and are governed by international law. The most important International Financial Institutions (IFIs) funding also activities in the marine and maritime sector include organizations of World Bank Group like International Bank for Reconstruction and Development promoting the flow of capital internationally by lending funds for development projects. The Global Environmental Facility (GEF) is a partnership of 18 agencies that provides grants to developing countries for projects that benefit the global environment and promote sustainable livelihoods in local communities. Also, on European level IFIs are among the largest finance organisations:

European Bank for Reconstruction and Development (EBRD) provides project financing for banks, industries and businesses, and funds both new ventures and investments in existing firms. The work of EBRD is organized by topics and sectors, the key ones including infrastructure, small businesses, energy and transport.

European Investment Bank (EIB) is the lending arm of the European Union and one of the largest providers of climate finance. EIB has following priority areas: climate and environment, development, innovation and skills, small and medium-sized businesses, infrastructure and cohesion. Although currently there are specific support programmes for the Baltic and North seas, EIB has supported water environment management in the Baltic Sea area (2014) and offshore wind development in the North Sea (2018).

The Council of Europe Development Bank (CEB) is a multilateral development bank with an exclusively social mandate. The CEB contributes to inclusive growth, support for vulnerable groups and environmental sustainability: supporting a liveable society that promotes environmental sustainability, mitigates and adapts to climate change. The projects are funded in several relevant sectors for Europe, sustainable environment development and energy efficiency measures being among the key ones.

International Investment Bank (IIB) is a multilateral development institution specialising in medium- and long-term financing of projects aimed at supporting the economies of its members that would have a significant positive social, economic and environmental impact.

European Union funds available for financing activities relevant to Blue Economy include European Maritime, Fisheries and Aquaculture Fund (EMFAF), Connecting Europe Facility (CEF), European Regional Development Fund (ERDF); through Interreg programmes of macroregional level) and the Cohesion Fund. The latter is also related to the regional smart specialisation strategies (RIS3). These strategies focus economic development efforts and investments on each region's relative strengths, exploiting its economic opportunities and emerging trends, and taking action to boost its economic growth. The EU will be providing funding to implement activities in line with RIS3 through the EU Cohesion Policy, Just Transition Mechanism and the Recovery and Resilience Facility.

On the macroregional level, organizations include some IFIs:

- Nordic Investment Bank (NIB) - the international financial institution of the Nordic and Baltic countries, finances projects that improve the productivity and benefit the environment of the Nordic and Baltic countries, has a specific focus on supporting the development of small businesses in the Bank’s member countries.

- The European Investment Fund (EIF) - a part of the European Investment Bank group, supports Europe's micro, small and medium-sized businesses by helping them to access finance. EIF has specific initiatives aimed at, e.g., Baltic Sea countries in the form of Baltic Investment Fund (BIF) and BIF2.

- NEFCO finances the initial scale-up of Nordic green solutions on international markets and has a special emphasis on funding of green transition initiatives. EU Green Deal, Agenda 2030 and Paris Agreement criteria are the most relevant criteria when evaluating projects to be funded. NEFCO funds also region-specific activities – the reduction of pollution of the Baltic Sea is among the priorities, both as public and private sector projects.

At the macroregional level, Interreg programmes are one of central funding instruments to implement the macroregional strategies. The activities are funded through targeted project calls on topics relevant for implementation of these respective strategies. Additional cooperation funding instruments on macroregional level are:

- Grant schemes of Nordic Council of Ministers – for cooperation of NGOs, for cooperation between diplomatic missions, for bilateral cooperation and research projects. Themes include, *inter alia*, aquaculture, transition to circular and low carbon economy, low emission transportation, renewable energy.

- EEA and Norway Grants - funded by Iceland, Liechtenstein and Norway, have two goals – to contribute to a more equal Europe, both socially and economically – and to strengthen the relations between Iceland, Liechtenstein and Norway, and the 15 Beneficiary States in Europe, including Eastern Baltic countries. Their list of project themes include; the transition to a circular and low carbon economy, cooperation in the field of renewable energy as tools for climate change mitigation and adaptation.

- Baltic Sea Action Plan Fund - financed projects involve nutrient recycling, manure management, small-scale sanitation plants, wastewater treatment, alternative fuels, or harbour facilities for wastewater management. The fund is co-managed by Nordic Investment Bank (NIB) and Nefco.

- Swedish Institute - provides funding for joint projects between Swedish organisations to solve transnational challenges together with institutions from the Baltic Sea region countries including Russia. The challenges include sustainable use of marine resources as a feed, sustainability aspects of boating, cross-sectoral digitalization, including maritime transport.

Table 56 Major mariTIme financIAL organisations at the national level

Country	Major finance organisations
Belgium	The Belgium Development Agency, Research Foundation – Flanders, National Fund for Scientific Research, Agency For Innovation By Science And Technology (IWT), Ministry of Economic Affairs, VLAIO (innovation funding agency)
Denmark	Innovation Fund Denmark, Novo Nordisk Foundation, Green Development and Demonstration Programme, Velux Foundations; Energy research funding is largely the prerogative of the Council for Strategic Research under the Danish Agency for Science, Technology and Innovation, and the Energy Technology Development and Demonstration Programme (EUDP) under the Danish Energy Agency.
Estonia	Enterprise Estonia, Ministry of Finance, Ministry of Economic Affairs and Communications, Bank of Estonia, Baltic Horizon Fund, Estonian Research Council, Trind VC, Superangel
Finland	Business Finland, Walter and Andrée de Nottbeck Foundation, Nessling Foundation, John Nurminen Foundation, Finnish Innovation Fund (SITRA)
France	Ministry of Economy, Finance and Recovery, French Development Agency, Initiative France, National Research Agency, France Invest, France Region Investment, Business France
Germany	Federal Ministry for Economic Cooperation and Development, Federal Ministry of Economics and Technology, German Federal Foundation for Environment, German Research Foundation, German Private Equity and Venture Capital

	Association, Fraunhofer Association
Latvia	Ministry of Finance, Investment and Development Agency of Latvia, Latvian Environmental Investment Fund, Flycap, Latvian Council of Science
Lithuania	Ministry of Finance, Agency for Science, Innovation and Technology Lithuanian Business Support Agency, Lithuanian Research Council, Iron Wolf Capital, Practica Capital
Netherlands	Ministry of Finance, Netherlands Foreign Investment Agency, Dutch Research Council, FMO, Dutch Central Bank, Dutch Ministry of Economic Affairs and Climate Policy
Norway	Royal Norwegian Ministry of Finance, ENOVA, Sina, Eksfin, The Official Investment Promotion Agency of Norway, Research Council of Norway
Poland	Association of Financial Companies in Poland, National Fund for Environmental Protection and Water Management, National Science Centre, Polish Agency for Enterprise Development, KUKE, Ministry of Finance, Bank Gospodarstwa Krajowego, Polish Development Fund Group
Russia	Ministry of Finance of the Russian Federation, Russian Science Foundation, Russian Foundation for Basic Research, The Foundation for Assistance to Small Innovative Enterprises, Russian Foundation for Technological Development
Sweden	Svenska Skeppshypotek, Business Sweden, Swedish Research Council, Formas, Vinnova, Mistra, Swedish Energy Agency, Ministry of Finance
United Kingdom	Sustainable Management of UK Marine Resources (SMMR), UK Research and Innovation, Innovate UK, Maritime UK, HM Treasury, the Department for Environment, Food and Rural Affairs (Defra), the Offshore Renewable Energy Catapult.

Source: own production, 2022

7.5. Conclusions

7.5.1. Overview of governance structures in the Lighthouse area

The governance of marine environments and Blue Economy activities in the Lighthouse area is complex. It is characterised by a dense multilevel web of governance structures (e.g. regulatory frameworks) and processes (such as science-policy interactions), which are linked to various forms of stakeholder participation and communication arrangements. The governance structures consist of multi-level legal/regulatory, institutional and policy frameworks: international/global, (macro)regional, national and sub-national. The international structures provide a uniform basis for management of marine resources and maritime affairs globally. Despite that, significant differences in governance structures remain due to diverse strategies, priorities, institutional settings, contextual factors and additional regulations set at the EU, macroregional, national/sub-national levels.

The governance of maritime space is characterised by a top-down approach, where international organisations, policies and legal conventions regulate marine resources, activities and stakeholders, superseding the EU, macroregional or national laws. Thus, EU, macroregional and national laws are, generally, aligned with the international agreements. However, the national governments remain in control over their territory and decide whether they ratify/adopt, enforce and implement international laws and regulations.

The governance of marine and coastal areas in many countries and in international waters is primarily sectoral (e.g., fisheries, offshore energy, maritime safety and security, environmental, shipping, trade). These sectoral structures have evolved over time under the pressure of various environmental, political, economic, technological and other issues. Sectoral structures are interlinked, although a greater coordination of regulations, strategies and policies is needed, as well as, a clearer framework of cross-institutional collaboration.

Our analysis shows that the marine governance of the Baltic/North Sea area is rather the outcome of historical development at various levels over the years, than the result of a well-designed structure. As a result, there is a large number of organisations with overlapping mandates and activities at different levels. In addition, some interests and mandates are contradictory/conflicting (for example, regulation of fisheries/establishing fishing quotas, and protection of marine biodiversity), therefore governance actors at times struggle to reconcile them.[377]

7.5.2. Institutional and regulatory framework in the Lighthouse area

The United Nations (UN) still remains the main institution that governs oceans/seas at an international level. Overall, the UN bodies are focused on promoting cooperation in a specific area among Member States, stimulating formulation of legally binding agreements and standards, settling legal disputes, providing advisory, scientific and technical support. The UN system of marine environmental governance is very complex, as different autonomous UN organisations have a limited, sector-focused mandate. There is a large number of international legal conventions. Nevertheless, the UN cannot enforce compliance with international legal agreements, as the ultimate decision-making power belongs to the national governments.

---

[377] https://www.frontiersin.org/articles/10.3389/fmars.2021.681546/full

The EU laws and regulations are coherent with the international framework. However, the EU has been introducing complementary legislation in several cases: if international regulations have gaps, if collective action at the EU level is needed, or when the EU seeks to establish stricter rules or higher standards, building on EU policies and strategies. There were occasions when the EU managed to encourage the UN bodies to apply higher standards or rules, following the EU practice. The key organisation responsible for the blue sector is the European Commission, its Directorate-General for Maritime Affairs and Fisheries (DG MARE).

The EU has designed regional policies for the Baltic and North Sea region: the European Union Strategy for the Baltic Sea Region (EUSBSR) and the North Sea Region Programme. This reflects dualism of the EU: on the one hand, the EU has been expanding its policy and regulatory scope, fostering regionalism at the EU level; on the other hand, the EU has been stimulating collaboration at a macroregional/sea basin level.

At the macroregional level, HELCOM and OSPAR have a common vision of an ecosystem approach to managing human activities impacting on the marine environment in the Baltic and North Sea. Despite a prominent coordination and monitoring role of HELCOM and OSPAR, the member states in the Baltic and North Sea area hold the ultimate decision-making power over maritime affairs and do not tend to form stronger regional/macroregional governance structures. As a result, the institutional and regulatory frameworks at the EU and international levels have a greater influence on the developments in the basin.

At the national level, the institutional and regulatory framework of governance in the maritime sector is also sub-divided according to thematic/sectoral areas (e.g., energy, transport, fisheries/food). In general, all national ministries are somehow involved in the governance of the maritime sector, given diversity of areas that are encompassed in the sector. The progress of the MSP development differs across countries, as some plans are in preparation, adoption or a review phase. The difference is noticed between the two Lighthouse areas - while most of MSPs in the North Sea are in place, many MSPs in the Baltic Sea are still not ready (detailed overview about status of the MSP in the two lighthouse areas is provided in DEL2).

7.5.3. Mechanisms of monitoring, evaluation and control in the Lighthouse area

The monitoring and evaluation of marine environments and activities are conducted at different levels (i.e., international, EU, macroregional, national), leading to a complex network of organisations and processes that are, at times, insufficiently aligned. Control and decision-making power primarily belongs to the national governments, although control by non-national authorities may apply when examining fulfilment of obligations in line with international/EU/macroregional laws and regulations. Overall, there is no coordinated and comprehensive framework for data monitoring, evaluation and control in the maritime sector. These activities are conducted by multiple organisations for specific maritime-related areas, including by institutions that are issuing policies and strategies. Nevertheless, the characteristics of the mechanisms are similar. The system of monitoring, evaluation and control is built bottom-up, as national authorities provide data and information to the macroregional, EU and international authorities.

At the international level, the UN agencies are actively involved in monitoring and evaluation. In general, two types of organisations can be distinguished conducting these activities. The first group represents organisations that are examining compliance with specific laws and regulations that were adopted under their auspices, while the second group of organisations consists of bodies that focus on research activities, checking current status and progress in reaching specific targets (i.e., reduction of greenhouse emission, mitigation of climate change).

The monitoring, evaluation and control at the European level is also sector-oriented, although the unifying EU policy programmes in the blue sector create connections between a network of organisations that are involved in these activities. Collected data is analysed and used to inform policymaking for different DGs of the European Commission, as well as, by national governments. Similarly to the UN bodies, different DGs (e.g., DG MARE, DG ENV, DG RTD) monitor specific marine-related areas that are in the focus of their programmes, policies and regulations, and launch projects to collect, monitor, analyse, evaluate developments in a specific area. The recent study conducted by the JRC highlights that monitoring of environmental threats and impacts is not adequate in the EU (Box 19). Suggestions for improved monitoring programmes included improved design, increased monitoring effort, and better linkages with research and new technologies.

At the macroregional level, HELCOM and OSPAR pursue their obligations to monitor and assess the status of the marine environment. Nevertheless, both organisations do not have a mandate to control affairs in the basins. At the national level, each country has to follow the international and EU requirements, therefore some maritime procedures related to monitoring, evaluation and control are standard. For example, each country in the Lighthouse area has to conduct a port state control. Besides complying with international and EU regulations, some Member States also set additional requirements, which are then translated into specific monitoring. In addition, some countries develop national monitoring, evaluation and control programmes that specify how particular marine areas are being monitored and what control mechanisms are available. In most cases, national monitoring programmes are carried out by specialized institutes, or a cluster of them, and involve other parties – regional environmental authorities, border guards, non-profit organizations.

Box 17 Results of the JRC study on Gaps between environmental threats adn monitoring impacts

The recent study (2020) of JRC outlined that the current level of providing high-value physical, chemical and biological datasets for addressing key challenges at a European level remains an issue.

During the study, 36 participants from 12 European countries (Finland, France, Germany, Greece, Ireland, Italy, Malta, Norway, Poland, Spain, Sweden, UK) completed the questionnaire (reporting on 38 monitoring programmes), providing new insights into gaps between environmental threats and monitoring of impacts. The main policy drivers of monitoring were identified as the EU Water Framework Directive (WFD), the Marine Strategy Framework Directive (MSFD), Regional Seas Conventions (e.g. OSPAR), and local drivers. The most commonly identified threats to the marine environment were marine litter, shipping, contaminants, organic enrichment, and fishing. Regime change was identified as a pressure by 67% of respondents.

The main impacts of these pressures or threats were identified by the majority of respondents (> 70 %) to be habitat loss or destruction, underwater noise, and contamination, with 60 % identifying undesirable disturbance (e.g. oxygen depletion), changes in sediment and/or substrate composition, changes in community composition, harmful microorganisms, and invasive species as impacts. Most respondents considered current monitoring of threats to be partially adequate or not adequate. Many responses were related to the spatial and/or temporal scales at which monitoring takes place and inadequate monitoring of particular parameters.

Suggestions for improved monitoring programmes included improved design, increased monitoring effort, and better linkages with research and new technologies.

Source: JRC, 2020[378]

7.5.4. Stakeholders supporting policy design and implementation in the Lighthouse area

In the governance of regional seas, collaboration fostering initiatives by nongovernmental and subnational organisations, as well as transnational stakeholder networks, have also been found to be particularly influential. Also, the bodies that encourage stakeholder participation such as the Regional Advisory Councils (RACs) in EU fisheries management and stakeholder forums organised by HELCOM have a high degree of influence on decision-making process.

The roles of various stakeholder groups in marine/maritime governance can be broadly characterized as follows:

- R&D&I - advisory, technical support, monitoring/evaluation, influence policy agenda, provide data or research findings to inform policymakers,
- Industry – lobby, collaboration on R&D&I, stimulate development of the Blue economy,
- Civil society, NGO – raise attention to societal, environmental, economic issues in the Blue economy, represent groups of maritime stakeholders,
- Financial sector – invest, stimulate development of the Blue economy.

7.5.5. Overview of governance structures in a specific area

7.5.5.1. Maritime transport

Maritime transport is mostly governed at two levels: national and international. The IMO is the principal authority of traffic management globally and in the Baltic and North Sea basins. At a national level, each country has a ministry that focuses on maritime transport (e.g., ministry of transport, infrastructure) and a main administrative authority/agency that issues permit, licence, registration, conducts inspection on vessels, gives approval, is responsible for safety and security matters related to maritime transport.

The EU policies and directives complement international rules when there are gaps or when it does not match EU strategic goals. At the EU level, DG MARE, DG MOVE, EMSA and EEA play key roles in the governance processes. The macroregional bodies (HELCOM, OSPAR) in the Baltic and North Sea area have a supportive function in the maritime

378 https://www.researchgate.net/publication/339364946_Marine_monitoring_in_Europe_is_it_adequate_to_address_environmental_threats_and_pressures

transport area. For example, they work on adaptation of international conventions for the Lighthouse area.

7.5.5.2. *Maritime infrastructure - ports*

Ports are usually governed between the city and the national level. The main governance is usually at a local level via the port authority and its interaction with the city and local planning regulations and approvals.

The ports and associated port state control have been key for monitoring, inspection, prevention or mitigation of accidents. The IMO's Sub-Committee on Implementation of IMO Instruments (III) provides a forum for both flag States - responsible for the certifying of ships - and port States - who may inspect ships of any flag - to get together to discuss issues relating to implementation, and also reviews casualty investigation reports, to identify lessons learned and make recommendations for further work.

7.5.5.3. *Offshore renewable energy*

As outlined in DEL2, both the Baltic and North Sea have a high natural potential for offshore wind energy, thus there is considerable potential for the development of offshore renewable energy projects. Currently, the North Sea basin is a frontrunner in the deployment of offshore renewable energy parks, due to the geographically advantageous conditions. On a similar note, the Baltic Sea basin area also has promising conditions for the deployment of offshore renewable energy projects. However, countries in the Baltic Sea area are lagging behind in terms of installed renewable energy capacity.

In light of Russia’s invasion of Ukraine, the European Commission has presented the REPowerEU plan to become independent from Russian fossil fuels and to tackle the climate crisis. Although, the situation is highly dynamic and there is no clarity on the impact of the invasion yet, through the REPowerEU plan the EC aims to increase and promote the use and development of renewable energy (facilities), as well as offshore renewable energy (facilities) as it proposed to raise the 2030 target of 40% renewables to 45%.

Given diverse renewable energy sources, there are several organisations that are involved in governance structures of offshore renewable energy at international and EU levels (e.g., International Energy Agency, International Renewable Energy Agency, UNEP, UN Energy, DG ENER, DG MARE, DG RTD, EEA). At the macroregional level, regional cooperation initiatives exist to promote the development of renewable energy projects and interconnection at the sea basin level. These are the North Sea Energy Cooperation and the Baltic Energy Market Interconnection Plan. Given the fact that both sea basins are enclosed by multiple countries, there are significant opportunities to share best practices, technological know-how, and create synergies between the developments within both sea basins.

At the national level, there are considerable differences between the governance systems. This is related to the fact that some countries have a longer history of developing maritime spatial plans in which the short- and long-term objectives for the development and deployment of offshore renewable energy facilities are set out. In addition, some countries have adopted policies that make the procedure to develop new offshore RE project a less administrative process.

7.5.5.4. Multi-purpose platforms

The governance of multi-purpose platforms at the current moment is mostly not defined at any of the levels. The MSPs of countries foresee the multi-use of marine space although only few (Germany, Poland, Belgium) have allocated specific areas or defined the combination of sectors.

The current status indicates that governance challenges are case-specific and depend on combination of technologies, sectors and location of the multi-purpose platforms. The multi-purpose platforms are a tempting solution on the aspect of cost reduction, but it has not been proved yet empirically. Thus, although multi-purpose platforms are expected to be governed in close cooperation with industry, the economic importance and consequently the interest from entrepreneurs still is low.

7.5.5.5. Aquaculture

Governance of aquaculture occurs at the national level, but international and EU level recommendations and guidelines should be included in the principles of national policies and regulations. EU Member States have to follow provided Strategic Guidelines on aquaculture when creating their national strategic development plans.

Marine aquaculture is seen as an option of sea use in most of the Maritime Spatial Plans in the Lighthouse area countries, although in some cases only as an addition to the offshore wind parks and not necessarily in the particularly designed area.

The legal frame for governance is set up by environmental regulations though, which are interpreted differently in each country and increase the level of complexity. At the EU level this complexity also prevents the growth of the aquaculture sector. Regulations particularly for aquaculture exist in a very few countries of Lighthouse area.

7.6. Efficiency of governance and recommendations

Overall, it can be concluded that the picture regarding implementation of policies is mixed. Some targeted management measures, or legal obligations, resulting from EU policy have been fully implemented and have been successful in reducing, or even removing, some well-known marine pressures. Other measures/obligations have not been implemented or implemented only in part and/or slowly and with limited success. The latter could be the case because there is a time lag between implementing a strong pressure-impact causality measure and it having an effect. Furthermore, it could also be because the measures were not designed to deal with multiple pressures and their cumulative impacts. There are several positive examples of recovery of specific biodiversity features across Europe's seas, reversing increasing pressure trends, and improved sustainability of some uses of the sea. However, it seems that these partial successes do not measure up against the observed continued degradation and the expected increased use of the sea, as well as the observed and forecast worsening of climate change impacts on Europe's seas.[379]

In addition, challenges remain regarding the amount and quality of information available to evaluate progress. For example, no Member State had adequately reported the up-to-date state of its marine waters by the October 2018 (required by the MSFD). Certain pressures

[379] State of Environment Report 2020, Chapter 6 "Marine Environment". EEA, 2019

are still addressed through fragmented, ineffective approaches. The problem lies not only in the low rate and slow speed of policy implementation, but also in a lack of coherence and coordination between all the policies aiming to protect European Seas.

Therefore, the way forward could be to focus efforts on implementing and integrating existing policies and on fulfilling the intentions behind several thematic policy visions. There is also a need for better monitoring programmes - they should be fit for purpose and underpin longer-term scientific objectives which cut across policy and other drivers, and consider cumulative effects of multiple pressures.

To improve governance in the **Lighthouse area** and to speed up the process of the Mission implementation the following is suggested:

- EU, macroregional and national institutions should play a stronger role in promoting the Mission and in facilitating collaboration of stakeholders for the Mission implementation in the Baltic and North Sea area. Mobilisation of macroregional and national networks of R&D&I, industry and finance organisations is critical for the Mission implementation.

- HELCOM and OSPAR should increase the intensity of collaboration between the two organisations, given they have a common Mission in the Lighthouse area, overlapping strategic goals/objectives, shared challenges and common member states. The possibility to launch a joint working group on the Mission could be explored.

- It is essential to improve data sharing for better monitoring, evaluation and control over developments in the Lighthouse area, as well as, to inform stakeholders on how to access data. This would stimulate collaboration among the stakeholders and improve knowledge sharing. The EU and macroregional organisations in the blue sector should discuss how this could be arranged in practical terms.

- Synergies with other Horizon Europe Missions, blue programmes and strategies should be fostered at a macroregional and EU levels to ensure cooperation, coherence and better use of resources for the Mission implementation. The EU should organise a forum with macroregional and national organisations to identify, facilitate and monitor synergies. A Blue Forum, proposed in the Mission implementation plan, could serve as a useful platform for multilateral and multi-sectoral discussions.

- The ecosystem approach towards marine planning and management should be promoted by the governance actors at all levels to support a dialogue across different blue sectors/areas and to account for diverse impacts of human activities in the Lighthouse area. The intermediate results of the eMSP should be followed-up closely.

In the **Maritime Transport and Infrastructure area** it is advisable to:

- Organise joint discussions among the HELCOM and OSPAR working groups that focus on maritime transport and infrastructure. This would improve knowledge sharing, learning of best practices, and facilitate identification of joint actions.

- Launch a forum, such as a Blue Forum presented in the Mission implementation plan, among representatives of the maritime transport industry, research and policymakers to foster trade, blue innovation in the Lighthouse area, as well as, to discuss regulatory barriers that impede the development of the maritime transport industry. The forum should also raise discussions related to environmental sustainability, inviting experts and representatives of environmental groups.

In the **Renewable Energy area** it is advisable to:

- Promote and facilitate knowledge transfer between the different macroregional initiatives. There are already successful macroregional initiatives, such as the North Sea Energy Cooperation (NSEC), in the Lighthouse area. Best practices on collaboratively planning offshore renewable energy developments can be shared through such a facilitation.

- The European Commission should support efforts of Member States in the Lighthouse area to transfer their knowledge on setting up a clear and concise governance system with regards to the process of granting permits and developing offshore renewable energy projects. In some countries in the Lighthouse area, harmonisation is lacking and this results in lengthy processes for developing renewable offshore energy projects.

In the **Aquaculture sector** it is advisable to:

- Promote and facilitate cooperation between the existing international stakeholder forums and organisations to enhance the knowledge exchange on technologies, social benefits and environmental impacts. Demonstration of best practices could boost the development of marine aquaculture production in countries currently delivering it a low level.

- The efforts of national stakeholders to have a clear governance of the aquaculture should be supported on the European Commission level. Inclusion of marine aquaculture in the national MSPs and harmonised requirements for acquisition of licenses could promote the development of the sector.

In the **Multi-purpose platform area** it is advisable to:

- Promote the idea of national/local communities of practice to boost the development of multi-purpose platforms and help with implementation of this idea to have groups of relevant stakeholders including national authorities, solving all challenges in the framework of existing regulations.

- Establish a forum or network for cooperation and experience exchange within the holders/owners of the MPPs in the Lighthouse area. Link to already existing structures like North Sea Energy Cooperation can also enhance the development of the area.

8. DEL6: Smart Specialisation and other strategies analysis

8.1. Introduction

8.1.1. Focus areas

For the analysis, we focused on the synergies within Mission objective 3. The desired outcomes of Mission Objective 3 include the deployment of zero emission (zero carbon, zero pollution, noise included) marine technologies and solutions; battery, hydrogen or ammonia propelled ferries; emission reduction technological solutions for renewables, ports and infrastructures (e.g. grid connections, electricity supply for ports); circular, zero pollution offshore clean energy facilities; zero-carbon and toxin-free aquaculture/ algae production; applied solutions for multi-use of water space (e.g. multi-purpose platforms and management); digital platform - digital twin ocean; and applied solutions for marine and freshwater carbon sinks.

Besides these topics, we also looked at the other Mission Objectives for restoring our ocean and waters (e.g., protecting marine ecosystems and biodiversity and preventing and eliminating pollution of oceans). Looking at the possible contributions of the (macro-)regional strategies to the Marine Strategy Framework Directive (MSFD), we find that they will mostly lie in contributing to the aforementioned topics (protecting marine ecosystems and biodiversity and preventing and eliminating pollution of oceans) as well. The descriptors for determining good environmental status (mentioned in Annex 1 of the MSFD) include maintaining biological diversity, avoiding ecosystem degradation, keeping concentrations of contaminants low and keeping marine litter and underwater noise at low levels, not harming the marine environment.

Finally, the aforementioned topics (both from Mission Objective 3 and from the other MO's and the MSFD) align well with the Commission Communication for achieving a sustainable blue economy.[380] This Commission Communication mentions climate neutrality and zero pollution objectives, specifically referring to offshore renewable energy, maritime transport, zero emission vessels and zero-emission ports as important areas to address in order to reach the Commission goals. Furthermore, the Communication mentions preventing waste, (including minimising plastic litter at sea), conserving and protecting biodiversity, (including restoring degraded ecosystems), maritime spatial planning and a responsible food system, (including aquaculture and algae). The only area mentioned in the Commission Communication that does not seem to be an important focus point of the Mission Objectives is that of coastal resilience, including closing the knowledge gap for increased climate resilience for coastal areas and anticipate the effects of extreme weather events and regional sea-level rise.

Based on Mission objective 3, and to a lesser extent the other Mission Objectives, the MSFD and the Commission Communication for a sustainable blue economy, we made a list of topics to pay attention to in the analysis:

---

[380] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:240:FIN

- Deployment of zero emission (zero carbon, zero pollution, noise included) marine technologies and solutions.
- Battery, hydrogen, or ammonia propelled ferries.
- Emission reduction technological solutions for renewables, ports and infrastructures (e.g., grid connections, electricity supply for ports).
- Circular, zero pollution offshore clean energy facilities.
- Zero-carbon and toxin-free aquaculture/ algae production.
- Applied solutions for multi-use of water space (e.g., multi-purpose platforms and management).
- Applied solutions for marine and freshwater carbon sinks.
- Other contributions to restoring our ocean and waters (e.g., protecting marine ecosystems and biodiversity and preventing and eliminating pollution of oceans).

8.1.2. Approach

In short, we started with mapping the relevant Research & Innovation Smart Specialisation Strategies (RIS3) Policy Objectives for all regions bordering the Baltic and North Sea, using the EYE@RIS3 database (1). In parallel, we looked for other relevant strategy documents like recovery and resilience plans (RRPs) (2). Then, we selected the strategies where most synergies are to be expected (3) and analysed the selected strategies (4).

1. For a first understanding of the possible synergies between Mission Objective 3 (MO) and the RIS3 objectives, we looked at the Eye@RIS3 database.[381] This database, managed by the JRC, gives a harmonised overview of the approved RIS3 strategies. Furthermore, the database contains a list of Policy Objectives and gives an overview of the relevant policy objectives selected by the regions.

2. Specifically, we looked at the Policy Objectives under the “blue growth” label (other labels are aeronautics & space, cultural & creative industries, digital transformation, KETs, nature & biodiversity, public health & security, service innovation, social innovation, and sustainable innovation). We focused on the Policy Objectives aquaculture, blue renewable energy, shipbuilding & ship repair, and transport and logistics, as these seemed most relevant to Mission Objective 3. That said, we also considered the other blue growth Policy Objectives of coastal & maritime tourism, fisheries, marine biotechnology and offshore mining, and oil & gas. The data is not perfect: for some regions there was no information and the information that was available could be outdated, as many of the RIS3 references in the

[381] https://s3platform.jrc.ec.europa.eu/map

database were from 2014-2020. However, the data does give a first impression of how many synergies can be expected and in which areas. This helps us in selecting regions where synergies are to be expected, to further look into these regions.

3. Besides the RIS3 strategies, which are the focus of this analysis, we also examined the national RRPs developed by Member States. These national plans specify the public investment projects for implementing the Recovery and Resilience Facility (RRF). The RRF is EU's plan to come out of the COVID-19 pandemic stronger, by providing funds to help Europe emerge stronger from the crisis and securing the green and digital transitions.

4. We looked at the factsheets developed for the RRPs (from countries in the scope of this study) to look for information relating to the abovementioned desired outcomes of Mission objective 3. Based on the data from the EYE@RIS3 database and the RRP factsheets we selected the strategies where we expect to see most synergies and which had their (updated/ recent) strategies and/or contact details available. We aimed for 15 – 20 strategies and selected 19 strategies (see chapter 2.4).

5. For the analysis on synergies between strategies and Mission Objective 3, we reached out to the coordinators of the abovementioned strategies, asking for the most updated version of the strategy and/or an interview. While we received most of the strategies, only a few coordinators were available for an interview. Most of the analysis is therefore based on the information from the written strategies, as was initially planned in the proposal.[382]

As the written strategies do not always provide information detailed enough to assess synergies, it is possible that more synergies can still be discovered than we have found in our assessment. Furthermore, most strategies did not contain specific actions. Therefore, we were limited to examining the objectives the strategies mentioned, without assessing specific actions.

In the following sections, we start with a mapping of the relevant RIS3 strategies and other strategies, presented in section 8.2. Section 8.2 also provides information on the actors involved and the status of the identified strategies. Then, section 8.3 provides an overview of the synergies between the strategies and Mission Objective 3. Finally, in section 8.4 we offer recommendations on how the synergies can be improved.

8.2. Mapping of the relevant strategies

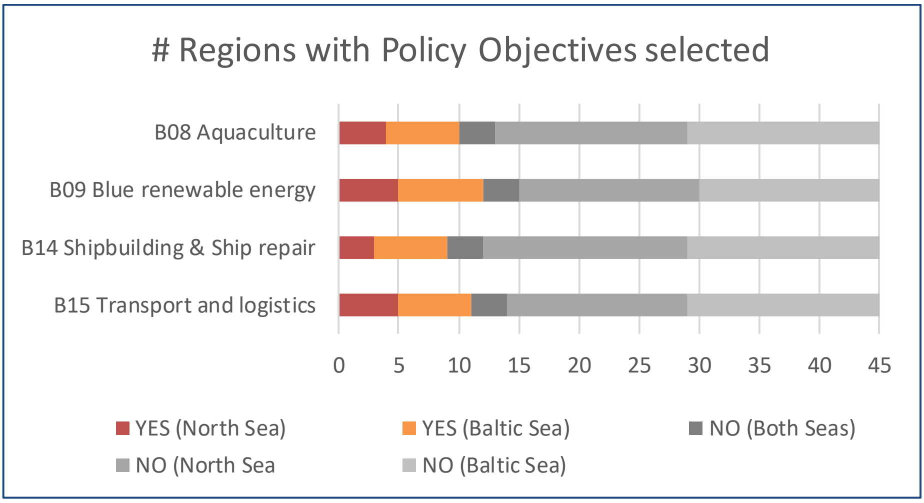
8.2.1. Smart Specialisation Strategies (RIS3)

To provide a first overview, the number of regions that selected one of the following four policy objectives: aquaculture, blue renewable energy, shipbuilding

[382] The main reason to ask for interviews was as an alternative for analysis the RIS3 strategy in case RIS3 strategies were outdated and new versions would not be ready yet, furthermore, interviews could provide additional information

& ship repair, and transport and logistics is shown in the figure below. For each of these Policy Objectives there are approximately 10 regions who selected this, with slightly more areas focusing on blue renewable energy (12 regions) and slightly fewer regions focusing on shipbuilding & ship repair (9 regions). It is also shown that more regions bordering the Baltic Sea focus on those area than regions bordering the North Sea.

Figure 53 Number of regions with Policy Objectives relevant to Mission Objective 3



Of the 45 regions that have submitted their smart specialisation strategies, there are 17 different regions (38%) which selected at least one of the four aforementioned Policy Objectives. The regions that had updated RIS3 strategies and/or contact details available were selected for further analysis to explore the synergies between the RIS3 and the activities under Mission Objective 3 in detail. This more detailed analysis concerned total 12 regions.The regions selected for further analysis are:

- North Jutland (Denmark);
- Satakunta (Finland);
- Southwest Finland (Finland);
- Elblaski (Poland);
- Vastra Gotalands lan (Sweden);
- Szczecinski (Poland);
- Trojmiejski (Poland);
- Mecklenburg-Western Pomerania (Germany);

- Lower Normandy (France);
- Nord/Pas-de-Calais (France);
- Lower Saxony (Germany);
- Brittany (France).

8.2.2. Recovery and Resilience Plans

To select Recovery and Resilience Plans (RRP's) for further analysis, we looked at all factsheets from Member States which fell within the scope of this study. Four RRP's had information in the factsheet relating to Mission Objective 3, so synergies could be expected in those countries. This does not mean that there are no synergies with RRP's from other countries as well, (for instance, France also dedicated a share of the RRP for the blue economy). However, as synergies are likely to be find in the RRP's with information in the fact sheet related to Mission Objective 3, these RRP's are further analysed.

The RRP's of the following countries have therefore been selected for further analysis:

- Belgium (mentioning plans for an off-shore energy island and a blue deal);
- Denmark (supporting purchasing of green ferries);
- Lithuania (developing offshore wind infrastructure); and
- Poland (constructing an offshore terminal infrastructure).

8.2.3. Other regional and macroregional strategies relevant for the Baltic and North Sea Basin

We have analysed two macroregional strategies covering:

- The Baltic Sea Region; and
- The North Sea Region.

Finally, as there are no RIS3 strategies for the UK, but they are an important player for the North Sea region, we looked at the UK innovation strategy from 2021.

8.2.4. Strategies selected for further analysis

Based on the mapping exercise, 19 strategies were selected for further analysis. The table below gives an overview of these strategies. Note that for two French regional strategies, the strategies of different regions were merged into one, broader strategy. So instead of looking at the Lower Normandy strategy and the Nord/Pas-de-Calais strategy we look at the Normandy strategy and the Hauts-de-France (upper France) strategy.

For all the RIS3 strategies, where no updated RIS3 strategies were available online for the period 2021 – 2027, we reached out to the contact persons of the region in question to ask for the most recent RIS3 strategy. We also asked them for interviews, but most regions were not available for an interview.

Table 57 Overview of strategies analysed in depth

Sea Basin	Country	Name of region	Strategy name	Time period	Type
Baltic Sea	Finland	Satakunta	SATAKUNTA RIS-3 Satakunta Regional Programme 2018-2021	2018 – 2021	RIS3
North Sea	France	Brittany	Breton Regional Innovation Smart Specialisation Strategy	2021-2027	RIS3
Baltic Sea	Denmark	North Jutland	North Denmark Region Strategy for Regional Development 2020 - 2023	2020 - 2023	RIS3
Baltic Sea	Finland	Southwest Finland	Southwest- Finland for sustainable partnerships Finland's Landscape Strategy 2040+	2021-2027	RIS3
Baltic Sea	Poland	Warminsko-Mazurskie	Strategię społeczno-gospodarczą do 2030 roku	2021-2030	RIS3
Baltic Sea	Sweden	Västra Götalands län	Program Stärka innovationskraften 2022–2025 och Västra Götalands strategi för smart specialisering (S3)	2022 – 2025	RIS3
Baltic Sea	Poland	Zachodnopomorski	Regionalna Strategia Innowacji Województwa Zachodniopomorskiego 2030	2021-2030	RIS3
Baltic Sea	Poland	Pomorski	Regionalny Program Strategiczny w zakresie gospodarki, rynku pracy, oferty turystycznej i czasu wolnego	2021-2030	RIS3
North Sea	Germany	Mecklenburg-Western Pomerania	Regionale Innovationsstrategie Für Intelligente Spezialisierung des Landes Mecklenburg-Vorpommern 2021–	2021-2027	RIS3

			2027		
North Sea	France	Normandy	Stratégie de spécialisation intelligente de la Normandie 2021-2027	2021-2027	RIS3
North Sea	France	Hauts-de-France	Smart Specialisation Strategy (S3) Hauts-de-France 2021-2027. (Stratégie Recherche Innovation pour le développement économique des Hauts-de-France)	2021-2027	RIS3
North Sea	Germany	Lower Saxony	Lower Saxony regional innovation strategy for intelligent specialization (RIS3)	2021-2027	RIS3
Both Seas	Denmark	Denmark	Denmark's Recovery and Resilience Plan - accelerating the green transition	2021-2025	RRP
Baltic Sea	Poland	Poland	Krajowy Plan Odbudowy i Zwiększania Odporności	2021-2026	RRP
Baltic Sea	Lithuania	Lithuania	Economic Recovery and Resilience Plan Next Generation Lithuania	2021-2026	RRP
North Sea	Belgium	Belgium	National plan for recovery and resilience	2021-2026	RRP
North Sea	UK	UK	UK Innovation Strategy	2021 - 2035	National strategy
Baltic Sea	Baltic Sea region	Baltic Sea region	EU macro-regional strategy for the Baltic Sea Region	2020 - 2030	Macroregional strategy
North Sea	North Sea region	North Sea region	North Sea Region 2030 Strategy	2020 - 2030	Macroregional strategy

8.2.5. Overview of actors involved in the preparation of strategies

Many actors were involved in drawing up the strategies, usually through workshops, interviews and/or surveys organised by regional and national authorities. For example, the RIS3 of Västra Götalands län (Sweden), a consultation was held, resulting in 127 replies from a broad range of actors. In Brittany (France) a different approach was chosen and a steering committee was set up with 15 representatives from higher education and research, innovation players, and industrial sectors. Existing federations were asked to join and represent their members.

In all cases, a combination of different actors was involved. But where some types of actors are (almost) always included, others are less often represented, as can be seen in the table below.

Table 58 Number of strategies where different actors were involved

Actors involved	Yes	Unclear	No
Governments	18		
Industry	12	5	1
Academia/ research organisations	14	4	
NGO's/ civil society	10	7	1
Financial actors	2	13	3

Stakeholders were always involved in the identification of the strengths and weaknesses and the selection of focus areas for the strategy. However, in many cases it is unclear from the strategies to what degree and how stakeholders were involved in the rest of the process.

The Entrepreneurial Discovery Process (EDP) is an interactive and inclusive decision-making process, where relevant stakeholders identify new opportunities for investments in innovations and inform governments. The government then assesses the information received and empowers actors to realise the potential.[383] The EDP is specifically mentioned in the strategy of Mecklenburg-Western Pomerania, and interviewees confirmed that EDP was used for Satakunta's RIS3, South-West Finland's' RIS3 and Lower Saxony's RIS3 as well. Five other RIS3 strategies (from Brittany, South-West Finland, Zachodnopomorski, Pomorski and Lower Normandy) do not specifically mention using the EDP but seem to have other measures in place to ensure the engagement of stakeholders during the implementation and the monitoring and evaluation of the strategy.

For example, in Brittany (France), the Steering Group ensures a regular monitoring of the implementation of the strategy: they organise the broader mobilisation of stakeholders and propose adaptations to the strategy. Furthermore, for each of the five strategic innovation areas chosen in their RIS3, (maritime for blue growth being one of them), the region leads a research and innovation collective. This collective brings the ecosystems' main players in this area together at least once a year and offers space for updating the S3 and adjusting priorities. Another example is Mecklenburg-Western Pomerania (Germany), which has a continuous process for discovering future, technological focus points and fields of application. Coordinators in the strategy's different fields of action ensure the further development of those fields. For each field, monitoring committees will be set up whose members will be drawn from the

[383] https://s3platform.jrc.ec.europa.eu/en/w/the-entrepreneurial-discovery-process

thematic focal points and will include representatives from science and industry. The overall coordination of the EDP is carried out by the German Ministry of Economic Affairs. Finally, under the macroregional strategy for the Baltic Sea Region, there is a different steering group for each policy area, as well as an annual forum for a wider stakeholder audience.

8.2.6. Status of updates of strategies to S4

Most RIS3 strategies do not appear to have been updated to S4 (smart specialisation strategies for sustainable and inclusive growth). Two contact persons for RIS3 strategies (from Satakunta and Southwest Finland) mention that they updated the RIS to Smart Specialisation Strategy for Sustainability, which also cover sustainable solutions. However, as one of them states “the starting point of the RIS is economic growth, the creation of new things and innovation, as well as the quest for interregional cooperation that creates European value chains.” Among the challenges for the regions, the effects of climate change and the deterioration of water conditions are mentioned. Besides this, several strategies refer to the Sustainable Development Goals. In the macroregional strategy for the Baltic Sea Region, all policy areas are linked to specific SDG’s.

8.3. Synergies between strategies and Mission objective 3

8.3.1. Scope and extent of synergies

All of the strategies we analysed had synergies with Mission Objective 3 (MO3). This is to be expected, as we selected strategies where we expected to find the most synergies (see the chapter before). Therefore, it is expected that other strategies (e.g., other RIS3 strategies and RRPs) have less synergies compared to those we analysed in more detail.

The extent to which there were synergies with the MO3 varied between the strategies in that some only had broader goals regarding the blue economy, with focus areas relating to the MO3 focus areas, but not necessarily contributing to it (e.g., objectives for offshore energy, but without specific statements on making the offshore energy facilities circular or zero pollution). Other strategies had more objectives or even some actions that could contribute to the MO3 directly.

We also noticed that the goals set out in the strategies were often on a higher level than the topics of Mission Objective 3 which we examined (listed under chapter 1). First, we looked at the goals regarding the blue economy. Here we found objectives on shipping, aquaculture, ports, etc, which in some cases, also mentioned zero-emission goals. Second, in some strategies there were goals for zero-carbon/ zero-emission/ circular technologies, sometimes including marine technologies/ offshore energy technologies. Finally, there were strategies where the transport industry was an important focus area, and this could include actions on sustainable shipping.

The high level of the goals formulated in the strategies made it difficult to see if and to what extent the strategy could contribute to Mission Objective 3. Where broader themes were mentioned, such as a focus on aquaculture or offshore energy, it was not always clear if this included zero-carbon/ circular solutions because this link with MO3 was not always specifically made in the strategies.

Looking at the synergies in the different topics derived from Mission Objective 3 outcomes, we made a distinction between clear synergies and possible synergies. The latter category includes strategies that had goals or actions which related to Mission Objective 3, but were not specific enough to assess whether they actually contribute to it directly.

An overview of the synergies encountered is provided in the table below. The first column shows the extent to which there are synergies between the strategies and these topics. A darker colour implies more synergies, and a lighter colour denotes less synergies. This is based on the number of strategies that had clear synergies (second column) and possible synergies (third column). The last two columns show in which areas the strategies were mostly focused and what type of strategies were found. The next sections elaborate more on the synergies identified.

Table 59 Overview of synergies found in the strategies per topic

Topic	# clear synergies	# possible synergies	Areas	Strategies
Zero emission marine technologies and solutions	6	4	Both Baltic and North Sea	All type of strategies (RIS, RRP and macro-regional)
Battery, hydrogen or ammonia propelled ferries	4	4	Both Baltic and North Sea	All type of strategies
Emission reduction technological solutions for renewables, ports and infrastructure	8	4	Both Baltic and North Sea	All type of strategies
Circular, zero pollution offshore clean energy facilities	2	11	More synergies found in North Sea area	All type of strategies
Zero-carbon and toxin-free aquaculture/ algae production	3	8	More synergies found in North Sea area	All type of strategies
Marine or freshwater carbon sinks	3	4	More synergies found in North Sea area	Not much synergies with RIS3 strategies
Multi-use of water space	2	1	Both Baltic and North Sea	Mostly in macro-regional strategies

8.3.2. Synergies on zero emission marine technologies and solutions

The strategies analysed often have objectives relating to marine technologies and solutions. In six strategies clear synergies were found, as they included a focus on zero emission marine technology and solutions, and four other strategies had possible synergies. The synergies can be seen in both regions bordering the Baltic Sea and regions bordering the North Sea.

The Mecklenburg-Western Pomerania region (Germany) includes this topic in their strategy: they have a focus area “resource-efficient production”, which includes zero emission marine technologies, but also many other technologies. The Lower Saxony area (Germany) mentions their expertise in environmentally friendly shipping (green shipping). The Belgium RRP mentions, as part of the project on sustainable, emission free transport, that they want to “encourage the use of cleaner fuels and engines for vessels”. Furthermore, in the UK there is a “Clean Maritime Demonstration Competition”, which will invest £20 million to support innovators in zero emission shipping. Finally, the strategy of Southwest Finland foresees “the creation of a carbon-neutral sea cluster that is compatible with the circular economy.”

8.3.3. Synergies on battery, hydrogen or ammonia propelled ferries

Eight of the strategies analysed have objectives that could contribute to the Mission Objective 3 focus area of battery, hydrogen, or ammonia propelled ferries. The (RIS) strategies do not directly contribute to purchasing battery, hydrogen, or ammonia propelled ferries, but can contribute to innovation and regional specializations in this area. In four cases, the objectives have a clear contribution to this outcome (e.g., goals on green ferries/ green shipping). In four other strategies the goal is somehow related to this outcome, but in a less direct manner (e.g., there are several regions where hydrogen is a focus area overall: Mecklenburg-Western Pomerania, Lower Normandy, Denmark and Belgium). We give specific examples in the next paragraphs. The synergies can be seen in both regions bordering the Baltic Sea and regions bordering the North Sea. It appears that there is slightly more emphasis on this topic in the Baltic Sea area.

In the Southwest Finland region, there are plans for “green shipbuilding” and for making the fleet equipped to run on hydrogen or electricity. Although there are currently no concrete plans for the ferries, these plans could also contribute to the Mission Objective 3. Furthermore, in Västra Götalands län (Sweden), the automotive and transport industries are very important. They also see potential in the electrification of all transportation, including ships. Moreover, the shipping industry in that region has developed a roadmap for fossil-free competitiveness.

At the national level, the RRP of Denmark has a clear goal regarding this topic: they will enable the green transition of approximately 23 ferries. Similarly, the UK Research and Innovation Strength in Places Fund is investing in the project “Decarbonisation of maritime transportation: a return to commercial sailing”.

Finally, in the EU macro-regional strategy for the Baltic Sea Region there is a clear emphasis on reducing emissions from shipping. The strategy mentions that there will be a focus on the research and development of solutions regarding alternative marine fuels and sources of energy. The focus will be on solutions that reduce both air pollutant and greenhouse gas emissions on a well-to-wake basis. The strategy mentions several possibilities, such as evaluating batteries, electricity, LNG, biofuels, hydrogen, ammonia, hybrid solutions, and methanol.

8.3.4. Synergies on emission reduction technological solutions for renewables, ports, and infrastructure

Most of the synergies between the strategies and the Mission Objective 3 identified relate to the topic of emission reduction technological solutions for renewables, ports, and infrastructure. Eight of the strategies we analysed have objectives or focus areas that could contribute to this topic. Synergies have been found in both regions bordering the Baltic Sea and regions bordering the North Sea.

The EU macro-regional strategy for the Baltic Sea Region has a specific action related to this topic: "Support development of shore-side facilities to enhance clean shipping measures including infrastructure for climate-neutral and clean fuels"**.** Strategic priorities in this action include:

- development of a regional infrastructure related to shore-side and climate-neutral and clean fuels;
- development of reliable, sustainable and resilient infrastructure, including regional and cross border infrastructure;
- upgrade infrastructure in passenger - and industrial ports and retrofit industries to make them sustainable;
- greater adoption of clean and environmentally sound technologies and industrial processes;
- improve port reception facilities and their ability to treat and separate waste from ships and marine litter brought to land;
- support the improvement of waste separation and handling on board ships.

The RIS3 strategies often have objectives related to this topic, though they do not often provide much detail on which actions will be taken to pursue this. The region Hauts-de-France sees its ports as major infrastructures whose activities must contribute to the low-carbon transition of the regional economy. Furthermore, the regional strategy states that the design of port facilities must allow for the reinforcement of biodiversity within the ports and be part of an eco-design logic, sediment recovery, and circular economy. The Hauts-de-France regional so sees opportunities for the development of solutions for capturing and transporting CO2 by boat to marine aquifers (Norway). Ports are also important to the region Västra Götalands län, for meeting the increased demand for transport. Developments in this field focus on efficiency, digitalisation, renewable fuels, and environmental adaptation of ships. The Västra Götalands län region mentions innovation needs on charging infrastructure for electrified truck transport, electrification of ports, traffic simulators for road and maritime transport.

8.3.5. Synergies on circular, zero pollution offshore clean energy facilities

Although 13 strategies mention plans for new offshore clean energy facilities (and often have some in place already), only two strategies mention specific plans that contribute to fully circular, zero pollution offshore clean energy facilities. The first is the Mecklenburg-Western Pomerania region (Germany), which already has much offshore wind energy and has plans for new offshore wind energy as well. One of the focus areas is resource-efficient production. This includes research to reduce the climate impact of newly developed products and to optimise the possibilities for the economical use of resources in existing production. Fields of action include maritime plant construction, wind and solar energy, and wind and energy plant construction. The second strategy is the Belgian RRP. It supports existing offshore wind projects in making maintenance activities more climate-neutral, for instance, by using hydrogen-powered crew ships. Furthermore, the strategy suggests looking for ways of achieving a larger impact with the same offshore wind projects, by for example, including storage to reduce the need of shutting down offshore wind turbines.

8.3.6. Synergies on zero-carbon and toxin-free aquaculture/ algae production

The strategies analysed often have objectives related to aquaculture/ algae production: 11 strategies demonstrate a possible synergy. In three of these cases, the strategies also mention a focus on making the aquaculture/ algae production zero-carbon and toxin-free, which other strategies do not. However, even if this focus is not specifically mentioned, it could be added to a strategy in a later phase. The clearest synergies were identified in the North Sea area, although regions bordering the Baltic Sea also show some synergies (though often without with a clear focus on zero-carbon/ toxin free aquaculture).

The Brittany region (France) strategy mentions sustainable macro- and microalgae, fishing, and aquaculture as one of their challenges. Their objective is to: “Finance R&D projects for the development of innovative technologies for integrated multi-trophic aquaculture technologies towards zero waste and alternative sources of nutrition (insects, microalgae, algae)”. The Lower Normandy region (also France) has a goal for aquaculture products to be known for their quality, and the industry for its expertise within 10 years. Additionally, the strategy has a goal for achieving a zero-waste industry in 2027. Furthermore, the North Sea Region 2030 strategy formulated a goal for 2030 in the domain of sustainable aquaculture and fisheries, namely on “Sustainable supply-chains in fisheries and aquaculture”.

8.3.7. 8.3.7 Synergies on marine or freshwater carbon sinks

Only two of the strategies analysed mention solutions for marine and freshwater carbon sinks that sequester carbon. The North Sea Region 2030 Strategy has a general goal to address the option of carbon sinks. The RRP from Denmark mentions carbon capture and storage, with a view to developing and demonstrating possibilities to store CO2 in depleted oil and gas fields under the North Sea.

8.3.8. Synergies on multi-use of water space

The multi-use of water space is briefly mentioned in the macro-regional strategies (mostly focused on maritime spatial planning) and does not seem to be a focus area in the RIS3 strategies or RRPs. There could be different reasons for why this topic is not mentioned in the strategies: it could be that this theme is very specific (e.g., developing multi-purpose platforms) or that the strategies are written on a higher level. This makes it difficult to identify concrete plans for multi-use of water space. The comparatively lower prevalence could also be because this topic is new and was not yet salient amongst stakeholders when the strategies were written. Another possibility is that regions are cautious about investing in this area as there are still obstacles in the legal framework and/or responsibilities regarding this area are not clear.

8.3.9. Synergies with other Mission objectives

The Blekinge area in Sweden has "Missions" as one of the three focus areas in their RIS3, referring to the EU Missions. The text box below gives more information on their approach.

Box 18 Mission oriented approach in the Blekinge region

The people from the Blekinge region responsible for the RIS3 started discussing the focus areas with stakeholders two years ago. Knowing about the EU Missions, they wanted to combine it with the smart specialisation, initially trying to make the Missions the overall focus of the RIS3. This was a step too far for the stakeholders included, so they agreed to have two focus areas and the Missions as a third one. For each focus area, the region has a working group that currently work on implementation plans for the next two years.

The Blekinge region decided to focus their efforts on two of the Missions: "Adaptation to Climate Change: support at least 150 European regions and communities to become climate resilient by 2030" and "Restore our Ocean and Waters by 2030". Within those Missions they look how their region could contribute to achieving the Missions. For example, a university in the region is specialized in digital twins, so they investigate if a digital twin for the coast and waters can be made.

The region thinks it has many characteristics that make the Mission work very suitable to them. It is a small region, with short decision-making processes and social proximity. It is also a closed community, with good test and demonstration capacity. These characteristics can be seen as strengths when exploring how to work with mission-oriented innovation in the region. These traits also made it easier to decide on a Mission oriented focus: because of the size and proximity it was easier for this region to get all different stakeholders in one room, making it easier to discuss and decide on trying something new.

Although the analysis focused on Mission Objective 3 "*Make the sustainable blue economy carbon-neutral and circular, in line with the European Climate Law and the holistic vision enshrined in the Sustainable Blue Economy Strategy*", some synergies with the other Missions ("*Protect and restore marine and freshwater ecosystems and biodiversity, in line with the EU Biodiversity Strategy 2030*" and "*Prevent and eliminate pollution of our ocean, seas and waters, in line with the EU Action Plan Towards Zero Pollution for Air, Water and Soil*") were also observed.

In several cases the region mentions a broader focus on the "blue economy", though the RIS3 does not always specify on which aspects of the blue economy the strategy intends to focus. But where the blue economy was mentioned as a focus area, this was often in conjunction with the prevention of pollution and the protection of marine ecosystems. A focus on areas related to Mission Objectives 1 and 2 are more often mentioned in regions bordering the Baltic Sea, compared to regions bordering the North Sea.

For example, the Satakunta region (Finland) mentions several strengths related to the different objectives, such as the marine industry and water protection. The Pomorski region (Poland) focuses on “technologies to clean the marine environment and reduce and eliminate pollution generated in the process of economic exploitation of marine resources”. Southwest Finland even mentions the blue economy as their primary focus. The region wants to fix the “bad shape” of the water (which is currently very polluted from agricultural waste streams) and emphasise protection (e.g., reducing flows of waste and chemicals into the Baltic Sea, and sulphur removing technologies). The RIS3 of Västra Götalands län (Sweden) mentions the importance of developing new and circular business models focusing on marine litter, especially plastics. Examples can be found in the RRPs as well. The Danish RRP refers to the Danish experience in the protection and restoration of water-related ecosystems. The region works to protect and restore water-related ecosystems based on the implementation of EU water legislation, including the Water Framework Directive. Similarly, the Polish RRP, considers improving the environmental quality in combination with adaptation to climate change. Specific attention is paid to decreasing hazardous substances and sunken explosives from WWII.

8.4. Recommendations on improving synergies

8.4.1. Areas in which synergies could be improved

For RIS3 strategies which already have focus areas or goals regarding the blue economy (which all strategies we analysed had, likely because we selected those with blue economy Policy Objectives), synergies between these strategies and Mission Objective 3 could be improved by including specific actions on carbon-neutrality and circularity. In some cases, the strategies have separate goals on the blue economy and on carbon-neutrality or circularity, which could be linked to each other. For example, in the region Warminsko-Mazurskie (Poland), the focus is on the “water economy”, but with an emphasis on tourism and transportation. As the “green and circular economy” are also a focus area in this region, the two focus areas could be further linked together, through specific actions aligned with Mission activities under Objective 3.

In other cases, there were blue economy goals, but no (clearly specified) goals on carbon-neutrality and circularity. In those cases, adding carbon-neutrality and circularity goals to the strategies could complement the blue economy goals and achieve better alignment with the Mission. This could be done by stressing the need to achieve carbon-neutrality and circularity in relation to the blue economy amongst the regions. Especially regions which have goals regarding offshore energy, ferries, aquaculture, and ports should be aware of the importance of making these activities carbon-neutral and circular.

There are also RIS3 strategies that do not have focus areas or goals of the blue economy (as indicated in chapter 2, less than half of the RIS3 strategies marked

Policy Objectives relating to the blue economy in their RIS3). Here, the easiest way to increase synergies with the MO3 could be to include carbon-neutral and circular marine technologies under broader existing goals regarding carbon-neutrality and circularity.

Increasing the focus of RIS3 strategies on multi-use of water space and carbon sinks seems to be more challenging, as these are specific solutions that are more difficult to integrate with regional goals. For these topics, synergies should be sought more on a national or macroregional level.

A final remark is that it should be considered by the EU how the transition of Europe to a fossil free economy relates to making the blue economy carbon-neutral and circular, as this transition itself will change the blue economy. For example, a significant part of the goods entering the port of Rotterdam (the Netherlands) are fossil energy. This will change in the future, impacting the way this port will operate in the future. Looking at the future of the blue economy (taking the transitions into account) and trying to make the blue economy zero-carbon and circular, instead of changing the current blue economy, could accelerate reaching Mission Objective 3 goals. The European Commission can investigate whether this is addressed well enough in their vision and approach (e.g., the Sustainable Blue Economy communication[384]) or whether there are more opportunities here to act on.

8.4.2. How synergies could be improved

Even though the strategies are written for a 7-year time period and are already completed or in a final stage, carbon-neutral and circularity aspects can still be added to the calls. The scope of the smart specialisations areas is often broader than the specific topics we were looking for (e.g., having the “blue economy” as a whole as a focus area) in the scope of this study. This made it more difficult to identify the synergies, but it does give opportunities for the next years as well, as the calls or implementation plans can be more concrete and can steer towards contributing to Mission Objective 3.

A concrete way for the regions to contribute more to Mission Objective 3 is to add zero-carbon as a design parameter for blue economy tenders (for instance, regarding offshore energy, aquaculture and ports). The subscribers must then integrate this topic in their projects and use their own expertise and ideas to decide how to achieve this, also for the benefit of the Mission. Providing examples of how the regions can include zero-carbon as a design parameter in the ERDF calls could aid this inclusion. Other appropriate mechanisms or pathways for scaling up action to meet Mission objective 3 can be considered as well.

Furthermore, information and best practices can be shared to provide inspiration for regions on how they can contribute to a carbon-neutral and circular blue economy, and what the region can gain from this. For this purpose, the S3 platform[385] can be used to disseminate information, the contact person for each

---

[384] Sustainable Blue Economy communication (COM/2021/240 final): https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0240&from=EN

[385] https://s3platform.jrc.ec.europa.eu/

RIS3 can be contacted, or a workshop could be organised. Additionally, for regions that have working groups, monitoring groups, or steering groups in place, these committees can be informed and involved in the Mission. A first step in identifying good practices could be taken by looking at the EU macro-regional strategy for the Baltic Sea Region, which has many flagship projects related to the MO3. For example, the work on the flagship ECOPRODIGI could be relevant, where digital solutions are being sought for increasing efficiency and reducing emissions for ships when at a port to reduce bunker consumption. And a zero-pollution transport regional workshop will be planned “Towards climate neutral operations of main transport hubs” (harbours, dry ports, intermodal terminals and inland ports). These projects could be used as flagships to inspire other regions to action.

Finally, as regions often report to national agencies or national agencies have a coordinating/ facilitating role towards the regions, these national agencies could play an important role in improving synergies. National agencies could help regions in linking their strengths and smart specialisations to contributing to the Missions. They can also make suggestions to the regions and provide them with more information on the Missions.

9. DEL7: Citizen engagement, blue economy and ocean and water literacy activities in the Lighthouse area

9.1. Literature review

9.1.1. Definition and background information

The current water literacy definitions, understandings, and applications vary substantially. Water literacy is mostly referred to as water related knowledge in a watershed or catchment area. A broader notion of literacy is thus perceived as the capacity to assess (a) the impact of spatial and temporal rainfall patterns on the comparative advantage of different agricultural micro-strategies, (b) capacity to find alternative ways to adapt to site-specific production potentials defined by water, and (c) long-term consequences of contemporary water use strategies.386

Ocean literacy is defined as "Understanding the ocean's influence on you, and your influence on the ocean".[387] It builds upon creating an open and global ocean-literate society which is able to make informed and responsible decisions on ocean resources and ocean sustainability, through formal education and informal learning. The concept of ocean literacy was developed and applied in the United States in the early 2000s before it received attention in the EU. The European Marine Science Educators Association (EMSEA) was established and launched the first conference on ocean literacy in Belgium in 2012.[388] EMSEA provides training and teaching material to support marine educators and acts to raise educators' awareness of marine issues. The Association is collaborating with European decision-makers in order to embed Ocean Literacy into formal educational programs.[389]

There are seven key ideas or Essential Principles about the Ocean which form the basis of Ocean Literacy:

- Earth has one big ocean with many features.
- The ocean and life in the ocean shape the features of Earth.
- The ocean is a major influence on weather and climate.
- The ocean makes Earth habitable.

---

[386] doi:10.3390/w12102803

[387] Cava, F., Schoedinger, S., Strang, C., Tuddenham, P. (2005). Science Content and Standards for Ocean Literacy: A Report on Ocean Literacy. https://www.coexploration.org/oceanliteracy/documents/OLit2004-05_Final_Report.pdf

[388] https://www.vliz.be/en/open-science-vliz

[389] https://www.marineboard.eu/sites/marineboard.eu/files/public/publication/EMB_PP23__Citizen_Science_web.pdf

- The ocean supports a great diversity of life and ecosystems.
- The ocean and humans are inextricably interconnected.
- The ocean is largely unexplored.[390]

Although all water systems on the Earth are related, considering the "geographical" division between the definitions of the terms and objectives of this report, the attention will be paid to ocean literacy activities mostly.

According to UNESCO,[391] "ocean literacy can lead to an improvement in economic stability and national security, and to allow society to understand critical issues associated with important ocean-related topics spanning ecology, trade, energy exploration, climate change, biodiversity, the ocean and human health, and developing a sustainable future." In addition to this, in order to protect the oceans and marine environments, it is important to improve citizens' knowledge regarding these issues contributing to an attitude change, but also to responsible policies, regulations and management strategies to ensure the sustainability of the ocean.[392] The project "Future Seas" has identified four drivers that can influence and improve ocean literacy and societal connections to the ocean: (1) education, (2) cultural connections, (3) technological developments, and (4) knowledge exchange and science-policy interconnections.[393][394] Marine environments are intrinsically complex and embedded in dynamic socio-ecological systems, therefore overlooking the human and social dimensions of the ocean is one of the most common factors behind conservation failure. This highlights the urgent need for actions that enhance peoples' understanding of, connection to, and resulting pro-environmental attitudes and behaviours towards the ocean.[395]

<u>Water and ocean literacy in the lighthouse area</u>

Nowadays, the development of the blue economy is an important component of national socio-economic development strategies. However, it can result in increasing pressures on marine and coastal ecosystems if this development is not designed and implemented with care. Thus, despite current regulatory framework across the globe (e.g. Oceans Act in the USA or Canada, the Marine Strategy Framework Directive in Europe, and UNCLOS), it is likely that this

---

[390] https://static1.squarespace.com/static/5b4cecfde2ccd188cfed8026/t/6101cb7536e2ed6426ba15b6/1627507591681/OceanLiteracyGuide_V3_2020.pdf

[391] https://unesdoc.unesco.org/ark:/48223/pf0000260721

[392] http://doi.org/10.3390/educsci11020062

[393] https://futureseas2030.org/

[394] https://link.springer.com/article/10.1007/s11160-020-09625-9#Sec1

[395] https://www.mdpi.com/2071-1050/14/2/926

challenging situation will continue into the future.[396] Therefore, a better understanding for every citizen of the importance of the oceans, the human-ocean interactions, and opportunities to act sustainably and reduce human impacts on marine ecosystem, is central to global Ocean Literacy. Ocean Literacy (OL) is a challenge for all parts of society and it is seen as an essential part of the strategies necessary to change human behaviours and practices that can result in healthier marine ecosystems, while allowing sustainable development opportunities.[397]

Studies across Europe indicate that OL has so far been implemented in Europe within the education sector and with the general public. The work done by OL practitioners has connected research and education and translated some of the best available marine knowledge into didactic contents, comprehensive for students and trainees of all ages.[398] For instance, the Horizon 2020 funded project ResponSEAble developed several OL tools - Key Stories, videos, interactive games - built on the idea that environment-friendly practices and the adoption of available knowledge could lead to more competitive maritime industries, with a better image of their business. The themes of the tools include renewable energy, sustainable aquaculture and fisheries, microplastics, eutrophication and coastal tourism and they are foreseen for citizens, scientists, educators, policy makers and professionals.[399] The ERASMUS+ project MATES worked to combine knowledge transfer in the maritime sector, i.e., the largest constituent of blue economy, with OL to provide a permanent route for state-of-the-art marine science for blue economy stakeholders.[400]

It is expected that good practices and insights in marine and maritime knowledge transfer can benefit future OL efforts and, vice versa, materials and lessons learnt from past experiences can be shared between the two communities of practitioners.[401] Increased education and skills development surrounding the ocean and the knowledge transfer practices (a) supports the synthesis of relevant knowledge, which is essential for a better understanding and for making informed decisions; (b) allows for creativity and innovation and for the development of the so-called “21st Century Skills”; and, (c) unveils for all the valuable services from the marine environment. Thus, through developing OL among blue economy stakeholders and through the systematisation of marine knowledge transfer, the environmental performance of marine and maritime sectors is expected to

[396] doi: 10.1038/s41559-016-0017

[397] https://www.frontiersin.org/articles/10.3389/fmars.2019.00837/full

[398] https://www.frontiersin.org/articles/10.3389/fmars.2019.00646/full#h6

[399] https://responseable.acteon-environment.eu/#about

[400] Maritime Alliance for fostering the European Blue Economy through a Marine Technology Skilling Strategy | Project Mates - Project Mates

[401] https://www.projectmates.eu

improve. The enhancement of the maritime sectors' images will come as a consequence.[402]

Besides the training and education, citizen engagement and most often citizen science is seen as a powerful tool to promote Ocean Literacy. As already mentioned, in the EU the EU4Ocean Coalition for Ocean Literacy is a platform for connecting and promoting diverse organisations, projects and people to contribute to OL and the sustainable management of the ocean. The Platform has also been named as one of the best examples of such regional activities, which combines all three types of education forms and ocean literacy principles.[403] [404] [405] [406] [407] It calls on citizens, businesses, organisations, authorities, and celebrities to commit to an action that can benefit the ocean. In the context of the European Marine Day 2021, an online Ocean Literacy festival for the Atlantic Ocean and the North Sea has been held.[408]

OL events are also a part of Ocean Decade (UN Decade of Ocean Science for Sustainable Development) activities – Ocean Decade laboratories and the satellite events of the laboratories.[409] Each Laboratory focuses on one of the seven outcomes of the Ocean Decade and are organised in a top-down manner. Meanwhile, the satellite activities are mostly ”bottom-up” initiatives, and include variety of virtual events like "pitch sessions" for new Ocean Decade programs or projects, design workshops and networking forums, skills training via short "Master Classes", virtual exhibitions and launch of videos or art initiatives, competitions and hackathons.[410]

Intensive development of macroregional OL activities took place in the period 2019 – 2020, most of them have taken place online and therefore the extent of citizen engagement is difficult to estimate as not many reports are publicly available. In the context of the EU4Ocean Coalition, an international film and photo competition "I Live by the Sea" for school youth was reported to have more

---

[402] https://www.frontiersin.org/articles/10.3389/fmars.2019.00646/full#h5

[403] https://www.mdpi.com/2071-1050/14/2/926

[404] https://webgate.ec.europa.eu/maritimeforum/en/system/files/eu4ocean_coalition_baltic_synthesis.pdf

[405] https://webgate.ec.europa.eu/maritimeforum/en/system/files/eu4ocean_atlanticnorthsea_basin_workshop_synthesis_v2.pdf

[406] https://webgate.ec.europa.eu/maritimeforum/en/node/6353

[407] https://webgate.ec.europa.eu/maritimeforum/en/node/5914

[408] https://webgate.ec.europa.eu/maritimeforum/en/node/5622

[409] https://www.oceandecade-conference.com/en/index.html

[410] https://www.oceandecade-conference.com/en/ocean-decade-laboratories.html

than 240 participants in 2021.[411] Ocean@Home international online summer school in 2021 for students of ages 14-17 gathered approximately 20 participants.[412]

Success factors

The success of OL activities can be linked to overall understanding of ocean and marine environment. The literature shows that educational programmes work well as a means to develop water and ocean literacy. Several studies reveal the need to implement OL in teaching starting from the early grades by combining teachers' professional development, strengthening ocean-related topics in school curricula, and promoting informal educational activities, e.g., acquisition of knowledge through games, short tests and quizzes organised by local science centre, museum or aquarium. Understanding the interrelationship between people and the ocean is necessary from an early age. In theory, this should result in adults that make informed and responsible decisions helping to conserve and sustainably manage marine resources and ecosystems.[413] Following this rationale, the Network of European Blue Schools was founded. European Blue schools include a topic related to the ocean in their curriculum and allow students get to know the ocean through problems-based learning.[414] Non-formal education (such as art festivals, competitions aimed at water/ocean-related topics, transfer and sharing of traditional knowledge, culture and practices related to ocean during Maritime Days) will bring more favourable results in terms of promoting Ocean Literacy, when besides schools and the general public, policy makers, public authorities and industry representatives are also targeted, as observed by EuroGOOS network.[415]

9.1.2. Citizen science activities

Definition and background information

Citizen Science is a research approach which allows science and civil society to cooperate, to learn, and to work together to generate and use scientific knowledge and understanding for a mutual benefit. The benefits include enhanced monitoring capability for scientific research, empowerment of civil society and increased environmental awareness. Citizen Science enables the co-generation of knowledge and understanding, inter alia, of the current health of ocean systems, how these are being impacted and how they can be protected. It also promotes education of the general public regarding these issues, and makes

---

411 https://todaywehave.com/Results_of_the_I_live_by_the_Sea_International_Youth_Photo_and_Film_Contest_2021.html

412 https://www.geomar.de/ocean-at-home

413 doi:10.3390/su122410647

414 https://webgate.ec.europa.eu/maritimeforum/en/node/5494

415 https://eurogoos.eu/download/Ocean-Literacy-Network-Report.pdf

the ocean seem more accessible, including in the context of its importance to human health.

The engagement of young citizens during the crucial stage of the development of their value system is likely to lead to better informed stewards of the marine environment and development of a lasting “Marine Citizenship” in the future. A shared knowledge and identity can instil behavioural change at the level of the individual, as well as a sense of care and responsibility within the general public, and can empower them to act. Citizen Science is a potentially powerful tool for the generation of scientific knowledge to a level that would not be possible for the scientific community alone.[416]

Putting the theory of Citizen Science into practice requires cooperation between experts and non-experts which involves interdisciplinary public engagement, education and data collection.[417] This interaction between representatives of public and science for the purposes of scientific research can take varying forms. This can include contractual projects, where communities ask professional researchers to conduct a specific scientific investigation and report on the results in more interactive approaches where public participants contribute to the data collection and may also be involved in project design, analysis and dissemination of findings.[418]

Citizen Science initiatives should be promoted because of the benefits in introducing the day-to-day working lives of scientists - their motivations and challenges, creating awareness of the threats facing the world’s oceans, and increasing Ocean Literacy. Many successful Marine Citizen Science projects have awareness-raising and education components. However, it is rather difficult to balance general public involvement with the aims of producing quality scientific data[419].

A successful Citizen Science project can be characterized by two criteria: when citizens are satisfied, and when useful data has been obtained to answer scientific questions. Still, this definition requires both satisfaction and usefulness to be measured and quantified. The variety of Citizen Science models means that not all will have every success factor in common. Therefore, nine steps for the development of a successful Citizen Science project have been outlined:[420]

- Choose a scientific question

---

[416] https://www.marineboard.eu/sites/marineboard.eu/files/public/publication/EMB_PP23__Citizen_Science_web.pdf

[417] https://academic.oup.com/bioscience/article/65/2/208/243853

[418] https://www.ecologyandsociety.org/vol17/iss2/art29/

[419] https://www.ceh.ac.uk/sites/default/files/sepa_choosingandusingcitizenscience_interactive_4web_final_amended-blue1.pdf

[420] https://files.eric.ed.gov/fulltext/ED519688.pdf

- Form an interdisciplinary team
- Develop, test, and refine protocols, data forms, and educational support materials
- Recruit participants
- Train participants
- Accept, edit, and display data
- Analyse and interpret data
- Disseminate results
- Measure outcomes

Citizen Science in the North Sea area

Recently, a couple of studies about Citizen Science have been performed for the North Sea area.[421][422] The study showed that among all Citizen Science (CS) projects in the North Sea area, the projects that recorded various living organisms have been the most popular type of CS projects - of 127 registered marine CS projects in the North Sea area (status of 2018) almost half of these (48%) dealt with the study of plant or animal species. The projects cover the distribution and abundance of one or more species, or gather information about population changes (migration patterns, behaviour). Most frequently projects in this “species” category relate to marine mammals (28%), fish (20%) and birds (20%), followed by seaweeds and plankton (each 11%) and molluscs (10%). Only seven projects deal with crustaceans, invasive species or cnidarians such as jellyfish. Another 17% of the projects deal with “pollution”, such as marine litter or oil contaminated seabirds. Some 16% have a more general “biodiversity” focus while the other categories (“Ecology”, “Fisheries”, “Environmental” and “Archaeology”) are less commonly featured among the projects.

In other parts of Europe, the integration of CS projects is relatively similar. In Norway for instance, 78% of the marine Citizen Science initiatives deal with life science; and in France, life sciences account for 94% of the projects. As for the Norwegian projects, there are relatively more CS activities on crustaceans (19%) and jellyfish (14%), with less focus on seabirds (11%) and marine mammals (17%). In France, many marine Citizen Science projects are not species-specific but deal with marine biodiversity as a whole (57%), although here larger animals (21%) are well-presented: marine mammals (7%), seabirds (10%), and turtles

[421] van Hee, F.M.; Seldenrath, A.; Seys, J. (2020). Policy Informing Brief: Marine citizen science in the North Sea area and what policy makers can learn from it. VLIZ Beleidsinformerende Nota's, 2020_007. Vlaams Instituut voor de Zee (VLIZ)/Van Hall Larenstein: Oostende/Leeuwarden. ISBN 9789464206029. 35 pp.

[422] https://www.frontiersin.org/articles/10.3389/fmars.2021.621472/full

(4%). 85 projects or 2/3 of the North Sea CS projects are country specific and of those projects, 66% take place in the part of the UK that borders the North Sea. For nine projects, the scope included the whole North Sea area, four projects studied European waters including the North Sea, and 28 projects have a worldwide scope.

Several types of organisations are involved in CS activities - charities and foundations, governmental organisations, research institutes, non-governmental organisations, partnerships or individuals. NGOs are the major contributors to North Sea CS initiatives and research institutes are the second. The interests and aim of involved organisations are different – e.g., government organisations prefer projects that draw attention to important policy issues, research institutes invest most in “descriptive” initiatives (i.e. when data is collected without a specific intended use), whereas NGOs have a slight preference for initiatives in which monitoring and evaluation are crucial.

According to the study performed by VLIZ and Applied University Van Hall Larenstein Citizen Science projects in the North Sea area on average last 19 years. Crowdsourcing activities, such as reporting observations on the beach, with not many obligations and little prior knowledge needed for the participants, is the most frequent format in terms of level of participation, while participatory science and extreme citizen science are rather rare and short in duration. Participatory science can be defined as the type of Citizen Science where citizens participate in defining the problem and method that will be used, as well as the data collection; Extreme citizen science can be defined as the type of CS where citizens are involved in all levels of research, so also the analysis and results.[423] So, the bias is towards “easy” projects, with rather low levels of involvement - like reporting of sightings. Under these circumstances, projects are able to carry on for a longer period. The most successful projects seem to be those that have found a balance between the aims of the organiser and what the participants want in terms of output and engagement. Therefore, more diverse approaches and tools (such as easy-to-use digital tools/apps) are necessary to enable citizens and governments, research institutes and NGOs to launch new projects of a wider range – from easy, well-attended beach-based reporting of sightings to more complex forms of citizen science that follow the previously mentioned participatory science- or extreme citizen science-approach.

Citizen Science in the Baltic Sea area

According to a study performed for BANOS, in the Baltic Sea area, the number of CS projects was smaller as compared to the CS activities in the North Sea area – 55 projects not older than 5 years were recorded.[424] Of the 55 Baltic CS projects identified, 40 are or were country-specific, meaning that the relevant project took place in territorial waters, categorised either as local, subregional, regional or

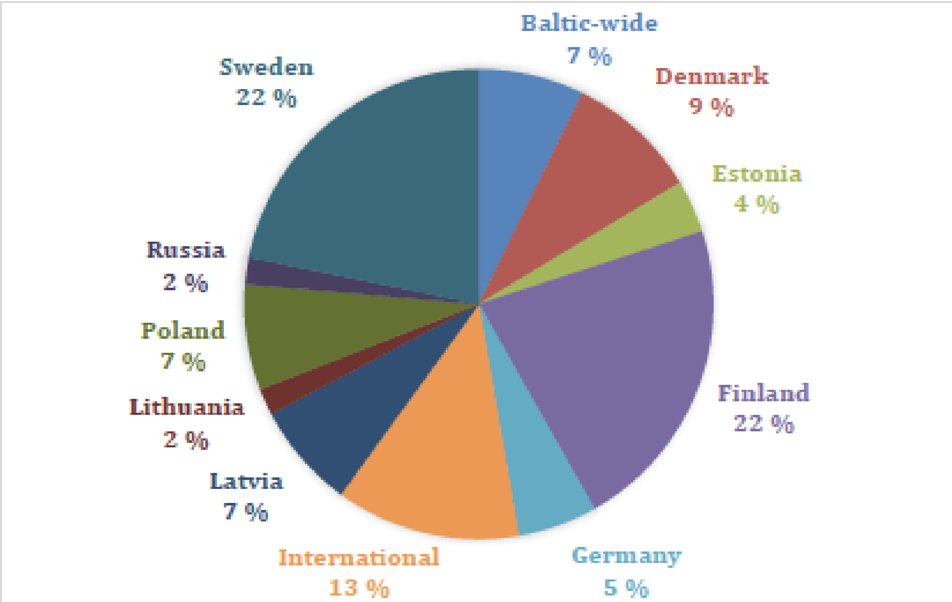
---

[423] Haklay, M. (2013). Citizen Science and Volunteered Geographic Information: Overview and Typology of Participation. In: Sui, D., Elwood, S., Goodchild, M. (eds) Crowdsourcing Geographic Knowledge. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-4587-2_7

[424] https://www.banoscsa.org/files/7322/Deliverable_4.8_Annex_3_BANOSCSA_BSR_MCS_Report_.pdf

national. Of those projects, the most took place in Finland, with 12 projects, and Sweden, also with 12 projects. Ten projects considered a supranational scale, with four projects focusing on the whole Baltic Sea Region, 6 projects focusing on the whole of Europe, and with four projects focusing on a wider international scale. The location of the projects by countries is depicted in Figure 54.

Figure 54 Location of the Baltic Sea area maritime Citizen Science projects



Source: s.Pro, 2021[425]

Similar to the CS activities in the North Sea, in the Baltic Sea, data collection on living organisms also was the most popular CS project category together with the CS category on environmental variables – 13 projects in each. Marine litter was the second most used category, with 8 projects. The least frequently chosen categories were Archaeology and Fisheries, with each category only being used once. Digital methods have been the most used also in the Baltic Sea area – of the 55 identified projects, 39 projects used either a web portal or a mobile phone app to allow citizen scientists to send their data to researchers.

Almost half of the identified CS projects in the Baltic Sea area took part in Sweden and in Finland. The local institutions organising many of these projects have a longstanding history in marine research as well as experience with the engagement of the general public. In addition, the information was often available online through dedicated webpages. For the projects in Finland, the Project leads often included the Finnish Environment Institute SYKE as well as the Natural Resources Institute LUKE. For the Swedish projects, the Project lead was often a university - the University of Gothenburg or the University of Uppsala, or a public

425 https://www.banoscsa.org/files/7322/Deliverable_4.8_Annex_3_BANOSCSA_BSR_MCS_Report_.pdf

authority – on national level, Swedish Maritime Administration or at local level, Stockholm County Administration.

A variety of institutions are involved as the project leads in the Baltic Sea, including education and research organisations, NGOs, governmental organisations and local authorities. In the most cases the university/education institution are the project leads (19 projects), followed by national environmental authorities (14 projects). NGOs are represented far less in the Baltic Sea (6 projects) as project leads compared to the North Sea.

<u>Success factors</u>

The success of any Marine Citizen Science project will require the ongoing involvement of citizens and will depend on the degree to which the project is seen as enjoyable and of value to them. Success of measures can be evaluated based on attention, accessibility, relevance and satisfaction. To catch the attention of possible public participants, an appropriate strategy is needed, such as interaction with professional associations, information campaign through various media channels, or celebrity advocates. Alternatively, the project can be promoted by aquaria or museums where all visitors are invited to participate.

Accessibility includes the lowering of hurdles to participation and making the participation low-effort, i.e., nothing has to be purchased or specifically built to participate at the CS project. Good examples are the projects that make use of smartphones and specially designed applications as their primary approach. Websites or printed questionnaires are other examples of low-effort participation. A willingness of citizens to participate in a CS project also depends on the relevance of the topic. This can be economic relevance for the individual, e.g., water quality monitoring at your coastal property, or relevance of its societal status, such as contribution to a community effort in marine litter monitoring. Therefore, the benefit of the CS project has to be clearly defined and highlighted by the project co-ordinators. The satisfaction of citizens with CS project should be understood and measured via communication with the citizen community. It is important that participating citizens gain a clear picture of why the scientific question should be answered; what the expected short-term and long-term impacts of addressing this issue are; and what the role of their contribution is. If a project is not requiring just one-time participation, but aims at repeated contributions, then development of individual skills should be included and eventually evaluated. Success within the project must be visible, the status of the project has to evolve, and individual advantages need to be granted. The project will benefit when the participants feel that they have an ownership of the results and outcomes, and when they can see how their contribution fits within the overall research question, the importance of their input and the use of their results.[426]

In order for citizens to become engaged participants in marine environmental issues, Ocean Literacy (OL) is essential. Formal education systems offer the opportunity to reach large parts of the European population. Furthermore, the

---

[426]https://www.marineboard.eu/sites/marineboard.eu/files/public/publication/EMB_PP23__Citizen_Science_web.pdf

seven principles of OL, mentioned in the previous sub-section, can constitute the focus of ocean science education at school. In Europe, environmental and science education focuses strongly on the terrestrial environment, while ocean topics are less well covered.[427]

Although for marine data CS more challenges exist (e.g., due to the inaccessibility of most of the marine environment and the extent of climate change impact on marine system), the need to have large datasets to assess the broad range of impacts on ecosystems over longer timeframes still gives the CS the potential to add to marine evidence base. Attempts to coordinate marine CS across the regions are still mostly missing and the compilation of information on a wider scale is also not common.

The studies on marine Citizen Science in the region have come to several conclusions for further promotion of CS, considering its importance for marine research. These are relevant also for implementation of Mission objectives:

- Development of overall directory of existing marine Citizen Science projects in Europe in order to increase transparency and overview.

Although majority of the Citizen Science projects have a focus on life sciences and the study of species, there are new opportunities to be developed in the fields of coastal morphology and protection, history, weather and climate, human health at the coast, etc. Marine and coastal Citizen Science is also a promising yet undervalued option in governance and policy. Citizen Science can provide policymakers insight into which topics resonate with the public, which subsequently can help to identify ‘low-hanging fruit’. Also, a higher awareness on marine, ocean and water issues and higher ocean literacy will bring higher societal involvement by providing more data and information for ocean management.

Development of new technologies - both as devices and virtual environment - shows great potential for advancing citizen science. Data collection can now be carried out through a wide range of new instruments, devices and tools including mobile apps, interactive web services and DIY technologies.

The capacity of marine conservation needs to be urgently improved and Citizen Science has potential to act upon this need at large geographic scales. The necessary methodological approaches for quality of data provided by citizen science should be aligned with technological development and the nature of projects. Good practice guidelines and toolkits for citizen science should be generated, including aspects of project design, data verification and avoiding sampling biases.[428] Larger share of EU funded research projects (LIFE+ programme) or Mission initiatives could include citizen science activities as a mandatory component. In this case, a training for participants should be provided.

[427] https://www.frontiersin.org/articles/10.3389/fmars.2019.00396/full#h5

[428] https://link.springer.com/chapter/10.1007/978-3-030-20389-4_1

Efforts should be deployed to support marine Citizen Science as compound in national and international research calls. Understanding of scientific reasoning helps evidence-based policymaking particularly nowadays when society has difficulties discerning between scientific facts and misinformation.[429] Involving citizens in the whole research cycle (i.e. from defining the problem, the methodology, data collection, analysis and results) helps the citizens understand the value of science (and scientific facts in general) and implications of the results. Participants of CS projects observe the impact of anthropogenic activities on marine environments, which may promote a sense of ownership and drive behavioural changes towards more sustainable actions. This subsequently results in a better understanding of the reasoning of the Mission objectives among the wider public.

9.1.3. Activities that use participatory and co-creation processes

Definition and background information

There is currently not a uniform definition of these activities, and it can be connected with participatory processes within other types of citizen engagement activities or considered as an activity that leads to co-creation, partaking in the decision-making. The literature review will therefore focus on the discussion of processes that are related to decision-making.

In most cases, participatory and co-creation processes have been employed to strengthen communities, democracy and governance processes. Citizen engagement activities that include such processes have been found effective in problem-solving, as they are successful in motivating participants and empowering them to participate in a change.430 Thus, some experts argue that local governments should move beyond the traditional type of hearing or informing citizens towards engaging in co-creation. Overall, this type of citizen engagement activities are characterised by a delegation of responsibilities to citizens, resulting in a moderate to high degree of decision-making power that is co-shared by the organisers of the activities and their participants. If the transition of power is leaning towards citizens, the organiser(s) may merely play the role of facilitator of the activities. Instead of having a top-down approach where the government stipulates what to do, in a co-creation process the initiative comes from the citizens who steer the process and jointly take the necessary decisions.

Participatory and co-creation processes in the lighthouse area

Stakeholder integration in transboundary process has been analysed and presented in several publications based on research within the BONUS BASMATI, BONUS BALTSPACE, and Pan Baltic Scope projects. Moodie et al. analysed the challenges and enablers identified by the Pan Baltic Scope project.[431] Stakeholder integration is one of the assessed dimensions that

[429] doi: 10.1073/pnas.1805871115

[430] https://rb.gy/ip5p1s

[431] https://vbn.aau.dk/en/publications/challenges-and-enablers-for-transboundary-integration-in-msp-prac

concerns the inclusion and active involvement of stakeholders in transboundary Maritime Spatial Planning (MSP) processes, particularly which stakeholders are involved, what they need, and their level of involvement and influence. The article highlights the success of the Pan Baltic Scope approach and the formal and informal collaboration methods applied. At the same time, one of the findings is that integrating stakeholders into transboundary MSP activities remains a serious challenge outside project settings, especially if they do not see their role in the participatory process clearly. Furthermore, due to the complex and technical nature of (maritime) planning processes, the integration of stakeholders into transboundary activities on a regular basis was seen as difficult, especially for citizens in highly complex and technical planning processes.

Morf et al. address the challenges and enablers for stakeholder integration in transboundary marine spatial planning in the Baltic Sea by synthesizing the results of two transboundary projects - BaltSpace and Baltic SCOPE.[432] The authors conclude that, with the exceptions of countries with well-established marine planning at some level (Germany, Sweden) and Latvia as an ambitious pioneer, stakeholder involvement in MSP has often been either top-down or ad hoc and project-driven or sector-based – even more so across borders. The legal codification of stakeholder integration ranges from a minimum requirement (one-off consultation) to more intensive participation, both in terms of who are regarded as stakeholders and how to actually integrate the stakeholders. The two studies highlight that in the context of the large topics that are also covered by the Mission objectives (e.g. the MSP-process and the energy transition), participatory and co-creation activities aimed to engage the general public are difficult to achieve due to the complex nature of the topics.

However, another example of the participatory citizen engagement strategies is the so-called participatory budgeting, which aims to include citizens from the start of a policy-making process. Using this process, decisions on public policies and spending of the public budget can be decided by community members. The citizens are typically involved in both the preparation as well as the adopting of the budget. Local communities are often the best stakeholder in terms of the knowledge of the local needs and sensitivities, and their involvement makes the decision-making process more inclusive. The EmPaci – Empowering Participatory Budgeting in the Baltic Sea Region-project is a great example of participatory budgeting. This EU Interreg-funded project aimed to develop and implement participatory budgeting in nine municipalities in six European countries (Finland, Germany, Lithuania, Latvia, Poland and Russia) between 2019 and 2021. The project aimed to find out what works in terms of participatory budgeting within these countries and develop guidelines that can be used.[433]

Alternatively, the Dutch Ministry of Infrastructure and Water Management has a directorate Participation which engages with citizens in order to achieve more participation in the policy-making process. This directorate manages the so-called *Platform Participatie*.[434] This online platform provides citizens the possibility to

[432] https://link.springer.com/chapter/10.1007/978-3-319-98696-8_10

[433] The outcomes of the project are available at: https://empaci.eu/index.php?id=49

[434] https://www.platformparticipatie.nl/home/default.aspx

comment and provide feedback on the projects that the Ministry of Infrastructure and Water Management proposes to do. As of March 2022, there were three policy plans related to the blue economy on which citizens could provide feedback, namely the National Water Programme 2022-2027, Programme North Sea and the update of the Marine Strategy.

Another interesting method of participatory citizen engagement are youth fora. For instance, the Baltic Sea Youth Platform (BSYP) aims to introduce the voice of the youth to policymakers. The youth can contribute to innovative ways of tackling societal and/or future problems. Similarly, the Youth4Ocean Forum provides a similar platform that promotes the Mission objectives through the involvement of youth.

These participatory and co-creation activities are good examples of activities that could be used to engage with citizens in the context of the Mission objectives in the Lighthouse area in the future to motivate and empower them to act. The activities where there are close links to the community, such as designing local projects, participatory budgeting at the local level, could be a first good step to let citizens get in touch with the Mission objectives. The local benefits of the Mission implementation should be clear though before the start of any participatory and co-creation initiatives.

Success factors

The literature highlights among success factors that the need to involve citizens should be in the process from its early stage so that all views can be heard. Moreover, the topic should matter to attract all identified stakeholders, communication and expectations should be clear to ensure mutual trust. Depending on the complexity and longevity of the topic, it should be carefully considered which key stakeholders are necessary to be involved in the planning process, and if there are other groups and actors that need to be informed. The engagement methods which need to be used need to be adjusted to the different roles of these groups.[435] The national context also plays a determining role in the process and to what extent participatory and co-creation can be successful. This holds true for most types of citizen engagement. For instance, according to the project coordinator of the EmPaci Interreg project, great differences within the Baltic Sea region exist, whereas the concept was widely accepted in Finland, this was not the case in Latvia and Lithuania.[436]

Participatory and co-creation activities are already used to involve citizens in the decision-making process in the Lighthouse area and the Mission can build on those activities in the future regarding foreseen open governance processes. The next phase of review and monitoring of the national MSPs of the countries with wide involvement of stakeholders could be used to introduce and promote Mission objectives. These stakeholder forums could also be asked to provide suggestions for respective implementation.

---

[435] https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0253166&type=printable

[436] https://interreg-baltic.eu/all/how-citizens-drive-favorable-change-in-the-baltic-sea-region/

9.1.4. Social innovations resulting in engaged citizens and public mobilization

Definition and background information

Social innovations are new solutions (products, services, models, markets, processes etc.) that simultaneously meet a social need (more effectively than existing solutions) and lead to new or improved capabilities and relationships and better use of assets and resources.[437] In the context of the blue economy, this implies innovations that affect policy, address societal challenges, make use of innovative methods of citizen engagement and involve multiple stakeholders all related to the sea, water or ocean. Social innovation is the type of citizen engagement that is the most difficult to achieve, as it requires stakeholders to be aligned and ready to solve common challenges. However, at the same time, social innovation has the highest potential to have impact and to deliver on the Mission objectives.

Social innovation is a relatively novel way of taking along different stakeholders into societal changes. It requires a changed mindset, where the different stakeholders (with all different objectives and backgrounds) need to find the middle ground between their different ideas and values.

The Mission Implementation Plan reflects on the mobilisation of citizens as a means to achieve the objectives of the Mission: "To empower and activate citizens to take action, the Mission will promote the practice of social innovation and ocean and water citizen stewardship, where appropriate through the voluntary European Solidarity Corps. It will leverage social innovation throughout the co-design, co-development, co-implementation, and co-monitoring of solutions for sustainable use of the ocean and waters."[438] It must be ensured that the transitions are widely supported by the general public. Only then will it be possible to achieve the ambitious objectives of the Mission. Therefore, it is very important to bring together the stakeholders and align their goals, objectives and visions. Once the alignment process between the different stakeholders has been achieved, social innovations can optimally be developed and used.

Social innovations in the lighthouse area

In literature, it has been shown that the level of trust between different actors plays an important role in the success rate of the development of social innovations. For instance, as part of a study on social innovation in the North Sea, researchers interviewed industry stakeholders from the mussel cultivation industry. This research highlighted that the levels of trust between mussel

---

[437] The Young Foundation, Social Innovation Overview, A deliverable of the project: "The theoretical, empirical and policy foundations for building social innovation in Europe" (TEPSIE), European Commission – 7th Framework

[438] https://ec.europa.eu/info/sites/default/files/research_and_innovation/funding/documents/ocean_and_waters_implementation_plan_for_publication.pdf

cultivators and the Dutch government are low. This subsequently makes the mussel cultivators averse to change their current practices to the cultivation of mussels in offshore regions, which could be seen as an innovative way to reach societal goals, while also providing innovative input into the industry.[439] For social innovation to reach maximum impact, it is therefore vital that the different actors experience trust between each other and that both the public as well as private actors understand each other.

Several interviewees also stressed the importance of the involvement of intermediaries or other organisations that aim to increase the participation of all stakeholders. For instance, it was mentioned that companies collaborate with NGOs to get their social innovation to reach their targeted audience (e.g., citizens). This is similar to the Entrepreneurial Discovery Process, where including all stakeholders throughout the process of sustainable and inclusive policymaking is key to achieving sustainable innovation strategies.[440]

A notable method through which community-led innovations can be promoted is crowdfunding. Crowdfunding allows companies or projects to receive funding from a large group of individuals. Typically, individuals invest in companies or projects in which they believe. Therefore, crowdfunding can be seen as a way to finance companies with a vision or mission that resonates with the general public. As the objective of the Mission also touches upon great challenges that peak to people's imagination, this method of fostering (social) innovations can play an important role in achieving the Mission objectives. For instance, in the context of the Lighthouse area, in 2020 the Scottish company Orbital Marine Power was partially funded by crowdfunding, just like the Danish wave energy company Wavepiston and the tidal energy company QED Naval.[441] Similarly the Interreg MED BLUE CROWDFUNDING-project, although it takes place in a different Lighthouse area, aims to inform the public on the possibilities of crowdfunding and crowdsourcing to fund, test and validate innovative blue economy products and services. Some of the topics that are in scope of the Mission could resonate very well with the general public, such as renewable energy, low-carbon aquaculture, algae production, and restoration ocean farming. This makes crowdfunding in these specific areas interesting.

An alternative way to foster social innovations is with the help of finance organisations and/or funds with a mandate to contribute to some of the Mission objectives. More recently, sustainable finance gained importance in the financial world. Many firms introduced ESG goals into their investment practices. Therefore, thematic funds or companies that specifically focus on investing in marine products, projects or firms can play a pivotal role in fostering social innovations. For instance, through the 2021 latest round of the Baltic Sea Action Plan Fund 15 projects are financed. This fund is a key instrument specifically

[439] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3710713

[440] The Entrepreneurial Discovery Process (EDP) is an interactive and inclusive process, where relevant actors identify new opportunities and inform governments. The government then assesses the information received and empowers actors to realise the potential. The chapter 8 on Smart Specialisation and other Strategies also touches upon the EDP.

[441] https://www.offshore-energy.biz/marine-energy-companies-ride-crowdfunding-success-wave/

aimed to accelerate the implementation of the Baltic Sea Action Plan defined by HELCOM. This means that the projects that are funded through this fund have a specific social aspect to them, namely to improve the environmental status of the Baltic Sea. Similarly, the European Investment Bank Group is also involved in multiple activities, such as the European Maritime Fisheries and Aquaculture Fund (EMFAF), BlueInvest and the Clean Ocean Initiative, to foster the access to financing blue economy projects that simultaneously contribute to the Mission objectives.

Similarly, tech hubs (business incubators/accelerators, technology centres) with a specific goal (in this case to promote activities related to the Blue economy) also act as good catalysts of social innovations. It helps innovative projects on multiple fronts: to develop and test their solutions; build valuable partnerships; give access to cutting-edge infrastructures and expertise. Throughout the Lighthouse area several incubators specifically related to the Blue economy exist. For example, at the Port of Amsterdam the incubator Prodock has been operational since 2016. Another example includes the Alliance + Accelerator supported by Submariner Network.[442] The main benefit of these types of accelerators is that they bring together different stakeholders with common goals, thereby effectively and efficiently contribution to the Mission objectives. As is exemplified by the French and Dutch example, these incubators can be located close to important marine locations, such as an aquarium or in an important port.

Finally, Interreg projects can also play an important role in stimulating social innovations. As Interreg projects aim to support (regional and international) cooperation that tackles common issues, Interreg is in a perfect position to encourage social innovations. For instance, the Interreg 2 Seas Programme has dedicated objectives aimed to foster social innovations which subsequently support the programme's objectives (specifically to contribute to increase the delivery of technological innovation and to enhance the uptake of innovative low-carbon technologies).[443] While the majority of the social innovation projects funded by the Interreg 2 Seas Programme are not relevant to the Mission Objectives, one project stands out. The FLAVOUR (Food surplus and Labour, the Valorisation of Underused Resources) project aims to investigate socially innovative business models that deal with food surplus more effectively and efficiently.[444] Currently, there is much food waste, therefore an improvement in the situation can both decrease the number of food waste and decrease the pressure on the environment, while creating employment. The project was inspired by the Le Panier de la Mer organisation, which also is partner of FLAVOUR, who redistribute left-over fish.

<u>Success factors</u>

Out of the different citizen engagement strategies covered in this section, social innovations are the most difficult to achieve. However, if successful, this type of citizen engagement possibly has the largest impact, since it solves both unmet

[442] https://www.submariner-network.eu/apply-for-alliance-accelerator

[443] https://www.interreg2seas.eu/en/content/social-innovation

[444] https://flavour2seas.eu/en/

social needs and provides the general public with the opportunity to act more effectively to achieve the Mission Objectives. To foster social innovation, relevant stakeholders should be identified, and their respective perspectives should be known. In the next step, the stakeholders should be brought together to find a common ground, in terms of shared values, needs and goals. If all stakeholders are on the same level (which is the case with crowdfunding, the incubators and thematic funds) and have a similar goal in mind, the perquisites for social innovations are open. We recommend that the Mission supports collaboration between the blue economy actors and NGOs on specific topics to ensure citizen engagement in social innovation. Such collaboration could involve joint initiatives, formulation of common goals or themes on which stakeholders work in parallel.

9.2. Methodology

This sub-chapter presents the methodology for the two research activities that entail data collection within this research. First, the compilation of the database of citizen engagement activities that will result in the analysis of citizen engagement activities and processes at an aggregate level. Second, for the performance and analysis of interviews with organisations that have extensive experience in conducting citizen engagement activities in the lighthouse area, resulting in findings at the activity level. For these purposes, this chapter elaborates on the scope of the research (chapter 9.2.1), methods employed in the compilation of the database that lists relevant citizen engagement activities (chapter 9.2.2), composition of the database (chapter 9.2.3), and the criteria for selection of interviewees (chapter 9.2.4).

9.2.1. Scope and focus of the research

In this research, a citizen engagement activity is defined as an act of interaction between the organiser(s) of the activity and its participants. This implies the presence of institutionalised structures that organise citizen engagement activities and invite the public to participate in them. Thus, activities that are organised by citizens and do not lead to interaction with institutional stakeholders, such as NGOs, academia, government, and industry organisations during the design and implementation phase are not included in the scope of the research. Such activities belong to public activism rather to citizen engagement. In general, public activism, especially those forms of public activism that are associated with political activism, are expressed in demonstrations, boycotts, and strikes. Such activities might prevent collaboration between stakeholders that is necessary for implementation of the Mission. Hence, they are excluded from the research scope.

Apart from conceptual considerations, the selected definition of citizen engagement activities is based on practical, methodological issues. An activity that has been designed and implemented only by citizens is unlikely to be recorded and published in an open source. Thus, it will not be possible to identify them during the desk research.

Similarly, a citizen engagement activity that makes a citizen only the recipient of information, such as a public information activity, is excluded from the scope of the research. In case of education and awareness raising activities, only those activities that lead to information/consultation with the citizens, when an activity has been co-designed or tailored to citizens based on feedback, is considered a citizen engagement activity.

The research focuses on four, previously mentioned, types of citizen engagement activities (e.g., water and ocean literacy activities, citizen science activities, activities that use participatory and co-creation processes, and social innovations resulting in engaged citizens and public mobilisation) that have been conducted in the Baltic and/or North Sea region in the maritime sector. Given that activities that use participatory and co-creation processes are not uniformly defined, the research team has assigned an activity to this category if it aims at increasing participation, co-creation and decision-making, or it refers to a practical, creative activity/process that is not directly related to increasing knowledge (such as ocean literacy), supporting science (such as citizen science) or to stimulate industrial/product innovation (such as social innovation). The social innovations resulting in engaged citizens and public mobilisation within the scope of this research include activities that are related to supporting the design, implementation or promotion of social innovation.

Originally, the research aimed at citizen engagement activities conducted in the six thematic areas that are in the focus of the study (maritime transport, maritime ports & facilities, offshore renewable energy facilities, offshore renewable energy storage facilities, multipurpose platforms, and aquaculture). However, the literature review and the preliminary mapping of citizen engagement activities revealed that citizen engagement activities in these thematic areas are rare for several reasons. First, many of these areas are novel and the public lacks awareness of their potential or existing impact. Second, these areas have a technical focus, which requires professional knowledge to engage in a dialogue with decision/policymakers or other relevant stakeholders. This already indicates the Mission should carefully select areas and issues that could be appealing and useful for the public to engage.

In light of the above, the research team decided to expand the scope of the research and focus on citizen engagement activities in the maritime sector that are linked to the Mission objective in general - sustainability, carbon-neutrality and circularity of the blue economy. This will also help to establish in what thematic areas it is useful to engage with citizens.

As it was mentioned earlier, citizen engagement may occur in institutions, processes (i.e., political process) or specific activities/undertakings, such as projects, campaigns, initiatives. This research will focus on the analysis of citizen engagement activities in the latter case, as, according to the Mission Implementation Plan "Restore our Ocean and Waters by 2030", the Mission aims to mobilise the public in specific activities, such as Citizen Science projects, ocean literacy campaigns, and social innovation. Based on this, the starting unit of analysis is the activity/undertaking within which a citizen engagement activity has been organised. To avoid confusion between the citizen engagement activity and an activity within which citizen engagement activity is organised (e.g., project), the latter will be denoted as an activity/undertaking throughout the research.

To ensure relevance of findings and recommendations it is critical to identify and analyse citizen engagement activities that have been conducted recently (in the last 3 years) and have a significant citizen engagement focus. The indicators for this, as well as the selection and exclusion criteria for all above-listed aspects are summarised in Table 60. The size of the citizen engagement activity has been difficult to determine, due to lack of information about the number of participants or impacts. The team strived to map larger activities, but it has not been included as an explicit criterion.

Table 60 Scope of the research for mapping and analysis of relevant citizen engagement activities

Scope of the research	Selection criteria	Justification for selection	Exclusion criteria	Justification for exclusion
Type of citizen-related processes in focus of the research	Citizen engagement – a process that implies two-way interaction between the organiser(s) and the participant(s)	This is in line with the purpose of the research, and it will allow to develop recommendations on how to mobilise citizens towards the implementation of the Mission objectives	Citizen-related process that imply one-way communication between the organiser(s) and the participant(s). This includes public activism, citizen communication, dissemination, public information sharing	These processes would shed little insight on effective citizen mobilisation and collaboration
Types of citizen engagement activities	Water and ocean literacy activity, training and education activity related to blue economy (excluding professional training and education activities that result in certification) Citizen science activity Activity that uses participatory and co-creation processes to implement measures and actions relevant for blue economy and for the Mission objective Social innovation resulting in engaged citizens and public mobilisation	These types of citizen engagement activities have been defined in the Terms of Reference by the European Commission. The exclusion of professional training and education activities is necessary to avoid inclusion of traditional educational activities that do not focus on citizen engagement	Other types of citizen engagement activities	They are outside the scope of the research

Thematic focus of citizen engagement activities	Maritime/marine sector and its related thematic areas (e.g., sustainability, circular economy, aquaculture).	Relevant for the implementation of the Mission in the Lighthouse area. The list of related thematic areas has not been definitive during the mapping, given a broad scope of the Mission objective	Activities in non-marine/maritime related thematic areas	This falls outside the scope of the Mission
Geographic scope of citizen engagement activities	An activity should be conducted in at least one country of the Baltic or North Sea region. This includes Belgium, Denmark, Estonia, Finland, France, Germany, Latvia, Lithuania, Netherlands, Norway, Poland, Russia, Sweden, United Kingdom.	This is in line with the geographic scope of the Mission in the Lighthouse area	An activity that has not involved citizens in at least one country of the Baltic or North Sea region	This falls outside the scope of the Mission
Type of activities/undertakings within which citizen engagement is conducted	Projects, programmes, initiatives, events, public campaigns	Based on the desk research, these are the most common types of activities/undertakings within which citizen engagement is conducted. However, this list has not been definitive, as other types of activities/undertakings could be added if they include a two-way engagement process between the organiser(s) and the participant(s)	Forms of public activism, especially those that are typically associated with political activism and disobedience – boycotts, strikes, demonstrations, protests	These forms of public activism are typically destructive for collaboration that is necessary for the implementation of the Mission objective
Relevance of the activities/undertakings within which citizen engagement is conducted	An activity/undertaking has a significant citizen engagement focus, indicated by at least one of the following criteria: An activity/undertaking has an aim/objective to engage with the public or its specific groups (e.g., youth, teachers, entrepreneurs)	Such relevance criteria will ensure that collected and analysed activities/undertakings have a significant citizen engagement element. Thus, they are expected to provide useful findings and insight to develop recommendations for the Mission implementation in the Lighthouse area	An activity/undertaking that does not fit the criteria	An analysis would not produce useful findings

	An activity/undertaking used multiple (more than one) citizen engagement methods An activity/undertaking conducted at least one long-term citizen engagement activity (for at least half a year) An activity/undertaking conducted at impactful citizen engagement activity (it involved more than 100 participants or presented other successful results/impacts)			
Period of implementation of the citizen engagement activities	Activities that either started, ended or continue to be active during the period: January 2019 – January 2022. This includes activities that: started prior to January 2019 but ended by January 2022 or are still ongoing, started between January 2019 and ended by January 2022 or are still ongoing	The research seeks to analyse recent citizen engagement activities, meaning those that have been active in the last 3 years, to ensure relevance of findings. In addition, the research accounts for practical considerations – availability of data on the Internet about the activities.	Activities that ended prior to January 2019	This could reduce relevance of research findings and lead to gaps in available data

Source: own production, 2022

9.2.2. Methods of mapping of relevant citizen engagement activities

The research used three methods for mapping of relevant citizen engagement activities. The term “relevant” refers to activities that fall in the research scope, as explained in the previous chapter. These methods include:

- Literature review;
- Desk research of the official webpages of non-governmental organisations and of macroregional organisations mentioned in the report on Governance in the Lighthouse area (DEL4, chapter 7);
- Desk research that used keywords during the Internet search.

These methods are discussed in more detail below.

The literature review focused on identification of relevant citizen engagement activities, or on identification of sources that could lead to such activities. Among such sources were listed databases and platforms on citizen engagement activities, relevant organisations, and activities/undertakings within which citizen engagement activities were organised. The literature review has been conducted for each type of the citizen engagement activity that is in the scope of research. The snowballing effect during the literature review facilitated the search of relevant activities.

During the literature review the research team came across 22 organisations or platforms that contained a repository of some types of relevant citizen engagement activities and/or pointed to other useful data sources (e.g. organisations, databases, and activities/undertakings within which citizen engagement activities were organised). These were found particularly useful for the research; therefore they are presented in Table 61. All relevant data from their webpages has been extracted and recorded in the research database.

Table 61 List of organisations or platforms that facilitated the mapping of relevant citizen engagement activities

Name of the organisation or platform	Short description of the source	Official webpage
EU4Ocean	The EU4Ocean Platform is part of the EU4Ocean Coalition, which connects diverse organisations, projects and people that contribute to ocean literacy and the sustainable management of the ocean.	https://www.eurocean.org/np4/1666.html
Youth4Ocean Forum	The Youth4Ocean Forum is the second part of EU4Ocean Coalition - a free platform for young ocean changemakers between ages 16 and 30. The platform provides opportunities to speak up for young generation, share ideas, present projects and connect with like-minded young people and experts all over Europe.	https://webgate.ec.europa.eu/maritimeforum/en/frontpage/1484
Network of European Blue Schools	The Network of European Blue Schools is the third compound of EU4Ocean Coalition. The Network aims to inspire educators, to challenge their students of all age groups and education levels to develop a “Find the blue” project that links them to the ocean or the sea. By	https://webgate.ec.europa.eu/maritimeforum/en/frontpage/1485

	successfully completing the project and sharing its results, schools will receive the European Blue School label.	
European Network Science Centres & Museums	This network connects more than 320 science engagement organisations and professionals, extending the reach and strengthening the impact of their work. Network members participate in European projects, share knowledge and work together on key topics.	https://www.ecsite.eu/
Ocean edge directory	A product of the SeaChange project, the database contains a collection of educational resources and activities that are either available as downloadable products or serve as an inspiration to help you to share ocean knowledge to any type of audience. It includes both formal and informal learning resources developed in the framework of European projects, or projects with a European involvement.	https://www.seachangeproject.eu/seachange-about-4/campaign/sea-change-database
EU-Citizen.Science	It is an online platform for sharing knowledge, tools, training and resources for citizen science. The vision for the platform is to serve as a Knowledge Hub and to become the European reference point for citizen science in aid of its mainstreaming.	https://eu-citizen.science/
EurOcean	EurOcean is an independent, non-profit, scientific organization, which supports European Ocean Science and Technology advances, by fostering information exchange, interaction, and innovation among its members, the ocean community, and society.	https://www.eurocean.org
World ocean network	Network is an international organisation promoting public awareness about the importance of the Ocean for humanity, about the impact of humans' behaviour on the environment and by uniting everyone around the goal of preserving the Global Ocean.	https://www.worldoceannetwork.org/en/about-us/
European association of Zoos and Aquaria	Association is a membership organisation of the leading zoos and aquaria in Europe and Western Asia. Its mission is to facilitate cooperation within the European zoo and aquaria community towards the goals of education, research and conservation.	https://www.eaza.net/about-us/
Iedereen wetenschapper	The platform “Iedereen wetenschapper” (Everyone Scientist in Dutch) brings together as many Citizen Science projects as possible: scientific studies in which non-scientists can participate.	https://www.iedereenwetenschapper.be
Zooniverse	Zooniverse is the world’s largest and most popular platform for people-powered research. This research is made possible by volunteers who come together to assist professional researchers. Platform's goal is to enable research that would not be possible, or practical, otherwise.	https://www.zooniverse.org/about
Bürger schaffen Wissen	Bürger schaffen Wissen (citizens create knowledge) is the central platform for citizen science in Germany. The platform presents, connects and supports Citizen Science projects. Its main purpose is to give an overview of citizen science projects to illustrate the concept of citizen science, to further develop the landscape of citizen science and so increase its visibility.	https://www.buergerschaffenwissen.de/
meeresbuerger.de	The network/project shows concrete ways in which everyone can make their contribution to protecting the oceans. Educating about the need for marine protected areas is also key. The focus is on the North and Baltic Seas and the watercourses connected to them.	https://www.meeresbuerger.de/netzwerk-koordinator.html
European Alien Species	EASIN is an initiative of the Joint Research Centre of the European Commission. Network facilitates the	https://easin.jrc.ec.europa.eu/easin/E

Information Network (EASIN)	exploration of existing Alien Species information from a variety of distributed information sources through freely available tools and interoperable web services. The tools and services can be used freely and independently by policy makers, researchers, stakeholders and users from the public.	ASINNutshell
National Biodiversity Network	The National Biodiversity Network is a collaborative partnership created to exchange biodiversity information. Wildlife data are recorded by many organisations and people, collected together using a range of systems, verified by experts, curated by a wide range of organisations and then aggregated and shared regionally.	https://nbn.org.uk/about-us/who-we-are/
Scistarter.org	SciStarter is a globally acclaimed, online citizen science hub where more than 3,000 projects have been registered by individual project leaders or imported through partnerships with governments, NGOs, and universities.	https://scistarter.org/about
Scotland's environment citizen science portal	The portal helps to bring information on a variety of projects into one place, covering diverse topics. It brings together volunteers who are already taking part in a Citizen Science project or are looking for a new project, and the organisers of Citizen Science projects in the Scottish Environment Protection Agency.	https://envscot-csportal.org.uk
Submariner Network	The Network is a platform that brings actors from the Baltic Sea Region together to actively promote innovative and sustainable uses of marine resources. It operates across the knowledge triangle integrating perspectives from local to international scale, different science disciplines as well as policy and economic stakeholders.	https://www.submariner-network.eu/about-us
Citizen-science.at	The Citizen Science Network Austria with the associated online platform Österreich forscht is a network of institutions from the fields of science, research, education and practice.	https://www.citizen-science.at/en/about
European Citizen Science Association	Association supports the exploration of how citizen science should be understood and practised, and help to shape different aspects of the citizen science movement, in Europe and around the world.	https://ecsa.citizen-science.net

Source: own production, 2022

The second research method employed has been desk research of the official webpages of non-governmental organisations and of regional/macroregional organisations mentioned in the report on Governance in the Lighthouse area (Task 3, chapter 1). As stated earlier, the NGOs have been traditionally interacting with the communities and conducting different types of citizen engagement activities.

The webpages of the macroregional/regional organisations that are involved in the governance of the Lighthouse area have also been checked, given the macroregional/regional focus of the research and their connectivity to various organisations in the Baltic and North Sea basin. Thus, Task 3 contributed to Task 5 of the Lighthouse project, supporting continuity between Tasks and increasing efficiency of the research. This method proved to be effective, as a large number of identified organisations, especially NGOs, have been conducting citizen engagement activities.

The third research method was desk research using specific keywords. This method entailed a rigorous Internet search at the macroregional and country levels, meaning that the keywords had been tested with the terms “Baltic Sea”, “North Sea”, and with the name of each country (Belgium, Denmark, Estonia etc.) that is in the scope of the research.

The list of keywords has been developed for each type of the citizen engagement activity through multiple iterations. Following several sounds of testing and analysis of displayed results, two categories of keywords have been developed. The first category “selected keywords” represents the main set of keywords that had to be tested at macroregional and national levels. The second category “broader list of keywords” represents a list of alternative, supporting keywords that could be used if the search results based on “selected keywords” do not display expected or meaningful information.

This approach increased the chances of identifying relevant citizen engagement activities and allowed for necessary variation of the keywords to account for linguistic differences, given that the keywords were tested in both the English and the national languages. In addition, to improve effectiveness of displayed results the research team also added neutral terms, such as “project”, “initiative”, “event”, and “campaign”. The limitation of such approach is that it does not use one standardised keyword for each type of the citizen engagement activity and therefore distorts the number of activities that would be identified using one keyword. However, considering that our research uses several research methods to map relevant citizen engagement activities and does not seek to determine the most effective of these methods or keywords that produce most meaningful results for a specific country or type of activity, this limitation is not been considered critical for the research.

Table 62 presents the keywords that have been used for the mapping of relevant citizen engagement activities. It shows that apart from the five types of citizen engagement activities, the generic keywords have been employed.

Table 62 Keywords used for mapping of relevant citizen engagement activities

Type of citizen engagement activities	Selected keywords	Broader list of keywords
Generic	Marine citizen engagement	Maritime citizen engagement, marine civic engagement
Water and ocean literacy activity, training and education activities related to Blue economy	Water literacy, ocean literacy, marine training	Maritime literacy, water literacy, water literacy public participation, ocean literacy public participation, maritime training, water training, capacity building training marine, public marine training, marine learning
Citizen science activity	Marine citizen science	Maritime citizen science, citizen science in marine research
Activity that uses participatory and co-creation processes to implement measures and actions relevant for the Blue economy and for the Mission objective	Co-creation citizen marine, citizen participation marine	Citizen involvement marine, citizen participation maritime, citizen participation water, co-creation citizen water, co-creation public marine
Social innovations implemented in the Lighthouse area resulting in engaged citizens and public mobilization	Social innovation citizen marine	Social innovation citizen engagement, social innovation citizen water, social innovation public marine

Source: own production, 2022

During the compilation of the database, the project team came across organisations that, based on their official webpages, conducted a large number of activities/undertakings during the designated period (January 2019 – January 2022). To prevent the dominance of several organisations in the database and a consequent bias in the analysis, the limit for the inclusion of relevant activities/undertakings in the database was set. Namely, if the number of such activities/undertakings is more than 4 during the designated period, then the project team should record only 3 most relevant activities/undertakings of that organisation. Such limit was set only for per webpage. Thus, if the activity was identified on another webpage or if an organisation participated as a partner in several activities, it was still included in the database. This approach allowed the project team to identify the so-called champions in citizen engagement activities and to limit the prevalence bias.

The discussion in the literature highlights that many citizen engagement activities, including Citizen Science, activities that use co-creation approaches or in social innovation, are not reported. Therefore it is not always possible to collect information through desk research, presenting the limitation of the current research methods. Given the large volume of citizen engagement activities, their identification could continue for several more months to get a full list of activities that fit the scope. Nevertheless, the process of mapping stopped once the research team used above-presented methods. This implies that the compiled database is a sample of relevant citizen engagement activities that have been conducted in the Lighthouse area, which should however be sufficiently representative, as the research team recorded all citizen engagement activities it has come across during the research.

9.2.3. Composition of the database

To ensure sufficient quality of data, the team used data only from official, publicly accessible online sources. Nevertheless, some data has been missing or not clearly stated in a source. In such cases, the team did not record data in the database, leaving an empty cell, or made a logical assumption/extrapolation when it was possible.

The database recorded different types of information about the citizen engagement activities and of activities within which they have organised. Table 63 provides details on types of collected information and methodological clarifications on categories of collected data or ways of data recording.

Table 63 Composition of the database and methodological clarifications

Name	Methodological clarifications
Name of the activity/undertaking within which citizen engagement is organised	Name of the activity in local language and in English in brackets
Type of activity/undertaking within which citizen engagement is organised (e.g., project, event, initiative, programme, campaign).	Type of activity/undertaking as it is described on the website of the activity. The list of these types was not restrictive and could include types beyond those listed.
Date when the activity/undertaking was organized (dd/mm/yyyy)	Start and end date of the activity/undertaking (dd/mm/yyyy) has been indicated if data was available. If the activity started in a specific year (i.e., in 2015) and is ongoing, then information was recorded "Since 2015". If there is no information on the website when it started, but it is still ongoing, then it was recorded "Ongoing".
Organiser(s) of the activity/undertaking	This column presented the list of organisers, starting with the main organiser.
Sector in which the organiser is involved (government, academia, industry, civil society)	This column allowed only 4 answer categories - government, academia, industry, civil society
Location in which the activity/undertaking is organised (name of the country)	Name of the country(ies) where citizen engagement activities were organised have been recorded
Type of citizen engagement activity (Water/ocean literacy, Citizen science, Participatory process, Social innovations)	This column allowed only 4 answer categories - Water/ocean literacy, Citizen science, Participatory process, Social innovations. Education and training activities have been included in Water/ocean literacy category.
Level of citizen engagement (international, European, macroregional, national, regional/local)	Five answer options were offered: -If an activity is organized in several countries beyond the EU, then it is international. -If an activity was organized in several EU countries then it is European. -If an activity was organized in several countries of the Baltic/North Sea region then it's macroregional. -If an activity was organized in one country then it's national. -If an activity was organized in one region or community within one country then it's regional/local.
Target group of the citizen engagement	The list of target groups was not restrictive, although once data was collected it was sorted into specific groups to facilitate the analysis. If the activity targeted all members of the civil society then it has been recorded "general public".
Degree of citizen engagement in an activity/undertaking (e.g., Information/Consultation, Collaboration, Empowerment)	Three answer options were allowed. They indicate the perceived degree of the decision-making power and of the type of activities in which citizens were involved. -Information/Consultation refers to a low degree of decision-making power when citizens are invited to learn about an issue, provide feedback and suggest ideas. -Collaboration refers to a moderate degree of decision-making power when citizens take some part in the decision-making process.

	-Empowerment refers to cases when a larger share or full decision-making power is in the hands of citizens.
Method of citizen engagement	The methods of citizen engagement refer to activities or formats of those activities in which citizens have been involved. This may include workshops, focus groups, platforms for co-creation, citizens, jury panels. The list of methods of citizen engagement was not restrictive, but it was later sorted into specific groups of methods to facilitate the analysis.
Thematic area of the activity/undertaking (e.g. aquaculture, renewable energy)	The list of thematic area of the activity/undertaking was not restrictive, but it was later sorted into specific categories to facilitate the analysis.
Short description of the of the activity/undertaking and/or of the citizen engagement activity (e.g., purpose, number of participants, effectiveness/impact)	This column included information on the aims/purposes, number of participants, effectiveness/impact of the activity/undertaking and/or of the citizen engagement activity. This depended on available information.
Source of information about the activity (website)	Webpage where information was found.

Source: own production, 2022

9.2.4. Selection of interviewees

Given that interviews are expected to highlight factors determining the success of citizen engagement activities as a basis for developing recommendations for the implementation of the Mission in the Lighthouse area, a key selection criterion of interviewees was having significant experience in organising citizen engagement activities. This has been measured by the number and scale of performed citizen engagement activities. The indicators for the scale include the number of years during which the activity has been running, the number of participants involved, the number of countries that have been involved, and the results/impacts that the activity had.

In addition, the overall composition of selected interviewees should ensure diversity in terms of:

- conducted citizen engagement activities to draw lessons for all types of activities that are in the scope of research,
- organisations that conducted citizen engagement activities to learn from experiences of various organisations, to analyse different methods of citizen engagement and the role different types of organisations,
- geographic diversity in terms of where the organisations are conducting citizen engagement activities,
- diversity of topics that will be discussed (e.g., methods of citizen engagement, degrees of citizen involvement, use of digital technologies in citizen engagement activities).
- Lastly, the research team prioritised organisations that have been conducting citizen engagement activities in several countries of the Baltic and North Sea basin to gain insight on specificities of activities at a macroregional level.

Such criteria resulted in the selection of the following ten organisations for interview (Table 64). The interviews were conducted in a semi-structured format, using questions from the interview guide (Appendix A) to open the discussion.

Table 64 Selection of interviewed organisations

Name of the organisation	Type of organisation	Country/region where the organisation is based	Type(s) of citizen engagement activities that an organisation conduct(s)	Experience in citizen engagement activities at macro-regional level
Nausicaa Centre National de la Mer	Aquarium	France	Ocean and water literacy, training and education, citizen science activities, social innovation activities	Yes
Marine Conservation Society	Volunteer-based NGO	United Kingdom	Ocean and water literacy, training and education, citizen science activities	Yes
Flanders Marine	Research organisation	Belgium	Ocean and water literacy, training and education,	Yes

Institute			citizen science activities	
CPMR North Sea Commission	Government organisation at a macroregional level	Sweden (North Sea region)	Activities that use participatory and co-creation processes, ocean and water literacy, training and education	Yes
Baltic Environmental Forum Germany	Professional NGO	Germany	Activities that use participatory and co-creation processes, ocean and water literacy, training and education, social innovation activities, citizen science activities	Yes
Submariner Network	Network-focused NGO (at a macroregional level)	Germany (Baltic Sea region)	Social innovation activities, activities that use participatory and co-creation processes, ocean and water literacy, training and education, citizen science activities	Yes
Institute of Oceanology of the Polish Academy of Sciences	Research organisation	Poland	Citizen science activities, ocean and water literacy, training and education	Yes
Fjord CleanUP	Grassroot organisation	Norway	Activities that use participatory and co-creation processes, social innovation activities	No
Tartu Nature House	Professional NGO	Estonia	Ocean and water literacy, training and education, citizen science activities	Yes
KIMO	Network for government organisations	United Kingdom (Baltic and North Sea region)	Ocean and water literacy, training and education, activities that use participatory and co-creation processes, citizen science activities, social innovation activities	Yes

Source: own production, 2022

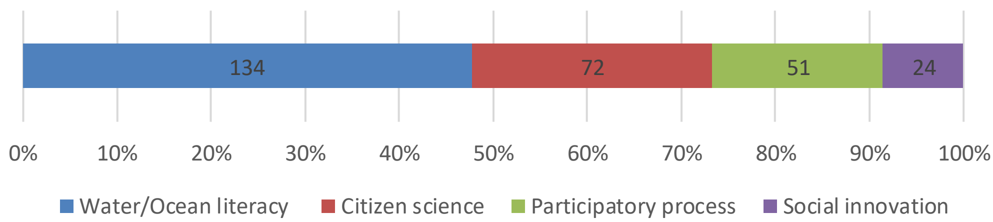
9.3. Analysis of the citizen engagement activities and processes at an aggregate level

This chapter presents the analysis of citizen engagement activities and processes at an aggregate level, based on a compiled database. It presents main findings per topic in focus. Throughout the chapter, examples of citizen engagement activities are presented in boxes to better illustrate findings.

9.3.1. Overview of the types of citizen engagement activities and methods of engagement

The researchers found 281 relevant citizen engagement activities and processes that focused on the Baltic and North Sea basins. Among them, the most common type of the citizen engagement activity is water and/or ocean literacy (133, 47%) (Figure 55). This group includes all other education and training activities in the blue sector. The prevalent methods of citizen engagement within these type of activities are education classes, workshops, conferences, and webinars. Among other activities are listed learning platforms, lectures, school projects, exhibitions, field trips, interactive exercises, quizzes and games.

Figure 55 Types of citizen engagement activities mapped



Source: compiled database*, 2022.*

Box 19 Den spiselige havnatur (the edible coast nature)

This project set up by Havhøst invites general public (but especially youth) from Denmark to discover which things you can eat at the surface and the bottom of the ocean, and how to do so sustainably. The project also teaches how to treat the marine ecosystem responsibly. Since 2018, thousands have already participated in the exhibition, that is using both interactive and consultative elements in their citizen engagement model. Its ultimate aim is to create awareness about aquaculture.

Source: Havhøst*, 2022.*

The Citizen Science activities were the second most frequently occurring type of activities (72, 25%). These activities involved members of the public in the scientific studies, usually by contributing to the data collection processes. This was the case for 53 out of the 72 citizen science activities that the researchers found. Citizens have been asked to report on, for example, bycatch of recreational fisherman, algae-blooms that they came across or sightings of different animals. This data has been often entered through mobile applications or websites/platforms. Other methods of engagement with the citizens which were listed included public events, seminars, debates, hackathons and workshops. During these activities, citizens have been consulted on an issue and it served as a research input.

Box 20 Grote Schelpendag (big Shell-day)

This citizen science activity invites everyone to join with the goal of collecting data on the beach on biodiversity that researchers can use. A consortium of institutes organised this activity, including the Flemish Marine Institute VLIZ. There have been 5 annual editions already in Belgium, while in 2022 the first Dutch edition has taken place. In 2022, 750 Belgium citizens collected ca. 38,000 shells, while in the Netherlands ca. 200 people collected 20,000 shells. In the Netherlands this was organised at 7 locations and a workshop was part of the activity. Belgium picked 10 locations in 2022 and organised 3 workshops.

Source: Grote Schelpendag, 2022

According to Figure 55, around 18% (51) of mapped citizen engagement activities have been implemented by using a participatory/co-creation process. The most common activity within this method of citizen engagement is the cleaning event, in particular a beach or ocean cleaning event. It represents over 40% of all activities that have been organised within this type. Other methods of engagement listed were competitions, awareness raising campaigns and webinars, workshops or conferences that focused on policy/decision-making processes. In most cases, these were organised for a consultation/co-creation of the maritime spatial planning.

Box 21 Mana jūra (My Sea)

A campaign organised by The Foundation for Environmental Education to unite the Latvian society in a joint effort of protecting the coast and Baltic Sea. Since 2011, the Foundation organises beach clean-up walks that take several days and cover the whole coastline of Latvia. Around 100 to 200 citizens take part in this activity every year.

Source: Foundation for Environmental Education, 2022

Based on collected data, the rarest type of the citizen engagement activity is related to social innovation. It included activities that aim to address societal needs or are associated with innovation in relation to citizens. Methods of engagement associated with these types of activities include co-operation platforms aimed at building transnational innovation partnerships or at generating ideas for urban, sustainable development, crowdfunding events or campaigns, hackathons, and projects/platforms that connect entrepreneurs with the civil society to pitch and test new ideas, products.

Box 22 Blue-Cloud hackathon

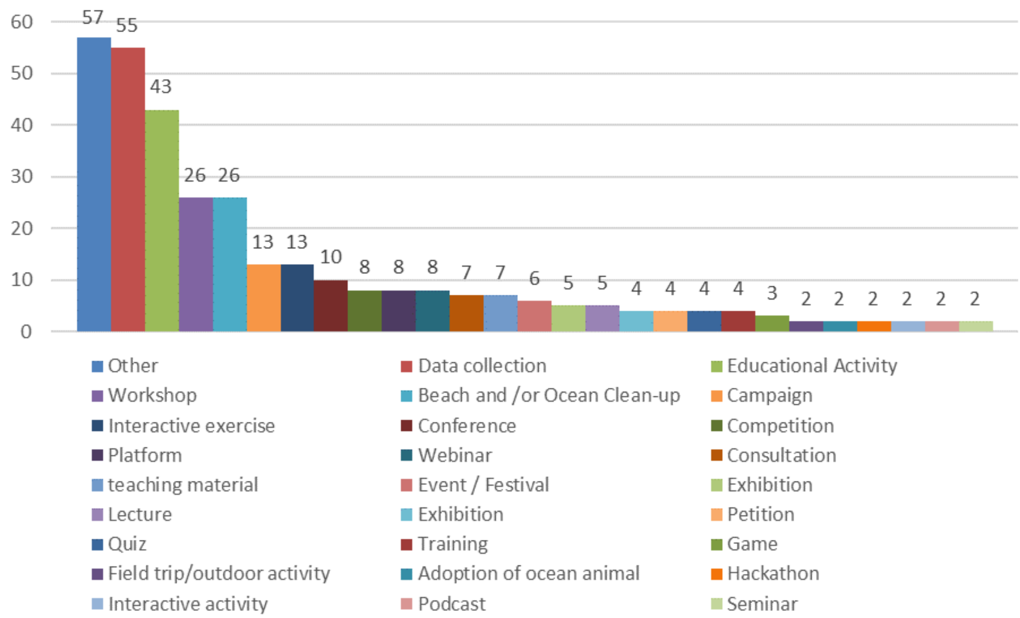
The aim of this Hackathon was to challenge participants to develop applications that contribute to improving knowledge of marine ecosystems. It was organised all around Europe by Open Science Platform Blue-Cloud in January/February 2022 for marine scientists & researchers, data scientists, ICT experts, innovators, students and anyone who is passionate about the Ocean and wants to explore and test Blue-Cloud. Through the platform, citizens learned about issues related to the ocean, while contributing to better conditions for the oceans by developing innovative solutions.

Source: Blue Cloud, 2022

It is worth higlighting the variety of methods of citizen engagement. Figure 56 illustrates the types of methods of citizen engagement that were found 2 or more times in the database.

The category 'Other' is the largest, emphasizing a large diversity of methods that could not be presented at once in the figure. These include learning platforms, activities in sea gardens, school knowledge exchange projects etc. The methods that were most frequently identified in the database were related to data collection for Citizen Science programmes, educational activities, workshops and beach and / or ocean clean-ups.

Figure 56 Methods of citizen engagement



Source: compiled database*, 2022.*

The boxes below provide a few interesting examples of citizen engagement activities, indicating the methods that have been used by the organisers.

Box 23 Beaufort

This tri-annual art festival takes since 2003 place on the Belgian North Sea beaches. The theme of the art festival is based on current marine issues, such as the rising sea level, and reflects on the question: how did the North Sea change men? The activity is organised by a consortium of partners, including the Province of West-Flanders, and hopes to raise the level of Ocean Literacy of the general public.

Source: Beaufort*, 2022.*

Box 24 Network of European Blue schools

Schools can become Blue Schools through this programme organised by EU4Ocean, and through the programme students can become agents for change and sustainability in oceans and schools, find inspiration and support on how to address ocean topics that are relevant to curricula. The overall aim is to unite the voices of Europeans to make the ocean a concern of everyone. Tens of schools and student ambassadors have already joined the programme.

Source: EU4Ocean*, 2022.*

Box 25 Net cuttings

This project aims to tackle the plastic pollution of cuttings of rope, cord and nets, as these have a significant impact on our marine environment. Swedish Agency for Marine and Water Management KIMO, organiser of the project, consults face-to-face with fishermen and harbour staff in four different countries how to prevent this kind of pollution. This has led in 2020 to best practice recommendations, which demonstrate some of the most simple, practical and inexpensive ways in which fishers and harbour authorities can cut pollution.

Source: KIMO, 2020.

Box 26 Atlantic Observers

Pelagis is already since 1996 inviting the general public to submit their observations on sealife in a database. This data collection of sea life helps to better understand dolphins, seals and whales of the French Atlantic Ocean. The public can retrieve these insights from the database themselves as well, meaning the programme has a participatory character.

Source: Pelagis, 2020.

Box 27 Baltic Sea Day

This summertime festival organised by the John Nurminen Foundation highlights important information on marine nature, culture and history and ultimately aims to encourages people to take concrete action for the Baltic Sea. The organisers have been doing this annually since 2019, welcoming every Finnish citizen that is interested. The citizen engagement activity includes concerts, exhibitions, lectures and beach clean-ups and is therefore based on an interaction and consultation model.

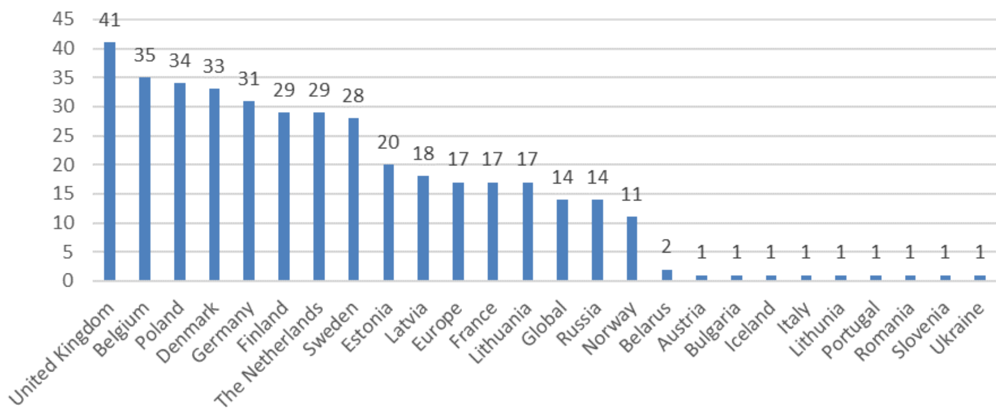
Source: John Nurminen Foundation, 2022

9.3.2. Overview of locations and scales of the citizen engagement activities

The geographic location of the citizen engagement activities is depicted in Figure 54. The United Kingdom, Belgium, Poland, Denmark, Germany, Finland, the Netherlands and Sweden have experienced a larger number of citizens engagement activities than other countries. Out of 281 mapped activities, 17 have been organised across most European countries, while 14 activities were held in at least 5 locations outside Europe. To avoid mapping of countries outside Europe, they are listed under "Global".

Figure 54 also lists countries that are outside the Baltic and North Sea region (e.g., Iceland, Ukraine), as some citizen engagement activities have been organised in partnership with stakeholders in these countries.

Figure 57 Countries where citizen engagement activities were organised



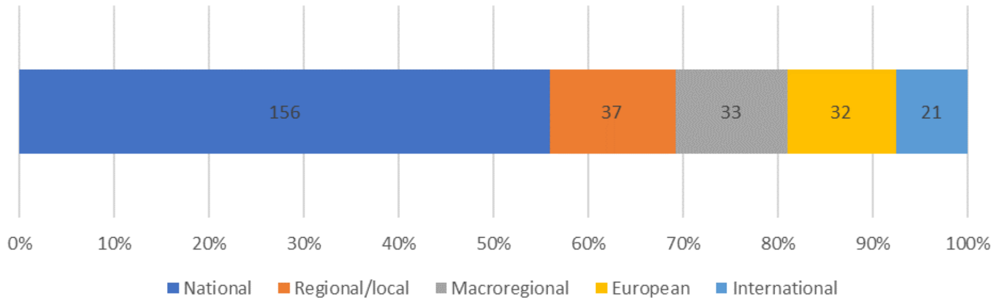
Source: compiled database*, 2022.*

The geographical scale of the citizen engagement activities differ (

Figure **58**). The majority of mapped activities (193, 69%) have been aimed at the national public. This includes activities that have been organised at a national and regional/local level within a single country. Most activities that were organised at a regional/local level (37, 13%) involved communities that live near the coasts.

The remaining 31% of citizen engagement activities have been organised in several countries: either internationally (21, 7%), meaning within and outside Europe, at a macroregional level (33, 11%), involving several countries in the Baltic and North Sea region, or at a European level (32, 11%).

Figure 58 Geographical scale of citizen engagement activities



Source: compiled database, *2022.*

9.3.3. Overview of thematic areas of the citizen engagement activities

The citizen engagement activities can be categorised into several thematic areas. The most popular thematic area is ocean and coast conservation (100, 36%) (Figure 59). Activities that have been organised in this thematic area have been revolving around the cleaning of beaches and oceans, and collecting data about pollution.

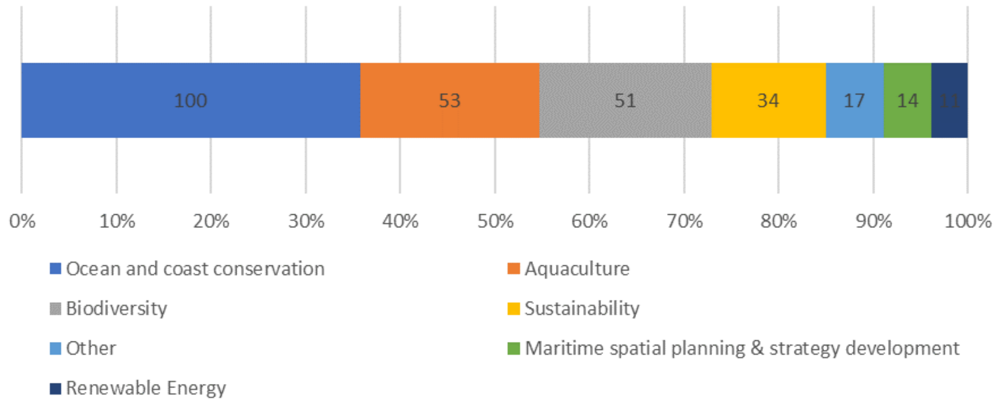
The second most frequently cited thematic area is aquaculture and fisheries (53, 19%), which refers to the cultivation or farming of aquatic organisms. It also includes activities that focus on fish and fisheries. Among the citizen engagement activities that are associated with this thematic area, fieldtrips to teach students about molluscs and educational programmes on fish and fisheries were highlighted.

The thematic area on biodiversity (51, 18%) has been most frequently associated with Citizen Science through data-collection activities. Citizens have been asked to record biodiversity in a certain area in a specific time period, to record whale, dolphin or shark sightings or report on algal blooms.

Other thematic areas listed include sustainability (34, 12%), maritime spatial planning & strategy development (14, 5%) and renewable energy (11, 4%). The latter refers to all renewable energy sources that are associated with the seas/oceans, both onshore and offshore. The category of activities that have been classified as “Other” (17, 6%) includes diverse education/training classes that relate to various sectors/topics of blue economy. Some of them are related to the maritime transport area, such as ship safety, rescue at the sea, and sailing.

The thematic areas that have been identified through the mapping, relate to the thematic areas that are in the focus of the Mission in the Lighthouse area (e.g., maritime transport, maritime ports & facilities, renewable energy and its offshore facilities, offshore renewable energy storage facilities, multipurpose platforms, and aquaculture). However, it is worth noting that the research team has not identified citizen engagement activities that would focus on maritime ports & facilities, offshore renewable energy storage facilities, and multipurpose platforms. These areas seem to be technical, requiring professional knowledge, therefore they have so far not been considered to be relevant for the general public.

Figure 59 Thematic areas of citizen engagement activities

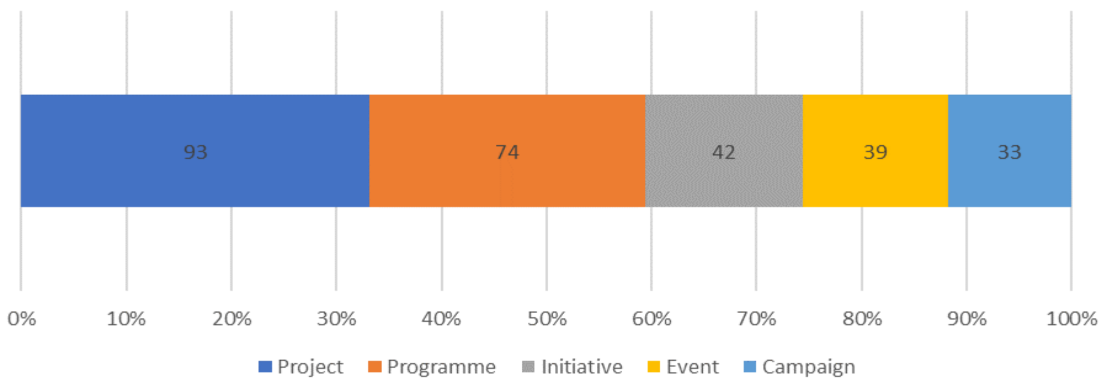


Source: compiled database*, 2022.*

9.3.4. Types of activities/undertaking within which citizen engagement activities were organised and their duration

According to Figure 5, most mapped citizen engagement activities have been organised within projects (93, 33%) and programmes (74, 26%), while the least number of activities took place within public campaigns. It is important to note that the definitions of what constitutes a programme, project, and initiative are not aligned. This is due to the fact that the research team recorded the types of activities/undertakings as they are defined on the webpages of the organisers of activities. Thus, the difference between these types might not be so significant.

Figure 60 Types of activities/undertakings within which citizen engagement activities have been organised



Source: compiled database*, 2022.*

As it was mentioned earlier, the research team focused on the citizen engagement activities that have been active in the period between January 2019 and January 2022. It is interesting to note that a large number of mapped citizen engagement activities (208, 74%)

are still ongoing. This implies that either an activity/undertaking within which citizen engagement activity is organised will end in the future or it is organised on a continuous/regular basis - an activity is organised every day, once a year etc.

For a large number of mapped activities, it was not possible to ascertain a start date, as this data is missing on the webpages of the organisations. For those activities where it was possible, researchers found that the majority had started in the last five to ten years, though there were a few exceptions such as the educational activities focused on ocean literacy organised by the Nausicaa Aquarium in the United Kingdom, which has been organised since 1992.

9.3.5. Overview of the organisers of the citizen engagement activities

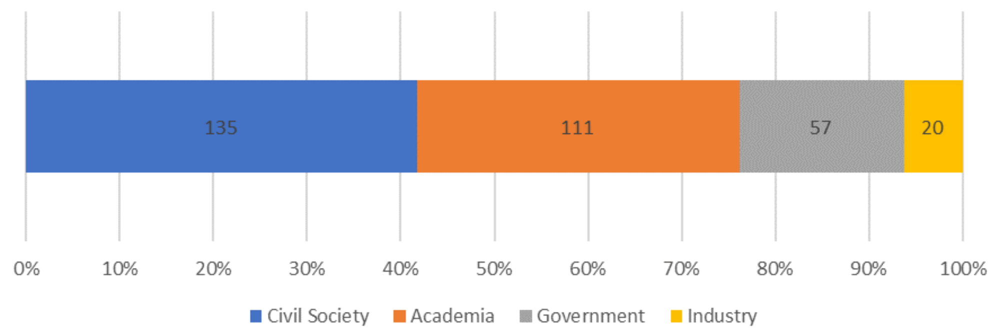
A large share of the citizen engagement activities has been (co-)organised by civil society organisations (135, 42%) (Figure 61). This group of organisations primarily consists of environmentally focused non-governmental organisations, museums, aquaria or network organisations in the blue economy sector. The civil society organisations have been leading or contributing to all types of citizen engagement activities. This reflects their broad scope of activities and capacity to mobilise the public for all of these activities.

Academia (111, 34%) makes up the second largest group of organisers of citizen engagement activities. The academic and research institutions have been most actively involvement in the organisation of citizen science and water/ocean literacy activities.

Governmental organisations are involved in a portion of the activities (57, 18%) either because they organise the activities themselves or in collaboration with other actors from both civil society, academia and/or industry. The activities, which they (co)organise more often, are implemented using participatory/co-creation processes and water/ocean literacy activities.

Based on collected data, industry actors rarely organise citizen engagement activities. In most cases that the research team has observed, they join the organisers of the activities to represent their stakeholder group. The industry organisations have been more frequently joining water/ocean literacy activities.

Figure 61 Sector of the organiser of the citizen engagement activity



Source: compiled database*, 2022.*

Of the 325 organisations that have been mapped, 51 (16%) were involved in more than one citizen engagement activity. In the table below we have listed all the organisations that have conducted at least three or more citizen engagement activities that are in the scope of the research. It is important to remember that the number of activities that have been collected from one webpage for one organisation has been limited to three. Thus, the total number of citizen engagement activities conducted by a specific organisation may be higher. Nevertheless, the table is indicative of the organisations which are the leaders in conducting citizen engagement activities in the lighthouse area.

Table 65 List of organisations that conduct a large number of citizen engagement activities

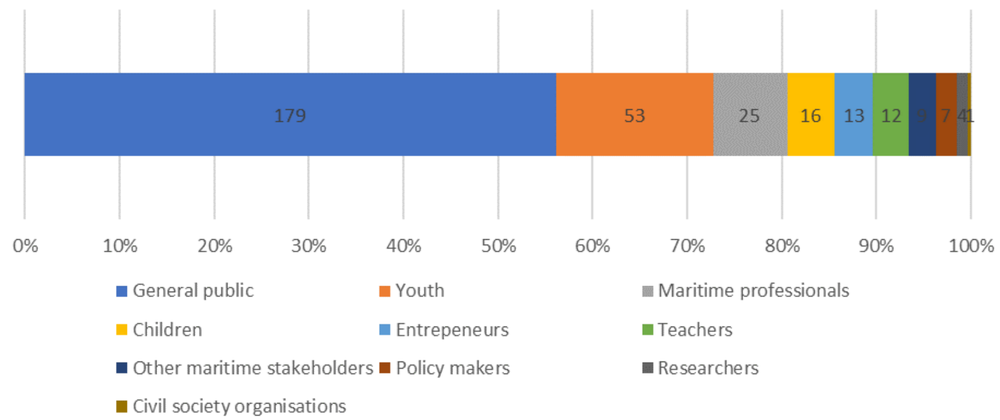
Name of the organisation/initiative	Organisation type	Number of activities recorded in the database
EU4Ocean	Government/public	9
VLIZ	Academia	9
Marine Biological Association	Civil Society	8
Marine Conservation Society	Civil Society	7
Stichting de Noordzee	Civil Society	6
Gdynia Aquarium	Civil Society	6
Havhost	Civil Society	5
John Nurmisen Saatio	Civil Society	5
IO PAN	Academia	5
NIOZ	Academia	4
Baltic Environmental Forum	Civil Society	4
WWF	Civil Society	4
Coalition Clean Baltic	Civil Society	4
ORCA	Civil Society	3
Ghost fishing UK	Civil Society	3
Ocean Conservancy	Civil Society	3
Surfrider Foundation Europe	Civil Society	3
Seawatch Foundation	Civil Society	3
CPMR North Sea Commission	Civil Society	3
Friends of the Baltic	Civil Society	3
Natuurpunt	Civil Society	3
KIMO	Government/public	3

Source: own production, 2022

9.3.6. Target audience and degrees of citizen engagement

The majority of the citizen engagement activities have been designed for the general public, namely 179 activities (56%). Some activities were aimed at specific groups such as youth (53, 19%) and children (16, 6%). These activities range from field trips to educational programmes, junior ranger groups and photo competitions. Several educational activities are also aimed at teachers, with the intent that insights from these activities might end-up in the student curriculum. Other specified target audiences include maritime professionals (25, 9%). For example, in some activities fishermen were asked to record their catches, or maritime professions were provided a training on sustainability and conservation.

Figure 62 Target audiences of citizen engagement activities



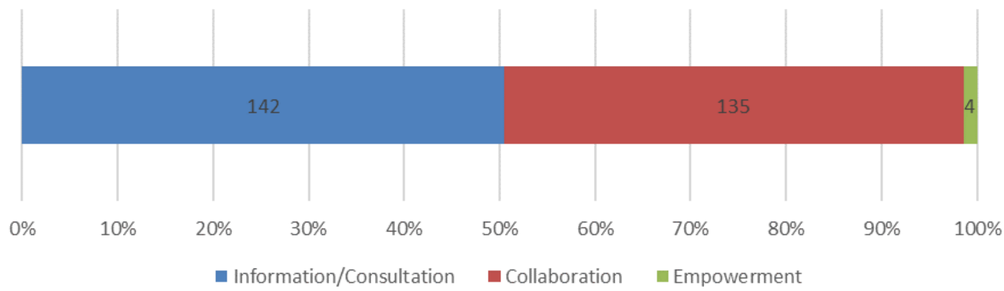
Source: compiled database, 2022.

As mentioned in the methodology (chapter 2.3), the researchers differentiated three degrees of citizen engagement: information/consultation, collaboration and empowerment. Activities that revolve around information and/or consultation have the lowest degree of citizen engagement. As this refers to activities where citizens were either educated about a subject or were asked for their opinions, views and knowledge of a subject. The researchers ensured that only activities that contained a feedback loop were included in the database. Around 50% of the mapped activities in the database assigned a low decision-making power to citizens (Figure 63).

Collaboration refers to an active role in the decision-making process that a citizen could take, even though the activity was not organised by them. These activities can take many forms, such as competitions, beach and/or ocean clean-ups, data-collections and hackathons. Similarly, almost half of the mapped activities in the database were participatory.

Empowerment refers to the level of decision-making where citizens have high or full control. The types of activities that make up this group are only a very small part of the database, as only 4 activities could be classified as such. However, it must be noted that such activities are often community focused and as such are difficult to find through desk research. The low number of activities might, to some extent, be a result of a bias in the database towards established institutions and organisations as these have a larger online presence and are more likely to broadcast their activities.

Figure 63 Degrees of citizen engagement in activities



Source: compiled database*, 2022.*

9.4. Analysis of citizen engagement activities and processes at an activity level

This chapter presents findings from interviews with ten organisations that have extensive experience with organising citizen engagement activities in the lighthouse area. It focuses on factors that, in the opinion of interviewed organisations, determine success of citizen engagement activities. The case studies, that have been developed based on the interviews with the organisations are presented in Appendix B. The case studies highlight the types of citizen engagement activities that these organisations have conducted, their methods of work, and provide examples of successful citizen engagement activities.

9.4.1. Discussion of interview findings

The interview findings reveal that the factors that determine success of citizen engagement activities are similar for all types of activities. The differences that exist are attributed to characteristics of specific types of activities. For example, it is advisable for the social innovation projects that engage with citizens to involve industry organisations across the value chain to generate more extensive support for the activity and make it more effective. This is not surprising, as collaboration with industry lies at the core of social innovation in general. Similarly, in citizen science activities it is particularly important to provide clear instructions for participants and, in some cases, to offer training, as data collection should be performed in line with the research protocols and methodologies to ensure high quality of data.

The interview findings indicate the list of success factors that determine effectiveness of citizen engagement activities is not very extensive. Most interviewees have been mentioning similar key factors. In general, these factors could be clustered in two categories: design and implementation, and attraction and retention of volunteers. The following sections discuss in more detail these two categories of factors, presented as lessons learned.

Lessons learned on effective design and implementation of successful citizen engagement activities

<u>Development of an effective strategy for citizen engagement is critical for success of the activity</u>

An effective citizen engagement strategy should be developed with a clear purpose for citizen engagement. In addition, it has to determine target groups that should be involved in the activity and identify the most useful methods for engagement.

Several interviewees stressed that **some organisers of citizen engagement activities do not have a clear, useful purpose for engagement of citizens in activities**. This is particularly common for activities that use participatory and co-creation processes, especially if they are organised to meet an obligation to involve citizens. As a result, collected data is not used and participants feel that their participation was not meaningful. The Baltic Environmental Forum Germany indicated that at times this led to significant scepticism of the population towards citizen engagement activities in general and demotivated participants to join any other activities of this kind in the future.

Once the purpose for engagement of citizens is determined, **it is crucial to identify population groups and stakeholders that should be involved in the activity**. This is essential for maximising the benefits of participation for the citizens and the organisers. This step has been particularly important for the design of activities that use participatory and co-creation processes.

When the population groups are determined then **the organiser should select the most useful, available, cost-effective methods for citizen engagement**. This is associated with the purpose for engagement, which citizens will support the organiser and the resources available to the organiser (e.g., physical, financial, human resources, and access to network of partners). In terms of the purpose of citizen engagement, several interviewees pointed out that campaigns and large-scale events are useful for raising awareness among citizens, while workshops and other interactive methods of engagement are effective at stimulating co-creation or enabling an effective consultation. In general, activities that are organised in small groups are more likely to foster collaboration between participants and to provide opportunities for citizens to exercise a higher decision-making power.

<u>Locally-focused citizen engagement activities have a higher degree of citizen involvement and a larger impact</u>

If the organiser has an effective citizen engagement strategy and receives significant support from the population, expressed in engagement of a large number of people, it is likely to produce a large impact. All interviewees felt that **only locally-relevant activities will generate an impact, as citizens will be incentivised to address local challenges, and that it is the most effective level of intervention.** The latter is linked to adaptability of the intervention/activity to a local context and a higher probability that the intervention will be sustained by local stakeholders.

A higher level of citizen involvement at a local level is associated with several factors. First, citizens are **more likely to observe the impact** of their participation in an activity, as it generates a change in a small community. This is a key motivator for continuous engagement, and it gives a feeling of accomplishment to the participants. Second, a higher level of involvement is linked to **greater trust of participants to the organiser**. Submariner Network and Baltic Environmental Forum Germany pointed out that the organisations that have a good reputation in a community and have been known as a long-standing actor in the field are likely to build that trust faster and easier with citizens. Moreover, it is likely to result in a **more personable contact between the organiser and**

the participants, leading to a long-lasting relationship that will encourage committed participation in various citizen engagement activities.

The case of Fjord CleanUP also highlights that **local citizen activities stimulate the formation of a community around the activity**. Such communities will be distinguished by a particular set of values and are more likely to generate a local, cultural change, influencing the behaviour of other actors in the community. For example, recently Fjord CleanUp started collaboration with an electric scooter company that is willing to offer electric scooters to volunteers for participation in cleaning events. Thus, Fjord CleanUp inspired and encouraged other local companies to follow their example and **served as a catalyst for grass root, sustainable transformation at a local level.**

An additional factor that could contribute to a higher level of citizen involvement in locally-oriented activities is the **ability to participate in the design of the citizen engagement activity**. More information about this is presented below.

Participation of citizens and stakeholders in the design of the citizen engagement activities results in a more effective design and involvement of citizens, and increases willingness to participate in the activities

In view of the interviewees, involvement of citizens and stakeholders in the design of the activity is very useful for determining issues/challenges that citizens find important to be addressed, activities in which citizens are willing to offer support, and the preferred methods and formats of engagement. In addition, the co-creation of the activity with citizens will instil a **greater sense of responsibility and empower citizens to act as change-makers, thereby influencing their role in the community and their behaviour.**

The involvement in the design of the citizen engagement activity will increase the probability that the general public and stakeholders will **contribute to implementation of the activity**. Participants will be more willing to contribute in some way to the activity, as they were the co-organisers. For example, one of the UK local community projects “Agents of Change” witnessed strong participation of citizens, as members of the local community have been interviewed and then collectively consulted on what local problems should be addressed.

The process of co-designing of the activity will also stimulate **relationship building between the organiser and the participants**. As it was mentioned earlier, this is critical for ensuring long-term commitment and participation in citizen engagement activities, and it will build a **better feedback mechanism**. Despite that the interviewed organisations highlighted importance of co-designing of the activities with the participants, **most of them rarely do it**. The reasons mentioned included limited resources for arranging co-designing sessions, lack of knowledge/skills how to do this in an effective manner, lack of culture of co-creation, and strong influence of funders, partners or stakeholders in the design of the activities. In Citizen Science projects, the co-designing is particularly challenging as there is a need to follow a rigorous methodology in a scientific project.

Nevertheless, **all interviewed organisations collect feedback** from participants of citizen engagement activities to consider it in the design of future initiatives. In general, receptiveness to feedback has been highlighted by almost all interviewees as a critical factor for attraction and effective involvement of citizens in the activities. However, **the mechanisms of feedback collection and analysis are not always optimal**. Organisations that have many participants in citizen engagement activities struggle to collect and process feedback. In most cases, **feedback is collected via surveys at the end of citizen engagement activities**, which offers limited opportunities for expressing opinions and suggestions. Moreover, surveys cannot be used as tools that encourage co-creation. For this purpose, **interactive formats are needed, such as consultative forums and workshops.**

MCS has been mentioned among the best practices for feedback collection. This organisation collects feedback at three stages: **before the activity starts** - to collect views on the design of the citizen engagement activity, **in the middle** – to discuss the clarity of instructions and to provide additional information about the activity, and **at the end** – to analyse experiences, impacts and results. This is possible in activities that have no more than 30 participants, especially if these participants are part of a community or network that is frequently interacting with the organiser.

Another successful feedback practice has been presented by IO PAN. The organisation co-develops ocean literacy activities and even Citizen Science projects with students, **encouraging them to find problems that could be address collectively**. In view of it researchers, at times students provide very creative ideas that later serve as a basis for a large research project.

<u>**Citizen engagement activities that offer an attractive experience to participants receive more attention and result in more effective collaboration between the organiser and the participants**</u>

The citizen engagement activities should be **easy to participate in, fun and innovative to offer an attractive and positive experience to participants**. Given that people are volunteering their free time and energy, it is key to make these activities entertaining to show benefits of participation to citizens. Moreover, this will increase chances of citizens' continuous participation in the activity and of **sharing positive feedback** within their personal and professional networks, bringing addition visibility to the activity.

The organiser should **remove all barriers for participation** in a citizen engagement activity to reach every citizen. This includes access to information about the activity, process of signing up for participation, and actual partaking in the activity. **Long instructions and complex trainings prior to an activity should be avoided.** At times, particularly in Citizen Science projects, instructors/scientists struggle to communicate in simple terms the purpose and process of data collection in which they seek support of the public. In addition, they might lack time to invest in building relations with the citizens that contribute to their research. In such cases, it is best to use short videos for giving instructions and involve individuals with great communication, interpersonal and teaching skills.

The experience of MCS, IO PAN and Fjord CleanUP showed that **less effort requested from participants results in engagement of wider audience.** For example, one of the citizen engagement activities that MCS has organised is called "Wildlife sightings". It asks citizens to inform the MCS team what wildlife they have spotted at the coast and at sea, especially marine turtles and jellyfish in UK and Irish waters. The user-friendly digital apps have been found particularly helpful in such activities.

Another important element of the citizen engagement activities is the so-called **fun aspect**. Nausicaa, Tartu Nature House, VLIZ and IO PAN highlighted that many people enjoy citizen engagement activities that involve animals, creative assignments, such as art projects, food tasting activities, backstage tours in aquariums and museums, lotteries, and competitions that offer a small prize or give recognition to a winner through visibility. For example, IO PAN mentioned a few cases when participants of citizen science projects were offered to publish a picture that they made in nature in a local newspaper. KIMO has organised a campaign on the beach that involved participants in a lottery. Such methods have been a **good motivating factor to encourage active participation.**

All interviewees stressed the **importance of interactivity** in the design of the citizen engagement activities. The interview with the Baltic Environmental Forum Germany showed that experienced organisers of the citizen engagement activities are aware of the psychology of interaction and use techniques that promote openness in discussions and collaboration between participants. In general, many people view citizen engagement activities as opportunities to engage with the community. Thus, the value of communication in these activities is very high.

Given the large number of existing citizen engagement activities, **it is important to impress participants with some innovative elements in the design of the activity**. The cleaning events of Fjord CleanUP, which includes an enjoyable outdoor activity, a sauna and a soup for participants illustrates the importance of an attractive experience that is offered to participants. The innovative design is particularly important for recurring activities that run for several years. Tartu Nature House indicated that in the last few years they have noticed that **young people, between 11 and 15 years of age, start to lose interest in conventional education and training activities**, therefore it is advisable to involve them in activities that are related to outdoor exercises, exploration projects and field trips, where they can use their own initiative and creativity. Based on interviews, young people enjoy hackathons, competitions, technology-related activities and education/training programmes that include different types of mentorships.

Digital technologies, application and social media channels are effective tools for communication and facilitation of engagement during the citizen engagement activities

Based on experience of several interviewees, **digital technologies, applications and social media channel**s have been effective in attracting the public to the citizen engagement activities and in facilitating communication between the organiser and the participants during and after the activity. The younger generation, in particular, appreciates digital technologies and finds citizen engagement activities that are related to these technologies more attractive, easy and fun. However, the development of such applications requires significant investment.

In terms of social media channels, **Instagram and Twitter** have been very effective in attracting the public to the citizen engagement activities and in facilitating interaction. Instagram, in particular, is popular, as it contains only user-friendly content – pictures and videos with little text.

9.4.2. Lessons learned on how to ensure effective design and implementation of successful citizen engagement activities

Effective messaging about the citizen engagement activity focuses on benefits of participation for citizens

The organisers of citizen engagement activities should **carefully choose their promotion messages**. In view of interviewees, to develop effective messaging the organiser should clearly formulate the purpose of the activity and consider what population groups should be involved in it. Based on that, the organiser should **determine potential motives of the**

targeted population group to join a citizen engagement activity and use these in the description of the activity.

Based on experience of interviewees, all population groups, but especially young people, would be attracted to a fun and innovative experience that a citizen engagement activity can offer. In general, the young population is keener to participate in citizen engagement activities, due to availability of time, a belief in the ability to change developments, and as an opportunity for social interaction.

The adult population is mostly attracted to activities that are expected to have a **large impact on a local community or those that will result in empowerment of citizens**. It is critical for citizens to observe or to know what impact their participation made on the society, economy, research, innovation or other areas. The adult population is more willing to participate in activities that use participatory and co-creation processes, as they feel more involved in the decision-making process. In addition, **the adult population can be attracted to activities that involve children**, in case participants have them. IO PAN indicated there is a **new trend to involve tourists in citizen engagement activities**. While adults are on a holiday, they might be willing to join an activity that is enjoyable and, in some way, informative. Tourists that enjoy their holiday with children are even more likely to participate in a citizen engagement activity, as it helps to entertain children and gives an opportunity for the entire family to be involved in a joint activity.

For population over 60 years of age, an important motivation for participation is an **opportunity to join a community and experience unity with society in an action**. In view of interviewees, they are keen to participate in citizen engagement activities, but the limitation on psychical activity should be considered in the design.

Regardless of the target group, **all promotional messages should be clear and concise** to draw attention of participants and to avoid misconceptions about the activity. Submariner Network and VLIZ indicated that at times the organisers confuse the public by using complex descriptions of the activities, providing irrelevant information and not indicating how their participation will make an impact.

Among important caveats that several interviewees highlighted is that **the messaging should not contain many negative, fear, shame or guilt-related statements**. In general, participants avoid activities that have **a negative connotation or organisations with compromised reputation**. For example, Nausicaa mentioned that many aquaria and zoos are struggling to involve citizens, as some citizens have a perception that animals are not being properly treated in aquaria or zoos. Interviewees pointed out that in the past some marine-related citizen engagement activities turned away many participants, because the messages included phrases that led to a feeling of hopelessness or tried to shame people who are not willing to take part in the activity. KIMO, VLIZ and IO PAN provided examples of several campaigns and events whose message was that the Baltic Sea is dying. Instead of encouraging citizens to take action, these activities had the opposite effect, as people want to be part of something that has a potential to improve.

<u>Media is effective in raising interest of the public in citizen engagement activities</u>

Both traditional and social media is effective in attracting the public to citizen engagement activities. The tradition media helps to raise awareness among a larger share of the population and attach significance to the activity. Typically, it attracts adults better than youth. In contrast, social media channels are more effective with reaching young people.

Citizens are unlikely to open webpages of different organisations and look for citizen engagement opportunities. **Thus, the organisers have to actively promote such opportunities through multiple communication channels and through the network of partners** to ensure that the invitation will reach maximum population.

Apart from media, **the word of mouth** has been a powerful communication tool in successful citizen engagement activities. For example, for many years the Fjord CleanUP events did not have a promotion or marketing strategy, however, they received significant interest from the local community through citizens that have been involved in their events.

Building relations with citizens is key for ensuring their commitment to the cause and continuous participation in citizen engagement activities

Most interviewees consider that **relationship building is essential** for encouraging people to participate in volunteering activities and for ensuring their good experience. **Citizens should trust the organisers**, preferably not just the organisation but specific individuals that work in them, to form a personal connection. This will result in effective communication, sharing of feedback, and a proactive approach of citizens in generation of new ideas.

Mobilisation of influencers, networks and institutions that frequently interact with citizens is essential for promotion of the citizen engagement activities

Several interviewees emphasized that **the organisers of the citizen engagement activities should identify influencers-leaders** that are being followed by large population groups. This can be a local celebrity, an expert, a politician, an activist or any other respected and highly esteemed person or organisation. Their involvement will raise attention to the citizen engagement activities and is likely to lead to higher participation rate.

In addition, it is critical for the organisation to **use all available promotion platforms**. This includes relevant networks of partners and organisations that have frequent access to citizens, such as aquaria, zoos, NGOs, museums, tourist centres, research organisations and other networks.

Interest in the marine sector is critical for involving the public in citizen engagement activities

The experiences of interviewees reveal that the volunteers that participate in citizen engagement activities already have, at least, some interest in the maritime sector. The mobilisation of this population group is relatively easy, although they represent a small share of the population. Thus, the major challenge is to engage citizens that have little interest in the maritime sector. To enhance that interest, **it is important to invest in ocean literacy, in activities that raise a general awareness about the state of the marine environment and urge citizens to participate in a change.**

9.5. Conclusions

The current research reveals that the Baltic and North Sea region has witnessed **a large number of citizen engagement activities** in the last 3 years. Thus, it is important to **consider building synergies with other activities**, avoiding excessive competition for citizens' attention and using resources more efficiently. The number of citizen engagement activities organised at a macroregional level is much smaller than on a national level and, in the view of interviewees, these activities are typically less impactful and of a smaller scale in each region/country, due to their lower relevance. However, those **macroregional activities that have an adaptive design**, meaning that the design can be tailored to local needs and context, **can be very attractive for participants and effective/useful.**

Some activities, such as water and ocean literacy, which have been introduced earlier to the public and represent an umbrella activity for other citizen engagement activities (e.g., citizen science, social innovation) by directly or indirectly contributing to the improvement of knowledge about the ocean and seas, are still prevalent in the Lighthouse area. Nevertheless, **the organisations and stakeholders in the blue sector are exploring new methods and ways of interacting with the public**. These methods are associated with a higher level of citizens' decision-making power.

The interviews allowed examination of how different organisations conduct citizen engagement activities, to analyse their methods of engagement, perceived success factors and degrees of involvement of volunteers. It is interesting to note that all of them effectively engage with diverse stakeholders and with the general public, building their own unique networks within the civil society. This points to the **importance of inclusion of diverse organisations in the implementation of the Mission in the Lighthouse area.**

The analysis of findings indicates that **it is very difficult to measure results and impacts of citizen engagement activities**, especially of public campaigns as in most cases it is not even clear to the organisers who is following the campaign, and **there is no monitoring and evaluation framework with set indicators**. Regular campaigns are raising awareness about an issue, and invite the civil society to make a small action in their daily life. Most citizen engagement activities that have been conducted in the Lighthouse area are relatively **small in scale, while the societal challenges that they target are large**. Given that all citizen engagement activities aim to influence societal behaviour in one way or another, the change in the behaviour is very gradual.

The organisers of the citizen engagement activities have pointed to some challenges that they encounter while organising these activities. Among them are listed a lack of funding, scepticism of the population for participation in citizen engagement activities, and a large competition for attention of citizens among different initiatives. **The Covid-19 pandemic has been a major challenge for the performance of citizen engagement activities**, as it prevented gatherings of large groups of people. Nevertheless, several interviewees pointed out to innovative solutions they identified, such as mobile applications to facilitate interaction with the participants, and to novel methods of citizen engagement activities, such as online workshops and events. When the interviewees were asked about the challenges in organisation of activities at a macroregional level, they mentioned **the language barrier, as it prevents interaction of the local communities across countries.**

Water and ocean literacy activities, training and education activities related to blue economy

Each type of the citizen engagement activity that has been in the focus of the study has its special purpose and the public that it appeals to. For many years, **the water and ocean literacy, education and training activities have been raising awareness** about the developments in the blue sector, seeking to change society's attitude towards the environment in the ocean and land, and lead to more conscious decisions about consumption and production. This way, sustainability, carbon neutrality and circularity will be embedded in every aspect of human activities.

The analysis of the citizen engagement activities at the aggregate and activity level revealed that there are many non-blue but environmentally focused NGOs that also have been contributing to teaching and learning the impact of the society on marine environments, and vice versa. **This points to the need to involve all environmentally focused organisations in the Mission implementation.**

Several interviewees suggested that ocean literacy activities **should primarily target children and youth** for the following reasons. First, it is easier to educate young people, as ocean literacy can be embedded in the educational curricula of schools. Second, the younger generation should take a lead in building a sustainable future.

The training of educators/teachers in the blue economy sector is an important aspect that requires particular attention of policymakers. Based on experience of Tartu Nature House and several other organisations, significant investment in the education of teachers is needed to ensure high quality of teaching. Interviewees insisted that teachers should regularly interact with the researchers in the blue sector to uncover its potential and increase its attractiveness to students.

Citizen science activities

The analysis of the citizen engagement activities at the aggregate and activity level illustrated that C**itizen Science is considered a very attractive type of activity**, as it has been recently introduced even in non-scientifically oriented organisations. There are several factors that explain growing attention to Citizen Science. First, **the Citizen Science projects create many benefits for researchers and society at large**. These activities produce useful and cost-effective data for researchers, indirectly contribute to ocean literacy as involved citizens become more informed and interested in marine issues, and stimulate community building. To illustrate the latter, MCS's volunteers go to schools and other local organisations, and invite other members of the public to help them collect the data. As such, the volunteers act as catalysts for expanding the network of volunteers and stimulate the culture of volunteering and community-based action.

Second, **Citizen Science activities prove to be an impactful exercise**. For example, based on collected data, Nausicaa develops education materials for schools and the general public, contributes to research and monitoring activities of other organisations, and influences policymakers to generate a change in the society and industry. VLIZ also pointed out that due to several citizen engagement projects their organisation was able to provide useful data and influence a change in public policy.

Despite that, the interviews revealed that **many scientists do not believe in the power of Citizen Science**, claiming that citizens are not researchers and data produced by them cannot be of high quality. The experience of research institutions, such as VLIZ and IO

PAN, shows the opposite, although they highlight importance of good instructions and, in some cases, training for citizens. In addition, research organisations should have a good data management plan to ensure that data is properly stored and that there are tools that support communication between the public and the researchers.

The digital technologies have significantly facilitated data collection and supported involvement of citizens in marine research. For example, in the global citizen science project CoastSnap, in which VLIZ participates, people are asked to make photos at specific locations/cradles to help scientists track how the coast is changing over time due to processes such as storms, rising sea levels, human activities and other factors. Using a specialised technique known as photogrammetry, CoastSnap application turns photos into valuable coastal data that is used by coastal scientists to understand and forecast how coastlines might change in the coming decades. Photogrammetry enables the position of the coastline to be pinpointed from snaps to an accuracy similar to that of professional coastal survey teams.[445] This project continues to expand, as scientists put more locations/cradles in the CoastSnap application.

Undoubtedly, **there are many limitations on what data citizens can collect**. For example, the collection of microplastic for further analysis in a laboratory has not been successful, as many samples are typically contaminated during data collection. Nevertheless, the support that citizens offer to scientists has been appreciated by many research organisations.

One important aspect that should be considered in citizen science is the **health and safety of participants while conducting research activities**. It is the responsibility of researchers to instruct citizens about potentially dangerous substances they might get in contact with and to ensure that they do not get sick after collecting data in cold or wet conditions.

<u>**Activity that uses participatory and co-creation processes**</u>

As mentioned earlier, this category of activities is not well defined, and it has been connected with participatory processes within other types of citizen engagement activities. Our research has shown that **the organisers have been involving citizens in different participatory processes, although these activities were typically characterised by a low decision-making power of citizens**. For example, the most popular type of activity has been the cleaning of the beaches. Among the processes that have been marked by a higher level of decision-making power was the involvement of citizens in the maritime spatial planning.

The interviews found that the organisers of citizen engagement activities are not always willing to invite citizens in the co-creation process, primarily due to **lack of knowledge/skills on how to guide that process and to use input of citizens effectively**. Overall, interviewees stressed that the culture of co-creation is missing. In addition, even when a participatory process is launched, the organisers are prone to make two significant mistakes. First, **they involve citizens very late in the process within the activity**, making it impossible for citizens to significantly affect the ultimate design or result of the activity. The second mistake is related to **poor organisation of participatory activities from a practical perspective**. Typically, citizens are not aware that such

[445] https://www.coastsnap.com/

activities are taking place or learning about them at a last minute. In addition, the organisers do not share relevant information in advance. Thus, the usefulness of citizens' participants is compromised, as they are not aware about the issues in focus and, as a result, cannot make a meaningful contribution to the discussion.

Those organisations that conducted co-creation type of activities admit that **citizens appreciate involvement and seek greater influence on developments in a local community**. The experienced organisers of the activities stressed that particular attention should be paid to the recruitment and selection of participants. **It is critical to involve citizens or stakeholders for whom the discussion is relevant**, meaning in line with their expertise, knowledge and sphere of interests and influence.

Social innovations resulting in engaged citizens and public mobilization

Based on collected and analysed data, **social innovation in the blue sector is a novel concept and is primarily driven by the industry sector**, as the industry stakeholders have the knowledge, facilities and networks to develop, launch, put a product on a market, use it and promote it. Nevertheless, in our research we interviewed three NGOs that are exploring and/or supporting social innovation, namely Nausicaa and its Blue Living Lab, Submariner and its incubation programme, and Fjord CleanUP, which is still developing social innovation projects. These organisations pointed out that they are still learning on how to do social innovation, what methodologies are helpful and how to involve citizens.

Among the citizens that joined the Blue Living Lab and the Submariner's incubation programme are researchers, students and (potential) entrepreneurs. In view of Nausicaa, **citizens are willing to develop a social innovation project, although there has been a limited number of platforms that would support them.** Fjord CleanUP confirmed that their journey in social innovation has been marked by a lack of support, although potential customers have been expressing enthusiasm for new, locally developed, sustainable products.

Until now, **citizens' involvement in social innovation has been primarily limited to participation in the market analysis for the development of a new product**. Namely, the innovators approached the public with samples of a product or a survey to learn about their consumer preferences. The interviews showed that the organisations that have access to the general public have been supporting innovators. For instance, Nausicaa has been offering its research and incubation facilities, and allowed members of the Blue Living Lab to approach visitors of the aquarium and invite them to participate in a market research.

Submariner believes that social innovation has great potential in the blue sector. The NGO has expanded its activities to incubation services to support its members, start-ups and SMEs in the development of blue, sustainable products. However, Submariner warns that the **role of social engagement in social innovation should not be overestimated**, as the general public can offer only limited contribution to the design of a novel product or a service. Thus, it will be limited to the existing activities, namely contribution to market research, and daily consumer choices, as citizens would have to choose between sustainable and unsustainable products. To support a change in consumer behaviour, **it is essential to involve industry actors across the entire value chain and encourage citizens to taste or test innovative products**. The latter will require promotion of the novel products on mass media, in aquariums, sea gardens, with the involvement of different influencers. In case of sustainable, blue food products, they should reach the shelves of supermarkets, public canteens at schools, universities and restaurants.

The interview findings reveal that **social innovation is a useful concept that should be more strongly promoted and supported by the public sector**. Innovators would benefit from support in the development of ideas, technical advice, provision of facilities and equipment for pilot development, and financial assistance. Nausicaa pointed out that in France a useful mechanism to stimulate social innovation has been the research tax credits that encouraged the public to develop research projects in exchange for decrease in taxes.

9.6. Recommendations

The current chapter presents the list of recommendations for the implementation of the Mission in the Lighthouse area of the Baltic and North Sea region. These recommendations are developed based on research findings and with the reference to public mobilisation and engagement activities and outcomes outlined in the Mission Implementation Plan. The latter is presented in the Box below.

Box 28 Outcomes of the mission

By 2025:

- Tried and applied deliberative democracy mechanisms and social innovation practices for the co-design and co-implementation of solutions for the restoration of the aquatic environment.
- Developed and piloted frameworks and processes for participatory governance and deliberative democracy, including an EU-wide network of assemblies to enable effective citizen and stakeholder involvement in the Lighthouses.
- Up-scaled the European Research Area funded pilot citizen science campaign "Plastic Pirates – Go Europe" together with further member states.
- Involved the European solidarity corps in restoration projects.
- Promoted apps allowing citizens to collect data and observations and will promote (digital) data collection and participatory research involving citizens for the monitoring and restoration of ocean and waters.

By 2030:

- All European citizens have the opportunity to engage in the preservation and restoration of oceans and waters through participative means, volunteering and citizen science.
- All European citizens are empowered to be actors in the preservation and restoration of oceans and waters through social innovation, awareness raising, education and training.
- Promoted EU-wide annual ocean literacy campaigns, in cooperation with the EU4Ocean Coalition to strengthen public awareness and overcome the emotional disconnect with the ocean and waters
- Launched regular citizen science campaigns as a part of novel participatory research initiatives to increase the reach, quality and impact of scientific initiatives and boost the environmental awareness of the participants.

Source: *European Missions. Restore Our Ocean And Waters By 2030, Implementation Plan*[446]

---

446 HTTPS://EC.EUROPA.EU/INFO/SITES/DEFAULT/FILES/RESEARCH_AND_INNOVATION/FUNDING/DOCUMENTS/OCEAN_AND_WATERS_IMPLEMENTATION_PLAN_FOR_PUBLICATION.PDF

Considering the expected outcomes presented in the Mission Implementation Plan, the priorities of the Mission are the following:

- Application of democratic governance in several formats as social innovation, participatory governance, to ensure involvement of citizens and stakeholders in the Lighthouses,
- Have wide annual ocean literacy campaigns for strengthening citizen awareness, increasing education level and training,
- Promote the engagement of citizens into citizen science activities for wider restoration and monitoring of ocean and waters.

To address these priorities, we recommend the following actions:

- The Mission and its goal should be widely promoted and clearly stated. Most interviewees indicated that they and their network are not aware of the Mission goals and implementation plans. Thus, efforts should be put into raising awareness about the Mission. This could be paired with the ocean literacy campaigns that the Missions envisages to organise. Like any other activity aimed at citizen engagement, the Mission also requires clear and understandable justification. The focus of the Mission should also be unambiguous – will it be growth of maritime sectors or conservation of environment. To create a clear and positive association with the Mission during promotion activities, it is suggested to use well-known marine-related symbols, such as seashells.
- A clear implementation process of the Mission, also including funding instruments, with large-scale promotion throughout Europe, using both traditional media and social media tools for public engagement is needed. Due to great abundance of initiatives and competition for attention of the public, the endorsement of the Mission should connect to other global programmes like SDGs, UN Ocean Decade and the EU Green Deal.
- The Mission should choose topics and activities, which are relevant, relatable and easily understandable to citizens, like reduction of pollution, recording of species or simple measurements. The thematic areas that are in the focus of the Mission (i.e., maritime transport, maritime infrastructure, and offshore renewable energy) require technical knowledge. Thus, they need to be translated into topics that citizens can relate to. To identify those topics and associated relevant activities it is advisable to organise a co-designing/co-creation activity with the potential participants, stakeholders and experienced organisers.
- To involve young people (11-18 years old) in citizen engagement activities of the Mission it is critical to ensure an innovative design of the activities that focuses on interactivity and creativity. In addition, digital technologies, applications and social media channels should be used while promoting and engaging young people in these activities. To stimulate citizen engagement among children (below 11 years old) it is important to introduce high quality ocean and water literacy classes into educational curricula of schools.
- The citizen engagement activities should focus on all three Mission objectives (on the protection and restoration of marine and freshwater ecosystems and biodiversity, on prevention and elimination of pollution etc.), given connectivity of the thematic areas and greater appealing/relatability of some topics for the public.

- Social innovation needs additional promotion and support to maximise the potential of the sustainable, circular and carbon-neutral blue economy. It is essential to support collaboration between the blue industry actors and NGOs to ensure citizen engagement in social innovation. Collaboration could be fostered through joint initiatives, formulation of common goals or themes on which stakeholders work in parallel. In addition, it is important to encourage the use of participatory and co-creation approaches to mobilise public engagement and to stimulate the development of initiatives with a higher degree of citizens' decision-making power. Public actors that are involved in the organisation of activities with the co-creation elements should receive training on how to effectively involve citizens in the participatory processes.

- A well-known, experienced and global/macroregional actor (such as, environmental NGO) with extensive network in the blue economy and civil society sectors would be well-positioned to lead the EU-wide campaigns on ocean literacy. Such actor would mobilise existing networks and the networks of its partners, delivering the campaigns in an efficient and effective manner.

- Involvement of local existing resources - networks and actors - is critical for the implementation and continuous support of the Mission. These actors have been true advocates of sustainable, carbon neutral and circular blue economy, and they have developed networks that would catalyse a change on a local level. Museums, aquaria, zoos, blue and green NGOs, science centres and network organisations in the blue economy are the first to be involved.

- The Mission should launch open calls for Citizen Science. The local actors and networks that are implementing relevant activities should be encouraged to participate.

- Monitoring and evaluation framework should be developed and deployed across the EU to include the activities and success measurements of activities in all regions.

- The activities for effective citizen engagement should be organised in the following order: first, selection of topics and activities, which are relevant to citizens, and which will be endorsed by other global programmes; second, development of clear communication messages and symbols related to the Mission that will attract citizens' and stakeholders' interest; third, wide promotion of the Mission using existing networks and media channels; fourth, launch of several EU-wide citizen engagement activities (e.g., public campaigns); fifth, mobilisation of local actors, resources and networks for the uptake/implementation of the Mission at a local level.

RECOMMENDATIONS

Governance

- Since the marine environment is influenced by variety of sectoral policies and strategies, which developed over the time, and the regulation of most of sectors has been in place long before the sustainability requirements appeared, the full integration of these policies is yet to come. It is expected that adoption and implementation of MSPs in the European seas will enhance the application of ecosystem approach and thus strengthen the sustainability of marine ecosystems. Therefore, it is suggested by the study that the maritime spatial plans are used as a basis for developing the EU Blue Economy in the lighthouse areas.

- In order to improve governance, it is important to focus efforts on implementing and integrating existing policies, and on fulfilling the intentions behind thematic policy visions.

- Marine environmental monitoring programmes need to be improved (fit- for- purpose and underpinning longer-term scientific objectives which cut across policy and other drivers and consider cumulative effects of multiple pressures).

Maritime transport

- EU-wide statistics should be established on number of ferries operating in both Baltic and North Sea areas, including data on the age of vessels and fuels used. (Some national authorities are collecting this data already, another potential source could be European Maritime Safety Agency (EMSA).)

- Data on decarbonisation of ferry routes is linked to the vessels and as such, should be linked to data of ferries

- The indicator framework should be set-up based on the data that can be collected centrally through EMSA or national authorities reporting through EMSA.

- Further support R&I in alternative fuels/propulsion systems for application in the ferry transport, including batteries, hydrogen, ammonia and methanol, in particular demonstration projects operating in real conditions demonstrating both technical and economic feasibility of such solutions.

- Support R&I in alternative fuels infrastructure that goes hand in hand with the development of alternative fuels.

- Due to the lifetime of vessels, it is expected that many vessels operating today in the lighthouse areas will still be in operation in the medium term (by 2030), thus incentives to further reduce the overall emissions of ferry fleet should be developed, e.g., retrofitting programmes to improve energy efficiency.

- Support projects focused on overall optimisation of maritime traffic like just-in-time operations and Sea Traffic Management (see next section on ports) leading to fuel consumption savings and higher overall efficiency of operations.

- Showcase and share the best practices on the use of alternative fuels/propulsion systems as well as operational and technical measures to improve energy efficiency.

Ports

- Data collection on decarbonisation of port facilities and existing incentive schemes in accordance with the above proposed indicators by national authorities and reported on an annual basis.

- Together with the development of vessels using alternative fuels/propulsion systems (see section on maritime transport), support development of enabling infrastructure for those vessels.

- Further promote R&I on decarbonisation of port facilities, e.g., through projects like "Docks The Future" that focuses on developing the methodology for a coordinated approach to the clustering, monitoring and evaluation of results of actions under the Ports of the Future topic.

- Promote the introduction of green initiatives for ports to facilitate both decarbonisation of vessels and ports.

- Support projects focused on overall optimisation of maritime traffic like just-in-time operations and Sea Traffic Management.

Offshore Renewable energy (RE)

- Establish a more centralised collection (e.g. Eurostat) of indicators that enables an isolated assessment of offshore RE performance to ensure consistent data quality and avoid the fragmentation of data across national statistics and/or private stakeholders.

- Establish more comprehensive datasets on the performance of offshore RE facilities, such as environmental conditions, operational ability, reliability, and recyclability as well as environmental impact performance. This can be done by obtaining and merging datasets, for example, meteorological data and data from project developers, operators, and owners of offshore RE facilities.

- To support projects and activities that promote knowledge exchange among maritime spatial planners on how to enable a better uptake of offshore RE in MSPs.

- To support projects and activities that increase the uptake of multi-use offshore RE projects, such as in combinations with marine aquaculture or recreational purposes.

- To support projects and activities that help the exchange of effective practices to remove barriers to the permitting processes for offshore RE projects and promote multi-use approaches to offshore RE.

- To support R&I projects that introduce new approaches to achieving full circularity of offshore RE facilities, focusing particularly on materials that are currently not recyclable or difficult to recycle or reuse (e.g. wind turbine blades) and environmental impact.

Onshore facilities of offshore renewable energy

- The low number of operational offshore RE energy storage facilities makes it of limited relevance to ensuring the provision of centrally stored data. However, as more offshore RE storage facilities become operational, it is recommended to ensure that the data underlying the indicators proposed for the baseline are centrally collected, either by national authorities or the European Commission, to ensure harmonised data of sufficient quality.

Since countries championing energy storage are found in the lighthouse area, it is recommended to:

1. Promote projects and activities that research options to establish energy storage facilities on MPPs,

2. Promote projects and activities that investigate offshore energy storage on existing facilities, and particularly geological storage in the North Sea,

3. Promote knowledge exchanges, where championing regions within offshore energy storage (including conversion technologies that turn electricity into carbon neutral synthetic fuels, known also as Power-to-X) can share their insights and experiences in the lighthouse area,

4. Support early niche applications with promising commercial potential, including scalability of technology, manageable technology risk, and wider societal acceptance.

Multipurpose platforms (MPP)

- Due to the low number of operational MPPs and the overall infancy of the sector, they are currently of limited relevance to ensuring the provision of centrally stored data. However, once the number of operational MPPs start growing, it is recommended to ensure that the data underlying the indicators proposed above are systematically collected

- The analysis has shown that pilot studies and projects are ongoing but have yet to produce significant results or data that can signal a potential upscaling. It is therefore recommended to gather and disseminate more evidence on the experiences with MPPs, to learn about enabling factors and barriers, notably in terms of permitting and licensing.

It is recommended to:

1. Conduct knowledge dissemination activities on recent and on-going projects piloting the use of MPPs in the lighthouse area,

2. Support activities and projects that support maritime spatial planners on how multipurpose platforms (and multi-use of marine space) can be further integrated into MSPs.

Aquaculture

- EU-wide statistics should be established which further enable the separation of marine aquaculture from land-based aquaculture.

- EU-wide statistics should be established which enable the quantification of sub-types of marine aquaculture production, i.e. 'low impact', organic, and biofuels.

- The competition of marine aquaculture with other marine activities, such as transport, fishing, and offshore RE which often take precedence over aquaculture, calls for a more efficient use of aquaculture space and establish a more supportive permitting framework for marine aquaculture.

It is therefore recommended to:

1. Support activities & projects that promote and further mature the use of IMTA (Integrated Multi-Trophic aquaculture) to support more space-efficient marine aquaculture.

2. Support activities & projects that further develop multi-use concepts that make marine aquaculture an attractive addition to other offshore activities, such as offshore wind.

3. Support activities & projects that provide knowledge exchanges among stakeholders on how permitting for the use of marine space can help promote the integration of marine aquaculture with other uses of marine space.

4. Use research funding, e.g., Horizon Europe, to increase the competitiveness and energy efficiency of recirculating aquaculture systems (RAS) for marine production, with a focus on the Baltic Sea.

5. Support activities & projects that promote alternative approaches to mitigating eutrophication and nitrogen overloads in the Baltic Sea (e.g., IMTA and more intensified mussel production).

6. Support activities & projects that develop the production technologies and establish offtake markets for feed production (e.g., mussels for feed production), energy feedstocks (e.g., algae for biofuels), and other bio-based products from marine aquaculture.

Synergies with regional innovation strategies

- A concrete way for the regions to contribute more to Mission Objective 3 would be to add zero carbon as a design parameter for blue economy tenders (e.g. regarding offshore energy, aquaculture and ports).

- It would be useful to provide examples of how the regions can include zero-carbon as a design parameter in ERDF calls.

- Information and best practices should be shared, as an inspiration for regions on what they can do to contribute to a carbon-neutral and circular blue economy and what the region can gain from this. For this, the S3 platform can be used to disseminate information (by contacting nominated contact persons for each RIS3, or organizing workshop).

- For the regions that have working groups, monitoring groups or steering groups in place, these committees can be informed and involved in the Mission.

- A first step in identifying good practices could be to look at the EU macro-regional strategy for the Baltic Sea Region, which has many flagship projects related to the Mission Objective 3 (such as, the work on the flagship ECOPRODIGI, where digital solutions are being sought for increasing efficiency and reducing emissions for ships when at a port).

- National agencies could play an important role in improving the synergies between RIS3/RIS4 and Mission objectives. National agencies could help regions in linking their strengths and smart specialisations to contributing to the Mission, and/or making suggestions to the regions and provide them with more information on the Mission.

Citizen engagement

- The Mission and its goals should be widely promoted towards all groups of relevant stakeholders.

- Endorsement of the Mission should connect to other global programmes like SDGs, UN Ocean Decade, EU Green Deal. It is key to build synergies with other citizen engagement activities.

- The Mission should choose topics and activities which are relevant, relatable, and easily understandable to citizens.

- Social innovation needs additional promotion and support to maximise the potential of the sustainable, circular, and carbon-neutral blue economy

- Involvement of local existing resources - networks and actors is critical for the implementation and continuous support of the Mission. The design of citizen engagement activities should be tailored to local needs and context.

CONCLUSIONS

It is apparent that there are many initiatives underway in both The Baltic Sea and The North Sea area that are contributing to sustainable Blue Economy goals. The North Sea is pioneer in terms of decarbonizing ferry transport (especially Norway), there are fewer ferries running on alternative fuels operating in the Baltic Sea. Key projects related to decarbonisation of ferries illustrate the ways in which the North Sea is moving towards decarbonisation as well as Blue Growth. These projects are spread out across the lighthouse area and are related to ship conversion to alternative fuels rather than port infrastructure to support.

LNG and OPS infrastructure standout as leading measures for decarbonisation of ports and vessels in both lighthouse areas. In the North Sea area, Norway dominates in terms of number of both OPS and LNG fuelling facilities. In the Baltic Sea, there are fewer LNG and OPS facilities as compared to the North Sea (with higher number of facilities in Sweden). Other measures to support decarbonisation include port calls optimisation, such as just-in-time operations and the conception of Sea Traffic Management (STM). There are also individual port initiatives for ships across the lighthouse areas to adapt to support greener shipping, e.g. through reduction of port fees, funding and research.

Offshore wind energy in the Baltic Sea, and, especially in the North Sea has experienced rapid growth in recent years, and the annual cumulative installed capacity is expected to significantly increase in coming years. Untapping such potentials, while preventing degradation of the environment, will require addressing regulatory and legal barriers (e.g., complex permitting rules), strategic maritime and spatial planning, government support, and decommissioning practices.

The projects related to the integrated implementation of various offshore RE and storage systems are at an early stage of development. Unlocking the low-carbon energy potential of the North Sea and Baltic Sea requires integrated system thinking and interlinked changes in the system rather than merely individual technologies improvements. The opportunities for collaboration and synergies between sectors are vast. Several options are currently being considered and developed. The majority of these initiatives are taking place in the North Sea region due to its higher share of offshore wind capacity as compared to the Baltic Sea region.

The aquaculture sector is rapidly growing globally, but in the lighthouse area, the competition for space has made expansion difficult. The sector has significant potential to contribute to the decarbonisation through the contribution to the production of biofuels, for example the seaweed industry or implementing circular feed practices. Combining uses of both aquaculture and offshore wind for example through IMTA or MPPs will help the Baltic and North Seas to account for spatial issues that arise from large fish farms. MPPs and IMTA have yet to see significant uptake and will require regulatory support. Finally, using mussels or oysters to filter nutrients out of coastal waters can lead to an improved acceptance of the sector by environmentalists.

Regarding overall governance situation, the picture regarding implementation of marine/ maritime policies is mixed. Some targeted management measures, or legal obligations, resulting from EU policy have been fully implemented and have been successful in reducing, or even removing, some well-known marine pressures. Other measures/obligations have not been implemented or implemented only in part and/or slowly and with limited success. Next to that, challenges remain also regarding the amount and quality of information available to evaluate progress. For example, no Member State had adequately reported the up-to-date state of its marine waters by the October 2018 (required by the MSFD). Certain pressures are still addressed through fragmented, ineffective approaches. The problem lies not only in the low rate and slow speed of policy implementation, but also in a lack of coherence and coordination between all the policies aiming to protect European Seas.

The European Mission “Restore our Ocean and Waters by 2030” is very well placed to accelerate actions, and stimulate stakeholder engagement and cooperation in the lighthouse areas, but our findings at the time of writing of this report (June 2022) show that the Mission is not very well known outside the research community, and awareness of citizens about the Mission and its potential contribution to sustainable Blue Economy is very low.

Looking at synergies between Regional Innovation Strategies (RIS3/RIS4) in the lighthouse area, it was found that the goals set out in the strategies were often on a higher level than the topics of Mission Objective 3. The objectives were found on the whole ‘blue economy’ as well as on shipping, aquaculture, ports, etc, which in some cases also mentioned zero-emission goals. In some strategies there were goals for zero-carbon/ zero-emission/ circular technologies, sometimes including marine technologies/ offshore energy technologies. However, the high level of the goals formulated in the strategies made it difficult to see if and to what extent the strategy could contribute to Mission Objective 3. Where broader themes were mentioned, such as a focus on aquaculture or offshore energy, it was not always clear if this included zero-carbon/ circular solutions (no specific links to Mission objectives were found). The most of clear synergies were found in relation to marine technologies and solutions (in both regions bordering the Baltic Sea and regions bordering the North Sea). Synergies on battery, hydrogen or ammonia propelled ferries were also found in considerable number of the strategies analysed. And, finally, the strategies analysed often have objectives related to aquaculture/ algae production.

Our findings regarding R&I potential in lighthouse areas show, that there is substantial research potential in both The Baltic Sea, and The North Sea area. There are peak performers or “R&I Hubs”, which are more developed in terms of connectivity to EU networks (considerably higher proportion of them found in The North Sea area, thus indicating relatively significant level of efficiency in the North Sea regions’ research and innovation systems). Next to that, looking at research and innovation results such as patents, H2020 projects and publications, it is clear also that the North Sea basin performs above the EU average on every aspect. However, it is clear also that cities in both lighthouse areas with major universities or industrial strongholds (such as Stockholm, London, Hamburg, Copenhagen, Skane and Vastra Gotaland) are consistently showing high performance. This potential is a promising asset in further development of measures, projects and programmes that will contribute to innovation that will lead to reduction of emissions, implementation of circular economy solutions and other measures leading to sustainable Blue Economy in the lighthouse areas.

Annex A : DEL1 : Description of the Lighthouse areas

Overview of the regions in scope at different NUTS-levels

Sea Basin	Country	NUTS2*	NUTS3*
Baltic Sea	Estonia	EE00	EE001 EE004 EE009 EE00A
	Finland	FI19 FI1B FI1C FI1D FI20	FI195 FI196 FI1B1 FI1C1 FI1C4 FI1D5 FI1D7 FI1D9 FI200
	Latvia	LV00	LV003 LV006 LV007
	Lithuania	LT02	LT023
	Poland	PL42 PL62 PL63	PL424 PL426 PL428 PL621 PL633 PL634 PL636 PL638
	Russia		
Both	Germany	DE50 DE60 DE80 DE93 DE94 DEF0	DE501 DE502 DE600 DE803 DE804 DE80K DE80L DE80M DE80N DE932 DE936 DE939 DE941 DE942 DE943 DE945 DE946 DE947 DE94A DE94C DE94D DE94G DE94H DEF01 DEF02

			DEF03 DEF04 DEF05 DEF07 DEF08 DEF09 DEF0A DEF0B DEF0C DEF0D DEF0E
	Denmark	DK01 DK02 DK03 DK04 DK05	DK011 DK012 DK013 DK014 DK021 DK022 DK031 DK032 DK041 DK042 DK050
	Sweden	SE11 SE12 SE21 SE22 SE23 SE31 SE32	SE110 SE121 SE122 SE123 SE213 SE214 SE221 SE224 SE231 SE232 SE313 SE321 SE331 SE332
North Sea	Belgium	BE21 BE23 BE25	BE211 BE212 BE231 BE232 BE233 BE234 BE236 BE251 BE252 BE253 BE255 BE256 BE257 BE258
	France	FRD1 FRD2 FRE1 FRE2 FRH0	FRD11 FRD12 FRD21 FRD22 FRE11 FRE12 FRE23 FRH01 FRH02 FRH03

			FRH04
	The Netherlands	NL11 NL12 NL13 NL23 NL32 NL33 NL34 NL41	NL111 NL112 NL113 NL124 NL125 NL126 NL131 NL230 NL321 NL323 NL324 NL325 NL327 NL328 NL329 NL332 NL333 NL337 NL33A NL33B NL33C NL341 NL342 NL411
	Norway	NO08 NO09 NO0A	NO081 NO082 NO091 NO092 NO0A1 NO0A2
	United Kingdom	UKC1 UKC2 UKE1 UKE2 UKE3 UKE4 UKF1 UKF3 UKH1 UKH2 UKH3 UKI3 UKI4 UKI5 UKI6 UKI7 UKJ1 UKJ2 UKJ3 UKJ4 UKK1 UKK2 UKK3 UKK4 UKM5 UKM6 UKM7 UKM8 UKM9	UKC11 UKC12 UKC13 UKC14 UKC21 UKC22 UKC23 UKE11 UKE12 UKE13 UKE21 UKE22 UKE31 UKE32 UKE42 UKE45 UKF15 UKF30 UKH11 UKH14 UKH15 UKH16 UKH17 UKH21 UKH23 UKH31 UKH32 UKH34 UKH35

			UKH36 UKH37 UKI31 UKI32 UKI33 UKI34 UKI41 UKI42 UKI43 UKI44 UKI45 UKI51 UKI52 UKI53 UKI54 UKI61 UKI62 UKI63 UKI71 UKI72 UKI73 UKI74 UKI75 UKJ11 UKJ13 UKJ21 UKJ22 UKJ25 UKJ26 UKJ27 UKJ28 UKJ31 UKJ32 UKJ34 UKJ35 UKJ36 UKJ37 UKJ41 UKJ43 UKJ44 UKJ45 UKJ46 UKK15 UKK23 UKK24 UKK25 UKK30 UKK41 UKK42 UKK43 UKM50 UKM61 UKM62 UKM63 UKM64 UKM65 UKM66 UKM71 UKM72 UKM73

			UKM75 UKM76 UKM77 UKM78 UKM81 UKM82 UKM83 UKM84 UKM91 UKM92 UKM93 UKM94 UKM95

* Depending on the data availability either the NUTS2021 Classification or the NUTS2016 Classification was used. There are several changes between the two Revisions that are relevant to the Lighthouse area. These changes include:

- EE006 and EE007 recoded into EE009 and EE00A (boundary changes)

- NUTS2: NO08 is new, replaced NO01, NO09 is new, replaced NO04 and NO03. NUTS3: NO082 = NO012+NO031+NO032 ; NO081 = NO011; NO091 = NO033+NO034 ; NO092 = NO041+NO042 ; NO0A1 = NO043 ; NO0A2 = NO051+NO052

- UKK21 and UKK22 recoded in UKK24 and UKK25

For more information on the changes between the two revisions and correspondence tables, see: https://ec.europa.eu/eurostat/web/nuts/background

Annex B: DEL2 – Baseline

Case studies

This Appendix constitutes an add-on to the second of the Baseline study for the implementation of the lighthouse in the Baltic and North Sea basin for the Mission ”Restore our ocean and waters by 2030”. The report contains four case studies which cover routes in the Baltic and the North Sea that are running on clean technologies, namely electric, LNG, hydrogen and methanol. The case studies have the following structure and inputs:

1. Technology & supportive infrastructure

2. Business setup that secures profitability of the route (Operations and Management)

3. Financing setup that enabled investment

4. Timeline

5. Engaged stakeholders

Table 66 below presents basic information on the case studies. The case studies that follow have been developed through interviews, desk research, and analysis from the baseline study (part of Task 2) and which has been described in the interim report.

Table 66 Case study information.

Case Study	Lighthouse Area	Company	Technology
Hjelmeland-Skipavik Line (Norway)	North Sea	Norled	Hydrogen
Gothenburg-Kiel Line (Germany / Sweden)	Baltic Sea	Stena Line	Methanol
Stockholm-Turku Line (Sweden / Finland)	Baltic Sea	Viking Line	LNG
Æro Ferry (Denmark)	Baltic Sea	Ærø Ferry	Electric

Case Study 1: Hjelmeland-Skipavik Line (Hydrogen)

Background Information

The ferry, MF Hydra commissioned by Norled, designed by LMG Marin and built by Westcon, is the world's first liquid hydrogen (LH_2) powered ship.[447] The ship uses LH_2 and is equipped with two 200 kW fuel cells, a 1.36 MWh battery, and two 440 kW diesel generators. The MF Hydra began battery-supplied-only operation in the summer of 2021 and is expected to operate fully operate on LH_2 in the fall of 2022.[448] The ferry can carry up to 300 passengers and 80 cars. The ship was awarded the Ship of the Year for 2021 award by the Norwegian Ministry of Transport "for its a marvellous display of climate-friendly innovation created with the best collaboration of business and authorities".[449]

Technology and supportive infrastructure

LMG Marin, which was responsible for the design of the ship, was a first-mover on the market to introduce an LH_2 fuelled ferry. This reportedly proved to be challenging for the design, as all available technology was only available for the use of this fuel on land. Much of the equipment therefore needed to be extensively modified for the purposes of maritime transport. For example, LMG Marin reports challenges in terms of the bunkering of LH_2, as hydrogen is highly explosive when in contact with oxygen, and its need to be stored at cryogenic temperatures. Additionally, in terms of the process of obtaining the Class and Flag certificates, a comprehensive approval process was required as no rules were established at this stage for LH_2 vessels. As of June 2022, hydrogen fuelled vessels still require an individual approval process.[450]

The fuel for the ferry is sourced from a hydrogen plant in Germany and is subsequently trucked to Norway. The hydrogen produced is currently grey, but is foreseen to become blue and green hydrogen in the course of 2022.[451,452,453] The hydrogen is trucked from Leipzig in Germany, where it is produced by German Linde, which currently produces primarily grey hydrogen. In light of the high associated GHG footprint, the operator is planning to bring the hydrogen sourcing locally to Norway. The foreseen time schedule and exact sourcing location are however yet to be determined.

---

447 https://www.lmgmarin.no/references/485/hydra

448 https://issuu.com/coxbox/docs/norled_a_rsrapport_2021

449 https://www.fleetmon.com/maritime-news/2021/35417/worlds-first-hydrogen-ferry-wins-ship-year-award/

450 https://www.hylaw.eu/database/#/database/vehicles/boats-ships/design-type-approval

451 Input from interview with LMG Marin. Unless specified elsewhere, the input will be based on the interview with the company representative.

452 https://www.linde-engineering.com/en/about-linde-engineering/success-stories/hydrogen-in-leuna-the-success-story-continues.html

453 Grey hydrogen is produced from natural gas and is therefore a fossil-fuel based fuel;
Blue hydrogen is produced from natural gas and combined with carbon capture and storage;
Green-hydrogen is produced from renewable sources.

Being a zero-emission waterborne transport (ZEWT) fuel, LH_2, among other benefits, has low-pressure storage and can be a carbon neutral fuel if sourced from renewable sources. Hydrogen is one of few available options for ZEWT over longer distances. For example, purely battery-driven ships only have a short range.

The main risks regarding the use of LH_2 were to i) secure an acceptable level of safety for passengers and ii) achieve an LH_2 functionality on a moving water vessel. According to LMG marin, the LH_2 bunkering process is more challenging than any traditional fuel. The risks associated with the technology design were overcome by using experienced suppliers that have hands on experience with hydrogen from other applications. To prevent safety risks, the design solution was to use an open deck to secure maximum natural ventilation as well as proper distance from other functions on board.

Regarding bunkering, there are still bunkering solutions to be developed in the calling ports of the Hjelmeland-Skipavik Line. The plan is to build a special bunkering tower on a dedicated quay for the purpose of improving the bunkering rate. The target bunkering rate has thus far proven to be challenging to achieve in rough water conditions. Maintaining drive pressure for fuel cells in choppy, wave-heavy conditions have led to additional costs which were not anticipated. It has, however, not been possible to quantify these costs nor the measures that had to be taken.

Permits and administrative procedures

The main burden of the development was the Class approval of the vessel, which required a Non-Class type approval for the project with a need to change safety protocols to achieve Class approval.[454] In order to get Class approval, a third-party quantitative risk assessment (QRA) must be conducted, which was originally planned to be conducted in-house.

The commissioning of the vessel was subject to some delays. Particularly, as there was a need for a deck solution for the ship to be able to operate without hydrogen. The deck solution contributed to these delays as this involved intensive planning for the other machines and operations on board.

Administratively, both Class and Flag approval have proved to be burdensome.

Business set-up that secures profitability of the route (Operations and Management)

The hydrogen-fuelled ferry from LMG Marin was built as a result of a tender announced by the Norwegian state organisation Navigational Risk Assessment (NRA). The operation costs are born by Norled and are not offset by any sort of grant or ticket sales. In terms of technological costs, there are heightened investment costs and operation and maintenance (O&M) costs from operating with hydrogen. Furthermore, additional training is needed for personnel working with LH_2 operations, which makes being a first-mover on the technology particularly difficult. It has, however, not been possible to identify more precise estimations of the investment and O&M costs as part of this case study.

[454] Every vessel is subject to an approval process that certifies the safety of the safe operation is ensured. As vessels can have some degree of commonality, vessels of the same class can be approved based on the same type approval, which eliminates unnecessary duplication of the approval processes. If a vessel does not fit to an existing type approval, the vessel must be approved individually.

Financing setup that enabled investment

The vessel was procured by the Norwegian Public Roads Administration (Statens Vegvesen) and was as such funded publicly. The operator, Norled, is however a private company that serves as a ferry-supplier and agreed with Statens Vegvesen to construct the world's first hydrogen ferry.

With regard to the enabling environment as well as barriers encountered at the wider EU level LMG Marin reported challenges in obtaining flag approval for LH_2 vessels, despite support by a special task force that was organised by Statens Vegvesen to support on the individual approval process.

Timeline

The construction began in 2018 and the ferry started battery-powered operation in 2021. As of June 2022, the ferry is still operating on batteries only. The vessel is thus not yet complete but is planned to operate on LH_2 from autumn of 2022 on.

Engaged stakeholders

The key stakeholders involved in the project ranged from actors involved in the containment and process systems to the shipyard and end client. Linde, based in Germany, was responsible for containment and process systems as well as hydrogen supply. Gexcon was the QRA responsible andLMG Marin was responsible for the ship design with Norled as operator and owner. Ballard supplied the fuel cells, Seam provided the electric system integrator and Westcon is the shipyard where the ferry was being outfitted. The approval systems of DNV Class and NMA Flag are key stakeholders alongside Norled and Statens Vegvesen.

No local engagement with citizens nor publicity events regarding the introduction of the vessel have been identified. The ferry has, however, received some publicity owing to its Ship of the Year for 2021 award by the Norwegian Ministry of Transport mentioned above.

Case Study 2: Gothenburg-Kiel Line (Methanol)

Background Information

In 2015, the Swedish company Stena Line refitted its RoPax ferry Stena Germanica with engines that can run on methanol. Stena Line is one of the world's largest operators of RoPax and RoRo ferries with 40 vessels on 23 routes within Northern Europe. The ferry is the world's first methanol ferry and operates using a dual fuel system with both methanol and diesel. The methanol for the specific vessel qualifies as a recycled carbon fuel produced using residual steel gases, a by-product of steel production. The fuel emits 90% less sulphur and particulates, 60% less nitrogen, as well as 25% less CO_2 compared to traditional diesel fuel. The 240-metre-long ferry has a 1,500 passenger and 300 car capacity. The vessel has been built in cooperation with Methanex, Wartsila and the EU's motorways of the Seas project as part of the Horizon 2020 programme.[455]

Technology and supportive infrastructure

Green methanol is a low-carbon fuel that can be produced via biomass gasification, renewable electricity, and captured carbon dioxide. In the case of the Stena Germanica line, the methanol is produced from CO_2 that has been captured from an industrial blast furnace used for steel production as well as H_2 that has been recovered from the furnace gas itself, and H_2 produced by electrolysis.[456] The project was the first of its kind making the Stena Line a first-mover on methanol for ships at its start in 2015.[457]

The methanol is supplied from two pilot plants: one for the separation of H_2 and CO_2 and the other for the production of methanol from a CO_2-H_2 syngas system. The H_2 and CO_2 captured, as well as residual Coke oven gas from the blast furnace-basic oxygen steel plant (BF-BOF), are also used as feedstock for methanol production.

In other ferries, Stena Line injects AdBlue, an Aqueous Urea solution, into the exhaust steam in front of a catalytic converter to create nitrogen and water vapour out of nitrogen oxides.[458] The implementation of methanol allows for a reduction in the use of AdBlue. In addition, Heavy Fuel Oil is no longer required on board, which improves the working environment of the crew as the machinery room is cleaner than when oil is being used. On the other hand, the fuel valves of the technology require the crew to make more maintenance efforts to mitigate fuel and lube oil leakage. Finally, the use of double pipes makes it cumbersome to locate and repair leaks.

New bunkering and storage tanks for methanol were constructed in the port of Gothenburg as a result of this project. The storage tank was built with all the safety features necessary to fulfil the safe handling of the fuel. It has, however, not been possible to identify whether additional bunkering is foreseen in the port of Kiel, and what implications the bunkering process has on the turnaround time of the vessel in the port of Gothenburg.

---

455 http://www.fresme.eu/news/fresme-final-use-demonstration.php

456 http://www.fresme.eu/news/fresme-final-use-demonstration.php

457 Input from interview with Stena Line representative. Unless specified elsewhere, the input will be based on the interview with the company representative.

458 https://www.wartsila.com/encyclopedia/term/adblue

Permits and administrative procedures

The main barriers to the technology were the use of nitrogen in large quantities, ATEX equipment (equipment for potentially explosive atmospheres), as well as the need for a long and high-pressure system. Methanol is a low flashpoint fuel, which makes use and storage difficult for the first-mover.[459] The bunkering process for the storing and distribution of the fuel are therefore still subject to further development in order to increase the safety of handling the fuel. The risks of using methanol as fuel were overcome by using the risk assessment methods of a Hazard Identification and Hazard and Operability (HAZOP) Study, in close cooperation with classification stakeholders, harbour authorities, and technological partners. The risk tools allow for all hazards to be identified at the outset and ensure the safety of using methanol as a fuel.

Business setup that secures profitability of the route (Operations and Management)

The O&M costs associated with the sourcing of the methanol fuel was in part supported by external funding through the Horizon 2020 project From Residual Steel gases to Methanol, or FReSMe, (see further information below).

The additional costs associated with methanol use were mainly caused by the need for new parts and spare parts to convert the engines. The case study could, however, not identify the detailed O&M costs, nor the extent of the price premium for the fuel and the implications for the profitability of the route. In addition, new staff was needed for the operation of the ferry, including training costs for the additional crew members. There were, however, no further financial inputs that would help offset the costs of operation and management.

Financing setup that enabled investment

The project was funded through H2020 under the FReSMe project and integrates technology from previous projects also funded by the EU. The FReSMel, project had the objective of demonstrating that methanol production from residual steel gases for ship transportation was feasible. The project received about EUR 11.4 mio. of funding, which partly financed the methanol production. The classification of the conversion to methanol was conducted by Lloyd's register.

The projects, STEPWISE and MefCO2, focussed on CO_2 capture and improvement in technology to produce methanol from CO_2. The results from these projects were able to be transferred over to the FReSMe project and were used in the pilot plant for the production of methanol.

Timeline

The vessel was updated with newer engines in 2015 and entered back into service the same year.

---

[459] Low-flashpoint fuel means gaseous or liquid fuel having a flashpoint lower than otherwise permitted under paragraph 2.1. 1 of SOLAS regulation II-2/4 (https://www.itfseafarers.org/sites/default/files/node/resources/files/ITF%20Guideline%20on%20IGF%20Code.pdf)

The FReSMe project on the production of methanol fuel started in 2017, initiating the pilot design, construction, and process optimisation. By 2019, the pilot plant was commissioned, followed by materials production testing. By mid-2021, the FReSMe project was concluded, but the vessel is still operating on recycled carbon methanol from the pilot plant.[460]

Engaged stakeholders

The main stakeholders for operations and ferry management were the Stena Line, the Port of Gothenburg, the Port of Kiel, Methanex and Wartsila. The FReSMe project consortium was also involved as contributors. The decision by Stena to be a first-mover provided a high degree of visibility and marketing surrounding the vessel in 2015. In 2021, when the FReSMe project demonstrated the use of the recycled carbon methanol, this visibility and marketing was renewed.

Since the project has ended, interest in methanol technology is growing according to Stena Lines and will continue to due to the success of the Stena Germanica. This can be attributed to the fact that methanol is suitable for longer voyages and has a high decarbonisation potential, as it can also be produced synthetically through power-to-x. This growing interesting the technology is enhanced by the fact that the world's largest shipping operator, Mærsk, has made substantial investments into 12 new methanol vessels.[461]

[460] http://www.fresme.eu/index.php#PROJECT

[461] https://www.offshore-energy.biz/maersk-secures-green-fuel-supply-for-12-methanol-powered-boxships/

Case Study 3: Turku – Marihamn - Stockholm (LNG/hybrid)

Background Information

Viking Line has introduced the first vessel in the Baltic Sea – and the first "large" passenger vessel in the world – that runs on LNG. The ferry, operating under the name 'Viking Grace', started its service between Turku (FI), Mariehamn (FI) and Stockholm (SE) in 2013.[462] The vessel is a Ro-Pax ferry, 218 metres in length, and with a capacity of 2,800 passengers.

In March 2022, a second LNG-powered vessel, the "Viking Glory", started operations on the same route, building on similar technologies as its predecessor. The vessel is a Ro-Pax ferry, with a gross tonnage of 63,000, 223 metres in length, a capacity of 2,800 passengers, and 1,500 lane metres of cargo.[463]

Technology and supportive infrastructure

The vessels can operate on LNG and liquified biomethane (i.e. bio-LNG), where the cold from the evaporation of the gas is used for cooling functions of the vessels. Both the "Viking Grace" and "Viking Glory" are equipped with LNG-powered Wartsila engines.[462,464] The "Viking Grace" was further equipped with a rotor sail in 2018 and is the world's first hybrid vessel to run on both LNG and wind power.[469]

The idea behind using LNG-fuelled engines was to use LNG as a transition fuel and to be flexible regarding the choice of future, alternative liquefied fuels. The vessel's engines can be run with renewable fuels, such as pure bio-LNG or synthetic fuels. Viking Lines intends to switch to renewable fuels once these become sufficiently price competitive. The choice of an engine that can run on several alternative fuels does not bind Viking Lines to a specific technology, thereby reducing the risk of making a sub-optimal fuel choice. Batteries were not considered, as the travel distance is too far for the size of the vessel.

The engines and supply systems are supplied by Wartsila, which has been offering LNG-fuelled marine engines for over two decades. The engines for "Viking Glory" are "dual-fuelled", which means that these are able to burn natural gas, marine light fuel oil, and heavy fuel oil.[465] Accordingly, the vessel has the flexibility to utilise oil in case LNG is not available.

As has been mentioned, the engine is also able to be fitted to renewable or synthetic liquefied gasses to be used once these become economically viable.[466, 470] The engine for

[462] https://www.vikingline.com/environment/viking-grace/; https://lngprime.com/europe/viking-lines-lng-powered-newbuild-arrives-in-turku/41357/

[463] https://www.newship.vikingline.com/new-technology/

[464] https://cdn.wartsila.com/docs/default-source/oil-gas-documents/brochure-lng-shipping-solutions.pdf?utm_source=engines&utm_medium=dfengines&utm_term=dfengines&utm_content=brochure&utm_campaign=msleadscoring

[465] https://www.wartsila.com/media/news/07-12-2020-best-in-its-class-wartsila-31df-engine-gets-even-more-power-2828036

[466] https://www.wartsila.com/media/news/03-09-2019-new-wartsila-31df-engine-makes-entry-to-energy-industry-with-unprecedented-efficiency-with-fuel-and-operational-flexibility-3051586

the “Viking Glory” was originally introduced in 2015 and is recognised by Guinness World Records as the world’s most efficient 4-stroke diesel engine. Wartsila has however already been offering LNG-powered engines since the early 2000s, and this technology can thus be considered as reliable and well-established.

Nevertheless, Viking Lines perceived the choice of using LNG as challenging back in 2013, as it was for example, unclear where the LNG should be sourced from or how the LNG should be stored on board. However, once the “Viking Grace” entered operations, Viking Lines reports that the choice of LNG was a success, which made LNG a “natural” choice for the “Viking Glory”.

The LNG powered engines are reported to produce only little particulates or sulphuric emissions, as well as 15-20% less GHG and 85-90% less nitrogen emissions than traditional marine fuels. The use of LNG is, however, also subject to methane slip, which is the release of unburned fuel. To minimise the methane slip, Viking Lines has introduced and plans to introduce further mitigating measures, such as running two engines on full speed instead of four engines at half speed.

As stated above, the “Viking Grace” was equipped with a rotor sail in 2018, which was produced by Finnish Norsepower.[467] A rotor sail uses the Magnus effect, in which wind flows create pressure differences that ultimately lead to a propulsion force. For the update of the “Viking Grace” with a rotor sail, Viking Lines was awarded the “Sustainable Achievement of the Year” award by the Finnish Travel Gal in 2018. Viking Lines concluded that the rotor sail provides an average propulsion power of 207-282 kW, providing 300 tons of fuel savings out of 900 tonnes of CO_2 per year.[468]

In order to further reduce GHG emissions, the update of the vessels and route has entailed further investments to reduce the fuel consumption:

“Viking Grace” was the first ship in the world to use the **waste heat energy recycling system** Ocean Marine.[462] The system recovers excess heat from the engines into 700,000 kWh electricity per year. The electricity is primarily used on the cabin decks, for lighting, for example.[462] An updated version of the technology was installed on-board the “Viking Glory”, where the recovered energy is estimated to provide up to 40% of the electricity needed for passenger operations and reduce GHG emissions by around 4,000 tonnes per year.[469]

The “Viking Glory” is further equipped with an **azimuth propulsion system** that increases manoeuvrability of the vessel in ports, which is expected to reduce fuel consumption and to lead to a reduction in GHG emissions of around 10,000 tonnes per year.[469]

An **automatic mooring system** was installed in the ports of Turku and Mariehamn, which dock the vessel through a vacuum. These can be used by both vessels. It is expected that

---

[467] https://www.vikingline.com/globalassets/documents/market_specific/corporate/environment/hbr2018-vikingline-en.pdf

[468] https://www.offshore-energy.biz/rotor-sail-delivers-savings-on-viking-grace-tests-confirm/; https://www.vikingline.com/the-group/viking-line/vessels/ms-viking-grace/rotor-sail/

[469] https://www.vikingline.com/globalassets/documents/market_specific/corporate/environment/hbr2021-vikingline-en.pdf

the automatic mooring system will reduce the speed and time the engines need for port manoeuvres, saving fuel, and thus GHG emissions.[469]

The LNG is supplied from a bunkering vessel (M/S Seagas) when the ferries are moored in the ferry terminal of Stockholm.[470] The bunkering vessel has a capacity of 60 tonnes LNG and obtains its supply from the port of Stockholm which lies 60 km south of the ferry terminal in Nynäshamn, where an LNG terminal is located.

Viking Lines reports that the switch to LNG engines has led to a cleaner engine room, which has been welcomed by the on-board staff. "Viking Grace" also has high requirements when it comes to the elimination of external noise and is one of the quietest ships in the world.[462] Finally, the "Viking Grace" separates its biowaste which is supplied to biogas production.[470]

Permits and administrative procedures

When introducing "Viking Grace", Viking Lines emphasised the safety aspects of LNG to its staff and passengers by educating staff (as part of the regular training required for seamen) and by conducting Q&A sessions for passengers, as it was expected that some stakeholders would express safety concerns. These concerns did not materialise.

In 2019, the rotor sail system by Norsepower was the first auxiliary wind propulsion system that obtained a type approval design certificate, which is the first to receive such a certificate on board a commercial ship. It is however unclear, to which extent Viking Lines intends to retrofit its existing vessels or design future vessels with a rotor sail.

Business setup that secures profitability of the route (Operations and Management)

Viking Lines reports that the choice of LNG has not led to additional O&M costs as LNG was already an established fuel when the "Viking Grace" had been commissioned. Being a fossil fuel, the price of LNG fluctuates, making it at times more or less expensive than, for example MGO. Viking Lines has therefore at times opted to using MGO over LNG when LNG prices were substantially higher.

Overall however, the choice of LNG as a technology has not led to substantial changes in the business setup to secure profitability of the route.

Viking Line has conducted education and training activities for its staff, but these were reportedly not significant, as these were part of the regular safety education & training.

Financing set-up that enabled investments

Both the "Viking Grace" and "Viking Glory" replaced older vessels that were due for replacement. The investment therefore occurred as part of the life cycle of Viking's vessels. The "Viking Grace" was financed by Viking Lines alone and without financial incentives.

---

[470] https://www.vikingline.com/globalassets/documents/market_specific/corporate/environment/hbr2016-vikingline-eng.pdf

The update of the route with "Viking Glory" received funds from the project EU NextGen link, which allocates EU funding from the Connecting Europe Facility's (CEF) "Motorways of the Sea" instrument. The funding amounted to up to EUR 12.7 mio. and was implemented from 2017 to 2021.[471,472] The funding was granted from the CEF, as the ferry route is part of the Scandinavian-Mediterranean Corridor of the Trans-European Transport Network (TEN-T).

The NextGen project entailed investment into "Viking Glory's" engines and environmental technologies (as also presented on the technology above), and port infrastructures.[462, 473] The investments helped to make the "Viking Glory" 10% more fuel-efficient than the "Viking Grace". On the port infrastructure, the investments covered traffic logistics, automated mooring systems, and Intelligent Transport Systems (ITS), which all contribute to a more efficient loading and reduced turnaround time of the vessel.[474] Apart from the EU funds, no additional financial incentives were used.

Timeline

The procurement of "Viking Grace" started in 2009, following an assessment of the sustainability performance of the design. The vessel was manufactured in Turku, Finland and began operation in 2013. The company experienced some technical challenges, particularly with respect to the bunkering and on-board storage of the LNG fuel. Simultaneously, the company received a lot of media attention because the shipping sector took a strong interest in Viking Line's ambition. The "Viking Grace" launched operations in 2013. As mentioned above, the operation of "Viking Grace" was seen as a success, which led to the decision to order a second LNG-fuelled vessel, the "Viking Glory", which was ordered in 2017. The manufacturing of the vessel was delayed by one year due to the COVID-19 pandemic and it started operations in 2022.

Engaged stakeholders

For both vessels, the suppliers of equipment and technology were key to optimising the efficiency of the vessels.

The NextGen project was coordinated by the Port of Turku, with Viking Line, the ports of Mariehamn and Stockholm, and the City of Turku as project partners. The City and Port of Turku focussed their investment on developing the necessary logistics in the port area. The Ports of Turku and Mariehamn further invested in the automatic vessel mooring system. The Port of Stockholm increased the efficiency of the cargo loading system by investing in, among others, the ITS.

---

[471] https://ec.europa.eu/inea/en/connecting-europe-facility/cef-transport/2016-eu-tm-0092-w

[472] https://www.europeantransportmaps.com/news/nextgen-link-gets-eu-money

[473] https://www.portofturku.fi/2020/10/20/nextgen-link-projekti-etenee-aikataulussa/

[474] Intelligent transportation systems (ITS) is a categorisation of transportation infrastructures that apply information and communication technologies to enable data exchange between different modes of transport, transport systems, and traffic management to enable 'smarter' use of transport networks.

The launch of the vessels had a limited impact on local residents in Stockholm and Turku, as these do not live in close proximity to the harbour. Viking Lines is, however, the largest employer on Åland and has received strong support from the local population to future-proof its activities.

Nevertheless, the choice of an LNG-fuelled vessel has also met criticism for choosing a fossil fuel powered vessel. Viking Lines addressed this by actively communicating the rationale behind the choice to use a a technology that enables the use of transitional- but also renewable fuels when these become more economically viable.

Case Study 4: Æro Ferry (Electric)

Background Information

The E-ferry, christened "Ellen", is a 100% electric ferry connecting the Danish Island of Ærø, situated in the Baltic Sea, to the mainland of Denmark. The ferry project was funded by Horizon 2020 and has the largest battery capacity for maritime use (3.5-4 MWh). The vessel was built at Søby Shipyards and uses standard Lithium-ion batteries.[475] The objective in terms of emissions is to reduce CO_2 emissions by roughly 2,000 tonnes, NOX by 41.5 tonnes, SO_2 by 1.35 tonnes, and particulates by 2.5 tonnes per year starting in 2017.476

The vessel has a capacity of 31 cars or 5 trucks on an open deck, with 147 passengers in winter and 198 in summer. The ferry is a single-ended drive-through Ro-Ro passenger ferry with a continuous main deck for trailers and cars. The ferry runs between Søby-Fynshav at a distance of 10.7 Nm and between Søby-Faaborg at a distance of 9.6 Nm. A second objective of the Horizon 2020 project was to demonstrate that a purely electric ferry could cover a distance of up to 22 miles. At the time, this target distance was up to seven times the distance that electric ferries could cover.

Technology and supportive infrastructure

The vessel can be charged up to 3.8 MWh overnight and consumes 140—1700 kWh of energy from batteries to cover 22 nautical miles. The ferry is connected to the charger upon returning to the Søby charging harbour until batteries reach a capacity of around 1600 kWh. By the end of the day, the battery load is typically reduced to around 30%.477

The main barriers to implementing a battery-powered ferry was in coming up with a solution to have only one charging station for a longer distance ferry.478 The Ærø ferry was a first-mover in this regard. In establishing one port, the need for a large amount of power presented a difficulty, as it requires 4 MW for the charging effect. Ærø is already able to supply renewable electricity, so that choosing an electric ferry was the most viable solution for cutting CO_2 emissions. New bunkering facilities for the charging had to be constructed strictly for this project and the ferry.

In terms of technical risks, the batteries themselves are standard Lithium-Ion batteries, and the challenges related more to safety and ensuring a sufficient energy density. In order to mitigate safety risks associated with exploding batteries, the battery room is held at a cold temperature and a safety foam has been developed that works like a cooling airbag in the case of exploding cells.[479]

---

475 https://videnskab.dk/teknologi-innovation/moed-ellen-fremtidens-elfaerge-soesaettes-paa-aeroe

476 http://e-ferryproject.eu/

477 https://cordis.europa.eu/project/id/636027/reporting

478 Input from interview with Ærø Ferry representative. Unless specified elsewhere, the input will be based on the interview with the company representative.

479

The development of the ferry had already been started through a Danish ERDF project, in which the feasibility and cost effectiveness of the concept was proven.[480] The technical challenges and risks were therefore already known and addressed prior to the start of the Horizon 2020 project. The technology for electric ferries had already been established and tested globally, making the distance and power needed the main issues to address before the ferry was fully running. Since the vessel has been running, the main setback was a technological difficulty with the recharging facility leading to reduced charging speeds, which meant that one of the journeys had to be temporarily halted.

That being said, the positive impacts of the ferry include reduction in particulate matter pollution, as well as reduction in noise and movement of the ferry.

Permits and administrative procedures

There were only minor permitting issues with the certification of the ferry through the Danish Maritime Authority (Søfarsstyrelsen). The process required the rewriting of safety procedures as they could not be built upon existing material, e.g. the need for additional fire extinguisher systems for the batteries.

Business setup that secures profitability of the route (Operations and Management)

The support for the project came from H2020 and the project would not have been established if there had been extra costs for the municipality or the inhabitants of the island. Regarding the operational costs compared to traditional diesel fuelled vessels, costs in the long-term have proven to be lower than for operating a diesel ferry. Initial costs were high due to the need for new facilities and innovation as first-movers, yet the operational costs have not been higher as a result of choosing an electric propulsion system.

Regarding necessary additional staff, there has been a reduction in staff as the technology is simpler than that of a diesel ferry. Some training was needed to ensure sufficient safety in using a new technology.

Financing setup that enabled investment

The enabling environment for the ferry, apart from the H2020 funding was the participation in the Green Ferry Vision to investigate potential challenges and risks.[480] The Danish ERDF funded project proved the feasibility of the concept and indicated that a purely electric ferry can be possible for a distance of 22 nm. The project found that there could be emissions savings of up to 50% of the annual emissions, which was approx. 2,000 tonnes, CO_2 41.5 tonnes, NOX, 1.35 tonnes, SO_2 and 2.500 tonnes particulates.

Furthermore, there was regional financial support in Denmark to investigate the financial viability of the project before making the investment.

[480] The funded project was called "Green Ferry Vision", which concluded in 2014. The project website is however no longer available, http://www.greenferryvision.dk/. Limited information can be found in the 1st Newsletter of the Horizon 2020 project, which is available at http://E-ferryproject.eu/Output-Material

Timeline

The development of the ferry started in 2013 as part of the Green Ferry Vision project, which assessed the feasibility of a purely electric ferry, and which concluded in 2014. In 2015, the Horizon 2020 project E-ferry was kicked off and was completed in 2019 with a 1.5-year delay due to technical challenges of various components.

During the first 48 months, the E-ferry project focused on technological innovations necessary for the ferry. Following the innovation studies, the ferry was constructed in order to have the Bessel surveyed by Class and Maritime Authorities. After a year in operation starting in August 2019, the concept met the standards of operation and operates 7 trips between Søby and Fynshav per day.

Engaged stakeholders

The project came about through local cooperation between the ship architect and a teacher at the local maritime school. Both were interested in the idea for an energy efficient ferry and conducted a background analysis on the possibility for electric ferries. The local political setting was focussed on the green transition and pushed for the project to go through. The local shipyard and the companies delivering the new technologies were heavily involved. Overall, the ferry was implemented through a partnership between Ærø Kommune, Søby Shipyard, Naval Architects Jens Kristensen, Yuco Yacht, Visedo Oy, Leclanche GmbH / SA, The Danish Institute of Fire and Security Technology, The Danish maritime Authority, and the Hellenic Institute of Transport.

The local community was heavily involved in the process in order to improve tourist access to the island. The inhabitants were mostly supportive of project, with some hesitation from some residents on the uncertainty attached to the success of a demonstration project. In Denmark, several companies were contracted for support in marketing the ferry.

Annex C: DEL4 – Governance in the Lighthouse Area

Governance structures in the area of Maritime transport and maritime infrastructure

Introduction

The Baltic and North Sea transport traffic is one of the busiest on Earth. Cargo ships, tankers, fishing vessels, maritime passenger transport, service ships and other types of maritime transport are operating in the Baltic and North Sea basin. Some straits for shipping are narrow, while shallow waters, multiple islands and creation of offshore wind farms limit space for navigation. The changing weather conditions, a lack of legally binding emissions targets for shipping, oil spills, accidents on maritime transport, water and air pollution from maritime transport are among a few issues that raise safety and security concerns. These challenges call for a definition of consistent transnational shipping traffic corridors, development of safety and security standards.

Maritime transport is mostly governed at two levels: national, as all vessels must be registered/flagged in a particular country, and international, in terms of certain rules regarding safety and environmental performance. However, as it was discussed earlier, the EU policies and directives also complement international laws when there are gaps or when those laws do not match EU strategic goals, creating thus a framework at the macroregional level.

Ports are governed usually at the city and the national level. The main governance is usually at a local level via the port authority and its interaction with the city and local planning regulations and approvals. At times, countries also have a national port policy which may be quite general or prescriptive. The ports also follow international, European and national regulations aimed at reduction of emissions while at berth, pollution, other issues such as noise, dust, waste and water pollution, as well as inspection of compliance with set standards and procedures. In addition, there is a set of mostly voluntary rather than binding procedures that ports are conducting, such as providing electricity to power handling equipment, requiring slow steaming or use of LNG (liquefied natural gas) while in the port area and incentivising of rail and barge hinterland transport rather than road.

The following chapters discuss governance structures mostly for the maritime transport area in connection with ports, as key regulations apply to both areas.

Institutional and regulatory framework of governance

International level

The IMO is responsible for developing and adopting measures to improve the safety and security of international shipping and to prevent pollution from ships, while contributing to UN SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.481 It provides a framework for cooperation among governments

[481] https://www.un.org/en/chronicle/article/role-international-maritime-organization-preventing-pollution-worlds-oceans-ships-and-shipping

in order to regulate technical matters affecting shipping engaged in international trade. All states in the Baltic and North Sea area are members of the IMO.

Box 29 International Maritime Organization

The IMO is involved in specific legal matters, including liability and compensation issues and the facilitation of international maritime traffic.[482] Currently, the IMO concentrates on trying to ensure that designed legislation is up to date, adopted by national governments and properly implemented. The main technical work within IMO is carried out by the Maritime Safety, Marine Environment Protection, Legal, Technical Co-operation and Facilitation Committees and a number of sub-committees.

The IMO conventions are typically enforced in member states once signed and serve as key legislation, but their level of enforcement might differ depending on a category of a state. The IMO continuously reassesses the need for the updating of existing legislative documents or for creation of new regulations. The Marine Environment Protection Committee (MEPC) of the IMO is delegated the responsibility for identifying, discussing and evaluating new regulations. Since its foundation, the IMO has adopted more than 50 international treaties regulating international shipping, of which 40 % are directly related to the environment (21 treaties).

At the moment, the IMO has 174 member states. All states in the Baltic and North Sea area are members of the IMO. The member states participate in the main committees where the adoption of the relevant legislative measures and amendments to international conventions is discussed. Shipping and other interests are represented at the IMO through Inter-Governmental Organizations (IGOs) which have concluded agreements of co-operation with IMO and Non- Governmental Organizations (NGOs) in Consultative Status with the IMO. The European Commission has a recognised consultative status at the IMO.

Source: International Maritime Organisation: About IMO, 2022[483]

IMO's Sub-Committee on Implementation of IMO Instruments (III) provides a forum for both flag States - responsible for the certification of ships - and port States - who may inspect ships of any flag in their ports - to get together to discuss issues relating to implementation. The III Sub-Committee also reviews casualty investigation reports, to identify lessons learned and make recommendations for further work. Regional port state control organizations have been established to share information on ships inspected. These regional port state control agreements now cover the whole globe. In Europe and the north Atlantic the Paris MOU ensures a harmonized system of port state control

The IMO has a number of affiliated bodies and programmes that support its work, mostly through consultation and technical support (Table 67). Among the UN bodies, the IMO frequently collaborates with the United Nations Conference on Trade and Development (UNCTAD), as it focuses on international trade and, as a consequence, on maritime transport. Beyond the UN, the IMO collaborates with many international environmental organisations, national ministries and is influenced by diverse industry and non-governmental organisations, such as Baltic and International Maritime Council (BIMCO),

[482] https://www.imo.org/en/About/Pages/FAQs.aspx

[483] https://www.imo.org/en/About/Pages/FAQs.aspx

Global Maritime Forum, International Chamber of Shipping, International Transport Forum, World Shipping Council, Euroshore, International Association of Ports and Harbors. Over 80 non-governmental international organisations have been granted consultative status with the IMO. The full list can be found on its website.484 In general, lobbying is relatively strong in this sector. Some shipping industry representatives have lobbied actively against IMO regulations, especially in relation to climate change policies.

TABLE 67 IMO AFFILIATED BODIES AND PROGRAMMES RELEVANT FOR THE LIGHTHOUSE AREA

Name of the affiliated body and programme	Short description
Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)	GESAMP deals with all scientific aspects on the prevention, reduction and control of the degradation of the marine environment to sustain life support systems, resources and amenities.
GloBallast Partnerships	A joint initiative to assist developing countries to; reduce the transfer of harmful aquatic organisms and pathogens in ships' ballast water.
Global Marine Litter Information Gateway	Joint UNEP GPA Coordination Office/International Maritime Organization marine litter (marine debris) node of the GPA Clearing-House Mechanism.

Source: IMO, 2022[485]

In terms of maritime infrastructure, in 2008, the International Association of Ports and Harbors (IAPH) produced the C40 World Ports Climate Declaration, establishing the World Port Climate Initiative (WPCI). This group includes 55 ports around the world that pursue various green measures such as giving discounts to vessels scoring above a certain threshold on the Environmental Ship Index (ESI). This initiative has since been expanded with the launch in 2018 of the World Ports Sustainability Programme (WPSP) - a joint initiative by the International Association of Ports and Harbours (IAPH), the American Association of Port Authorities (AAPA), the European Sea Ports Organisation (ESPO), the Worldwide Network of Port Cities (AIVP) and the World Association for Waterborne Transport Infrastructure (PIANC). The programme's aims are linked to the 17 sustainable development goals set by the United Nations, under five key themes: resilient infrastructure, climate and energy, community outreach and port-city dialogue, safety and security, governance and ethics.486

With respect to the area of maritime transport and infrastructure, regulations adopted under the auspices of IMO focus on three topics – pollution, safety and traffic management. Below we present key regulations in these topics.

---

[484] https://www.imo.org/en/About/Membership/Pages/NGOsInConsultativeStatus.aspx

[485] https://www.imo.org/en/About/Pages/Affiliated-Bodies-and-Programmes.aspx

[486] https://www.researchgate.net/publication/337603802_Environmental_Governance_in_Shipping_and_Ports_Sustainability_and_Scale_Challenges/link/5ddfe40592851c836451b27b/download

Pollution

The IMO has been active in the resolution of various environmental problems in shipping. Its particular focus has been on pollution. The IMO has several conventions that are governing maritime transport globally and seek to reduce pollution resulting from this transport: the International Convention for the Prevention of Pollution from Ships (MARPOL), the International Convention for the Control and Management of Ship's Ballast Water and Sediments (BWMC), the International Convention for the Safety of Life at Sea (SOLAS). A longer list of relevant IMO conventions was provided in

Table **46**.

MARPOL includes regulations aimed at both accidental pollution and that from routine operations. Pollution mainly results from ships using heavy-fuel oil or marine diesel oil and exhausting pollutants such as nitrogen oxide (NOx), sulphur oxide (SOx) and particulate matter (PM). Currently, MARPOL includes six technical Annexes that specify regulations in particular areas[487]:

- Annex I Regulations for the Prevention of Pollution by Oil
- Annex II Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk
- Annex III Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form
- Annex IV Prevention of Pollution by Sewage from Ships
- Annex V Prevention of Pollution by Garbage from Ships
- Annex VI Prevention of Air Pollution from Ships.

Annex VI led to the establishment of emission control areas (ECA) in the Baltic and North Sea, as IMO considers that marine areas in these Seas are particularly sensitive. As a result, the level of sulphur oxides and particulate matter emission is supposed to be lower in the basin than in other areas.[488]

The IMO acts as a global regulator for the management of ballast water, seeking to address the ecosystem damage from ballast water discharge. Both MARPOL and BWMC provide guidelines and set standards regarding emission control, discharge of waste at sea and ballast water exchange in the Baltic and North Sea. According to BWMC, ballast water exchange has to take place at least 200 nautical miles (nm) from the nearest land and in water at least 200 meters in depth, unless approved ballast water treatment systems are installed. These requirements do not work for the Baltic and North Sea, therefore macroregional authorities – OSPAR, HELCOM and the Barcelona Convention decided that vessels transiting the Atlantic or entering the North-East Atlantic from routes passing the West African Coast are requested to conduct, on a voluntary basis, ballast water exchange before passing through the OSPAR area and heading to the Baltic Sea.[489] This is a good illustration of intervention by macroregional authorities when the international regulation is not applicable.

---

[487] https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx

[488] https://www.imo.org/en/OurWork/Environment/Pages/Sulphur-oxides-(SOx)-%E2%80%93-Regulation-14.aspx

[489] https://www.researchgate.net/publication/337603802_Environmental_Governance_in_Shipping_and_Ports_Sustainability_and_Scale_Challenges

Among other IMO instruments that protect the marine environment are listed:

- The London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) that aimed to promote effective control of all sources of marine pollution, including practical steps to prevent pollution by the dumping of waste;

- The International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC Convention) that provides the international framework for cooperation in and assistance for major oil spills;

- The International Convention on the Control of Harmful Anti-fouling Systems on Ships that prohibits the use of certain harmful chemicals in anti-fouling paints used on ships' hulls to discourage barnacles and algae from settling.[490]

Safety

SOLAS is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety. Flag States are responsible for ensuring that ships under their flag comply with its requirements, and a number of certificates are prescribed in the Convention as proof that this has been done. Control provisions also allow Contracting Governments to inspect ships of other Contracting States if there are clear grounds for believing that the ship and its equipment do not substantially comply with the requirements of the Convention - this procedure is known as port state control.[491] The International Mobile Satellite Organisation (IMSO) serves as the Coordinator for the Long Range Identification and Tracking of Ships (LRIT), appointed by the Safety of Life at Sea (SOLAS) party States at the IMO to ensure the worldwide operation of the system.

In 2009, the IMO adopted the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (Hong Kong Convention). It is aimed at ensuring that ships, when being recycled after reaching the end of their operational lives, do not pose any unnecessary risks to human health, safety and to the environment.

It is important to note that the UN (specifically within the UNEP's Regional Seas Programme), there is a Convention that is also relevant for maritime safety. In 2007, the Nairobi Convention on the Removal of Wrecks has been adopted. It aims to remove shipwrecks that may have the potential to adversely affect maritime safety as well as the marine environment. It also covers the prevention, mitigation and elimination of hazards created by objects lost at sea from a ship, such as lost containers.[492]

Traffic management

---

[490] https://www.euneighbours.eu/sites/default/files/publications/2021-09/EMTER_Report_TH-AL-21-004-EN-N.pdf

[491] https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx

[492] https://www.unep.org/nairobiconvention/who-we-are

To improve traffic management in areas where corridors for shipping are narrow or/and bending, the IMO developed traffic separation schemes and designated deep water routes in the Baltic and North Sea. The Collision Regulation (COLREG), designed in 1972, presented the traffic separation scheme, providing guidance in determining safe speed, the risk of collision and the conduct of vessels operating in or near traffic separation schemes.[493] In addition, the IMO created a platform for the discussion between Member States that led to the creation of ships routing and reporting systems. These systems enable the vessel traffic service (VTS) centres to better monitor and manage the traffic. Due to these measures, the risk and the number of collisions in the Baltic and North Sea has significantly decreased. Currently, most of the major congested shipping areas of the world have traffic separation schemes and other ship routing systems.

Among other measures that the IMO regulations require is the automatic identification systems (AIS) transponder for all ships larger than 300 GT and 500 GT on international and non-international voyages respectively. These systems allow to collect data on shipping flow.[494]

EU level

The EU is not eligible to become a member of the IMO, although it has been developing policies and regulations in the maritime transport area since 1993 that apply to ships trading in EU waters or sailing to or from EU ports. In contrast to the IMO's rules, the EU laws also apply to ships on EU domestic voyages.

In terms of institutions that govern the maritime transport and maritime infrastructure area at the EU level, DG MOVE and DG MARE are considered central. The European Maritime Safety Agency (EMSA) provides technical expertise and operational assistance to improve maritime safety, pollution preparedness and response and maritime security. As previously mentioned, EMSA monitors how certain laws are being applied by EU Member States and evaluates their overall effectiveness. In addition, EMSA provides EU countries with oil recovery ships in the event of a major spill at sea and detecting marine pollution through satellite surveillance. In terms of areas in which EMSA offers maritime services are listed: vessel reporting, earth observation, integrated maritime information, pollution response and port state control.

EMSA’s activities and capabilities on the technical front serve to underpin and enhance IMO’s international regulatory framework, therefore the IMO and EMSA are engaged in active collaboration. In addition, EMSA is working closely with other EU marine-focused institutions (i.e., European Border and Coast Guard Agency, European Space Agency, European Fisheries Control Agency (EFTA), Joint Research Centre), EU national maritime administrations, EFTA coastal state maritime administrations, as well as, with countries bordering the Mediterranean Sea, Black Sea and Caspian Sea as part of the European Neighbourhood Policy.

The European Environment Agency (EEA) is also recognised as important actor for the maritime transport and maritime infrastructure area, as it covers transport, air pollution, climate change mitigation and adaptation, environment, health and other relevant areas. Its task is to provide sound, independent information on the environment to support

[493] https://www.imo.org/en/OurWork/Safety/Pages/Preventing-Collisions.aspx

[494] https://vasab.org/wp-content/uploads/2018/06/Baltic-LINes-Shipping_Report-20122016.pdf

environmental management processes, environmental policymaking and assessment, as well as citizen participation. The previously mentioned EEA network organisation Eionet brings together environmental information from individual countries concentrating on the delivery of timely, nationally validated, high-quality data.

The European Sustainable Shipping Forum (ESSF) provides a platform for structural dialogue, exchange of technical knowledge, cooperation and coordination between the Commission, Member States' authorities and maritime transport stakeholders on issues pertaining to the sustainability and the competitiveness of EU maritime transport.[495] The ESSF operates since 2013 and has become an effective tool to engage and exchange views on a wide range of environmental issues in maritime transport, such as air pollution and greenhouse gas emissions. The ESSF has been used to prepare the ground for numerous coordinated submissions to the International Maritime Organization (IMO) or the International Organization for Standardization (ISO).

The European Sea Ports Organisation (ESPO) promotes environmental management in European ports. The current top ten environmental priorities of ESPO ports are air quality, energy consumption, noise, relationship with local community, garbage/port waste, ship waste, port development, water quality, dust and dredging operations.

In the EU, there is a large number of industry and non-governmental organisations that represent interests of stakeholders in the maritime transport and infrastructure sectors. Among them are listed the Maritime Industries Forum, European Boatmen Association, European Community Association of Ship Brokers and Agents, European Community Shipowners' Association, European Shippers' Council, Federation of European Private Port Operators, European Federation of Inland Ports, UNISTOCK (European association of professional portside storekeepers for agribulk commodities).

In the maritime transport sector, EU laws and institutions have been designed in response to necessities. For example, following several oil spills in the EU waters, the European Commission brought in three sets of laws that apply to maritime transport; pushing new standards on double hulls, port state control, flag states and creating the European Maritime Safety Agency (EMSA).496 Similarly, to ensure implementation of the Sulphur Directive the EU launched the European Sustainable Shipping Forum (ESSF).[497]

EU regulations in the maritime transport sector cover a broad spectrum of topics, including rules and standards for ships, prevention of pollution, trading and sailing in EU waters. However, major regulations can be clustered into two areas - air emissions, marine and maritime environment protection.

Air emissions

---

[495] https://transport.ec.europa.eu/transport-themes/sustainable-transport/european-sustainable-shipping-forum_en

[496] https://www.researchgate.net/publication/337603802_Environmental_Governance_in_Shipping_and_Ports_Sustainability_and_Scale_Challenges

[497] https://www.bsh.de/DE/PUBLIKATIONEN/_Anlagen/Downloads/Projekte/Scrubber/Scrubber.pdf?__blob=publicationFile&v=12

This area includes regulations on air pollution and greenhouse gases.

The Ambient Air Quality Directive provides rules for the control of ambient concentrations of air pollution in the EU. This includes control of emissions from mobile sources, improving fuel quality, and promoting and integrating environmental protection requirements into the transport and energy sector. In addition, the EU has the National Emissions reduction Commitments (NEC) Directive that calls on Member States to design national air pollution control programmes that will support implementation of the Ambient Air Quality Directive.

With respect to carbon emissions, the European Commission developed the EU Sulphur Directive that sets stricter rules and higher targets of cutting carbon emissions than the IMO Directive (MARPOL Annex VI). Later on, the European Green Deal and the Sustainable Smart Mobility Strategy raised these targets even higher, aiming for 80-82% reduction in emissions by the EU's international seagoing maritime transport sector by 2050. To meet set targets the EU Directive 2005/33/EC defined emission control areas in the Baltic and North Sea, setting a sulphur cap of 1.5%, and requiring ships at anchorage or in an EU port to use fuel with a maximum of 0.1% sulphur. In addition, the Directive 2012/33/EU established additional restrictions on sulphur content of fuels in line with the revised MARPOL Annex VI and discussed the possibility of extending emission control areas (ECAs).[498] As a result, the EU regulations encouraged the IMO for more stringent environmental standards and shorter timescales for implementation, particularly on double hulls, Port State Control and Sulphur oxides emission. To support achievement of carbon emission targets and compliance with the EU Sulphur Directive, the EU designed the EU Alternative Fuels Directive that defines alternative fuels, encourages their use in the European territory.

The lack of greenhouse gas (GHG) targets set by the IMO have been criticized by the EU and led to the EU Regulation on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport, and setting GHG reduction targets for the maritime transport sector.499 In response, the IMO introduced an amendment to MARPOL Annex VI requiring vessels above 5,000 GT to record their fuel oil consumption. Together with the Alternative Fuels Directive, the EU Renewable Energy Directive (RED II) also contributes to the reduction in GHG emissions by requiring fuel suppliers to ensure by 2030 that a minimum mandatory share of 14 % of the energy consumed in the transport sector is renewable energy.

Another main instrument applicable to scrubber wastewater under European law is the EU Directive on port reception facilities for the delivery of waste from ships (2019/883), which includes discharge norms for new waste categories, in particular the residues from EGCS, consisting of both sludge and bleed-off water from scrubbers. In addition, the EU Marine Strategy Framework Directive (MSFD) and the EU Water Framework Directive (WFD)

---

498 https://www.researchgate.net/publication/337603802_Environmental_Governance_in_Shipping_and_Ports_Sustainability_and_Scale_Challenges

499 https://www.standard-club.com/knowledge-news/decarbonisation-in-shipping-overview-of-the-regulatory-framework-3919/

contain general European environmental protection objectives that might be considered for the regulation of scrubber wash water discharge.[500]

Marine and maritime environment protection

This area includes ecosystem-based laws, regulations on non-indigenous species, sea pollution, maritime-based laws, such as marine litter and ship waste.

The Marine Strategy Framework Directive (MSFD), Water Framework Directive (WFD), Maritime Spatial Planning (MSP) are key directives that specify rules and set targets for marine and maritime environmental protection. In addition, EU Habitat Directive that focuses on conservation of flora and fauna is also one of important ecosystem-based laws.

Based on the IMO OPRC Convention, states are required to develop national systems for pollution response and to maintain adequate capacity and resources to address oil pollution emergencies. In the EU, the cooperation framework between the EU Member States, EMSA and the European Commission Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO), with a number of regional agreements, have been effective in reducing pollution incidents by hazardous and noxious substances.

For addressing issues related to marine litter and ship waste, the EU Directive 501 requires vessels to land the waste they generate on voyages at waste reception facilities in port and obliges EU ports to provide facilities for landing this waste for ships using the port. The Directive covers all waste from all ships (including relevant fishing vessels and recreational craft), including residues from exhaust gas cleaning systems and passively fished waste (collected in nets during fishing operations) and ensures the availability of adequate port reception facilities by requiring segregated collection of waste in ports.[502]

The EU Regulation (No 1257/2013) on ship recycling rules aims to reduce the negative impacts linked to the recycling of ships registered under the flag of an EU Member State and to ensure that, as of 31 December 2020, ships calling at EU ports or anchorages either possess an inventory certificate (for ships registered under the flag of an EU Member State), or a certificate of compliance (for ships flagged in non-EU Member States).[503] In addition, this Regulation lists requirements that ships and recycling facilities must fulfil to make sure that ship recycling takes place in an environmentally sound and safe manner.

The ports and associated port state control authorities have been key for monitoring, inspection, prevention or mitigation of accidents. In 1995, the EU passed Directive 95/12/EC on PSC (with later amendments) which made port state control mandatory for EU

---

500 https://www.researchgate.net/publication/337603802_Environmental_Governance_in_Shipping_and_Ports_Sustainability_and_Scale_Challenges

501 https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2019)633180#:~:text=Based%20on%20international%20law%2C%20EU,developments%2C%20discharges%20at%20sea%20continue.

502 https://www.euneighbours.eu/sites/default/files/publications/2021-09/EMTER_Report_TH-AL-21-004-EN-N.pdf

503 https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32013R1257

Member States. Initially, the IMO had concerns about the EU-level Directive but later accepted it.

The EU also implemented directives incentivising cold ironing (shore connection) and liquefied natural gas (LNG) in EU ports. Directive 2014/94/EU on the deployment of Alternative Fuel Infrastructures states that "Member States shall ensure that the need for shore-side electricity supply for inland waterway vessels and sea-going ships in maritime and inland ports is assessed in their national policy frameworks. Such shore-side electricity supply shall be installed as a priority in ports of the TEN-T Core Network, and in other ports, by 31 December 2025, unless there is no demand and the costs are disproportionate to the benefits, including environmental benefits" (European Commission, 2014).504 The Directive also provides that Member States should ensure an appropriate number of refuelling points for LNG at maritime ports. These directives mandate a response but not necessarily direct action, therefore responsibility for implementation remains with the Member States.

Macroregional level

HELCOM and OSPAR constitute the main macroregional institutional bodies and have been collaborating with the IMO on the regional implementation of international regulations, as some regulations should be adjusted for the Baltic and North Sea due to geographic and other specificities. This has been illustrated earlier in case of management of ballast water, where HELCOM and OSPAR suggested alternative procedures and standards505. In collaboration with the UN and EU bodies, the role of the macroregional bodies is focused on offering advice and developing supporting measures, initiatives that could be acceptable for both the UN, EU and Member States. Thus, the macroregional bodies have been playing a prominent role in facilitating and coordinating discussions between different parties.

In efforts to protect the environment, HELCOM and OSPAR have contributed to the IMO designation of the Baltic and North Seas as emission control areas (ECAs) for sulphur oxides (SOx; SECA) and nitrogen oxides (NOx; NECA). The Baltic Sea has become the world's first special area for sewage discharges from passenger ships. This led to stricter restrictions on discharge into the sea of oil or oily mixtures, sewage from passenger ships and garbage.

In addition to rules under IMO conventions, there are also shipping measures adopted by the HELCOM Contracting Parties as part of the 1992 Helsinki Convention. These include the prohibition of incineration of ship-generated wastes in the Territorial Seas of the Baltic Sea States as well as a general ban on dumping and incineration of other wastes, not incidental to or derived from the normal operation of ships, in the entire Baltic Sea area.506

In the area of maritime transport, HELCOM and OSPAR have been developing regional exemptions for ballast water, as ships' ballast water may carry alien species which are

---

[504] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02014L0094-20211112

[505] The Joint HELCOM/OSPAR Task Group on Ballast Water Management Convention (BWMC) and Biofouling (JTG BALLAST & BIOFOULING).

[506] https://helcom.fi/action-areas/shipping/

harmful to the marine environment.507 This collaboration was resulting in a Joint HELCOM/OSPAR Guidelines on the granting of exemptions under the International Convention for the Control and Management of Ships' Ballast Water and Sediments.508 These guidelines describe a protocol that should be carried out in ports of Member States. In addition, in 2017 HELCOM and OSPAR launched an online risk assessment tool for invasive non-indigenous species transfers via the ballast water of commercial ships.509 Collected data is shared between HELCOM and OSPAR.

HELCOM and OSPAR also have long worked on the issue for ensuring safer practices in the Baltic and North Seas. This includes determining target species that should be protected and safer navigation. Typically, HELCOM and OSPAR include diverse stakeholders from the shipping industry, NGOs to discuss such issues. In addition, both macroregional bodies have been conducting numerous research studies to better inform policymakers on the environmental conditions, activities and impacts caused by maritime transport in the Baltic and North Sea. Many of these research projects have been conducted in collaboration with international, EU and national R&D&I institutions.

At HELCOM and OSPAR there are dedicated working groups that focus on maritime transport. At HELCOM, this is "Maritime: Maritime Working Group". This group works to ensure that adopted regulations are observed and enforced effectively and uniformly through close international co-operation, and to identify and promote actions to limit sea-based pollution while ensuring safe navigation. The group works closely together with the International Maritime Organization (IMO) to ensure that international measures are properly applied and implemented in the Baltic or the Regional Seas Programme (RSP) and the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA) under UNEP to address the problem of maritime litter both at regional as well as global level.

Within this Group, there are four expert/sub-groups:

- Expert Working Group on Mutual Exchange and Deliveries of Automatic Identification System data (AIS EWG) – it works to facilitate mutual exchange and deliveries of AIS data and maintain and further develop HELCOM AIS

- Sub-group on Green Technology and Alternative Fuels for Shipping (GREEN team) – it aims to enhance the co-operation between the public and private stakeholders in promoting development and use of green technology and alternative fuels in shipping in the Baltic Sea

- Group of Experts on Safety of Navigation (Safe NAV) – it works to enhance navigational safety through regional cooperation

- The Joint HELCOM/OSPAR Task Group on Ballast Water Management Convention (BWMC) and Biofouling (JTG BALLAST & BIOFOULING) – it oversees practical

[507] https://helcom.fi/helcom-ospar-methods-for-invasive-species-tested-in-america/

[508] https://helcom.fi/media/documents/Joint-HELCOM_OSPAR-Guidelines.pdf

[509] https://www.ospar.org/news/helcom-and-ospar-release-online-ballast-water-risk-assessment-tool

implementation of the Joint Harmonised Procedure for the OSPAR and HELCOM regions on the issue of exemptions for the Ballast Water Management Convention.

In addition, HELCOM's working group "Response: Response Working Group" also works in the area of maritime transport. It aims to ensure swift national and international response to maritime pollution incidents, as well as to ensure that in case of an accident the right equipment is available and routines are in place to respond immediately in co-operation with neighbouring states. The Group analyses developments in maritime transportation around the Baltic and investigates possible impacts on international cooperation with regard to pollution response. Further, it coordinates the aerial surveillance of maritime shipping routes to provide a complete picture of sea-based pollution around the Baltic, and to help identify suspected polluters.

OSPAR also has a working group/ Committee that focuses on maritime transport – "EIHA: Environmental Impact of Human Activities Committee". This Committee has a broader scope, covering the following areas: marine litter, underwater noise, offshore renewables, shipping and ballast water, dredging & dumping, dumped chemical & conventional munitions, fisheries and mariculture, other human activities. In the area of shipping and ballast waters it seeks to address the following problems:

- accidental or illegal pollution with oil or Hazardous and Noxious Substances (HNS)
- the introduction of alien invasive species via ballast water
- air pollution emissions
- toxic substances from anti-fouling paints
- pollution from marine litter.

In addition, OSPAR has an associated body - the North Sea Network of Investigators and Prosecutors. It was set up in 2002 to help enforcement and prosecution of MARPOL maritime pollution offences aiming to prevent and minimize pollution from ships, both accidental and that from routine operations, in the North Sea.

At the European level, EMSA and EEA are key organisations with which HELCOM and OSPAR collaborate. The delegates of both macroregional bodies participate in discussions held by these organisations to discuss environmental protection, response to maritime pollution incidents and to share monitoring data.

Apart from European and international organisations, HELCOM and OSPAR collaborate with a number of organisations, such as Baltic Pilotage Authorities Commission, North-East Atlantic Fisheries Commission (NEAFC), Coalition Clean Baltic (CCB), Seas at Risk, Baltic Pilotage Authorities Commission (BPAC), Baltic Sea Hydrographic Commission, Cruise Lines International Association (CLIA), European Boating Association (EBA), Baltic Ports Organization (BPO), Baltic and International Maritime Council (BIMCO), Baltic Sea Action Group. Among them, it is important to highlight the Baltic Ports Organization (BPO) and - a regional ports organization that aims to facilitate cooperation among the ports and to monitor and improve the possibilities for shipping in the Baltic Sea region.

National and sub-national level

As mentioned in the introduction of this chapter, ports are governed usually between the city and the national level via the port authority. Table 68 presents a list of port authorities in the Baltic and North Sea region. It is apparent that some countries do not have a national port authority. Instead, each port is governing affairs on its territory in line with national policies and in consultation with national/local authorities.

Planning in the context of port development also has a national component, as port developments are usually large enough to require national approval. In terms of the daily operations of ports, there are many other areas of environmental management to consider that fall within the remit of the port authorities in conjunction with local and national regulations.

TABLE 68 LIST OF ADMINISTRATIVE BODIES THAT MANAGE PORTS AND PORT AUTHORITIES IN THE BALTIC AND NORTH SEA REGION

Country	Administrative bodies that manage ports	National port authority (if available)	Other port authorities
Belgium	Federal Public Service Mobility and Transport	No national port authority	Antwerp Port Authority, North Sea Port, Port Authority Zeebrugge
Denmark	Danish Maritime Authority	Danish Ports	Lindø Port of Odense, Associated Danish Ports – ADP, Port of Koge
Estonia	Estonian Transport Administration	No national port authority	Port of Tallinn
Finland	Finnish Transport and Communications Agency (Traficom)	Finnish Port Association	-
France	Grand Port Maritime	Union des Ports de France (UPF)	-
Germany	German Social Accident Insurance Institution for Commercial Transport, Postal Logistics and Telecommunication (BG Verkehr)	No national port authority	Ministry of Economics and Ports, Bremen, Ministry for Economic Affairs, Transport, Employment, and Tourism Schleswig-Holstein, Hamburg Port Authority
Latvia	Maritime Administration of Latvia	No national port authority	Freeport of Riga Authority
Lithuania	Lithuanian Transport Safety Administration	No national port authority	Klaipeda State Seaport Authority
Netherlands	Human Environment and Transport Inspectorate	No national port authority	Port of Amsterdam, Groningen Seaports, Havenschap Moerdijk, Port of Rotterdam, North Sea Port
Norway	Norwegian Maritime Authority	Norwegian Ports Association	Norwegian Ports Association - Port of Kristiansand, Norwegian Ports Association - Port of Borg
Poland	Department of Maritime Economy	No national port authority	Port of Gdansk, Port of Gdynia Authority SA, Port of Szczecin-Swinoujscie
Russia	Federal Agency for Sea and Inland Water Transport	No national port authority	Ports in the Baltic Sea - Port of Kronshtadt, Port of Ust-Luga,

			Port of Saint Petersburg, Port of Lomonosov, Port of Kaliningrad
Sweden	Swedish Maritime Administration	Ports of Sweden	Port of Göteborg AB
United Kingdom	Maritime and Coast Guard Agency	British Ports Association / UK Major Ports Group	-

Source: ESPO, 2022[510]

In most Member States of the Baltic and North Sea, the governance of the maritime transport sector is organised through ministries that are governing transport or maritime sector in general and by maritime agencies/administration that conduct inspection on vessels, issue certificates for shipping, monitors traffic in the sea etc. However, in some countries these functions are merged under one national authority.

Belgium

The Federal Public Service Mobility and Transport (FPSMT), under the authority of the Minister of Mobility is the competent body of the Belgian administration for maritime transport issues. Its main mission is to contribute to safety, to the environment and to transport economics. Within the FPSMT, the Department for Shipping is responsible for navigation management, safety and control matters. Below are listed its areas of work:[511]

- safe shipping: taking measures that try to prevent shipwrecks but also, for example, piracy or sabotage. In addition, checking whether the crew of ships and boats is capable of sailing (steering license, medical examinations, knowledge of the sailing code, knowledge of the equipment)
- sustainable shipping: introducing regulations for more environmentally friendly fuels, against polluting discharges, in order to protect the fauna and flora in seas, rivers and coastal zones
- healthy competition between all players in the sector: by drawing up and enforcing regulations at international level, the same rules apply to all players in the market.

The Federal Bureau for the Investigation of Maritime Accidents (FEBIMA) - is an independent investigating body created after partial transposition of Directive 2009/18/EC of the European Parliament and of the Council of 23 April 2009 establishing the fundamental principles governing the investigation of accidents in the maritime transport sector. To contribute to the safety of navigation, FEBIMA conducts investigations into the cause of maritime accidents. These investigations do not serve the purpose of apportioning blame, but serve solely to track down the facts that have led to the accidents.

Denmark

---

[510] https://www.espo.be/membership-overview

[511] https://mobilit.belgium.be/nl/overfod/organisatie/martitiem

The Danish Maritime Authority is an agency of the Ministry of Economic and Business Affairs, that is responsible for the development of the shipping sector in Denmark.

The Danish Maritime Authority includes twelve departments, some of which are directly involved in maritime transport and maritime infrastructure areas:[512]

- Ship Survey, Certification and Manning: it is the responsibility of the Danish Maritime Authority to ensure that Danish shipping can rightly be considered as quality shipping with a high level of safety, health and environmental protection. The Authority is responsible for effective administration and enforcement of the rules governing Danish shipbuilding, equipment and operation

- Safety of Navigation, National Waters: it is responsible for work by the Danish Maritime Authority on safety in navigation, including buoyage, navigation aids and the Danish pilotage system. The office ensures visionary use of technology and conducts effective supervision of pilots and pilot stations to ensure exceptional safety in Danish, Greenlandic and Faroese waters

- Danish Ship Register: it is responsible for correct and service-oriented registration of rights and registration of Danish and Greenlandic ships and vessels and for ensuring that registration is developed over time.

Estonia

In general, the development of the maritime sector in Estonia is the responsibility of the Estonian Ministry of Economic Affairs and Communications. It designs policies to improve marine business development, safety of vessel traffic and other marine-related activities, the protection of marine and coastal environment and marine cultural heritage.[513]

On 1st January 2021, the Estonian Transport Administration was created. It merged the Civil Aviation Administration, the Road Administration and the Maritime Administration. One of the aims of the Estonian Transport Administration is to ensure safe navigation in Estonian territorial and inland waters, perform Flag State Implementation and Port State Control activities.

The Administration issues certificates of competency and endorsements for seafarers, investigates marine casualties, carries out the installation and maintenance of aids to navigation, performs hydrographic surveys, compiles both electronic and paper navigational charts and distributes information publications concerning safe navigation.

In addition, the Administration monitors vessel traffic in Estonian waters through the radar and AIS network and arranges icebreaker service in ice conditions. The fleet of the Administration consists of an ice breaker, a multi-purpose vessel (designed for icebreaking, combating oil pollution, firefighting on board ships and in ports, as well as installation and maintenance of buoys), special buoy tender ships and hydrographic survey ships.[514]

---

[512] https://dma.dk/about-us/organisation/sections

[513] https://www.mkm.ee/en/objectives-activities/transport/marine-sector

[514] https://edmo.seadatanet.org/report/3085

Finland

In Finland, the Ministry of Transport and Communications is the policy-making organization responsible for the provision of safe and secure transport and communications connections and services.

The Finnish Transport and Communications Agency (Traficom) is an authority in permit, licence, registration, approval, safety and security matters. In the area of maritime transport, it issues maritime certificates (e.g., certificate of competency, proficiency, pilotage for seafarers), monitors maritime accidents, provides useful information (e.g., regulations on maritime security, medical examination of seafarers, ship registration). In addition, Traficom develops guidelines and instructions for the maritime transport sector.[515]

In line with the Flag State Directive (2009/21/EC), Traficom's Transport System Services have developed a quality management system to have a certified quality management system for the operational parts of their flag state-related activities. Traficom conducts various inspection activities in ports, collects declarations of security and conducts ship security assessment.

The Finnish Ministry of Environment is an important regulatory body in the area of pollution, including water/sea pollution, and environmental protection. SYKE is also the nationally appointed competent authority that is empowered to request and give international assistance in response to marine pollution caused by oil or other harmful substances.

Within the Ministry of Justice, the Accident Investigation Board investigates all major accidents regardless of their nature as well as all aviation, maritime and rail accidents and their incidents.

France

The Ministry for the Ecological Transition is responsible for transport, including ports, **maritime transport**, **merchant shipping** and the social regulation of the maritime sector. Together with the Ministry of Marine Affairs, that defines and implements policy relating to the sustainable management of maritime issues, protection of the environment and the marine environment, they focus on the safety of navigation, the development of the ports and the sea transport.[516]

Within the Ministry for the Ecological Transition, the Directorate General for Infrastructure, Transport and the Sea (DGITM) prepares and implements the national maritime transport policy. The DGITM conducts planning of transport infrastructures, implementation of a sea policy that promotes development (blue growth) and respects biodiversity, supports compliance with a high level of reliability, safety and especially security. The DGITM manages all subjects relating to sea transport.

The DGITM has three directorates related to maritime transport and marine infrastructure:

---

[515] https://www.traficom.fi/en/transport/maritime

[516] https://learnandconnect.pollutec.com/en/new-ministry-of-marine-affairs-whats-the-remit/

- the transport infrastructure department, responsible for multimodal planning, management, modernization and development of waterways

- the transport services department, responsible for the regulation, safety, security, regulation and social aspects of major sea and river ports and issues relating to public transport

- the Maritime Affairs Department responsible for maritime safety, maritime training and education, monitoring of seafarers, development of the national flag, yachting policy and nautical activities.[517]

The Ministry of Economy, Finance and Recovery is involved when the funding for maritime infrastructure is needed.

The French marine casualties investigation board (BEAmer), set up in 1997, conducts technical investigations into marine casualties to prevent similar accidents in the future. The BEAmer is also intended to collect, analyse and disseminate information regarding professional practices or lessons learned from investigations into casualties or incidents.[518]

Since 2008, there are eight state-owned ports and the port authorities are called Grand Port Maritime (GPM):[519]

- GPM of Dunkerque (region Hauts-de-France)

- GPM of Havre (region Normandy)

- GPM of Rouen (region Normandy)

- GPM of Nantes Saint-Nazaire (region Pays de la Loire)

- GPM of La Rochelle (region Nouvelle-Aquitaine)

- GPM of Bordeaux (region Nouvelle-Aquitaine)

- GPM of Marseille (region Provence-Alpes-Côte d'Azur).

Germany

The Federal Ministry of Transport and Digital Infrastructure is the central policymaker in the area of maritime transport and maritime infrastructure. On the basis of the Federal Waterways Upgrading Act, the Ministry is investing in maintenance and improvement of maritime infrastructure.

---

[517] https://www.ecologie.gouv.fr/direction-generale-des-infrastructures-des-transports-et-mer-dgitm

[518] http://www.bea-mer.developpement-durable.gouv.fr/about-us-r50.html

[519] https://www.rvo.nl/sites/default/files/2022/01/French-ports-and-yards-analytic-overview-april-2021.pdf

Under the Federal Ministry of Transport and Digital Infrastructure, the Federal Maritime and Hydrographic Agency (BSH) performs a wide range of services for maritime shipping, protection of the environment and uses of the sea:[520]

- supports maritime shipping and the maritime economy
- consolidates safety and the protection of the environment
- promotes sustainable uses of the sea
- ensures continuity in the measurements, and
- provides current information about the conditions of the North and Baltic Sea.

The German Social Accident Insurance Institution for Commercial Transport, Postal Logistics and Telecommunication (BG Verkehr) performs state tasks on behalf of the federal government in the following areas:[521]

- Monitoring compliance with national and international rules and regulations concerning technical ship safety, including stability, fire protection, lifesaving appliances
- Monitoring compliance with rules and regulations concerning maritime pollution protection, the MARPOL-Convention in particular
- Determination of minimum safe manning on seagoing ships
- Monitoring compliance with rules and regulations concerning the International Safety Management Code (ISM Code)
- Verification of living and working conditions of seafarers on board (Maritime Labour Convention)
- Testing and certification body for lifesaving, fire protection and marine pollution prevention equipment.

Monitoring training facilities regarding training in accordance with the STCW Convention, Port state control of foreign-flagged ships in German ports. The Federal Bureau of Maritime Casualty Investigation (BSU) registers and investigates all types of marine casualties on board or with the involvement of German flagged ships world-wide. The BSU acts independently of the respective Flag State within the German territorial waters and in certain cases within the German Exclusive Economic Zone (EEZ) as well.[522]

Latvia

---

[520] https://www.deutsche-flagge.de/en/german-flag/flag-state/bsh-federal-martime-and-hydrographic-agency-1/bsh-federal-maritime-and-hydrographic-agency

[521] https://www.deutsche-flagge.de/en/german-flag/flag-state/bg-verkehr/bg-verkehr

[522] https://www.bsu-bund.de/EN/Home/home_node.html

The Ministry of Transport is a leading institution of state administration of transport and communication branches which elaborates legal acts and policy planning documents regulating the branch. It ensures the management, control and supervision of seafarer training and assessment of competence, and it issues certificates and permits for the performance of activities in the sea.

Maritime Administration of Latvia (MAL) is a non-profit organization, supervised by the Ministry of Transport. It consists of Latvian Hydrographic Service, Latvian Ship Register, Latvian Seamen's Registry, Maritime Safety Department. Among the activities that MAL performs are included:[523]

- monitor the conformity of ships included in the Ship Register to safety requirements, approve shipbuilding and modernisation technical projects and issue ship certificates
- approve ship documentation
- implement port State control regarding foreign ships
- control implementation of the requirements specified in the International Safety Management Code (ISM Code) on ships included in the Ship Register
- investigate and analyse marine accidents, as well as perform seafarer competence assessments if a violation has occurred, which is associated with the improper fulfilment or non-fulfilment of professional duties
- control observance of reporting procedures in Latvian waters regarding passengers on board, and dangerous and polluting cargoes
- harmonise port regulations regarding navigation safety issues and control compliance therewith.

Lithuania

State management (administration) of merchant shipping, maritime safety and inland waterway transport is implemented by the Ministry of Transport and Communications together with the Lithuanian Transport Safety Administration.

The Ministry of Transport and Communications establishes the requirements for merchant shipping and maritime safety as well as the procedure for implementing the requirements laid down in EU legislation and international agreements which govern water transport activities and maritime safety. This ministry also publishes mandatory legislation.

The Water and Railway Transport Policy Department under the Ministry of Transport and Communications is responsible for implementing the state water transport strategy and policy, coordinating water transport activities and projects, and representing Lithuania in international organisations and institutions. These functions are performed by the department's Water Transport Division.

---

[523] https://www.lja.lv/en/about-mal/about-us

The following water transport institutions and companies are subordinate to the Ministry of Transport and Communications:

- The Lithuanian Transport Safety Administration
- The Klaipėda State Seaport Authority
- The Lithuanian Inland Waterways Authority
- AB Smiltynės Perkėla.

The Lithuanian Transport Safety Administration establishes the technical and organisational requirements which govern maritime safety, controls the implementation of legislative requirements at shipping companies and on ships. Thus, it acts as the state's water navigation inspectorate. Overall, the Lithuanian Transport Safety Administration performs the functions assigned to it in the Republic of Lithuania Law on Maritime Safety, the Republic of Lithuania Law on Merchant Shipping, and the Republic of Lithuania Inland Waterways Transport Code.[524]

Netherlands

The Ministry of Infrastructure and Water Management focuses on the maritime transport and seaports. Its work is supported by the Royal Netherlands Meteorological Institute (KNMI), which is the Dutch national weather service. Primary tasks of KNMI are weather forecasting and monitoring of weather, climate, air quality and seismic activity. Thus, the Institute acts as a monitoring organization for the maritime sector that reports to the Ministry.

The Human Environment and Transport Inspectorate under the Ministry of Infrastructure and Water Management has authorised a number of organisations to perform certain inspections. These organisations conduct inspections and certification under the supervision of the Inspectorate. For example, the Netherlands Shipping Inspectorate (Inspectie Leefomgeving en Transport) monitors vessels flying the Dutch flag, foreign vessels, crews, shipping companies and classification societies. Vessels flying a foreign flag are regulated in accordance with the Paris Memorandum of Understanding on Port State Control.[525]

Norway

The Norwegian Maritime Authority (NMA) is the administrative and supervisory authority in matters related to safety of life, health, material values and the environment on vessels flying the Norwegian flag and foreign ships in Norwegian waters. The NMA is also responsible for ensuring the legal protection of Norwegian-registered ships and registered

---

[524] https://sumin.lrv.lt/en/sector-activities/water-transport-2

[525] https://english.ilent.nl/themes/themes/merchant-shipping#:~:text=The%20Netherlands%20Shipping%20Inspectorate%20(Inspectie,Understanding%20on%20Port%20State%20Control.

rights in those ships. The NMA is subordinate to the Ministry of Trade, Industry and Fisheries and the Ministry of Climate and Environment.

The functions of the NMA include:

- Provide advice to the ministries
- Stimulate safety and environmental activities at the seas
- Conduct research, innovation, risk assessments and lessons learned from marine accidents
- Provide supervision for certification, document control, inspection and auditing to ensure compliance with the legislation.

The Norwegian Maritime Authority is in charge of inspections of Norwegian ships. Inspections and supervisions may, however, be delegated to the recognised classification societies.

Poland

The Ministry of Infrastructure in Poland manages the departments of government administration in transport, inland sailing, maritime economy and water management.

Some of the tasks of the Department of Maritime Economy are listed below:[526]

- Development of maritime transport as well as port infrastructure and infrastructure ensuring access to ports
- Implementation of the development of maritime transport infrastructure
- Handling matters related to the protection of the marine environment against pollution resulting from the use of the sea
- Handling matters related to the safety of shipping of sea-going vessels and the protection of shipping and ports
- Planning and spatial development of Polish maritime areas.

The Maritime Economy Department supervises directors of maritime offices, The Maritime Search and Rescue Service in Gdynia, sea chambers and the Minister's delegates to sea chambers.

Transport Technical Supervision (TDT) is a technical inspection unit, created from the merger of the Railway Technical Inspection and the Maritime Technical Inspection. TDT exercises technical supervision over technical devices located on sea and inland navigation ships, on pontoons, in docks, in ports and marinas and inland navigation, as well as over devices related to sea and inland navigation, or located in technological lines port reloading

---

[526] https://www.gov.pl/web/infrastruktura/departament-gospodarki-morskiej-dgm

bases. Technical inspection carried out by TDT also covers passenger and goods cableways and ski lifts.[527]

In addition, TDT performs certification and assessment of compliance with different marine-focused directives, conducts examinations checking the qualifications of advisers for the safety of the transport of dangerous goods, and offers trainings.

Russia

The Ministry of Transport (Mintrans) is a federal executive body responsible for drafting and implementing government policy and legal regulation, including in the field of maritime (including sea ports), domestic water. In addition, Mintrans has control over certification and related transactions, and management procedures to control traffic.[528]

The Federal Agency for Sea and Inland Water Transport, that operates under Mintrans, is a federal executive body responsible for providing government services and managing government property, such as sea ports (except for terminals intended to service fishing ships and boats). It also is in charge of providing services to ensure water transport safety.[529] Among the Agencies key tasks are listed:[530]

- Issuance of permits for navigation
- Certification of emergency rescue teams
- Registration of shipping lines, seaports
- Port State Control
- Implementation of infrastructure projects in the field of maritime transport
- Certification of training and training centres in the maritime sector.

Sweden

The Ministry of Infrastructure is responsible for matters relating to transport, infrastructure and port issues.[531] Within the Ministry, the Swedish Transport Agency is responsible for most regulation and supervision in the transport sector, including in shipping, while the Swedish National Road and Transport Research Institute provides research data for the development of the sector.

---

527 https://www.tdt.gov.pl/o-tdt/o-nas/

528 http://government.ru/en/department/68/events/

529 http://government.ru/en/department/88/

530 https://morflot.gov.ru/deyatelnost/napravleniya_deyatelnosti.html

531 https://www.government.se/government-policy/transport-and-infrastructure/

The key administrative authority devoted to maritime transport and maritime infrastructure is Swedish Maritime Administration (SMA). SMA is a governmental agency and enterprise within the transport sector and is responsible for maritime safety and availability. The primary tasks of the SMA include:

- Promoting safe, environmentally sound and efficient shipping
- Meeting the needs of the maritime sector for infrastructural services in the form of sea routes, pilotage, icebreaking, nautical information, communications and service
- Managing maritime and aeronautical search and rescue operations
- Safeguarding the competitiveness of the Swedish maritime sector.

Thus, SMA's services include pilotage, fairway service, maritime traffic information, icebreaking, hydrography, maritime and aeronautical search and rescue, seamen's service. In addition, SMA initiates and runs international projects contributing to the development of the shipping industry and maritime infrastructure in Norway.

United Kingdom

In the UK, Department for Environment, Food & Rural Affairs is the main Ministry responsible for policy and regulation related to fishing, marine conservation and environmental pollution. The Maritime and Coast Guard Agency is an executive agency of the UK Department for Transport. It is responsible throughout the UK for implementing the Government's maritime safety policy, specifically it produces legislation and guidance on maritime matters, and provides certification to seafarers. Through the survey and inspection regime, the Agency enforces standards for ship safety, security, pollution prevention and seafarer health, safety and welfare. In addition, the Agency promotes maritime standards, encourages economic growth and minimises the maritime sector's environmental impact.

Thus, among the core responsibilities of the Agency are listed:[532]

- co-ordinating a 24-hour search and rescue service by HM Coastguard and all search and rescue helicopter operations throughout the United Kingdom
- preventing maritime pollution and responding to pollution events
- monitoring vessel movement in United Kingdom waters and further offshore
- promoting and administering the UK Ship Register
- promoting and enforcing compliance with maritime rules, regulations and best practice, making sure that legislation is proportionate for business
- checking the safety and quality of ships and welfare, certification and training of seafarers operating under the Red Ensign.

[532] https://www.gov.uk/government/organisations/maritime-and-coastguard-agency/about

Governance structures in the area of Renewable Energy, its offshore facilities and Offshore Renewable Energy storage facilities

Introduction

Offshore renewable energy will likely play a critical role in achieving the European Mission "Restore our ocean and waters by 2030" objective to make the sustainable blue carbon-neutral and circular. This can be accomplished by the upscaling of offshore RE, including offshore wind power and ocean energy (wave and tidal) technologies. In addition, developing a sustainable offshore renewable energy industry could help Member States to achieve their 2030 and 2050 climate targets introduced through the European Climate Law. Both sea basins in the lighthouse area have high potential for the exploitation of renewable energy, due to the shallow waters and favourable wind conditions. According to the 2022 EU Blue Economy Report the main type of renewable energy is offshore wind, as the North Sea has 84% of all installed offshore wind capacity in Europe, while the Baltic Sea is home to about 15% of the total installed capacity in Europe.[533]

Box 30 Impact of Russia's invasion of Ukraine on governance of renewable energy, its offshore facilities and offshore renewable energy storage facilities in the Lighthouse area

As the recent Russia's invasion of Ukraine will likely have significant impact on the Lighthouse areas and Europe in general, it will inevitably also affect the Mission and its objectives. The research for this study was mostly conducted prior to the invasion. Considering that the situation is highly dynamic and there is no clarity on the impact yet, this chapter will include some initial reflections on the impact for the offshore renewable energy sector in the Lighthouse area.

Effects of the Russian invasion to the Ukraine include high energy prices and disruptions in the supply chains. Combined with the strong dependence of the EU on Russia for oil and gas, this has made the European Commission to act in the energy sector. On May 18th 2022 the European Commission presented the REPowerEU plan.[534] Through REPowerEU Europe, on the one hand, should be made independent from Russian fossil fuels and, on the other hand, be pushed to tackle the climate crisis. This means that it will be required to increase and promote the use and development of renewable energy (facilities), as well as offshore renewable energy (facilities). Specifically, this means that the European Commission proposes to increase the 2030 target of 40% renewables to 45% (going from 1,067 GW total renewable energy generation to 1,236 GW). Offshore wind energy is also identified as one of the means to achieve the REPowerEU plan. To support the rapid development of the offshore renewable energy industry, the EC proposes that the supply chain needs to be strengthened, potentially through a common effort by Member States to pool their public resources and engage in Important Projects of Common European Interest (IPCEI).

Furthermore, the EC has formulated several short-term and medium-term measures,

[533] For more information, see: https://op.europa.eu/en/publication-detail/-/publication/156eecbd-d7eb-11ec-a95f-01aa75ed71a1

[534] For more information, see: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

including measures relevant to the Mission objectives.

Short-term measures:

- Rapid roll out of solar and wind energy projects combined with renewable hydrogen deployment to save around 50 bcm of gas imports;
- New legislation and recommendations for faster permitting of renewables especially in dedicated 'go–to areas' with low environmental risk;
- Approval of first EU-wide hydrogen projects by the summer.
- Medium term measures to be completed before 2027:
- Increased ambition on energy savings by raising the EU-wide target on efficiency for 2030 from 9% to 13%;
- Increase the European renewables target for 2030 from 40% to 45%;
- A hydrogen accelerator to build 17.5 GW by 2025 of electrolysers to fuel EU industry with homegrown production of 10 million tonnes renewable hydrogen;
- A modern regulatory framework for hydrogen.

With the significant increase in (planned) renewable energy infrastructures, it is also important to have supporting innovations and technologies. Due to dependence on intermittent natural resources, such as sun and wind, large fluctuations between the supply and demand for renewable energy could arise. A solution to the mismatch between energy supply and demand can be energy storage. For instance, batteries or hydrogen can act as a location or as fuel to store energy over longer periods of time. An alternative way to contribute to a carbon-neutral and circular blue economy is through the electrification of existing oil & gas platforms making them more efficient, as well as, compatible for carbon capture and storage. Since both offshore renewable energy in general and the storage thereof will play vital roles in the energy transition, it is important that different stakeholders, such as industry, national and macroregional public organisations and NGOs come together.

Currently, large differences between the set-ups of national energy markets, national regulations and MSP procedures exist. Regional agreements and policies can address the barriers that hinder a coordinated development of the offshore RE industry. Cooperation on offshore renewable energy currently is more developed in the North Sea basin than in the Baltic Sea basin. Therefore, to ensure an efficient development of the offshore renewable energy projects in the Baltic Sea, best practices and technical expertise can be shared within the lighthouse area. Additionally, for a cost-effective development of other offshore renewable energy technologies that currently are less technologically advanced, such as floating wind farms, ocean energy, interregional cooperation is needed. It can bring many benefits to the lighthouse area, help the North Sea region maintain the status as an international frontrunner in these promising technologies and transfer know-how and best-practices to the Baltic Sea basin.

Institutional and regulatory framework of governance

International level

In the transition towards a carbon-free (blue) economy, offshore renewable energy solutions and other innovative related technologies can play an important role. Following the Paris Agreement, an international treaty on climate change, countries have pledged to limit climate change and try to limit the rise of global average temperatures to well below 2 degrees Celsius, and ideally below 1.5 degrees Celsius above pre-industrial levels. Similarly, limiting the negative effects of the use, production and exploration of fossil fuels can be an important part of transition in the energy sector. Fostering an innovative offshore renewable energy (storage) industry can contribute specifically to the UN Sustainable Development Goals 7 (Ensure access to affordable, reliable, sustainable and modern energy for all) and 14 (Conserve and sustainably use the oceans, seas and marine resources for sustainable development).

In the context of Renewable Energy and its offshore (storage) facilities, the United Nations Convention on the Law of the Sea (UNCLOS) is relevant, as it dictates the rights and jurisdiction that countries have over their offshore territories. As was previously mentioned, UNCLOS divides sea territories into four maritime zones[535]. Due to the full jurisdictional power in the territorial sea, states can regulate the construction and operations of offshore energy platforms. Beyond the territorial sea, coastal states have limited rights, the so-called “functional jurisdiction” (i.e., jurisdiction only for the purpose of regulating these particular activities/function[536]). In the context of this chapter, it means that coastal states, within their CS, have sovereign rights for the purposes of natural resource exploration and exploitation. Furthermore, states also have the right to construct and regulate artificial islands, installations and structures with economic purposes).[537] In an EEZ, coastal states also have sovereign rights for the purpose of exploring, exploiting, conserving and managing natural (living and non-living) resources and other activities for the economic exploitation and exploration of the zone, which includes the production of energy using water’s currents and wind.[538]

Coastal states therefore have sovereign rights to develop offshore (renewable energy) infrastructure within their territorial waters, as well as their EEZ- and CS-territories as long as it is compliant with other rules of international law, such as rights of navigation.

The 1994 Energy Charter Treaty or the International Energy Charter (non-binding political declaration signed in 2015) is a multilateral framework for cooperation within the energy sector[539]. It concerns the commercial aspects of the energy sector as it intends to introduce WTO principles to the energy sector to foster an open international energy market.

---

[535] (i) the territorial sea, (ii) the Exclusive Economic Zone (EEZ), (iii) the continental shelf (CS), and (iv) the high seas. First three types of territories are relevant for the Baltic and North Sea areas.

[536] Articles 56 and Article 77 of the UNCLOS.

[537] Article 60, 77(1), 80 of the UNCLOS

[538] Article 56(1)(a) of the UNCLOS

[539] All countries in the lighthouse area have signed the 1994 Energy Charter Treaty and all countries, except Russia, have signed the 2015 International Energy Charter.

The 1989 Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone issued by the International Maritime Organisation (IMO) provide guidelines on decommissioning and removing offshore energy facilities. It stipulates that decommissioned installations should be removed. The exceptions include cases when the platforms can be re-used, when the platforms do not significantly interfere with other activities or when it is too difficult to dismantle.

Furthermore, the Espoo Convention sets out the obligation to assess the environmental impact of activities when planning major projects. The Protocol on Strategic Environmental Assessment (Kyiv Protocol) sets out the obligation to have an environmental impact assessment of projected activities and conceptual plans for public plans to prevent negative environmental impact. Offshore renewable energy projects fall under this category.

Regarding key stakeholders in the (renewable) energy sector, the International Energy Agency (IEA) stands out. The IEA is established in the framework of the OECD. The IEA works together with governments and industry to achieve a sustainable energy industry. Furthermore, another key stakeholder is the International Renewable Energy Agency (IRENA), which was created by IEA member countries. IRENA is an intergovernmental organisation aimed to promote different forms renewable energy, such as wind, biomass and solar energy. Several United Nations daughter organisations also are engaged in matters concerning (renewable) energy. For instance, the United Nations Environment Programme (UNEP) promotes the uptake of renewable energy projects and policies. Other relevant mechanism and groups are UN Energy and the UNECE Group of Experts on Renewable Energy. This Group of Experts facilitates regulatory and policy dialogue.

An important stakeholder in the maritime sector is the IMO. With respect to CCS, the IMO's London Protocol (which is the successor of the London Convention) is relevant as it prohibits the dumping of materials at sea, with the exception of some materials if a permit is granted by the national competent authorities. Carbon dioxide can be dumped at sea according to the Protocol, but only if it originates from CCS projects aimed at sequestration.[540]

Apart from governmental organisations, the renewable energy sector has a large number of non-governmental organisations, research and other organisations that influence policy-making, such as the World Wind Energy Association, the Global Wind Energy Council, IEA's Ocean Energy Systems (OES) and the Hydrogen Council.

[540] There are three conditions: 1. CO2 should be disposed into a sub-seabed geological formation; 2. The material should consist of mainly CO2; 3. No other waste should be added for the purpose of disposing those other matters.

EU level

At the European level, the maritime spatial planning, the MSFD, the European Green Deal and the European Climate Law are highly relevant to the offshore renewable energy industry. As part of the European Green Deal, the European Commission introduced the 2030 climate and energy framework, which sets the target for renewable energy integration in 2030 for at least 32% of the total energy mix.

Another important legal framework at the European level is the Renewable Energy Directive. It introduces measures, common standards and rules to improve the integration of renewable energy infrastructures across Europe. Offshore renewables activities may require an Environmental Impact Assessment (EIA) and/or a Strategic Environmental Assessment according to the SEA and EIA Directive, which implements the Espoo Convention to prevent adverse environmental impacts.[541] A SEA is mandatory for plans with respect to energy and water management. At the national level, competent authorities are responsible for the EIAs and the SEAs, specifically for the SEAs national environmental authorities need to be consulted during the screening stage of the process.

At a more granular level, this translates into policy plans and strategies specific to the support and development of high potential technologies. For instance, in 2020 the EU Strategy on Offshore Renewable Energy was presented.[542] This strategy sets out the goal to increase Europe's offshore wind capacity to at least 60 GW by 2030 and to 300 GW by 2050. Additionally, this should be complemented with 40 GW of ocean energy and other promising technologies, such as floating wind and solar by 2050. Furthermore, following this Strategy each Member State has to integrate their offshore renewable energy development objectives into the national MSPs.

In 2020, the European Commission published the EU Hydrogen Strategy.[543] Given that green hydrogen can be used as a feedstock, a fuel or an energy carrier and storage, the use of hydrogen alongside renewable energy can become very important in the transition towards carbon neutrality in Europe. The Hydrogen strategy introduces an objective of 40 GW of renewable hydrogen electrolysers in the EU by 2030.

As for Europe-wide legal frameworks on Carbon Capture Storage (CCS), there is CCS Directive (2009/31/EC) which sets the minimum requirements for storage permits, liability, roles, tasks and touches upon rules for the safety and health. However, ultimately the decision to engage in CCS is made by the Members States.

At the level of the European Commission, Directorate-General for Energy (DG ENER is responsible for the development of EU energy policy. Additionally, as offshore renewable energy projects have become a main component of the national energy and climate plans of many countries, maritime spatial planning is highly relevant. The Directorate General Maritime Affairs and Fisheries (DG MARE) is involved in this process. The Directorate

---

[541] The 'Environmental Impact Assessment' – EIA Directive sets out that environmental assessments should be undertaken for individual projects. The Strategic Environmental Assessment' – SEA Directive sets out that the same should be undertaken for public plans or programmes.

[542] For more information, see: https://energy.ec.europa.eu/topics/renewable-energy/eu-strategy-offshore-renewable-energy_en

[543] For more information, see: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0301

General Research and Innovation (DG RTD) is responsible for R&I, for research into emerging technologies, such as hydrogen, but also into making already existing technologies, such as wind energy more efficient. Additional important stakeholders include DG Climate Action (DG CLIMA) and the European Climate, Infrastructure and Environment Executive Agency (CINEA), which was officially established on 15 February 2021 and became operational on 1 April 2021 to support EU Green Deal. For instance, CINEA will implement the Innovation Fund, a funding instrument for investments into low-carbon innovative technologies, such as renewables, CCS and energy storage projects that can contribute to the Mission objectives.

The European Commission has prioritised to interconnect the European energy system infrastructure, through projects are classified as Projects of Common Interest (PCI), among others to integrate the electricity grids at the regional level (see next section for more information), but also four projects CO2 networks.

The European Environment Agency (EEA), together with its network organisations Eoinet, provide information on renewable energy.

The European Network of Transmission System Operators for Electricity (ENTSO-E) is the network where the different national Transmission System Operators (TSOs) cooperate. The network aims to promote cooperation on the implementation of a common energy policy at a European level, but also is involved in efficiently and effectively integrating renewable energy into the existing electricity grid. It is the responsibility of the TSOs to maintain and interconnect the electricity markets and grids.

Macroregional level

OSPAR has several Committees and Working Groups tasked with individual thematic areas. Within the OSPAR's Environmental impacts of human activities thematic area, offshore renewables is one of the topics that are studied. Regarding CCS, in 2007 OSPAR adopted a Decision (2007/2) to ensure safe storage of carbon dioxide streams together with guidelines for risk assessment and management of storage of CO2 streams in geological formations (OSPAR Agreement 2007-12). HELCOM does not have a specific working group that deals with renewable energy, however since offshore RE infrastructure is part of maritime spatial plans, some topics that are studied or monitored by HELCOM, also touch upon RE developments.

In the North Sea basin, several regional stakeholders are active. For instance, the North Sea Energy Cooperation (NSEC) (previously known under the name "Political Declaration on energy cooperation between North Seas Countries") is a regional cooperation, where nine European countries and the European Commission discuss, coordinate and work on their plans with respect to offshore wind energy and offshore grid infrastructure. The goals of the NSEC are to enable an efficient regional offshore renewable energy sector and to improve the interconnectivity of different national electricity grids. Within the NSEC, four thematic areas are studied by support groups, namely:

- Hybrid and joint projects
- Maritime Spatial Planning
- Support framework and finance

- Delivering 2050.[544]

The CPMR North Sea Commission also has a support group that focuses on RE, namely the NSC Climate and Energy Group. This support groups were responsible for the strategy concerning RE for the NSC's North Sea Strategy 2030.

As for the Baltic Sea basin, the Baltic Energy Market Interconnection Plan (BEMIP) was established by the governments of countries bordering the Baltic Sea and the European Commission. BEMIP aims to reach an open and integrated regional energy market for all European countries in the sea basin. To realise the potential of renewable energy generation in the Baltic Sea basin, the BEMIP Offshore Wind Working Group, which will be a working group that focuses on offshore development, was set-up. Following a joint declaration on cooperation on offshore wind in 2020, a work programme on offshore wind energy projects in the Baltic Sea was agreed upon in 2021.[545] The BEMIP Offshore Wind Working Group will be responsible for this area and is tasked to operationalise the Baltic Sea Offshore Wind Declaration. Since the NSEC has been operational for a longer period, BEMIP aims to make use of the experience of NSEC and work together where possible. Furthermore, the two initiatives work in a complementary manner as some countries are members in both initiatives.

The Baltic Sea Region Energy Cooperation (BASREC), founded in 1998, is used by ministers for energy and the European Commission as a platform for regional dialogue on energy policy and the use of renewable energy amongst others. However, the different stakeholders meet only on an ad-hoc basis. Similarly, the Nordic Council and the Nordic Council of Ministers also work on renewable energy. The intergovernmental Working Group Renewable Energy supports the Nordic countries' efforts in renewable energy development, commissions analyses, and provides advice to the Energy Ministers of the Nordic countries.

Similar to how ENTSO-E operates at the European level, at the macroregional level the different national TSOs also collaborate or have done so in the past. For instance, up until 2016 the North Seas Countries' Offshore Grid Initiative (NSOCGI) was a regional platform where the ten countries bordering the North Sea area collaborated to facilitate the coordinated development of a possible offshore electricity grid in the greater North Sea area. In 2016, this Initiative resulted the "Political Declaration on energy cooperation between North Seas Countries" that is currently known under the name North Sea Energy Cooperation (NSEC).

In the Baltic Sea basin, the Interreg Baltic InteGrid project (Integrated Baltic Offshore Wind Electricity Grid Development) mapped out the opportunities for regional offshore wind energy projects between 2016 and 2019. While the project ended in 2019, it has resulted in the Baltic Offshore Grid Forum (BOGF) which is a communication platform for stakeholders including universities, research institutes and public authorities.[546] Similarly, the Baltic

[544] https://energy.ec.europa.eu/topics/infrastructure/high-level-groups/north-seas-energy-cooperation_en

[545] The Baltic Sea Offshore Wind Joint Declaration of Intent. From: https://ec.europa.eu/info/news/new-baltic-offshore-wind-work-programme-agreed-through-bemip-2021-oct-29_en

[546] For more information, see https://bogf.eu/

Offshore Grid Initiative is a declaration signed by eight countries[547] and Transmission System Operators (TSOs) bordering the Baltic Sea with the goal to develop common planning of the electricity grids for the offshore energy networks. Moreover, in May 2022 the Baltic transmission system operators collaboratively established a Regional Coordination Centre (RCC)[548], which will be a centralised organization for the Baltic TSOs. This will ensure a coordinated approach to region's capacity calculation methodologies, supervision, strategic planning and development of new infrastructure.[549]

National and sub-national level

To comply with the ambitious EU energy transition plans, many governments have updated their climate policies and set out ambitious objectives for Renewable Energy projects. In the lighthouse area, the governance systems at the national level related to offshore renewable energy range from rather simple governance structures with few stakeholders to complex governance systems where multiple ministries, councils and other authorities are involved. This is also holds true for the process of applying for and being granted permits and licensing for the development of offshore RE projects. Whereas in some countries in the lighthouse area this process is streamlined through a single authority, the same does hold not true for other countries, where multiple authorities are involved in the complicated process.

A group of major stakeholders are the national Transmission System Operators (TSO) that play a major role in the energy sector in general as well as the renewable energy sector due to their responsibility to maintain and interconnect the electricity markets and grids. TSOs are also responsible for connecting offshore renewable energy projects to the electricity grid. Often a TSO is also the authority responsible for the development of the electricity grid infrastructure. In Europe, the national TSOs are members of ENTSO-E, the European Network of Transmission System Operators for Electricity. The network is involved in activities ranging from promoting an effectively competitive internal market to Research, Development and Innovation. Moreover, in December 2021, a political agreement was reached by the European Council, Parliament and Commission negotiators on the new EU TEN-E Regulation (Trans-European Networks for Energy).[550] It sets the (non-binding) rules and vision for the joint planning of offshore wind grids per sea basin. Additionally, the so-called Projects of Common Interest shall have designated points of contact that will support the permitting process.

[547] **Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Sweden, and Norway as an observing party. For more information, see: https://www.offshorewind.biz/2020/12/29/baltic-sea-tsos-agree-to-cooperate/**

[548] Estonia's "Elering", Lithuania's "Litgrid" and the Latvian JSC "Augstsprieguma tīkls" (AST)

[549] https://ast.lv/en/events/baltic-tsos-established-baltic-electricity-system-joint-coordination-centre

[550] For more information, see https://data.consilium.europa.eu/doc/document/PE-2-2022-INIT/en/pdf

Table **69** provides an overview of the different TSOs responsible for the electricity grids in the Baltic and North Sea basins.

Table 69 Overview national transmission system operators

Countries	Transmission System Operators (TSO)
Denmark	Energinet.dk
Estonia	Elering
Finland	Fingrid
France	RTE
Germany	50Hertz, Tennet, Amprion, Transnet BW
Latvia	Augstsprieguma tīkls
Lithuania	Litgrid
Netherlands	Tennet
Norway	Statnett
Poland	Polskie Sieci Elektroenergetyczne (PSE)
Russia	Federal Grid Company of Unified Energy System?
Sweden	Svenska kraftnät
United Kingdom	National Grid ESO

Source: own production, 2022

The following sections provide an overview of the institutional and regulatory framework of governance in offshore RE area at the national level.

Belgium

Table 70 Overview Belgian regulatory documents

Name of the regulatory document	Short description
Maritime Spatial Plan 2020-2026	The overarching document that sets out the strategy for the Belgian maritime zones. It includes a long-term vision for renewable energy generation in the North Sea.
Electricity Act	It introduces a competitive tendering procedure for the development of new offshore wind parks similar to neighbouring countries551

Source: Belgian government, 2022

In Belgium, renewable energy falls in principle within the competence of the regions. The Federal Government is responsible for renewable energy planning in the North Sea.

The territory that is designated for the generation of renewable energy in the current 2020-2026 MSP grew as compared to the previous MSP. The second zone will almost double the energy capacity of Belgium. Furthermore, the 2020-2026 MSP assigns multiple other areas as zones for renewable energy in order to achieve the energy and climate targets that the Belgian State has committed to. In the future, multipurpose zones, where renewable energy activities are combined with other activities, are seen as a preferential way to use maritime areas.

551 http://www.ejustice.just.fgov.be/cgi_loi/change_lg.pl?language=nl&la=N&table_name=wet&cn=1999042942

The legal framework for the development and deployment of offshore renewable energy infrastructures in the North Sea is the Electricity Act. The main competent authorities are the federal Minister of Energy and the Minister for the North Sea.

Currently four federal permits are needed:

- A domain concession by the DG Energy from the Federal Public Service Economy, this is granted in a tendering procedure

- A permit from the Health, Food Chain Safety and Environment resulting from the EIA

- A permit for cabling in the sea (electric cables) by DG Energy from the Federal Public Service Economy

- A road permit for the installation of onshore electric cables and connection to Elia's (the Belgian transmission system operator) transmission grid.

Other long-term policy priorities mentioned in the latest MSP include the provision of sufficient space for research into improved or new forms of offshore renewable and sustainable energy production and close cooperation with other North Sea countries. Other maritime renewable energy exploitation techniques are being studied but are still at an experimental or pilot stage.[552] An example of this is the Blue Accelerator Offshore living lab, which is an maritime innovation platform focused on testing and experimenting with new offshore renewable energy and is located in the North Sea.

The Management Unit of the North Sea Mathematical Models and the Scheldt estuary (MUMM) is a department of the Royal Belgian Institute of Natural Sciences (RBINS), a federal scientific establishment that comes under the Federal Science Policy (previously known as OSTC). MUMM is involved in modelling, monitoring and management and it works on the EIAs, monitors the quality of the sea and advises the Minister responsible for the marine environment.

Emerging offshore renewable energy governance

The MSP for period 2020-2026 specifies that a maritime zone that was originally designated for energy storage, has been newly assigned for industrial and commercial activities.

Capture and storage of CO2 is mentioned in the Belgian Recovery and Resilience plans, however the direct connection to the Blue economy remains unclear. 553 The MSP 2020-2026 does not mention hydrogen. However, in 2021 the Federal Belgian government published the Hydrogen Strategy.[554] According to this Hydrogen Strategy, the federal government will play an active role in achieving the goal of becoming an important import and transit hub for hydrogen. The strategy however does not specify to what extent these

[552] https://economie.fgov.be/nl/themas/energie/energiebronnen/hernieuwbare-energieen/ontwikkeling-van-de

[553] https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility/belgiums-recovery-and-resilience-plan_en

[554] https://economie.fgov.be/en/themes/energy/belgian-federal-hydrogen

plans are related to offshore activities. Additionally, hydrogen plays a considerable role in the Belgian recovery and resilience plans. According to Belgium's recovery and resilience plan, the Belgian government aims to support projects related to hydrogen and offshore wind activities.[555]

Denmark

Table 71 Overview Danish regulatory documents

Name of the regulatory document	Short description
Danish Energy Agreement for 2012-2020	The agreement sets out the framework for the policy on climate and energy up to 2020 and outlines the direction Denmark will take until 2050. In 2018, the agreement was extended to the period 2020-2024. In the 2018 update of the Energy Agreement, Denmark signed an agreement to develop three additional offshore wind farms with a total capacity of at least 2.4 GW by 2030.
Executive order on electricity production (elproduktionsbekendtgørelsen)	The executive order stipulates that new RE facilities are exempt from the licensing requirements outlined by the Electricity Supply Act. This does not mean that there are no requirements, only that the procedure has become less demanding.[556]
The Promotion of Renewable Energy Act of 2009	The act aims to promote renewable energy production, reduce dependency on fossil fuels and is specifically aimed at wind energy. Moreover, the Promotion of Renewable Energy Act sets out the conditions for offshore wind activities.
The Climate Act of 2020	The Climate Act has two legally binding targets, namely to reduce Denmark's GHG emissions by 70% compared to 1990 levels by 2030, and reach climate neutrality by 2050.

Source: Danish government, 2022

The Danish Ministry of Energy, Utilities and Climate is the responsible authority for energy policy in Denmark. The Danish Ministry of Industry, Business and Financial Affairs is tasked with determining the physical and temporal distribution of existing and future activities and uses in the national maritime spatial plan for that purpose. It is involved in the policy setting, but not in granting of licences or permits for the offshore activities.

The Danish Energy Agency (Energistyrelsen) (DEA) is in charge of implementing the energy policy in all sectors except transport. This means that the Danish Energy Agency, is responsible for the tender procedures concerning new offshore wind power projects. The Danish Energy Agency falls under the Ministry of Climate, Energy and Utilities. With respect to the development and licensing of offshore renewable energy infrastructure and activities, the DEA can be seen as the authority that acts as a coordinator of a single policy. DEA interacts with a range of relevant (governmental) organisations, including the Danish Maritime Authority, the Danish Maritime Safety Administration, the Danish Environmental

[555] For more information, seehttps://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility/belgiums-recovery-and-resilience-plan_en#further-information

[556] https://www.bechbruun.com/en/news/2022/re-plants-to-go-from-licences-to-electricity-production-permits

Protection Agency (Miljøstyrelsen), the Danish Forest and Nature Agency (Naturstyrelsen), the Cultural Heritage Authority, and the Fisheries Inspectorate and others. In order to establish an offshore wind farm, one needs a license to do preliminary investigations, a license to establish it and a license to exploit the wind power. In addition to that, an environmental impact assessment needs to be carried out. This process is part of either a tender procedure or an open-door procedure. The Danish Climate Act of June 2020 stipulates that an independent body, the Danish Council on Climate Change (DCCC), is to make recommendations for and provide a status update on the government's climate action efforts on an annual basis.

Emerging offshore renewable energy governance

On 14 December 2021, the Danish government published a CO2 capture and storage strategy that clarifies how CO2 capture and storage can be used to reach the environmental goals.[557] With respect to hydrogen and Power-to-X plans, on 15 December 2021 the Danish government published a PtX Strategy to promote the development of PtX infrastructure in Denmark. The proposal is aimed to establish a regulatory framework for hydrogen and PtX. An important part of the Strategy is also to link the PtX and hydrogen infrastructure to the offshore renewable energy plants.

The Danish government has decided to construct two so-called Energy islands. One of the artificial energy islands will be constructed in the North Sea. It will provide a minimum of 2 GW offshore wind connected by 2030 and a long-term capacity of 10 GW. Furthermore, it will connect Denmark and the Netherlands. Likewise, Germany, Belgium and Luxembourg have expressed their interest in the projects. The second artificial island will be constructed in the Baltic Sea and would also need to be ready by 2030. This artificial island might connect offshore facilities from Germany, Poland and Denmark.

Estonia

Table 72 Overview Estonian regulatory documents

Name of the regulatory document	Short description
2030 National Energy and Climate plan (NCEP)	This plan stipulates that in 2030 at least 42% of total energy consumption should be from renewable energy.
Estonian Energy Development Plan until 2030 (ENMAK)	The plan includes the goal to have a higher electricity production capacity than the domestic consumption needs, which needs to be supported by offshore wind energy project.
Electricity Market Act	The Act regulates incentives for renewable energy projects. This Act enables the government to hold tender procedures to procure new renewable electricity generation projects

Source: Estonian government, 2022

One of the main energy policies in Estonia is the 2030 National Energy and Climate plan (NCEP). Furthermore, the Government of Estonia approved the Estonian Energy Development Plan until 2030 (ENMAK). Additionally, in 2018, the Estonian Parliament

[557] For more information, see Appendix 2 _ 1112-00004A - Mission CCUS – a roadmap for Carbon Capture, Utilisation and Storage.pdf (innovationsfonden.dk)

voted to adjust the Electricity Market Act, which provide the legal framework for the procedure to develop renewable energy projects.

The Ministry of Finance is responsible for maritime spatial planning in the Baltic Sea. Furthermore, the Ministry of Environment also is an important stakeholder when it comes to Renewable Energy policy design. The Ministry of the Interior is responsible for issuing the country's spatial plan. When doing so, it consults with the Ministry of the Environment, the Ministry of Defence and the Maritime Administration, among others.

Emerging offshore renewable energy governance

The Estonian government has published a national hydrogen plan.[558] It sets out the plans concerning hydrogen up until 2026. This roadmap has not yet been translated in English, therefore the plans are not yet included in this section.

Finland

Table 73 Overview Finnish regulatory documents

Name of the regulatory document	Short description
Integrated Energy and Climate Plan (2019)	This plan sets out the plans of the Finnish government to achieve carbon neutrality by 2035.
Climate Change Act (2015 and 2021)	The legal basis for the Integrated Energy and Climate Plan. In 2021, a draft proposal to update the Climate Change Act was submitted to the Finnish parliament.559 This updated version of the Climate Change Act is expected to be discussed in 2022.
2019 Government Programme	According to the Government Programme, the government will improve conditions for offshore wind energy projects.560
The Act on Production Subsidy for Electricity Produced from Renewable Energy Sources	The Act introduced a tender process to promote energy infrastructures.

Source: Finnish government, 2022

The main legislation on energy policy in Finland is the Integrated Energy and Climate Plan from 2019. The legal basis of this plan is the Climate Change Act. Generally, the Ministry of Economic Affairs and Employment is responsible for the long-term plan for climate change policy. Other relevant stakeholders include Ministry of Agriculture and Forestry and the Ministry of the Environment.

In terms of offshore renewable energy activities, the Maritime Spatial Plan is an important legal instrument. It sets out the plans for the maritime regions belonging to Finland. In the latest MSP, only offshore wind energy is covered. According to the Act on Production

[558] https://www.riigikogu.ee/tegevus/eelnoud/eelnou/b468d1c6-7d78-4a52-a523-f4738b74df10/Riigikogu%20otsus%20_Ettepanek%20Vabariigi%20Valitsusele%20vesinikustrateegia%20v%C3%A4ljat%C3%B6%C3%B6tamine_

[559] https://ym.fi/en/the-reform-of-the-climate-change-act

[560] https://valtioneuvosto.fi/en/marin/government-programme/carbon-neutral-finland-that-protects-biodiversity

Subsidy for Electricity Produced from Renewable Energy Sources, the Ministry of Economic Affairs and Employment can grant energy subsidies on a case-by-case basis to companies, municipalities or organisations to support climate- and environmentally-friendly investments that promote (among others) the generation or use of renewable energy. In case of offshore wind projects, the Government's Ministerial Committee on Economic Policy decided in December 2021 that an auction model will be introduced to boost offshore wind projects.[561] The holder of public water areas, Metsähallitus, will be an important stakeholder together with the Government or the Ministerial Committee on Economic Policy. Metsähallitus will be a facilitator in the process. The Government or the Ministerial Committee on Economic Policy will make the final decision on who will receive the exclusive rights for the offshore wind projects. Finally, depending on several conditions different permits and licenses are needed (e.g., facilities located in territorial waters or the EEZ).

Emerging offshore renewable energy governance

In 2020, Business Finland, a public organisation under the Finnish Ministry of Employment and the Economy, published a national hydrogen roadmap which sets out the plans and potential for hydrogen in Finland. [562] The plans also highlights the significant potential of offshore wind energy in Finland as it has good offshore wind resources.

France

TABLE 74 OVERVIEW FRENCH REGULATORY DOCUMENTS

Name of the regulatory document	Short description
Energy transition for Green growth Act (2015)	A climate act that details the French energy policy towards emission reductions. Additionally, it sets legally-binding targets for the energy transition.
Energy-Climate law (2019)	The law sets the framework to achieve carbon-neutrality by 2050. It also provides supporting mechanisms for the energy transition
National Low-carbon Strategy	National Low-carbon Strategy was introduced by the Energy transition for Green growth Act. The strategy is roadmap that sets out guidelines towards achieving carbon neutrality in France.
Multi-Annual Energy Plan (2019-2028)	The Multi-Annual Energy Plan was also introduced under the Energy transition for Green Growth act. It sets out the strategic priorities and short-term objectives for the French energy policy. This Plan includes the agenda for future tenders for offshore wind energy projects.
End to hydrocarbon research and exploration law (2017)	The law stipulates that by 2040 all activities related to the exploration and exploitation of hydrocarbon fossil fuels will be stopped. This is relevant for the French territory, including the EEZ and CS. The End to hydrocarbon research and exploration law also introduces a competitive tendering procedure for offshore RE. It also appoints RTE, the French TSO, as authority for building and financing offshore RE platforms.
The État au service d'une société de confiance (ESSOC)	Law which streamlined the legal framework (e.g. by reforming the permitting system).

[561] https://valtioneuvosto.fi/en/-//10616/ministerial-committee-on-economic-policy-supports-auction-model-for-leasing-public-water-areas-for-offshore-wind-power-production

[562] https://www.businessfinland.fi/en/whats-new/news/cision-releases/2020/national-hydrogen-roadmap-guides-finland-towards-carbon-neutrality

law (2018)	
Acceleration and simplification of public action (ASAP) law (2020)	The law contains elements to facilitate administrative requirements for the deployment of renewables
Maritime and Coastline Strategy (SNML) (2017)	The National Maritime Spatial Plan
The Sea Basin Strategy Documents (DSF) (2019 and 2022)	The implementation plan of the MSP per sea basin

Source: French government, 2022

The French energy policy is mainly based on two acts, namely the Energy transition for Green growth Act and the Energy-Climate law. Both legislative pieces relate to the objective to become autonomous in terms of energy consumption and to reach carbon neutrality by 2050. Based on these two laws, the French government has published a National Low-carbon Strategy and the Multi-Annual Energy Plan (2019-2028). The legislative framework surrounding offshore wind projects is based on the Energy transition for Green growth Act and is set out in Table 74.

The Directorate-General for Energy and Climate (DGEC), which operates under the Ministry for Ecological and Inclusive Transition, is responsible for drafting and implementing policies on energy. They are also responsible for approving the offshore project tenders. The tenders are drawn up by the Ministry of Energy. In the past, the French Environment and Energy Management Agency (ADEME) also launched calls for projects within the "Investment for the Future" programme to provide incentives for renewable energy projects.

In 2017, France launched a Maritime and Coastline Strategy (SNML) to conduct the implementation of its maritime spatial planning (MSP). The national strategy is implemented at the sea basins by means of the Sea Basin Strategy documents (DSF) of which one is published on the North Sea area.[563] This DSF for the North Sea area also considers the deployment of renewable energy projects in the area. It includes plans to have launched five to eight calls for tenders on offshore wind turbines by 2030 (that covers a minimum of between 1500 to 2400 km² of potential areas).

Emerging offshore renewable energy governance

As part of the 2020 National Low Carbon Strategy, the French government has put CCS forward as one of the methods to achieve carbon neutrality. However, it is still unclear how this will be implemented. On 8 September 2020, the French government also published its national hydrogen strategy, in which it aims to invest 7.2bn EUR in hydrogen technologies up until 2030.[564] The Strategy sets out the goal to become a leading country in the green hydrogen industry.

[563] For more information, see : http://www.geolittoral.developpement-durable.gouv.fr/facade-maritime-manche-est-mer-du-nord-r561.html or the english translation: https://www.dirm.memn.developpement-durable.gouv.fr/IMG/pdf/en_dsfsynthetique_memnor_v1-4_vu_dirm.pdf

[564] https://www.economie.gouv.fr/plan-de-relance/profils/collectivites/strategie-nationale-developpement-hydrogene

The Bretagne region has also published a Hydrogen strategy, in which it sets the objective to support R&D into offshore hydrogen.[565] It specifically aims to have an offshore hydrogen production demonstrator by 2025 in anticipation of the future hydrogen production in combination with the large offshore wind farms that are planned. The National Research Agency (ANR) is the main public authority supporting hydrogen research. As part of the Hydrogen strategy, it is allocated EUR 65 mio. to support hydrogen research projects up until 2030. The French government also has plans for both floating and fixed offshore wind projects as well as ocean and tidal renewable energy.

Germany

Table 75 Overview German regulatory documents

Name of the regulatory document	Short description
Climate Action Plan 2050	The main regulatory framework for Germany to achieve carbon-neutrality by 2050.
2021 Coalition Treaty	The coalition treaty sets new offshore wind targets: 2030: 30 gigawatt, for 2035: 40 GW and for 2045: 70 GW. It also states that offshore wind projects will take precedence over other forms of use in German Exclusive Economic Zones (aside from MPP). It also mentions that the government wants to promote European offshore cooperation and strengthen cross-border projects in the North Sea and Baltic Sea.
Renewable Energy Sources Act (EEG)	The EEG sets the framework to support the expansion of Renewable Energy. The Act was updated in 2021 and introduces the plans for i.a. offshore wind energy projects.
Offshore Wind Act (Windenergie-auf-See-Gesetz)	The Act sets out the framework for future tenders for offshore wind projects. It also introduces a new target for offshore wind, namely to have 20 GW of offshore wind energy capacity by 2030. The pre-tender reviews are done by the Federal Network Agency. Under the Offshore Wind Act, auctions will be held for off-shore wind power sites. Permits and licenses for offshore wind energy projects are dependent on the geographical location of the projects: if it is within the territorial sea, the relevant German coastal state (Länder) needs to approve permits and licenses for projects; if it is within the EEZ, the BSH is responsible and follows the procedure set out in the WindSeeG.

Source: German government, 2022

[565] For more information, see: Renewable Hydrogen, Bretagne Renewable Hydrogen: https://www.bdi.fr/en/projects/renewable-hydrogen/

In 2016, the German government published its Climate Action Plan 2050. This Plan is the main future-oriented long-term strategic framework that sets out Germany's strategy for implementing the Paris Agreement. The plan includes the strategy roadmaps and objectives for different industries. More recently, in 2021, the new coalition agreement introduced new targets for (offshore) renewable energy.

The procedures for renewable energy funding are set in the Renewable Energy Sources Act, which was published by the German Ministry for Economic Affairs and Energy (BMWi) in 2017. The Ministry for Economic Affairs and Energy (BMWi) is the main authority responsible for energy and renewable energy policy. Furthermore, the Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) is also an important stakeholder, as it has the responsibility to develop policy on the environment and climate change. The most important document relevant to the planning of offshore renewable energy plans is the Maritime Spatial Plan 2021. It sets out the plans for the offshore wind energy zones and also include reservation zones for offshore renewable energy projects.

With respect to offshore wind energy projects, the Renewable Energy Sources Act (EEG) is complemented by the Offshore Wind Act (Windenergie-auf-See-Gesetz or WindSeeG). Within this framework the Federal Maritime and Hydrographic Agency (BSH, the main authority responsible for MSP) and Federal Network Agency (Bundesnetzagentur) collaborate in setting up the site development plans. According to the 2021 coalition agreement, the powers of the Federal Maritime and Hydrographic Agency (BSH) will be strengthened to increase the development of offshore RE projects. Other relevant actors include the federal mining authority, Federal Environmental Agency, the Federal Agency for Nature Conservation, Federal Ministry for Economic Affairs and Energy, the Federal Waterways and Shipping Agency and the coastal Länder.

Emerging offshore renewable energy governance

The Federal Institute for Geosciences and Natural Resources (BGR) is the authority responsible for CCS. The German CCS industry however is not that developed yet. With respect to hydrogen, in 2020, the German authorities published their National Hydrogen Strategy.[566] Furthermore, the 2021 update of the Renewable Energy Sources Act implemented a financial measure (i.e. exemption of paying surcharges) to reduce the costs associated with green hydrogen production. In the National Hydrogen Strategy, which was written by the Ministry for Economic Affairs and Energy, the role of international collaboration is stressed, especially in the North and Baltic Sea. The German government expressed its interest in establishing a regulatory framework for offshore wind energy and hydrogen production.

[566] https://www.bmwi.de/Redaktion/EN/Publikationen/Energie/the-national-hydrogen-strategy.html

Latvia

Table 76 Overview Latvian regulatory documents

Name of the regulatory document	Short description
Sustainable Development Strategy of Latvia until 2030	This strategy sets out the target for 2030 to have at least 50% of total energy consumption stemming from Renewable Energy sources.
National Energy and Climate Plan 2021 – 2030 (NECP)	The plan is the main legislative piece on energy policy in Latvia. It sets the targets and objectives for energy policy in Latvia. However, there are no specific targets for the offshore renewable energy industry.

Source: Latvian government, 2022

The Sustainable Development Strategy of Latvia until 2030 is the long-term strategy for policy in Latvia since 2010. Latvia's National Energy and Climate Plan 2021 – 2030 (NECP) is the main legislative piece on energy policy. In the MSP, five geographical zones for offshore RE were identified as potential locations for renewable energy projects.

The Minister of Economic Affairs is responsible for MSP, tenders and licensing. Other relevant authorities include the Ministry of Environmental Protection and Regional Development, the Latvian Maritime Authority, and the Building Administration (which issues the construction permit).

Lithuania

Table 77 Overview Lithuanian regulatory documents

Name of the regulatory document	Short description
National Energy Independence Strategy (NEIS) (2018)	The government states the aim to have at least 45% of its final energy consumption coming from renewable energy sources
National Energy and Climate Plan (NCEP)	Ten-year integrated document that sets out the vision up until 2030, which includes the goal to have 100% domestic energy supply by 2050.
Programme of Lithuania's 18th Government	The Programme states the intention of the government to have 1.2 GW of installed wind power plants by 2025, it does not specify whether this is onshore or offshore. It also states that the government will research the possibility to install high-capacity wind power plants in the Lithuanian marine waters after 2025.

Source: Lithuanian government, 2022

In the National Energy Independence Strategy (NEIS) of 2018, the government sets out the long-term energy strategy, which is heavily based on renewable energy. Furthermore, the plan introduces the plans to conduct research into generation of offshore wind energy in the Baltic Sea. A more recent legislative piece is the National Energy and Climate Plan (NCEP), which sets out the plans and objectives up until 2030. The Ministry of Energy works together with the Ministry of Environment and the Ministry of Transport and Communications on implementing the NCEP.

The MSP allocates different zones for renewable energy projects. In 2020, a plan to promote offshore renewable wind energy projects in the Baltic Sea was published by the government. The total capacity of these wind projects would be up to 700 MW and all projects need to be constructed by 2030, with a tender to be launched in February 2023.[567] The Lithuanian Energy Agency will be competent for the approvals of spatial planning and environmental procedures of these offshore RE projects. The Ministry of Energy is the key policymaker in the area of offshore wind energy and has a coordinating role. The Ministry of Environment has a supportive role, since it is the authority involved in the maritime spatial planning. Finally, the National Energy Regulatory Council has a role in assessing and granting permits for offshore wind projects.

Emerging offshore renewable energy governance

In Lithuania, underground CO2 storage is banned.[568] However, Lithuania is considering hydrogen as an essential component of the decarbonisation of Lithuania. As of February 2022, national guidelines for the development of hydrogen technology are being drafted.[569] In 2020, the Ministry of Energy launched the Lithuanian Hydrogen Platform, where public, private and academic stakeholders discussed the use of hydrogen in Lithuania.[570]

The Netherlands

Table 78 Overview Dutch regulatory documents

Name of the regulatory document	Short description
Water Act (Waterwet) (2021)	The Water Act is the main legislation and can be seen as an integral legal framework for water management in the Netherlands. The Act contains provisions for the use and management of water in the Netherlands, including the North Sea.
National Water Plan	The National Water Plan is the policy framework for Dutch water

[567] https://www.iea.org/policies/11497-proposals-for-location-of-wind-power-turbines?country=Lithuania&qs=lith

[568] https://www.infolex.lt/teise/DocumentSinglePart.aspx?AktoId=556859&StrNr=1

[569] https://www.ambergrid.lt/en/news/pressrelease/first-foundation-for-the-hydrogen-era-is-being-laid-in-lithuaniathe-drafting-of-the-national-guidelines-for-hydrogen-development-has-started

[570] For more information, see https://enmin.lrv.lt/en/sectoral-policy/hydrogen-platform/EU%20banner%20link

(2022)	management for six years. The 2022-2027 water plan was published in March 2022.571 The National Water Plan also has a specific North Sea policy Annex. The North Sea policy programme covers also renewable energy planning and CCS.
Spatial Planning Act (2008)	The Spatial Planning Act is the legal basis for the Water Act. In 2023 most likely the Environment law will be introduced, which will replace parts of the Spatial Planning Act. This new law will simplify the process of spatial planning by combining and replacing several existing laws.
National Energy and Climate Plan (2019)	The Dutch National Energy and Climate Plan stipulates the objective, policies and measures for the energy transition of the Dutch society and economy. The main legislative energy policy pieces are the Climate Act and Climate Agreement.
Wind Energy at Sea Act (Wet windenergie op zee) (2021)	The Act is the legal framework for the development offshore wind energy projects. The Act reduces the number of decision moments to make the process efficient. It sets the framework, procedures, rules and regulations for the development of offshore renewable energy projects.
Mining Act, Mining Decree and Mining Regulation	The combination of the three regulations, but especially the Mining Act, are relevant for the exploration and production of hydrocarbons and the usage of subsoil reservoirs for storage. The Decree and Regulation provide more rules and regulations on the exploration, production and storage underground.

Source: Dutch government, 2022

In the Netherlands, the legal framework on maritime policy and governance is built upon three main pillars, as was explained in section 7.2.10. The Water Act is the responsibility of the Ministry of Economic Affairs and Climate and the Ministry of Infrastructure and Water management. Based on the Water Act[572], the National Water Plan is drafted by the Ministries of the Interior and Kingdom Relations, Economic Affairs and Climate, Ministry of Infrastructure and Water management.

The Wind Energy at Sea Act (Wet windenergie op zee) was developed by the Ministry of Economic Affairs and Climate, the Ministry of Agriculture, Nature and Food Quality, the Ministry of the Interior and Kingdom Relations, and the Ministry of Infrastructure and Water management.[573] The Act stipulated that the previously mentioned ministries take lot decisions for the designated offshore areas (i.e. decide which areas will be designated for the production of wind energy).

The main coordinating authority in the Netherlands for North Sea policy is the Interdepartmental Directors North Sea Consultative Body (IDON), which brings together the

[571] https://www.noordzeeloket.nl/en/policy/north-sea-program-2022-2027/

[572] National Water Plan 2022-2027

[573] Wind Energy at Sea Act, article 1.

relevant legislative stakeholders.[574] Additionally, Rijkswaterstaat (Directorate-General for Public Works and Water Management) is the Dutch executive authority responsible for the execution of public and water works (i.e., the design, construction, management and maintenance). Rijkswaterstaat Sea and Delta (RWS ZD) is together with Staatstoezicht op de Mijnen (SodM) (Dutch State Supervision of the Mines) the competent authority for supervising the design, construction and operation of wind farms and offshore grids.

The North Sea Agreement contains the agreements between the central government (represented by the previously mentioned relevant ministries) and stakeholders (North Sea energy organisations, fisheries organisations, nature conservation and environmental organisations, and the Seaports Industry Association) on the sustainable use of the North Sea up to 2030 and beyond. It includes the offshore renewable energy plans of the government.

Emerging offshore renewable energy governance

In the Dutch Climate Agreement, both CCS as well as hydrogen are mentioned as means to reach carbon neutrality. For CCS, the Mining Act, Mining Decree and Mining Regulation are relevant legislative pieces. For the storage of CO2, two licenses are needed, namely a license for the exploration of storage sites and a license for the permanent storage itself. The Ministry of Economic Affairs and Climate is the responsible authority for the policy and the Dutch State Supervision of the Mines also is a relevant stakeholder. In 2020, the Dutch government published its National Hydrogen strategy, in which it identifies offshore wind energy as a key source to produce green hydrogen in the future.[575]

Norway

Table 79 Overview Norwegian regulatory documents

Name of the regulatory document	Short description
Offshore Energy Act (2020)	This Act outlines the licensing and application processes for offshore energy projects. It also touches upon how the Ministry of Petroleum and Energy allocates areas for renewable energy.576

Source: Norwegian government, 2022

Norway has an important offshore and energy industry, due to large natural resources located within Norway's (maritime) jurisdiction. The Ministry of Petroleum and Energy is responsible for a coordinated and integrated energy policy. In 2020, the Norwegian government adopted the Offshore Energy Act, which introduced the procedure for the development of offshore energy projects.

---

[574] The Ministries of Infrastructure and Environment (Chair), Economic Affairs, Defence, Finance, Education, Culture and Science and the executive organisations of Rijkswaterstaat and the Coastguard.

[575] https://www.government.nl/documents/publications/2020/04/06/government-strategy-on-hydrogen

[576] https://www.regjeringen.no/en/topics/energy/renewable-energy/offshore-energy-act/id2876913/

The Norwegian Water Resources and Energy Directorate is the authority responsible for Strategic Environment Assessments. Based on these assessments, areas can be designated as renewable energy areas. In February 2022, the Norwegian government introduced new plans for renewable energy projects.[577] It intends to implement a first phase of wind power production in the North Sea. In addition to that, it aims to introduce an auction model for allocating sea zones for renewable energy projects. This will be carried out by the Ministry of Petroleum and Energy. The government has stated the intention to only serve the domestic Norwegian market with these offshore wind farms, and not interconnect these projects with the networks of other countries. This could be different in the second phase of the offshore wind energy rollout, where an additional offshore wind area will be developed .

Among other relevant stakeholders in this area are the Ministry of Finance and the Ministry of Trade, Industry and Fisheries.

Emerging offshore renewable energy governance

Norway is a frontrunner in CCS. In 2021, it proposed to invest more than €2bn (NOK 25.1bn) into CCS project of the coast of Norway. The government will cover two-thirds of the total costs and industrial actors one-third.[578] The Norwegian government hopes to develop a full-scale CCS value chain by 2024. In 2020, the Norwegian *Ministry of Petroleum and Energy and Norwegian Ministry of Climate and Environment* also published the National Hydrogen Strategy, in which it sets out opportunities to combine the development of a hydrogen industry with offshore renewable energy projects and CCS.[579]

Poland

Table 80 Overview Polish regulatory documents

Name of the regulatory document	Short description
Poland's energy policy up to 2040 (PEP 2040) (2021)	The policy introduces the overall long-term plans and objectives for Poland's energy policy. Part of the plans is to have renewable energy sources, including offshore wind, play an important role. For instance, two offshore wind 2.5 GW auctions are planned in 2025 and 2027.
Offshore Wind Act (OWA) (2021)	The OWA regulates offshore wind projects. It also introduces the target to achieve 5.9 GW of capacity from offshore wind farms by 2030 and 8-11 GW by 2040. In the first phase (by 2030), state subsidies will be provided. Following that, competitive auctions will

[577] https://www.regjeringen.no/en/aktuelt/major-initiative-to-promote-offshore-wind-power/id2900436/

[578] https://www.regjeringen.no/en/historical-archive/solbergs-government/Ministries/smk/Press-releases/2020/the-government-launches-longship-for-carbon-capture-and-storage-in-norway/id2765288/

[579] https://www.regjeringen.no/en/dokumenter/the-norwegian-governments-hydrogen-strategy/id2704860/

	be held. The Act also simplifies administrative and legal procedures.

Source: Polish government, 2022

Poland introduced two relevant policy plans following the European Green Deal. First, the Poland's energy policy up to 2040 (PEP 2040) from 2021 is the main energy policy document. Additionally, in 2021, the Offshore Wind Act (OWA) was adopted. Furthermore, in 2021 an Offshore Wind Sector Deal was signed. In the deal, the government and key stakeholders set out the intention to ensure a coordinated approach to (future) offshore wind energy projects. This deal was initiated by the Ministry of Climate and Environment. The parties that signed the Deal include representatives from the Minister of State Assets, Minister of National Defence, Minister of Interior and Administration, Minister of Infrastructure, Minister of Education and Science, Minister of Finance, Funds and Regional Policy, Minister of Agriculture and Rural Development, Minister of Development, Labor and Technology, local governments, and industry associations.

Within the Polish government, the Deputy Minister for Climate was appointed as the Government Plenipotentiary for Renewable Energy Sources. The Plenipotentiary is tasked with the goal to reduce the barriers within the RE sector and coordinate effort in order to efficiently and effectively develop the RE sector. The Ministry of Climate produces the regulations for the offshore RE projects. The Polish Energy Regulatory Authority organizes the auctions for new offshore wind projects. It also grants the permits.

Emerging offshore renewable energy governance

In the PEP2040 plan, CCS is mentioned, however there are no detailed plans. Poland also has a Hydrogen Strategy for 2030 with a view to 2040. To further increase the efficiency of the future offshore wind energy, Poland wants to invest in the hydrogen economy. The strategy sets out the goal of having 50MW electrolyser capacity by 2030 and 2GW by 2040. The hydrogen facilities will be built close to the offshore facilities to foster synergies. The strategy outlines how the Polish government wants to improve the regulatory framework.

Russia

Table 81 Overview Russian regulatory documents

Name of the regulatory document	Short description
Energy Strategy to 2035 (2022)	The plans set out the goals for the Russian energy sector. In terms of renewable energy sources, in 2035 between 1-2% of the total production would be originating from renewable energy sources.

Source: Russian government, 2022

In Russia, the Oil and Gas industry is of vital importance to the economy. The main legislative energy policy document with a long-term view is the Energy Strategy to 2035, which was developed by the Ministry of Energy.[580] The key stakeholder in the energy policy

[580] http://government.ru/en/docs/39847/

sector is the Ministry of Natural Resources and Environment. Under this Ministry's monitoring functions are assigned to the Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet), while the Federal Service for Supervision of Natural Resources (Rosprirodnazdor) has a regulator role. The Ministry of Economic Development is a key stakeholder with respect to the climate change policy.

Emerging offshore renewable energy governance

Hydrogen is part of Russia's Energy Strategy to 2035 as Russia wants to develop the hydrogen industry. In 2021, the Russian government published the document "Concept for the Development of Hydrogen Energy in Russia". The concept sets out Russia's intention to create hydrogen clusters, of which one is located closely to the Baltic Sea region and is aimed for the export of hydrogen to European countries.

Sweden

Table 82 Overview Swedish regulatory documents

Name of the regulatory document	Short description
National Energy and Climate plan (NCEP) (2020)	The plan sets out the long-term energy and climate objectives for Sweden. Energy policy is regulated by the 2017 Climate Act.

Source: Swedish government, 2022

In 2020, the Swedish National Energy and Climate Plan was adopted. The main authorities responsible for the energy policy are the Ministry of Infrastructure and the Ministry of the Environment. In Sweden, the Swedish Energy Agency is responsible for leading the energy transition.

The territorial water belongs to the public and is represented by the *Kammarkollegiet* (the Legal, Financial and Administrative Services Agency), which falls under the Ministry of Finance. The Swedish Agency for Marine and Water Management is the main authority responsible for the Maritime Spatial Planning following the Marine Spatial Planning Ordinance (2015:400). However, in case offshore projects take place within the territorial waters, municipalities are responsible for the planning. This is one of the reasons that the development of offshore wind projects in Sweden is a rather complex process. If a project is located in territorial waters, both an environmental as well as a water permits are required and have to be granted by the County Administrative Board and the Land and Environmental Court. Before the development of an RE project, the Swedish Armed Forces need to be consulted. Furthermore, depending on the legal owner of the water body (i.e. private owner or the Legal, Financial and Administrative Services Agency) approval to develop a project in the area is required.

Other relevant authorities include the Environmental Authority (for the Environmental Impact Assessments), the Swedish Energy Agency (for grid connection? consenting), the Energy Markets Inspectorate (license to operate offshore grid infrastructure), and the Ministry of Enterprise, Energy and Communication (for licenses and permits related to the EEZ).

The coordination group and forum SAMHAV, that was set up in 2006 by the government, currently does not fall under the responsibility of the government anymore, it has the purpose to streamline the implementation of policy related to water in Sweden.[581] It is a platform where relevant stakeholders meet, such as the Swedish Agency for Marine and Water Management, the County Administrative Boards, the Coast Guard, etc..

Emerging offshore renewable energy governance

As the Swedish Energy Agency is responsible for the development of emerging renewable energy, it also has been tasked by the Swedish Government to serve as the national convener on carbon capture and storage. CCS is also mentioned in the Integrated National Energy and Climate Plan. CCS has been on the agenda in Sweden for a longer time, as it is exemplified by the 2010 study on the possibilities to implement a CCS infrastructure in the Baltic Sea region.[582] In November 2021, the Swedish Energy Agency published the National Hydrogen Strategy, in which it sets out the objective to have 5GW of hydrogen electrolyser capacity by 2030 and 15GW by 2045.[583]

United Kingdom

Table 83 Overview regulatory documents in the United Kingdom

Name of the regulatory document	Short description
Energy Act (2013)	This Act introduces objectives and targets for the decarbonisation of the UK.
Strategy and Policy Statement (2014)	The Statement set out the Government's strategic priorities and other main considerations of its energy policy
Ten Point Plan for a Green Industrial Revolution (2020)	This is general policy document that is aimed to set out the vision for the UK after the Coronavirus pandemic and the subsequent economic shock. One of the focuses of the document is advancing the offshore wind energy sector.
Plan for Growth and the Net Zero Strategy: Build Back Greener	The plans and the Strategy set out the targets, objectives and policies to decarbonise the UK economy. This includes specific targets with regards to offshore wind, low-carbon hydrogen and CCS. For instance, by 2030 there should be 40GW of offshore wind

581 https://www.havochvatten.se/planering-forvaltning-och-samverkan/program-projekt-och-andra-uppdrag/nationella-samverkansgrupper/samordningsgruppen-for-havs--och-vattenmiljofragor.html

582 System study of the possibilities for the implementation of an infrastructure for CCS in the Baltic Sea region (in Swedish: Systemstudieav mojligheter att etablera en infrastruktur for CCS i ¨Ostersjoregionen), 2010

583 Förslag till Strategi" och Underlagsrapport till vätgasstrategin (in Swedish) from https://www.energimyndigheten.se/remissvar-och-uppdrag/

(2021)	capacity, 5GW of hydrogen capacity and a scale-up of CCS projects584585. There are also plans to have floating offshore wind project with a capacity of 1GW.
Planning Act (2008)	The Planning Act stipulates that a development consent order (DCO) is required when an offshore wind energy project has a capacity of over 100MW. Due to their size, these projects receive the classification nationally significant infrastructure projects (NSIPs) and require a DCO.

Source: UK government, 2022

The UK Government's department for Business, Energy, and Industrial Strategy (BEIS) is responsible for the overarching energy policy (i.e. implementing strategy, policy and legislation). However, with regards to planning, fisheries and the promotion of energy efficiency the governments of Scotland, Wales, and Northern Ireland are responsible. The Energy Act of 2013 and the "Strategy and Policy Statement" are the legal framework underpinning the energy policy.[586]

The Energy White paper introduces the future of the UK's energy policy.[587] More specifically, the "Ten Point Plan for a Green Industrial Revolution", the 2021 "Plan for Growth" and the "Net Zero Strategy: Build Back Greener" set out specific targets for the UK Government. The Contracts for Difference (CfD) scheme is the UK's government main supporting mechanism for the development of offshore renewable energy projects, which currently is in the fourth allocation round (AR4). With respect to permits and licenses, if an offshore wind farm has a capacity over 100MW a development consent order (DCO) is required by the Planning Act of 2008. Ultimately, the BEIS Secretary of State is the authority who approves the DCOs for the NSIPs. If an offshore wind project has total installed capacity between 1MW and 100MW then a project needs to apply for a consent under Section 36 of the Electricity Act 1989. Aside from that, according to the Marine and Coastal Access Act of 2009, offshore wind projects require marine licenses that are granted by the Marine Management Organisation.

With regards to the overall marine policy framework is set out under the UK Marine Policy Statement.[588] Each of the governments in the UK need to develop these marine plans. Furthermore, in the United Kingdom, the Crown Estate is the owner and manager of the seabed belonging to the United Kingdom. This also includes offshore wind farms. Therefore, the Crown Estate is responsible for identifying and leasing potential offshore wind sites to the developers i.e. the previously mentioned allocation rounds. For all tenders, the Crown Estate is responsible for programme delivery, which includes geological modelling and zone contract management.

---

[584] https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution

[585] https://www.gov.uk/government/publications/build-back-better-our-plan-for-growth/build-back-better-our-plan-for-growth-html#net-zero

[586] Energy Act 2013 (2013 c. 32), available at http://www.legislation.gov.uk/ukpga/2013/32/contents/enacted

[587] https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future

[588] Marine and Coastal Act

Emerging offshore renewable energy governance

The CCS objectives follow the CCUS Deployment Pathway Action Plan from 2018.[589] The development of the CCS-industry is supported by CCUS Infrastructure Fund and the Industrial Energy Transformation Fund.[590] Furthermore, an Economic Regulatory Regime will be responsible for the licenses needed for CCS. As for hydrogen, following the "Ten Point Plan for a Green Industrial Revolution" and the 2021 "Plan for Growth", the UK government launched the UK Hydrogen Strategy. [591]

[589] https://www.gov.uk/government/publications/the-uk-carbon-capture-usage-and-storage-ccus-deployment-pathway-an-action-plan

[590] https://www.gov.uk/government/publications/design-of-the-carbon-capture-and-storage-ccs-infrastructure-fund

[591] https://www.gov.uk/government/publications/uk-hydrogen-strategy

Governance structures in the area of multipurpose platforms

Introduction

An offshore multi-purpose platform can be defined as a platform that serves the purpose of multiple offshore industries (aquaculture, biotechnology, maritime transport, tourism, renewable energy, etc.).[592] Multi-purpose platforms (MPPs) are seen as one of solutions for rational use of marine space in densely populated seas like the Baltic Sea and the North Sea. Supported through EU FP7 and Horizon 2020 research programmes, several prototypes of platforms have been developed and multiuse concepts have been investigated.

Given a variety of activities that could be performed in multi-purpose platforms, their governance has to incorporate several policy dimensions - economic, social, technical, environmental, and legal.[593] It is also critical to consider these dimensions while developing tailored business cases that can support the development of MPPs.

Clear policy frameworks at all levels are needed to ensure the effective functioning of the MPPs, including multi-use licensing procedures, environmental monitoring, mechanisms for financial support, due to high investment costs while launching the platform. In addition, different stakeholders should be involved while overcoming difficulties with the development and implementation of the platforms.

Currently, these are many barriers to the development of multi-purpose platforms. These arise from a lack of solutions for above-listed dimensions. For example, multi-use platforms have gained interest from research and political stakeholders, due to expected growth in the sectors (e.g., more aquaculture, more offshore wind energy) and anticipated cost-savings (cheaper aquaculture and cheaper offshore wind energy). Still, clear business cases for the creation of these platforms are missing, and economic risks are poorly understood.

The potential benefits of MPPs, such as social cohesion, territorial cohesion, equity and coastal community development and lower environmental impacts have received significantly less attention in studies.[594] The lack of in situ experience and data is has been emphasized, as some issues can only be addressed by full-scale testing of multi-use platforms - technological solutions for reducing collision risks of multiple users, operational challenges in harsh meteorological conditions, environmental impacts and acceptance of MPPs by stakeholders. [595] [596]The development of 'real-life' pilots – with an option of failure –

---

[592] https://strathprints.strath.ac.uk/69809/1/Collu_Bachynski_IET_2019_Multipurpose_platforms.pdf

[593] https://www.researchgate.net/publication/299765200_The_governance_of_Multi-Use_Platforms_at_Sea_for_energy_production_and_aquaculture_obstacles_and_challenges_for_policy_makers_in_European_Seas

[594] https://www.sciencedirect.com/science/article/pii/S0029801820309331

[595] https://www.sciencedirect.com/science/article/pii/S0048969718342049

is not an attractive business proposition and hence the financial support and incentives from public resources are necessary. Thus, in situ trials and demonstrators are critical for addressing both technical and non-technical barriers.

The initiatives of multi-purpose and multi-use platforms in the Lighthouse area have been mapped within Task 2 – they are only a few and mostly at the pilot stage (see Chapter 4.2.4). The project MUSES analysed possible multi-use combinations and provided potential governance aspects when developing multi-purpose platforms (Box 31). Overall, it appears to be pre-mature to discuss MPP's governance structures, given a lack of concrete cases and no specific regulations that focus on MPPs. Therefore, the chapters below describe the potentially relevant regulations and actors in case of MPPs upscaling at industrial level in the Baltic and North Sea. In addition, the discussion points to challenges for governance in this area, based on existing MPP cases in the Lighthouse area.

Box 31 Key findings on governance aspects discovered in the MUSES project

The project MUSES explored the opportunities for multi-use in European seas and assessed potential synergies, as well as the potential challenges. It identified that the degree of connectivity between different maritime uses can vary, ranging from two uses merely sharing the maritime space to shared platforms and other infrastructure. In ideal case the joint use of two maritime activities is planned as part of the same process (joint development). It is also possible to develop multi-use by integrating a second use with an already existing use (staggered development). The higher the level of connectivity, the higher the need is for the two or more maritime activities to coordinate well from the beginning.

Another issue investigated by the project was whether a primary user exists (e.g., a user who has been given primary rights to a certain maritime zone, has an existing permit or whose use is already fully developed). In such cases, the secondary user needs an approved claim for using the primary user's priority areas, and only if their use has been proven not to be detrimental . This leads to a power imbalance between the primary and secondary users. However, even when the two uses are developed and operated by the same entity, existing legislation often hampers multi-use as the two regimes established for each single use often contradict each other.

Source: Ocean Multi-Use Action Plan, MUSES project, 2018[597]

Institutional and regulatory framework of governance

International level

The location of the multipurpose platforms in marine areas determines the range of international institutions involved in general governance of the seas. The International Maritime Organization (IMO) as a body overlooking shipping and pollution from maritime

---

[596] B. Zanuttigh, E. Angelelli, A. Kortenhaus, K. Koca, Y. Krontira, P. Koundouri A methodology for multi-criteria design of multi-use offshore platforms for marine renewable energy harvesting Renew. Energy, 8 (2016) 5:1271–1289

[597] https://www.submariner-network.eu/images/news/MUSES_Multi-Use_Action_Plan.pdf

activities will be relevant also in case of multi-purpose platforms, assuming that operation of those involve maritime activities. The International Oceanographic Commission (IOC) promoting marine research and supporting capacity building for marine management is also an important governance actor, especially when it comes to distribution of the available knowledge in the field.

The international legal framework for governance of multi-purpose platforms is not fixed and on theoretical level, embraces a wide variety of general laws and agreements for the seas and oceans. A comprehensive list of significant regulations is available in chapter 7.2.

European level

At the European level, the range of potentially relevant institutions is defined by the location of multi-purpose platforms. For EU Member States those would be the respective European Commission Directorates – DG MARE, DG ENV and depending on purposes of platforms, possibly also others, listed in chapter 5.2.3. Considering the scope and possible combinations of sectors on the multi-purpose platforms also other EU sectoral organizations will be relevant, which are included in the chapters of thematic areas – on maritime transport, energy and aquaculture.

The multi-purpose platforms have not been specifically addressed in any of EU legislative documents, therefore regulations that are focused on spatial planning/territorial management of marine resources, as well as, on environmental protection and standards are highly relevant. A selection of EU policies is presented in Table 84 below.

Table 84 EU policies in the maritime sector that are of high relevance for the MPPs

Name of the policy	Short description and indication on relevance for the MPPs
Integrated Maritime Policy	This policy is a holistic approach to all sea-related EU policies. It is based on the idea that the Union can draw higher returns from its maritime space with less impact on the environment by coordinating its wide range of interlinked activities related to oceans, seas and coasts. Hence, the IMP aims at strengthening the blue economy, encompassing all sea-based economic activities. As MPPs are considered as one of innovative ways to enhance the blue economy, activities related to development of platforms in the European seas should be covered by IMP.
Maritime Spatial Planning (MSP) Directive 2014/89/EU	MSP requires EU Member States to develop and implement MSP, advocating for co-location of maritime activities and more efficient and sustainable use of maritime resources. EU legislation provides a framework for MSP, but Member States are responsible for designing and determining the format and content of the plans, including institutional arrangements and, where applicable, any allocation of maritime space to different activities and uses. Sound and sustainable use of marine space is one of pre-requisites for MPP's development and simultaneously also a requirement of MSP Directive.
The Marine Strategy Framework Directive (MSFD) (2008/56/EC)	MSFD aims to achieve Good Environmental Status (GES) of the EU's marine waters. This should help to protect the resource base upon which marine-related economic and social activities depend and in that way is expected to deliver the environmental aspects of the Integrated Maritime Policy. Deployment and operation of MPPs then should secure either improvement of environmental status or at least not cause the worsening of it.
Strategic Environmental Assessment (SEA)	Strategic Environmental Assessment (SEA) Directive (2001/42/EC) is addressing the various costs and menaces to the physical surroundings

Directive (2001/42/EC)	should be carried out before the development of each project. SEA requires an assessment of public plans and programmes, which are likely to have significant effects on the environment. In case of MPPs SEA is relevant if the platform is being planned as goal of public investments.
Environmental Impact Assessment Directive(85/337/EEC, 2014/52/EU)	Strategic Environmental Assessment (SEA) Directive (2001/42/EC) is addressing the various costs and menaces to the physical surroundings assessments of which should be carried out before the development of each project. SEA requires an assessment of public plans and programmes which are likely to have significant effects on the environment.598 In case of MPPs SEA is relevant if the platform is being planned as goal of public investments.

Source: own production, 2022

Macroregional level

The existing macroregional policies and strategies (e.g., European Union Strategy for the Baltic Sea Region (EUSBSR) and North Sea Region 2030 Strategy) serve as a mechanism and a platform for cooperation in the Baltic and North Sea regions. Although multi-use of the sea or multipurpose platforms as an economic or environmental solution have not been in the focus of these strategies, it is likely that a stronger cooperation in the Baltic Sea region will result in joint MPP projects in the North and Baltic Sea basins. As a consequence, an effective governance of the MPPs in the Lighthouse area can be developed. In addition, the macroregional policies and strategies have stimulated a dialogue between the EU and Member States. Thus, more synergies can be expected in the launch of join initiatives and regulations that focus on MPPs. The strategy and policy documents that have been developed to date were updated several times over the years. Thus, novel areas, such as MPPs, can be included in the future updates of these agreements.

In this context, HELCOM, VASAB, OSPAR, Interreg Baltic and North Sea Region and other organisations and programmes that operate at a macroregional level are likely to stimulate design and implementation of policies and strategies that focus on MPPs. By now, HELCOM has included the option of multi-use in its Regional Maritime Spatial Planning Roadmap 2021-2030 and plans to have descriptions of multi-use cases with recommendations for further activities in 2027.[599] It is noted that in the case of OSPAR, similar approaches are have not been documented.

Considering the importance of maritime spatial planning for MPPs, VASAB would be an important satekeholder in the Baltic Sea region. However, the VASAB Long Term Perspective for the Baltic Sea Region, adopted in 2010, does not touch upon multi-use of marine space[600]. However, it envisages that the Region should have integrated land and sea space planning. The understanding is reached that sea is a common asset and a development resource of all the countries, and the MSP alleviate the potential sea use conflicts.

[598] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052

[599] https://portal.helcom.fi/meetings/HELCOM%2042-2021-746/MeetingDocuments/5-10%20Draft%20Regional%20Maritime%20Spatial%20Planning%20Roadmap%202021-2030.pdf

[600] https://vasab.org/wp-content/uploads/2018/06/vasab_ltp_final-2.pdf

National and sub-national level

Although the topic of governance for multi-purpose platforms or multi-use space has been covered in fairly many scientific and conceptual project studies, the practical governance is not applicable yet.[601][602][603][604] Currently almost all cases of multi-purpose or multi-use in the marine space are either pilot studies or in the planning phase. In the Lighthouse area, Denmark, Belgium, Germany and the Netherlands have a case of multi-use. These cases, along with the consortium and stakeholders involved, are presented in Table 85. The last column of the Table highlights key challenges for governance of MPPs.

The unclear legal status of multi-use together with insurance aspects and lack of dialogue between stakeholders are the most frequent governance issues for multi-purpose pilots. Obviously, the existing regulations do not provide sufficient legal framework and further development of multi-use cases will require adjustments of regulatory documents. In case of aquaculture as one of uses, the loss of cultivated biomass is not insured. As the production from the multi-purpose pilots is of minor importance for the country's economy, the interest of stakeholders is low. The consortia of the pilot cases involve academic institutions, companies and public organizations but none of governmental authorities. We suggest that involvement of governmental actors would help in adjustments for regulatory framework.

Table 85 Multi-purpose initiatives in the Baltic and North Seas

Name of the MPP initiative	Consortium involved	Stakeholders	Challenges for governance
Middelgrunden wind farm, Denmark – accepting visitors to the turbines	HOFOR (Copenhagen water and energy supply), Middelgrunden wind cooperative (more than 8000 members)	Tourism operators, planners, wind energy professionals, diver associations, fisheries	Safety, health, insurance of visitors, the legal responsibility, lack of dialogue between institutions, unclear and fragmented regulation.
Kriegers Flak, Denmark - wind turbines and offshore aquaculture (fish farming)	Vattenfall (European energy company)	Wind energy producers and service companies, marine offshore fish farming companies	Dialogue between stakeholders
FINO3 platform – testing combination of offshore wind research with aquaculture (cultivation of	FuE-Zentrum FH Kiel GmbH (research and technology organisation), Kieler Meeresfarm (mariculture company)	Wind energy producers and service companies, marine aquaculture companies, research institutions	Unclear legal status of multi-use, lack of dialogue between stakeholders, insurance aspects.

[601] https://muses-project.eu

[602] https://cordis.europa.eu/project/id/652629

[603] doi:10.3390/su8040333

[604] https://link.springer.com/book/10.1007/978-3-319-51159-7

mussels and macroalgae)			
Belwind, Belgium – testing combinations of offshore wind, flat oyster aquaculture and restoration, and seaweed cultivation	Universiteit Gent, Jan De Nul Group (marine construction and offshore services company), Brevisco (aquaculture company), Colruyt Group (retailing company), ParkWind (renewable energy group), Royal Belgian Institute of Natural Sciences	Wind energy producers and service companies, marine aquaculture farmers, environment authorities, retailers	Biodiversity and environmental protection, security of operations. Ability to continue, if the turbines are decommissioned, insurance issues, missing dialogue between stakeholders.
North Sea Innovation Lab, Netherlands - seaweed cultivation, floating solar and other renewable energy innovations, and co-use of wind farms	North Sea Farmers (non-profit organization), Seaweed Company, Oceans of Energy (renewable energy company)	Renewable energy producers, marine aquaculture (seaweed) companies, retailers, research institutions	Lack of clear legal procedures and regulations, insurance issues.

Source: Report on identified risks, challenges and barriers, project UNITED, 2021.[605]

Multi-purpose platforms as a type of sea use should be governed by the national MSPs if this type of use is foreseen in a respective country's plan.[606]

Another option for governance, based more on practice than on policy, could be a "Community of Practice". In 2018 a "Community of Practice North Sea" was set up in the Netherlands to stimulate the development of multi-use pilots by bringing interested parties together, sharing experiences and learning from each other in a context of existing and developing spatial and social claims. The Ministry of Agriculture, Nature and Food Quality was strongly involved in this development. This was a part of the government's strategy aimed at finding a balance between offshore wind energy development, nature conservation and seafood production. The experience now shows that partly decoupling policy from practice helps creating a positive learning environment. Thus, the Communities of Practice have potential as a participatory tool for encouraging cooperation between stakeholders in an informal setting and facilitating a transition towards multi-use of marine resources.[607]

605 https://www.h2020united.eu/images/PDF_Reports/D11_Report_on_identified_risks_challenges_and_barriers_revised_after_ECReview_Dec2021_220207

606 https://www.h2020united.eu/images/PDF_Reports/D11_Report_on_identified_risks_challenges_and_barriers_revised_after_ECReview_Dec2021_220207

607 https://www.sciencedirect.com/science/article/pii/S0308597X20310228

Governance structures in the area of aquaculture

Introduction

Marine aquaculture encompasses the cultivation of living organisms either in coastal or offshore areas and can be classified according to the type of species cultivated (fish, crustaceans, molluscs, macroalgae) or after the type of facilities used (open/closed cages, longlines, nets etc.). Considering the growing global need for protein and increasing pressure on already overfished fish stocks, marine aquaculture is regarded as industry presenting opportunities for society and in the EU context, as a solution for creating jobs, providing food resources in the situation of diminishing fish stocks and boosting innovation on sustainable aquaculture practices.[608] Still, the risks both for society and environment are also present and should be considered in the governance infrastructure.[609] Governance itself together with socio-economic factors is considered to be a significant factor for successful growth of marine aquaculture.

The most commonly identified aspects to be governed in aquaculture are:

- a legal and strategic framework to facilitate the development of appropriate industrial infrastructure
- transfer of knowledge from freshwater to marine aquaculture and creation of synergies
- maritime spatial plan to identify the most suitable areas, streamline licensing and provide greater regulatory certainty.[610]

In the EU, additional issues for the sector must be considered, such as:

- availability of environmental data to aquaculture practitioners
- solutions of conflicts regarding the sea space
- assessment of sector's performance
- social acceptance of some aquaculture practices.[611]

Maritime spatial planning that is organised with inclusion of representatives of the sector in the design process is regarded as one of approaches to target above-listed issues. However, the governance of aquaculture appears to be lagging behind other sectors using the shared environmental resources like water and space. Although known and used in the

---

608 https://brill.com/view/journals/jeep/18/3/article-p256_256.xml?language=en#d7214594e821

609 https://www.sciencedirect.com/science/article/pii/S0308597X18302537?via%3Dihub

610 https://iopscience.iop.org/article/10.1088/1748-9326/abb908/pdf

611 https://maritime-spatial-planning.ec.europa.eu/sites/default/files/sector/pdf/mspforbluegrowth_sectorfiche_aquaculture.pdf

world centuries ago, aquaculture still has less property rights, established state policies, legislation, farmer cooperatives, supply chains or co-management arrangements. Moreover, climate change should be seriously taken into account in the governance of marine aquaculture, due to risks of acidification, spread of diseases and invasive predators.[612]

Institutional and regulatory framework of governance

International level

As previously mentioned, Food and Agricultural Organization (FAO) is a specialized agency of the United Nations that leads international efforts to defeat hunger. FAO has more than 70 thematic work areas and aquaculture is one of those.[613] For aquaculture a Sub-Committee on Aquaculture provides a forum for consultations and discussions. The respective Sub-Committee also advises Committee on Fisheries on technical and policy matters related to aquaculture and on the work to be performed by the FAO in the field of aquaculture.[614]

FAO's Code of Conduct for Responsible Fisheries (1995) includes the principles for aquaculture. However, to date there are no aquaculture-related binding international agreements.[615] A variety of voluntary instruments have been established within the framework of the Code to assist fishers, industry and governments in taking the necessary practical steps to implement the various facets of the Code. One of these instruments is "Strategy and Outline Plan for Improving Information on Status and Trends of Aquaculture" (Strategy).[616] The Strategy provides a framework and a plan for the improvement of knowledge and understanding of status and trends of aquaculture as a basis for policy-making and management. The Strategy proposes to significantly improve data collection and related research. Data collection needs for monitoring the status and trends of aquaculture are established by existing obligations of states to report fisheries statistics to FAO under Article XI of the FAO Constitution. The Strategy also foresees the use of existing information flows and systems for fisheries data to collect additional data on aquaculture.

The FAO Technical Guidelines on Aquaculture Certification is an additional tool for governance of the sector.[617] These guidelines provide direction for the development, organization and implementation of credible aquaculture certification schemes towards orderly and sustainable development of the sector.

Among organisations that are supporting policymaking at the international level, the following are worth mentioning: World Aquaculture Society, Global Seafood Alliance, Safe

---

[612] https://academic.oup.com/icesjms/article/78/1/315/6151698?login=false#232297050

[613] https://www.fao.org/themes/en/

[614] https://www.fao.org/aquaculture/en/

[615] https://www.fao.org/fishery/en/code/en

[616] https://www.fao.org/3/i0445t/i0445t00.pdf

[617] https://www.fao.org/publications/card/en/c/f6d747f5-8068-5dd9-bf03-d08f9223fff3/

Seaweed Coalition and Aquaculture Steering Group of ICES (International Council for the Exploration of the Sea).

The World Aquaculture Society is non-governmental, membership-based organization with an important role in assuring the progressive development of aquaculture worldwide by meeting the increased global demand for science-based information and technology. The Global Seafood Alliance (GSA) is an international nongovernmental organization based on membership and dedicated to advancing responsible seafood practices through education, advocacy and third-party assurances. The Safe Seaweed Coalition - a global partnership established to oversee the safety and sustainability of the seaweed industry as it scales up, supported through the investment of three major partners. The Aquaculture Steering Group of ICES is responsible for guiding and supporting expert groups that are working on science and advisory topics contributing to the sustainable development of aquaculture in ICES member countries.

EU level

The EU Common Fisheries Policy (CFP) sets rules for sustainable fishing and conservation of fish stocks, including the aquaculture policy. The strategic guidelines for the sustainable development of EU aquaculture (2013, 2021) served as the basis for the development of national strategic plans for aquaculture, for period 2015-2020 and 2021-2027.[618][619] In accordance with suggestions of the strategic guidelines, all plans of the Baltic Sea and North Sea countries included simplification of administrative procedures, mostly regarding permit application procedures. The updated guidelines (2021) aim to offer a common vision for EU Member States and relevant stakeholders to develop aquaculture in the EU, contributing to the European Green Deal strategy and addressing following challenges and opportunities:

- building resilience and competitiveness
- participating in the green transition
- ensuring social acceptance and consumer information
- increasing knowledge and innovation.

The complexity of the sector's governance is mentioned in the guidelines, and Member States are urged to streamline administrative procedures, mostly related to licensing and permits. The complexity is caused by the fact that no strict regulations specific for aquaculture are in force at the EU level – the sector is regulated by environmental directives (MSFD, WFD, Habitats and Birds Directives), regulations on human and animal health and welfare, legislation on organic production.[620]

---

[618] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:236:FIN

[619] https://ec.europa.eu/oceans-and-fisheries/ocean/blue-economy/aquaculture/aquaculture-multiannual-national-plans_en

[620] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0056 https://ec.europa.eu/oceans-and-fisheries/policy/aquaculture-policy_en

As a result, at the EU level the European Parliament, Council, and the European Commission, in particular its directorates-general responsible for related sectors to aquaculture operations (DG MARE, DG ENV, DG RTD) are responsible for setting up the governance and regulatory framework. CINEA – European Climate Infrastructure and Environment Executive Agency, as described in chapter 1, is in charge of the management of funding programmes, including EMFAF, relevant also for marine aquaculture and Horizon Europe, relevant for research and innovation in this area. The European Research Executive Agency (REA) has a mandate from the European Commission to support the EU Research and Innovation policy by funding high-quality research and innovation projects that generate knowledge for the benefit of society. REA manages Horizon Europe programme, relevant for Mission goals in the Lighthouse area, including aquaculture.The Aquaculture Advisory Council is an EU body created according to CFP, for provision of advice to the EC and Member States on any new legislative, regulatory or legal measure at European or national level that affects aquaculture.[621] The Council represents aquaculture stakeholders - sectoral organizations and interest groups related to aquaculture.

In addition, other less formal interest groups and stakeholder groups are providing advice and positions to the EC and EU structures. The Federation of European Aquaculture Producers represents production companies and serves as an advisory body, providing positions, documentation and data on European aquaculture issues to the European Commission, the European Parliament and other relevant stakeholders, both at the European and global levels. EFARO - the European Fisheries and Aquaculture Research Organisations, is an association composed of the Directors of the main European Research Institutes involved in Fisheries and Aquaculture research. EFARO works to achieve greater cohesion and coordination of Community fisheries Research and Development, provide knowledge and advice for fisheries and aquaculture.

Among the lobby organisations, the European Aquaculture Society (EAS) and Seaweed for Europe should be highlighted. The EAS stimulates engagement of all involved or interested in marine and freshwater aquaculture and promotes sponsorship of multi-disciplinary research concerning aquaculture. Seaweed for Europe is an European coalition that seeks to accelerate and scale the European seaweed industry by driving innovation and investment. Also European Aquaculture Technology and Innovation Platform (EATiP) is an international non-profit association dedicated to developing, supporting and promoting aquaculture through emphasis on technology and innovation, including all members of the European aquaculture value chain.

Still, the responsibility of the application of legislation and the management of aquaculture activities lies with public authorities of the EU countries.

There is currently a conflict between the objectives of aquaculture growth, on the one hand, and achieving good status for all coastal water bodies within the given timeframes, on the other hand. According to the EU's Scientific, Technical and Economic Committee for Fisheries (STEFC), a significant barrier to growth is the administration and regulation of aquaculture.[622] All EU Member States should follow the requirements of WFD on obtaining good ecological status and a ruling of Court of Justice of the European Union (2015) on avoiding deterioration of water quality even by one indicator and by one status class. This

---

[621] https://aac-europe.org/en/about-us

[622] Scientific, Technical and Economic Committee for Fisheries (stecf), The Economic Performance Report on the EU Aquaculture sector (stecf-13–29), Publications Office of the European Union 2013, Luxembourg, eur 26336 EN, jrc 86671.

ruling, known also as a Weser case, limits the Member States' discretion in achieving the objectives of the directive, making the attainment of a good status binding not only as an overall objective, but applicable in individual projects affecting a water body. As a consequence, national authorities may not permit activities that deteriorate the environmental quality of a water body or jeopardise the achievement of a good status on an individual project level.[623]

Macroregional level

HELCOM, as described in chapter 5.2.4, has the CG Aquaculture or "Correspondence Group concerning a draft document on BAT/BEP descriptions for sustainable aquaculture" which was created in 2016 to implement the HELCOM Recommendation 37/3 on sustainable aquaculture.[624] The group has to take account of the heterogeneous nature of aquaculture, variability in technology and geography with the need for a differentiated approach, when developing the set of Best Available Technology/Best Environmental Practices (BAT/BEP) descriptions[625]. Its Terms of Reference include, among others, exchange of BAT/BEP information and experience gained on aquaculture in the Baltic Sea region and development of BAT/BEP descriptions for sustainable aquaculture for the Baltic Sea region, by:

- defining environmentally acceptable, economically viable and socially equitable standards
- differentiating between land- and sea-based aquaculture, where appropriate
- promoting innovation, and
- not prescribing any specific technique to be applied by all Contracting Parties.[626]

The BAT/BEP descriptions developed by HELCOM should be relevant for both existing and new, sea-based aquaculture and land-based aquaculture with a potential impact on the Baltic Sea.[627]

OSPAR has a work area "Fisheries and Mariculture" inside the set of areas "Human activities", supervised by Environmental Impact of Human Activities Committee. Although a concern towards environmental impacts of mariculture/aquaculture is stated there are currently no specific recommendations or working plans for the member states.[628] A recent OSPAR report (2021) has been produced on aquaculture in the North-Atlantic including

[623] doi:10.1163/18760104-18030005

[624] https://helcom.fi/media/recommendations/Rec-37-3.pdf

[625] https://helcom.fi/helcom-at-work/groups/fish-group/cg-aquaculture/

[626] https://portal.helcom.fi/meetings/CG%20AQUACULTURE%204-2021-912/MeetingDocuments/2-1%20Updated%20Terms%20of%20Reference%20and%20Work%20Plan.pdf

[627] https://portal.helcom.fi/meetings/CG%20AQUACULTURE%204-2021-912/MeetingDocuments/Outcome%20CG%20AQUACULTURE%204-2021.pdf

[628] https://www.ospar.org/work-areas/eiha/fishing-mariculture

trends in the sector and trends regarding impact on environment.[629] Key conclusions of the report include:

1. a wish of OSPAR to increase understanding the potential impacts of future growth, as ambitions for substantial increase of the aquaculture production in the OSPAR Maritime Area are present, especially in Norway

2. consideration of future engagement with ICES to identify and address knowledge gaps of particular significance for environmental management of aquaculture

3. the implications of new or expanded forms of aquaculture - offshore aquaculture, recirculating aquaculture systems or of new species to be considered.

Besides the described entities of HELCOM and OSPAR, the Nordic Council of Ministers also constitutes a relevant organisation for aquaculture.[630] Its Council of Ministers for Fisheries, Aquaculture, Agriculture, Food and Forestry promotes the sustainable use of natural and genetic resources that are essential to human existence. The Council operates according to co-operation programme for 2017-2020.[631] The programme describes the two main Nordic political priorities for fisheries and aquaculture, agriculture, food and forestry in the period 2017–2020, i.e. the development of the Nordic bio-economy and sustainable food systems. The programme further develops and enhances co-operation on fisheries and aquaculture, agriculture, food and forestry.

Other relevant macroregional organisations/forums that influence policy-making in the area of aquaculture include , North Atlantic Salmon Conservation Organization (NASCO). NASCO's goal is to minimise the possible adverse impacts of aquaculture, introductions and transfers and transgenics on the wild stocks of Atlantic salmon, working with industry stakeholders where appropriate.

National and sub-national level

Belgium

The aquaculture production itself is very small in Belgium, less than 100 tonnes per annum in recent years.[632] The governance is complex and distributed between federal government and authorities in the regions. Under the 1994 cooperation agreement between the Federal Authorities, the Communities and the Regions, maritime fishing is the exclusive competence of the Flemish Region. In the Walloon Region and the Brussels-Capital Region, only recreational fishing and freshwater fish farming, mainly for trout, are practised.[633]

---

[629] https://oap.ospar.org/en/ospar-assessments/quality-status-reports/qsr-2023/other-assessments/aquaculture/#conclusions

[630] https://www.norden.org/en/information/about-nordic-council-ministers

[631] http://norden.diva-portal.org/smash/record.jsf?pid=diva2%3A1070949&dswid=1984

[632] https://www.fao.org/fishery/en/facp/bel?lang=en

[633] https://diplomatie.belgium.be/en/policy/coordination_european_affairs/policy/agriculture_and_fisheries

The federal government is responsible for standards on animal welfare and health and implementation of Common Fisheries Policy in Belgium, relevant also for aquaculture.[634] Department of Agriculture and Fisheries is responsible inter alia for fisheries policy and legislation.

Belgian MSP is coordinated by the Minister for the North Sea and the preparation and implementation of MSP is coordinated by the Marine Environment Service of the Federal Public Health Service.[635][636] In the Belgian part of the North Sea two zones have been set aside – under the new version of Maritime Spatial Plan (2019) – at which sustainable aquaculture is permitted, i.e. the wind turbine concession zones for Belwind (phase 1) and C-Power. Permission was granted on the condition that the aquaculture activity reduces seawater eutrophication in these zones.[637] Currently, still no commercial aquaculture is established in Belgian marine areas.

Denmark

Danish Ministry of Food, Agriculture and Fisheries is responsible for the legislation related to EU standards and implementation of Common Fisheries Policy, including the development of aquaculture. Danish Fisheries Agency, as a part of the Ministry, organize the use of EMFF/EMFAF for sustainable growth of fisheries and aquaculture.[638]

Marine aquaculture in Denmark is foreseen in specific areas of the Danish MSP. However, currently the fish aquaculture should not be enlarged due to negative environmental impacts and therefore, the maritime spatial plan only allocates areas for existing sea farming and currently pending applications for the establishment of sea farms, which are under official consideration. Hence, new areas are allocated for mussel production (mussel and oyster cultivation banks and transplantation banks) and the farming of mussels and oysters in the water column. The MSP does not plan for seaweed production, as this is a relatively new activity in Denmark and is still being developed. Seaweed production can therefore in principle take place throughout the sea area (except in the shipping corridors), but restrictions may follow from other legislation or if a licence is sought for seaweed production in a zone that is allocated for other purposes.

Danish Maritime Authority under the Ministry of Trade and Industry is responsible for the Danish MSP.

Estonia

[634] https://www.belgium.be/en/about_belgium/government/federal_authorities/federal_government

[635] https://www.health.belgium.be/nl/openbare-raadpleging-het-marien-ruimtelijk-plan-voor-het-belgische-deel-van-de-noordzee-2020-2026

[636] https://maritime-spatial-planning.ec.europa.eu/sites/default/files/download/belgium_may_2021_0.pdf

[637] https://odnature.naturalsciences.be/mumm/en/human-activities/aquaculture

[638] https://en.fvm.dk/the-ministry/

In Estonia, the marine aquaculture is included in the MSP as a new use of the marine space and MSP also outlines the spatial planning solution for fish, shellfish and seaweed aquaculture.639 Ministry of Finance is responsible for the Estonian MSP.

The Ministry of Rural Affairs manages aquaculture sector and is responsible for policy making regarding commercial fishing. The instrument for the implementation of the Estonian Fisheries Policy is the Estonian Fisheries Strategy for 2014–2020, which aims to develop the under-utilised potential of aquaculture and provides a guideline to focus on farming those aquaculture species that have a clear competitive edge on the Estonian as well as European markets.640 The strategy for the next period - 2021-2027 - is not publicly available yet. The overarching policy for the sector is described in the Agriculture and Fisheries Strategy 2030.641

Ministry of the Environment prepares and implements policies on protection and use of fishery resources including artificial reproduction of fish stocks and protection and restoration of spawning grounds and habitats. The ministry also provides permits for scientific research and special purpose fishing.

Finland

Ministry of Agriculture and Forestry of Finland steers the policy on sustainable use of natural resources, including the environment for successful aquaculture. The Aquaculture Strategy (2015) has an objective to enhance the competitiveness of the sector, support its continuous renewal and ensure the ecological, economic and social sustainability of aquaculture. The growth of aquaculture must be compatible with water quality requirements and other environmental objectives.[642] The perspectives for marine aquaculture are included also in the Finnish Bioeconomy Strategy and in the development plan on the blue bioeconomy.[643] [644]

The Ministry of the Environment is responsible for the general development, guidance, and international cooperation of maritime spatial planning. For maritime spatial planning Finland's territorial waters and its economic zone are divided into three planning areas. The Åland Islands have a separate maritime spatial plan for its region.[645] Thus, the Finnish

---

639 http://mereala.hendrikson.ee/dokumendid/Eskiis/Estonian_MSP_draft_plan_ENG.pdf

640 https://www.agri.ee/sites/default/files/public/juurkataloog/KALAMAJANDUS/EKS/2014-2020/strateegia-eks-2014.pdf

641 https://www.agri.ee/en/agriculture-and-fisheries-strategy-2030

642 https://mmm.fi/documents/1410837/1516655/1-3-Vesiviljelystrategia_2022.pdf/89ae6a1d-9fa5-4c51-b339-35029399801f/1-3-Vesiviljelystrategia_2022.pdf?t=1444216448000

643 https://biotalous.fi/wp-content/uploads/2014/08/The_Finnish_Bioeconomy_Strategy_110620141.pdf

644 https://mmm.fi/documents/1410837/1516671/Sinisen+biotalouden+kehittamissuunnitelma+25.11.2016/59427dec-711b-4ca3-be28-50a93702c393/Sinisen+biotalouden+kehittamissuunnitelma+25.11.2016.pdf?t=1480064717000

645 https://www.regeringen.ax/demokrati-hallbarhet/hallbar-utveckling/marin-kustomradesplanering-havsplanering

maritime spatial plan combines final versions of four plans. Aquaculture is included in the plans as a marine use for consideration.

France

The French ministry of Agriculture and Food prepares and coordinates policies in the fields of agriculture, agri-food business, forest and wood industry, fisheries and aquaculture. The Ministry's work is organized in four General Directorates and the Directorate General of Maritime and Aquaculture Fishing operates within the Ministry and is responsible for the management of the aquaculture sector. The Directorate governs finfish and shellfish (shellfish, mussels and oysters) farming activities.

The National Committee of Fisheries and Marine Farming (Comité National des Pêches Maritimes et des Elevages Marins -CNPEM) represents the general interests of fishermen in national and community authorities. It participates in the management of the marine living resources and is consulted on regulations for management of these resources (finfish, shellfish and marine plants). The CNPEM may adopt regulations for overseeing certain fisheries and impose them on all professionals concerned. It consists of 12 autonomous and independent regional committees and 13 departmental and interdepartmental committees.

The National Committee for Shellfish Farming (CNC - Comité National de la Conchyliculture) represents shellfish farmers, processors and distributors and their interests. It is an essential interlocutor of public authorities on regulations concerning shellfish farming. The Committee proposes, participates and leads actions relating to management of shellfish market, coastline protection, defence of water quality, health standards, legislation, scientific and technological research, promotion of shellfish products, education and training, information, and public relations. The Committee is under the Ministry of Agriculture and Food. Membership in the Committee is mandatory for all shellfish producers.

French aquaculture has separate legislation for inland and marine aquaculture. Specific provisions are made with regard to shellfish farming (conchyliculture), as opposed to marine fish farming (pisciculture marine). Thus, the marine aquaculture should comply with a set of laws on marine fisheries:

- Law No.97-1051 on Maritime Fisheries and Mariculture (Loi 97-1051 d'Orientation sur la Pêche Maritime et sur les Cultures Marines)

- Decree of January 9th, 1852 on Maritime Fisheries (and amends) explicitly extends the applicability of its provisions to the farming of marine animals and plants

- Decree No.83-228 (1983) establishes the authorization system for marine aquaculture, defines marine farms as enterprises intended for biological production purposes, including capture, cultivation, processing, storage, conditioning and shipping of marine products.[646]

In France, the Ministry of the Sea is responsible for the overall maritime spatial planning and preparation of four sea basin strategies and sea basin plans as a response to MSP

[646] https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000751904

Directive. Ministry of Ecological and Solidarity Transition has been responsible for development of sea basin strategy for the Eastern Channel - North Sea basin which should be further applied in MSP. The document summarises the current situation in the Eastern Channel - North Sea Basin with regard to the main activities and related socio-economic issues, ongoing research, as well as the state of the marine and coastal ecosystems and associated issues. It highlights the major challenges and provides a vision for 2030 with associated strategic objectives. Aquaculture is included in the scope of sea uses.[647]

Germany

The Federal Ministry of Food and Agriculture is the competent authority on fisheries and aquaculture at the federal level. It drafts policies, guidelines and promotes actions especially at the EU level in this area. The Ministry ensures that the production of freshwater and seawater fish strictly respects environmental sustainability and the priority of consumer protection.

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety deals with tasks relevant to aquaculture: protection of inland waters and the maritime zones, groundwater protection, wastewater treatment, pollutant in food and landscape planning.[648] The fisheries laws are executed by the regions, as according to the constitution, the federal laws and regulations are executed by the administration of the region. In terms of the legislative power at the federal level, the federal state can enact laws on sea and coastal fisheries within the so-called "concurrent legislation", whereas the regions are exclusively responsible for national inland water fisheries. Therefore, fishery acts exist both at the federal level and at the regions' level. None of the fisheries laws (Fischereigesetz) of the sixteen regions include the term aquaculture, although the National Bioeconomy Strategy for Germany includes further growth of aquaculture as provider of resources.[649]

The Federal Ministry of the Interior, for Building and Community is responsible for the German MSP, which has been recently revised and was approved on September 2021. The Federal Maritime and Hydrographic Agency organized the process of revision. The revised plan accepts the development of marine aquaculture in German marine space, stating that “aquaculture facilities should be set up in close proximity to or in combination with other existing or under-construction installations. Maintenance and operation of the installations should be adversely affected as little as possible by the establishment and operation of aquacultures. Environmentally friendly species and forms of aquaculture should be chosen.”[650]

---

647 https://maritime-spatial-planning.ec.europa.eu/practices/eastern-channel-north-sea-basin-strategy-document

648 https://aqua-lit.eu/assets/content/Country_Profiles_Germany.pdf

649 https://www.bmel.de/SharedDocs/Downloads/EN/Publications/national-bioeconomy-strategy.pdf;jsessionid=A33BCDEB163A4E6E48768933BAE3D1A8.live842?__blob=publicationFile&v=2

650 https://www.bsh.de/EN/TOPICS/Offshore/Maritime_spatial_planning/Maritime_Spatial_Plan_2021/_Anlagen/Downloads/ROP_2021/Maritime_Spatial_Plan_2021.pdf;jsessionid=9C9FE6869DBF4A801C180D6853C939E4.live21302?__blob=publicationFile&v=5

Latvia

In Latvia the Ministry of Agriculture is the responsible authority on fisheries and aquaculture, preparing policies and regulations. The multi-annual strategic guidelines for aquaculture in 2014-2020 do not include any development of marine aquaculture.[651]

Although currently there is no marine aquaculture in Latvia, the Latvian MSP foresees the possibility of its development. Areas of general use are allocated in the plan and aquaculture/mariculture is one of the allowed uses.[652] The Ministry of Environment Protection and Regional Development is responsible for the MSP.

Lithuania

The Ministry of Agriculture of the Republic of Lithuania formulates the public policy and also organizes, coordinates and controls the implementation of the policy in the areas within the competence of the minister of agriculture, including also fish farming. Fish farming is the only industrial form of aquaculture in Lithuania.[653] The aquaculture multi-annual development plan for 2014-2020 does not include any intentions for marine aquaculture.[654]

The Ministry of Environment is responsible for the Lithuanian MSP which is a legally binding planning document.[655] The MSP's objective is to create the favourable conditions for management of the sea uses, fostering the blue economy and securing the good environmental status and marine resources. The plan itself foresees that in the areas free of other uses and having no specific designation, aquaculture is included in the list of priorities to be developed here.[656]

Netherlands

The competent authority in Netherlands is the Ministry of Agriculture, Nature and Food Quality responsible for the implementation of Common Fisheries Policy according to the EU requirements, including marine aquaculture. The multi-annual national strategic plan for the development of sustainable aquaculture 2014-2020 projects a growth in marine aquaculture production by 3% in 2020 and due to space limitations – support to initiatives on multi-use, in particular with combination of wind farm areas.[657]

Regarding the planning of marine space, Ministry of Infrastructure and Water Management is the lead for national MSP. Policy Document on the North Sea 2016-2021 is the current

---

651 https://www.zm.gov.lv/public/files/CMS_Static_Page_Doc/00/00/00/35/82/akvakultura_2014.pdf

652 https://www.zm.gov.lv/public/files/CMS_Static_Page_Doc/00/00/00/35/82/akvakultura_2014.pdf

653 https://zum.lrv.lt/uploads/zum/documents/files/LT_versija/Veiklos_sritys/Zuvininkyste/Leidiniai/Fisheries%20and%20Aquaculture%20sector%20in%20Lithuania.pdf

654 https://www.e-tar.lt/portal/lt/legalAct/3b0a89b0010811e4bfca9cc6968de163/asr

655 https://www.e-tar.lt/portal/en/legalAct/acabfe0014e411e58569be21ff080a8c

656 https://vasab.org/wp-content/uploads/2021/05/Country-fiche_LT_May2021.pdf

657 https://ec.europa.eu/oceans-and-fisheries/ocean/blue-economy/aquaculture/aquaculture-multiannual-national-plans_en

vision framework for the planning[658]. The Netherlands has National Water Plan as a policy framework for MSP. Currently a new Plan is being prepared and will contain the North Sea Programme (the Program Noordzee 2022-2027) under which the MSP will be incorporated by the Dutch government. Multi-purpose and multi-use approach for use of marine space is emphasised also in MSP.

Norway

Norway has a specific Act on Aquaculture providing a framework for sustainable development of the sector.[659] The Ministry of Fisheries and Coastal Affairs is responsible for national regulations and policies on aquaculture, including the Act and recently adopted new strategy for aquaculture development "A sea of opportunities" aiming for sustainable growth.[660] The strategy aims to harmonize the regulatory system and promote an offshore farming.

The Norwegian Ministry of Climate and Environment is the competent authority for ensuring integrated governmental climate and environmental policies. Together with the underlying Environment Agency, Ministry has the main responsibility for the management plans for Norwegian waters.

In Norway, the management of marine waters is based on the principles of integrated ecosystem-based management and therefore the legislative authority behind Maritime Spatial Planning (MSP) in Norwegian waters is limited. Each sector (in particular, shipping, fisheries and aquaculture, petroleum and energy) is managed separately through specific legislations and dedicated ministries.[661] The legal tool for integrated coastal zone planning in Norway is the Planning and Building Act - to bring uniform planning for national-, county- and municipal activities.[662] The municipalities (428 in total) have the main responsibility for coastal zone planning, including aquaculture.

Poland

Currently, Polish aquaculture activities occur only in freshwater, although multi-annual strategic plan for aquaculture development includes start of marine fish aquaculture and cultivation of molluscs in 2020. [663] The Ministry of Agriculture and Rural Development is responsible for aquaculture policy in Poland.

Polish sea areas are governed by the Minister responsible for maritime economy affairs which is the Ministry of Infrastructure. The sea area is administered by his regional maritime

---

[658] https://www.government.nl/documents/policy-notes/2015/12/15/policy-document-on-the-north-sea-2016-2021

[659] https://www.regjeringen.no/globalassets/upload/kilde/fkd/reg/2005/0001/ddd/pdfv/255327-l-0525_akvakulturloveneng.pdf

[660] https://www.regjeringen.no/no/dokumenter/havbruksstrategien-et-hav-av-muligheter/id2864482/?ch=1

[661] https://vasab.org/wp-content/uploads/2018/06/Country-fiche_NO_Jan2015.pdf

[662] https://www.regjeringen.no/no/dokumenter/plan-og-bygningsloven/id570450/

[663] https://www.gov.pl/web/rolnictwo/program-po-ryby

administration, i.e. the Director of Maritime Office in Szczecin and Director of Maritime Office in Gdynia. These organizations are also responsible for the MSP of Poland where currently three pilot plans exist - for the Western part of the Gulf of Gdańsk, for Pomeranian Bight / Arkona Basin and Southern Middle Bank Mariculture as a sea use is foreseen only in the Southern Middle Bank (Polish EEZ) and only in the case of multi-use, i.e. in combination with the wind farm.[664]

Russia

In Russia, the Ministry of Agriculture (Minselkhoz) is the federal executive body responsible for drafting state policy and legal regulation in the fisheries industry, including fishing and fish farming (aquaculture). The policy of aquaculture development is regulated by several documents, key of which is the Strategy for Aquaculture Development in the Russian Federation through 2020 and Federal Law "About aquaculture (fish breeding) and about modification of separate legal acts of the Russian Federation".[665] Development of marine aquaculture in the Baltic Sea is not envisaged.

The information on MSP processes in Russia is quite scarce. There have been plans for 2020-2021 to develop the Russian MSP Roadmap within Interreg BSR project Capacity4MSP. The results at the project's website as proposals for MSP Roadmap have been published but they do not include marine aquaculture in the Baltic Sea.[666] The Ministry of Natural Resources and Environment of the Russian Federation has been mentioned as the responsible for this project from the Russian side.[667]

Sweden

The Swedish Board of Agriculture is responsible for the Swedish multi-annual strategic plan for aquaculture promoting practices in the sea which reduce eutrophication and increase biodiversity.[668] The Swedish Agency for Marine and Water Management is responsible for managing and implementing environmental policies in issues of conservation, restoration and sustainable use of lakes, rivers and seas. This includes sustainable management of fisheries resources and aquaculture.

The Ministry of Environment and the Swedish Agency for Marine and Water Management are responsible authorities for MSP. The draft Swedish MSPs include several designations, while aquaculture is included as topic but there is currently no designation for it in the plans. For the Baltic Sea, the development of aquaculture is almost stopped due to uncertainties in its regulation. After Wesser ruling (2015), the authorities responsible for permit issues, prioritise environmental quality to the level that even short-term and small-scale negative impacts (i.e. on individual project level) on marine environment are not allowed.

---

[664] https://vasab.org/wp-content/uploads/2021/04/Country-fiche_PL_April2021.pdf

[665] https://aquatechcluster.no/wp-content/uploads/2019/10/201909410-ktp-aquaculture-russia.pdf

[666] https://vasab.org/wp-content/uploads/2022/03/Proposals_to_Maritime_Spatial_Planning_Roadmap_of_the_Russian_Federation.pdf

[667] https://vasab.org/wp-content/uploads/2020/03/Country-fiche_RU_MSP_March_2020.pdf

[668] https://ec.europa.eu/oceans-and-fisheries/ocean/blue-economy/aquaculture/aquaculture-multiannual-national-plans_en

United Kingdom

Although Department of Environment, Food and Rural Affairs (Defra) has been responsible for national multi-annual strategic plan for fishing and aquaculture in the UK, aquaculture policy itself has separate administrations of Wales, England, Northern Ireland and Scotland responsible for its collective oversight. Therefore, there are differences across the UK in policy approaches and priorities in terms of cultivated species and amounts of production.

Scotland's aquaculture is mostly marine-based and Atlantic salmon is the key species being farmed. The other parts of the UK have mostly freshwater aquaculture and marine based shellfish aquaculture. In Scotland, the Ministerial Group for Sustainable Aquaculture works with implementation of the Aquaculture & Fisheries (Scotland) Act 2013.[669] The Act itself makes provision about fish farming and shellfish farming; about salmon fisheries and freshwater fisheries; about sea fisheries; about shellfish waters and fisheries for shellfish and also describes charging and penalty procedures.

In Wales, where the production of shellfish in the coastal areas is the largest per UK, the Welsh Government accepted Marine and Fisheries Strategic Action Plan for Wales until 2020 to be implemented together with Natural Resources Wales.[670]

The marine plan authorities responsible for developing Marine Plans are the Defra Secretary of State for the English inshore and offshore regions (including policy on Marine Conservation Zones), Scottish Ministers for the Scottish inshore and offshore regions, Welsh Ministers for the Welsh inshore and offshore regions and the Department of the Environment in Northern Ireland for the Northern Ireland inshore and offshore regions. [671]

[669] https://www.legislation.gov.uk/asp/2013/7/contents

[670] https://gov.wales/sites/default/files/publications/2018-05/strategic-action-plan-for-marine-and-fisheries.pdf

[671] https://maritime-spatial-planning.ec.europa.eu/countries/united-kingdom

Annex D: DEL7 - Citizen engagement, blue economy and ocean and water literacy activities in the Lighthouse area

Interview guide

Name of the interviewee	
Description of the organization which an interviewee represents and his/her role and responsibilities	
Could you please introduce your organization and your main responsibilities?	
Description of the citizen engagement activities which an interviewee's organization conducts	
Could you please describe citizen engagement activities in which your organization has been involved in, that you are aware of?	
Does your organization participate in macroregional citizen engagement activities (those that encompass several countries in the Baltic Sea, North Sea region)?	
What has been the purpose for organizing citizen engagement activities?	
What type of citizen engagement activities are more common for your organisation? Why?	
What methods of citizen engagement activities do you use? Why?	
To what extent citizens are engaged in these activities? What degree of decision-making power do they have?	
Is it difficult to mobilise the public? On average, how many people and what population groups (e.g., youth, general public, water-related activists) participate in citizen engagement activities that you have recently organized?	
Design, implementation, monitoring, and evaluation of citizen engagement activities	
How are citizen engagement activities designed in your organisation?	
How are citizen engagement activities implemented? Do you use support of volunteers?	
How do you monitor and assess effectiveness of citizen engagement activities?	
Discussion on effectiveness, impact of citizen engagement activities & lessons learned	
What have been the most effective citizen engagement activity(ies) which you have organised? Why were they successful? What methods of citizen engagement have you used in them? How many participants were involved? What impacts have they made?	
In your experience, what determines effectiveness/success of citizen engagement activities?	
What are the main barriers for organizing citizen engagement activities?	
What has been the impact of citizen engagement activities that you have organised on society, economy, regional development?	
What would be your advice for the implementation of the Mission objectives in the Baltic/North Sea area?	

Do you have any suggestions of other relevant organizations that conducted citizen engagement activities in the basin?	

Case studies

This Appendix presents ten case studies, based on interviews with organisations that have extensive experience in conducting citizen engagement activities. The case studies include an overview of the organisations, their citizen engagement activities and key success factors for the organisation of these activities.

Nausicaá Centre National de la Mer

Nausicaá Centre National de la Mer (Nausicaá) is a public aquarium located in Boulogne-sur-Mer in northern France. It is the largest public aquarium in Europe. Nausicaá was opened in 1991 and has been visited by more than 18 million people, including 5 million schoolchildren. Nausicaá has over 50,000 animals representing 1,600 different species in a 10,000 m² exhibition area. The aquarium offers visitors an unforgettable experience: the discovery of the global ocean and the deep bond that binds humanity to the ocean.

The aquarium defines its mission as follows: to discover, make people love, raise awareness and understand the issues around the ocean to as many people as possible thanks to innovative exhibitions that are constantly renewed and enriched. Given such mission and a wide range of citizen engagement activities that Nausicaá offers for both young people and adults, Nausicaá is much more than an aquarium. It offers education and training activities, develops education materials for national curriculum, organises educational activities for schools. These are delivered through various interactive activities, practical workshops, events and public campaigns.

In addition, Nausicaá initiates and participates in citizen science projects through partnerships with research organisations, and it facilitates research partnerships between schools and scientific organisations. Lastly, Nausicaá stimulates social innovation in the blue economy thought its Blue Living Lab. The Lab is the business incubator that offers support in the development of business ideas in the blue sector, including support with market research, development of prototypes, and user testing. The visitors of the aquarium sometimes participate in social innovation projects, at times not realising this. They are asked to provide their views and ideas, or to test or taste a product, thereby contributing to social innovation projects. In addition, the Lab provides a co-working space that includes facilities and equipment for scientific experimentation, and it connects members of the Lab with industry leaders and researchers in the blue sector to facilitate development and scaling of the product.

Nausicaá has an extensive network of partners. This is essential to ensure that the aquarium presents the most up-to-date scientific information, and raises awareness about trends, opportunities and challenges in the blue sector. Among Nausicaá's partners are listed scientific institutes, national research centres, government organisations that stimulate science and innovation, national museums and industry organisations. As an organisation that has a large network, frequently interacts with the public, provides access to and stimulates knowledge, it has been participating in lobby activities and influencing policies in the maritime sector, as well as in the areas of education, science and innovation.

Key factors that determine success of citizen engagement activities:

- Adaptive design of the activity: receptiveness and attentiveness to feedback of participants and finding of effective ways to collect it

- Good network of partners, which can support the design and implementation of innovative citizen engagement activities and dissemination activities

- Innovative design of citizen engagement activities: participants enjoy interactive activities, competitions with small gifts (could be a recognition award), seafood tasting, and activities that involve animals

- Involvement of media to raise awareness about the activity

- Identification and involvement of relevant stakeholders and participants that can make impact.

Box 32 Which Fish?

Which Fish? is an international campaign that ran in 2020 and 2021. It has been developed based on a national successful campaign “Mr. Goodfish”, launched in 2010 in France.

The campaign has been focused on raising awareness and encouraging sustainable consumption of seafood. Restaurants, shops, maritime sector stakeholders and general public were invited to participate in the campaign and raise awareness about sustainable human consumption of fish products, sustainable animal feed, and sustainable collection planning for aquatic species.

The campaign involved approximately 150 organisations, mostly aquariums and zoos, from 30 countries, predominantly from Europe. The main methods for distribution of information were interactive games, art installations, and online exhibitions.

The success of the international campaign was attributed to mobilisation of partners across the entire value chain and to effective communication about the campaign to the general public. The campaign developed messages about sustainable consumption of fish and use of plastic. The traditional media channels have been very effective in disseminating information about the campaign.

Source: interview with Nausicaá Centre National de la, 2022

Marine Conservation Society

Marine Conservation Society (MCS) is an NGO in the UK. As it is stated on their webpage, they are the community of ocean lovers. This NGO is one of the leading marine charity organisations in the country. It has been working for almost 40 years, engaging with communities, businesses and governments to defend habitats and species. Given their long history, they have been actively engaging with the public and have a large network of members – volunteers.

Over the years, MCS has been organising different types of citizen engagement activities, including citizen science activities, beach clean-ups, public campaigns, events and ocean literacy activities. At the moment, their main type of the citizen engagement activity is the citizen science. MCS has its own science team that involves the public in scientific projects, and the organisation also collaborates with many external researchers.

MCS has some very passionate and enthusiastic volunteers that are engaged in several marine NGOS - platforms that stimulate a dialogue between the civil society and the policymakers on maritime issues. Thus, they bring their own knowledge, resources and networks to MCS. Such individuals represent the core of the network of volunteers and are willing to support different kinds of activities at MCS, including citizen science projects, and organising events and awareness raising campaigns. Some of these individuals are keen to organise their own activities in their spare time, involving organisations to which they are connected through employment, education, or community.

Key factors that determine success of citizen engagement activities:

- Interactive tools and methods that are used in activities: interactive maps, use of digital technologies and applications
- Design that is oriented towards local communities: small scale, community-focused activities that address local challenges or concerns attract more attention and have a higher impact
- Design of the activity - fun, easy to participate in
- Involvement of citizens in the design of the activity: it will increase willingness to participate in the activity
- Involvement of enthusiasts that drive and inspire the community
- The cause/issue that resonates with the public will ensure citizen engagement
- Good and continuous communication between the organisers(s) and the participants during and after the activity to encourage future participation.

Box 33 Beach Watch programme

The Beach Watch programme is one of most successful citizen engagement activities of MCS. It has been running for over 30 years, involving thousands of people.

The programme asks volunteers to participate in cleaning the coastline and note down all items they found in a 100 meter stretch of the beach. This includes lost toys, pieces of plastic and other items. The data helps to track litter, clean the beach and contribute to research. In addition, based on collected and analysed data, MCS approaches local communities and organises campaigns to generate a change and to lobby the government for a legislative change that would influence industry practices and individual behaviour.

MCS believe the success of this programme is associated with several factors. Firstly, the programme stands for a cause that is generally supported by the public, as there is a recognition that the coastline should be cleaned. Secondly, this programme is well-known by the public, as it has been active for a long period. Thirdly, participants in the programme see an immediate impact of their activity on the coastline. Fourthly, to make this programme attractive for children and youth, MCS involves researchers that are telling educative, informative stories while collecting and counting items on the beach. And lastly, MCS has been effective in promoting this programme in communities through various events and activities. The long existence of MCS has been assisting in building trust between the organisation and the public. Apart from individual volunteers and groups of students/kids that are participating in the programme, some professional or organisation-related groups are joining to strengthen their team building skills and to express their corporate social responsibility.

Source: interview with Marine Conservation Society, 2022

Flanders Marine Institute

The Flanders Marine Institute (VLIZ) is the research organisation that promotes accumulation of marine knowledge and excellence in marine research in Flanders (Belgium). The marine research areas that are being explored at VLIZ include the ocean and seas, the coast and the tidal systems. Despite the fact that VLIZ targets the marine research community and educational institutions to support accumulation and sharing of knowledge, the Institute has been one of the pioneers of several types of citizen engagement activities in Europe. For example, VLIZ, together with its partner – Marine Biological Association, has been the first organisation in Europe to introduce ocean literacy activities. They organised the first conference on ocean literacy in 2012 to share their experience. Later, VLIZ encouraged other research organisations, especially from the European Marine Board network, to follow their practice.

Apart from publishing research findings in open sources that are accessible to the public, VLIZ organises public events to raise awareness about specific marine-related issues and to contribute to ocean literacy. However VLIZ currently has a strong focus on citizen science activities. Currently, the Institute has 5 ongoing projects on marine citizen science that are conducted with different European and international partners.

These projects are performed with the assistance of random volunteers, as well as with the so-called core group of volunteers. This core group, which later received the name “Beach Observation Network SeaWatch-B”, aims to generate reliable, long-term monitoring data on North Sea beach and coastal waters. The generated data are crucial to study the environmental changes of our sea and beaches, such as pollution, climate change, and overexploitation of ocean resources. The Network was formed in 2014. The volunteers are asked to measure 10 variables in a standardised way, such as temperate of the water, biodiversity, catchment of provided nets, and report on archaeological findings. This group consists of 20 volunteers that receive continuous training, participate in several projects and, in view of VLIZ, are part of VLIZ research family. Moreover, VLIZ tries to involve them in multi-stakeholder forums to further boost their learning experience and to include the voice of the civil society in discussions with policy makers or industry. As such, these volunteers have gained significant knowledge about the maritime sector and have become proud ambassadors of sustainable blue economy in their local communities.

Key factors that determine success of citizen engagement activities:

- High enthusiasm of citizens in the activity: this is attainable through co-design of the activity with citizens, or through an interesting story/message related to the activity or to a cause which the activity supports

- Presence of citizens-ambassadors that will catalyse a change and inspire the community to get involved

- Media attention: to raise awareness and attract participants
- Design of the activity: fun and educational
- Trust between the organiser(s) and the participants: this will encourage participation and stimulate co-creation of the activities
- Method/format of citizen engagement should encourage openness, knowledge and experience sharing: participants should feel that their views are heard and their participation is appreciated
- Clear instructions for participation in the activity.

Box 34 Great Shell Counting Day

In the last 5 years, VLIZ has been launching a Great Shell Counting Day event in Belgium. Every year, citizens were asked to collect and count shells on the beach. Findings are contributing to coastline monitoring projects.

In view of VLIZ, the Great Shell Counting Day has been very successful. It involves more than a thousand people each year, gets warm reception from the public and helps to collect and record data for over 200,000 seashells. This year, the event took place on Saturday 19 March 2022 in ten coastal municipalities in Belgium and in the Netherlands. Citizens in the Netherlands joined this event for the first time, as part of the event Leiden2022 - European City of Science, supported by the Naturalis Museum in Leiden. In coming years, other countries, such as France and Germany might join the event.

The success of this event is attributed to several factors. The activity is considered simple, participation does not require extensive training for the public, and the citizens find it easy to connect with the concept of the event, as most people in Belgium and the Netherlands have seen seashells. In addition, the event serves as an important community building activity and a tool to increase ocean literacy. Due to the above, each year this event receives significant attention of traditional media, such as TV and newspapers. Thus, the number of participants is growing every year.

Source: interview with Flanders Marine Institute, 2022

CPMR North Sea Commission

CPMR (Conference of Peripheral Maritime Regions) North Sea Commission is a cooperation platform for regions around the North Sea. It is one of the six geographical commissions of the Conference of Peripheral Maritime Regions (CPMR), including one in the Baltic Sea. The mission of the CPMR North Sea Commission is to strengthen partnerships between regional authorities which face the challenges and opportunities presented by the North Sea. Through dialogue and formal partnerships they seek to promote common interests, especially in relation to European Union institutions, national governments and other organisations dealing with issues that are relevant to the North Sea. The CPMR North Sea Commission frequently collaborates with the CPMR Baltic Sea Commission, especially through the Interreg programme and through organisation of joint events.

As a governmental institution, the CPMR North Sea Commission organises several large-scale public events, including the North Sea conference and One Ocean Summit. These are aimed to strengthen collaboration between the regional network of the organization, to raise awareness of the North Sea region as a major economic entity within Europe, to increase water and ocean literacy, to present the activities of the CPMR North Sea Commission, and to use them as an opportunity to lobby for a better North Sea region. However, as a political organization that operates at a macroregional level, its citizen engagement is limited. The most important citizen engagement activity that the CPMR North Sea Commission conducts is the Youth Initiative.

Key factors that determine success of citizen engagement activities:

- High involvement of young people in activities: they believe in change, are more active than adults in citizen engagement activities and they will influence the future

- Ability of citizens to understand, relate and contribute to the cause, issue, or activity

- Ability to see impact: this raises enthusiasm of participants and raises attention to the activity

- Participation of citizens in the design of the activity: it will stimulate more active participation.

Box 35 Youth initiative

Youth Initiative is the international network of young people, 14-24 years of age, created in 2019 to involve the youth of the North Sea region in the decision-making processes of the CPMR North Sea Commission and to increase involvement of young people in the blue sector. In view of the CPMR North Sea Commission, the Youth Initiative has brought a new voice to policymakers, and the members of the Youth Initiative have already provided several suggestions to the CPMR North Sea Commission, which have been accepted. Thus, they represent an important lobby group.

The members of the Youth Initiative meet every 2-3 month to discuss the work of the CPMR North Sea Commission, to report on relevant activities that are organised in their regions, and to discuss joint activities. The youth adviser that supervises the work of the Youth Initiative monitors and reports on their activities and future plans to the CPMR North Sea Commission.

The Youth Initiative members are expected to serve as ambassadors in their regions/countries to mobilise local youth in taking action on climate and marine-related issues. This will be achieved through organisation of events, public campaigns and participation in regional stakeholder forums.

In total, the Youth Initiative includes 35 members. The candidacies of members of the Youth Initiative have been proposed by their regional representatives. Most of selected young people were participating in the youth parliaments of their respective countries. Thus, they have experience in participatory and co-creation processes in policymaking, they possess public speaking skills and knowledge of how to organise public events. Most importantly, members of the Youth Initiative have access to a significant network of young people in their regions/countries that they can mobilise for taking action in the blue sector.

The members of the CPMR North Sea Commission have expressed a strong commitment to the continuous work of the Youth Initiative, as the budget for this Initiative has been assigned by all participating regions. In view of the Commission, this Initiative falls within the general European trend to involve young people in policymaking and reflects the willingness to empower the future generation of leaders for making a change in the blue sector.

The success of the Youth Initiative has been mixed so far. The Initiative is relatively new and there were few joint activities that have been organised by the Initiative to date. The general public and especially youth struggle to relate to some complex topics that the members of the Initiative seek to bring to their regions. Thus, the impact of Youth Initiative in the regions has been low so far. Nevertheless, the CPMR North Sea Commission believe that the Youth Initiative has achieved important results within the Commission and gained its niche.

Source: interview with CPMR North Sea Commission, 2022

Baltic Environmental Forum Germany

Baltic Environmental Forum (BEF) Germany was founded as a non-profit association in 2003 in Hamburg. It holds the chairmanship of the international BEF network, the so-called BEF-Group, with offices in Riga (Latvia), Tallinn (Estonia) and Vilnius (Lithuania) existing since 1995. These offices work independently, but frequently collaborate on projects.

The organisation aims to create awareness, promote and improve environmental management, and initiate communication and information exchange. It is funded through projects launched by public actors, mostly within the European programmes of Horizon Europe and Interreg. Thus, it is designing and implementing projects on behalf of public organisations and has extensive experience in public engagement.

BEF Germany works on the topics of chemical and waste management, water quality, nature, species and marine protection, energy efficiency, sustainable mobility and climate change. It develops concepts on how we as humans can interact more positively with our environment. The organisation runs many workshops and trainings for citizens, for instance to influence consumer behaviour, organises public campaigns to raise awareness about different environment issues, and launches and contributes to public events. For example, it creates information stands at local events to discuss with citizens specific environmental topics and hand out promotional materials.

At the moment, BEF Germany does not have a network of volunteers that can support the organisation in its citizen engagement activities. By now, all activities have been performed by the internal team. Nevertheless, BEF Germany is currently building the network to focus on more local activities.

Key factors that determine success of citizen engagement activities:

- Significant involvement of citizens in the design or co-creation process of the activity or of the decision. Willingness of the organiser to take on board suggestions of citizens

- Effective communication of the organiser with the citizens prior, during and following the activity: personal contact, good understanding of the purposes of the activity, and openness to feedback will increase citizen engagement in current and future activities

- Careful selection of the participants that join the activities that use participatory/co-creation processes: this will ensure relevance of the activity to participants/stakeholders

- Good organisation of the activity: good planning, timely invitation of the participants, reminders, creation of the atmosphere of openness and trust during the activity, and an interactive format of the activity

- Design of the activity that focuses on utilisation of citizens' participation: the organiser should have a clear plan on what it aims to achieve through citizen engagement

- Design of the activity that is built on existing best practices.

Box 36 Maritime Spatial Planning (MSP) Forum

BEF Germany has been organising a series of MSP Forums in the last few years. These were organised within the framework of several projects, such as Interreg BSR projects Capacity4MSP and Land-Sea-Act.

These events were organised to bring together maritime spatial planning community from the Baltic Sea Region (BSR) and beyond to discuss, share, learn and develop new ideas to enhance MSP in the region. The Forum has been the largest MSP related event in the Baltic Sea Region with free of charge entrance.

These events were considered successful by the audience and the project team, as they resulted in the effective design of the maritime spatial plans and contributed to the implementation phase of the MSPs. The main success factor has been the effective involvement of stakeholders from the government, academia, industry and civil society. The organisers have carefully selected participants and involved them in discussions that fall within their expertise or that are of particular relevance to them. As such, each participant has been effectively contributing to the discussions.

The audience felt engaged throughout the events and their ideas have been taken on board. This has been achieved through interactive workshops that allowed participants to express their ideas and with the support of an experienced moderator. The moderator created the atmosphere of openness and ensured that all participants are involved in the participatory/co-creation process.

Due to successful engagement of citizens' and stakeholders' voices during the first few events, the MSP Forum has gained good reputation and encouraged participants to join future events.

Source: interview with Baltic Environmental Forum Germany, 2022

Submariner Network

The Submariner Network is a unique, non-profit platform that brings together actors from the whole Baltic Sea Region to actively promote and support innovative and sustainable uses of marine resources. It offers a cooperation platform to actors and initiatives in the Baltic Sea Region. Among their members are research institutions, public administrations, business parks, investors, private companies, and specialists in marketing, communication and legal issues.

The Network coordinates several working groups of stakeholders that cover specific focus areas, such as marine litter, sustainable aquaculture, macroalgae, mussels and ocean literacy, and an accelerator working group. These groups support their members, connecting them to relevant stakeholders and coaches/mentors, and foster cooperation at the scientific, civil, industry and political level.

The Submariner Network has been organising various citizen engagement activities through projects, as well as, holding public and stakeholder events. The Network has also set up a mentoring and accelerator programme for Blue Growth to stimulate sustainable and social innovation in the blue economy. The programme connects start-ups, small and medium-sized enterprises (SMEs), mentors and business coaches, investors, regional and national authorities, business parks, R&D institutions and different specialists.

Key factors that determine success of citizen engagement activities:

- High impact and good visibility of impact: this will encourage participation in the activity. Sea gardens, museums, aquaria and zoos are effective agents that can demonstrate impact through exhibitions or pilots

- Involvement of local actors that have a strong influence on participation of the targeted group of citizens. These can be individuals with significant influence or reputation, or credible institutions that have a regular communication with the citizens or stakeholders: schools, aquaria, research organisations, innovation actors, museums, stakeholder networks etc

- Involvement of industry stakeholders, supermarkets, restaurants and other actors in the supply chain in the development of social innovation activities

- Tailoring of activities to local communities: this increases relevance and impact of the activities

- Design of the activity that offers a pleasant experience to participants: food tasting, fun and interactive activities, or activities that involve use of digital technologies

- Careful design of the activity that reflects the purpose of citizen engagement and maximises utility from citizens' participation

- Good promotion through the media and other networks to increase participation of citizens, and clear messaging about the aim and potential impact of the activity

- Adjustment to local culture and customer preferences in the design of social innovation projects

- Perceived relevance of the activity by citizens and clear messaging about it

- Professional team of organisers: a team that has experience in organising citizen engagement activities, technical knowledge, and a network of partners.

Box 37 Blue lobster app

The Submariner Network has been collecting good practices from its members and partners in the blue bioeconomy projects. Among them is the social innovation project that focused on the development of the mobile application: Blue Lobster App.

The App is changing the way fish is bought and sold. It enables customers to contact the fishermen directly through the App. This App has been used by restaurants and end-customers via a digital marketplace. By connecting customers, restaurants and chefs with low impact fishermen, the App allows to deliver the best quality seafood straight from the harbour and pay the fishermen fairly.

Source: Interview with Submariner Network, 2022

Institute of Oceanology of the Polish Academy of Sciences (IO PAN)

The mission of the Institute of Oceanology PAN is to seek, understand, and communicate the scientific understanding of the marine environment and the issues related to its protection and sustainable use in the Baltic Sea and in the seas of the European Arctic. IO PAN scientists and engineers have been carrying out innovative, high-level scientific and technological research and sharing the findings with the broader public and interested parties from the public and private sector.

IO PAN is concerned with the low level of ocean literacy in Europe, therefore it has organised a focus group consisting of three employees, whose full-time job is generating awareness of science and ocean literacy. IO PAN offers lectures and workshops for schools and for the general public. The ocean literacy activities for schools are designed in response to specific requests and interests of students. At times, these activities are included in the regular curriculum. The workshops and lectures for the general public are organised around 5-6 times a year. In most cases, the attendees are senior members of the society, those over 60 years of age, as they have more spare time available and consider these activities as opportunities to be involved in a community.

In addition to ocean literacy, IO PAN organises citizen science projects for schools together with their partner Sea Fisheries Institution in Gdynia. Children are invited to visit the so-called green and blue school at the premises of the Sea Fisheries Institution and participate in the research field work.

Key factors that determine success of citizen engagement activities:

- Clear and short instructions for participation in the activity
- Creative design of the activity: interactive format, combination of physical and educational activities, recognition or award for participation, use of artistic works and visually attractive elements
- Network of committed volunteers/participants: they will build the core group of participants and invite others to participate. This is particularly important in citizen science projects where training should be provided to participants
- Involvement of citizens in the design of the activity: it will increase willingness to participate in implementation of the activity

- The cause resonates with the public: citizens are convinced that immediate action is needed

- Effective promotion of the activity through the networks, partners, and institutions that are connected to citizens and media. A clear message and a good story about the cause and/or the activity

- Little effort for participation in the activity: simple tasks will stimulate participation. Use of simple research methods in citizen science activities.

Box 38 Bioblitz

BioBlitz is a free species-counting competition designed to showcase the environmental value of the natural habitats. Participants are given 12 hours to collect all possible animals in specific locations. Based on the previous competition, participants managed to collect 800 microscopic species. Following the collection, the researchers are telling participants about these species and returning them to their natural environments.

The participants of BioBlitz included families, children, youth groups, community members and local environmental experts. IO PAN has organised this competition several times in last few years and it received great reception. In view of IO PAN, the success of BioBlitz is based on several factors. First, citizens like to participate in competitions, especially if there is a small prize. It gives a sense of achievement. Second, the competition offers a great learning experience. Typically, participants are surprised how many species they can find in a small location. Third, the major group of participants are children. Thus, their parents join competitions, and this turns into an excellent opportunity to spend time together as a family.

Source: interview with IO PAN, 2022

Fjord CleanUP

The Fjord CleanUP is non-profit environmental organisation supporting the restoration and protection of the Inner Oslo Fjord's natural marine environment. This is a grassroots organisation that has been launched by a private company Mad Goats. Mad Goats offers sea kayak, river kayak and stand up paddleboard (SUP) tours, courses and rentals in and around Oslo, Nøtterøy and Sjoa.

In the last seven years, the company has been providing kayaks, diving equipment, stand up paddleboards and all the gear necessary to volunteers for free to clean marine pollution out of the fjord. Volunteers pick up plastic and other rubbish from the water and waterside. Following the cleaning activity, Mad Goats offers a free sauna and soup to volunteers. The initiative has become so popular that the company has been running a cleaning event every week, and even twice a week in summertime. Around 30 volunteers participate in each cleaning event, leading to between 1,500-2,000 volunteers per year. This is a maximum number of people to whom Mad Goats can provide all necessary equipment.

Only a year ago, the company decided to formalise its non-profit activities and opened the NGO Fjord CleanUP. The NGO continues to rapidly grow and expand its events to more communities. To support such high demand, the NGO has recruited staff members that work full time on the development of the NGO and on realisation of social innovation and citizen science projects. The NGO has been collaborating with the rubbish collecting service to collect rubbish that has been found by volunteers and to sort it. Recorded data on the types of rubbish has been shared with local universities to support research projects.

The Fjord CleanUP receives the most funding from private businesses, as many local companies express their support and admiration to the NGO. Access to public funding has been difficult, as the NGO is not experienced in grant application procedures. Nevertheless, the Fjord CleanUP receives advisory and promotional support from local, professional NGOs that have environmental and water expertise.

Key factors that determine success of citizen engagement activities:

- Attractive design: participants should enjoy the experience of participation. Thus, it should be fun, interactive, and conducted in a friendly atmosphere
- Adaptive design of the activity: it should be tailored based on feedback of citizens
- Transformative capacity of the activity that has been running for several years: the activity should be innovative or include novel elements to remain attractive for participants
- Building of a community around the citizen engagement activity: the activity should foster relations between citizens, and generate a cultural change to encourage committed participation
- A cause to which people can relate
- Little effort needed to start participating in the activity
- Enthusiastic promotion of the activity by participants, public influencers (e.g., influential individuals, relevant experts or stakeholders), the organiser and media.

Box 39 Social innovation at the fjord cleanup

The Fjord CleanUP is working on the realisation of several social innovation projects. They are not fully developed, although one of them is quite mature and has received support from different research and industry organisations.

The Fjord CleanUP seeks to launch a non-profit seaweed (sugar kelp) farming project. The project is expected to focus on carbon capture through environmentally sustainable technologies and on production of different food and compost products. These products will be sold on a local market, as there is significant interest for such produce there. The money accumulated from sales will be directed towards investment in the Fjord CleanUP cleaning events and other new projects.

Source: interview with Fjord CleanUP, 2022

Tartu Nature House

Tartu Nature House is an NGO that promotes sustainable, environmentally friendly development through different activities. It offers nature and environmental training for children, young people and adults, offers possibilities for nature and environmental hobbies, disseminates information about the environment and promotes a sustainable lifestyle. Tartu Nature House includes four different organisations:

Hobby school for children – this is the central organisation at Tartu Nature House. It offers diverse education classes on environment, nature, technology, sustainability design, exotic plans and marine environments

Environmental Information Centre that promotes and disseminates environmental information in multiple ways for publicity – mostly through public events, campaigns and exhibitions

Adult Training Centre offers training courses for families, educators and others. The Centre offers interactive workshops in different cities, such as candle or soap making, natural cosmetics, recycling empty bottles and many others

Nature educational programs for school teachers.

Each year, the NGO receives around 600 students in the hobby school and offers training to over a thousand teachers. The trainings are offered by staff of Tartu Nature House and by external scientists.

Key factors that determine success of citizen engagement activities:

- Openness to feedback and adjustment of ongoing activities to preferences of participants
- Effective design: combination of outdoor, interactive and educational activities
- Innovative methods/formats of engagement: hackathons and creative competitions
- Support of partners and stakeholders that share same values and commitment to a cause/activity: this will increase availability of resources and support in the design, implementation and promotion of the activity
- Citizens feel appreciation and gratitude of the organiser for participation in an activity: this will encourage participation in future citizen engagement activities and more positive feedback about the activity.

Box 40 Baltic sea project

The Baltic Sea Project (BSP) is a pilot project of the UNESCO Associated Schools Network that aims to bring together teachers and students from the Baltic Sea countries to work towards common goals: to raise the environmental awareness of future generations, to support environmentally friendly attitudes and to teach young people the skills to notice and explore changes in their environment.

At the moment, nine countries of the Baltic Sea region participate in this environmental programme for schools, namely Germany, Denmark, Sweden, Latvia, Estonia, Lithuania, Russia, Poland and Finland. In total, over 200 schools are involved in this project. Tartu

Nature House coordinates environmental education activities of this project in Estonia, supporting 58 Estonian schools that participate in the project.

The project has been active for 30 years and continues to grow and involve more schools and students. Thus, each year it has a stronger citizen engagement focus.

Its success is attributed to the opportunities to share best practices among teachers and to novel approaches in teaching and learning that implies an active role of a student and a guiding role of a teacher. Despite common practices that are applied at all participating schools, each school is able to develop its own unique set of education activities.

In addition, the BSP organises many impactful projects, activities and events that generate interest among students, teachers, parents and other members of the society. For example, the BSP has launched a citizen science programme to support their network of schools to cooperate in effort to learn more about the environment around the Baltic Sea. Each school collects some data, shares it with researchers and presents research findings to BSP partners.

From the perspective of students, they enjoy participation in the BSP due to innovative educational activities that call for their creativity and leadership. For example, students launch campaigns and organise summer camps in which they create workshops and share knowledge, seminars, adventures, field study trips and student science conferences.

Source: interview with Tartu Nature House, 2022

KIMO

KIMO stands for *Kommunernes International Miljøorganisation* (Local Authorities International Environmental Organisation) and was founded in Denmark in 1990. KIMO is a network of local governments, working together for healthy seas, clean beaches, and thriving coastal communities. Their mission is to prevent pollution and to protect, preserve and enhance the seas and coastal waters of the North-East Atlantic and Baltic regions. Thus, the organisation operates a wide network of government, NGO, industry and research organisations, encouraging a dialogue and a sharing of best practices.

KIMO conducts a broad range of activities, including lobbying, network management, running demonstrative projects, raising awareness with local stakeholders and citizens, and organising public events, workshops and discussions about issues affecting the marine environment. Citizen engagement is not a key activity of KIMO. Nevertheless, over the years the organisation has been conducting several citizen engagement activities, mostly in the UK where the KIMO International Secretariat is based. These were mostly ocean literacy, education and training activities, and activities that involve participatory processes, such as beach cleaning schemes. In addition, KIMO assists its network members in organisation or dissemination of information about their citizen engagement activities.

KIMO does not have a dedicated group of volunteers that participate in KIMO's citizen engagement activities. Participants-volunteers are identified for specific projects. Additional support in implementation of KIMO's projects comes from its network of members, that have diverse expertise.

Recently, KIMO started exploring opportunities for social innovation. Several citizen engagement projects which KIMO has been running are focused on collection of marine litter. Collected litter has been transported to a few recycling centres and other processing companies. However, KIMO is looking for new circular solutions which can utilise litter in production of novel products or in artistic projects. Thus, the secretariat of KIMO has been mapping and testing different opportunities within the supply chain. So far, they have not managed to identify partners that could take on the large volume of litter collected through KIMO projects.

Key factors that determine success of citizen engagement activities:

- Organisation of the activity by a professional, experienced team
- Effective messaging about the activity: it should not create fear, shame, guilt or other negative feelings if citizens do not want to take part in the activity
- The activity responds to concerns/challenges of the citizens: it is tailored to local needs to generate public support, encourage participation and have a higher impact
- Involvement of local stakeholders in the blue sector, government institutions and other organisations with extensive networks to raise awareness about the activity and to increase participation
- Little effort and few instructions for participation in the activity.

Box 41 Fishing for Litter

Fishing for Litter is a unique and award-winning project that works with fishermen and the fishing industry to reduce the amount of plastic pollution and marine litter in the sea and on the beaches. This project has been running from 2004 in several countries, such as the United Kingdom, the Netherlands, the Faroe Islands, Belgium, Germany, Ireland, Italy and others. Outside the UK, it is implemented by KIMO's network partners.

The project provides large, hard-wearing bags, which fishermen-volunteer attach to their boats. Fishermen continue to work as usual, but they bring any waste caught alongside the catch back to port. The project covers the costs of collection and disposal and demonstrates the fishing industry's commitment to a healthy environment. In addition, Fishing for Litter is helping to clean up the sea and to raises awareness about marine litter.

The success of this project is linked to effective stakeholder engagement, particularly from the fishing industry, and to ease of participation, as plastic is being collected without human efforts. In addition, KIMO has been effective in raising awareness about the impact of the project on the environment and this instigated great support in the UK and abroad.

Source: interview with KIMO, 2022

Summary notes from interviews

This annex includes a brief summary of the interviews.

Nausicaa Centre National de la Mer

Nausicaá Centre National de la Mer is a public aquarium located in Boulogne-sur-Mer in northern France. It is the largest public aquarium of Europe. Nausicaá is very active in terms of organisation of citizen engagement activities, including evets, exhibitions, educational workshops for schools, activities on the beach, public campaigns, citizen science projects, living labs and many more.

The aquarium has many partnerships with external organisations. Among them are listed – the Ministry of Education in France, public schools, European aquarium association, international aquarium network etc. Nausicaá is more than just an aquarium. They try to contribute to building a blue sustainable city, stimulating a cultural path of the blue economy. Nausicaá provides educational activities that are included in the general curriculum of schools. It also offers e-classes, online activities for students.

Nausicaá has a climate and ocean platform that stimulates innovation in the blue sector. There is a blue living lab (there is a call for application for anyone that has an idea in the area of ocean preservation, observation of the sea by drone etc). Most application don't have money to do market survey. So, the aquarium allows to use their public/attendees to do the survey and the analysis. In addition, the blue living lab provides advice on new products.

Last summer they offered the general public to taste seaweed. There were 4 different types of seaweed and they informed people how to cook it. This was organised within the "Mister Good Fish" campaign.

The largest campaign that Nausicaá is organising is called "Which Fish?". It gathers around 150 organisations (aquariums and zoos) from 30 countries. The main activity was distribution of information in various forms - interactive games, art installations, online exhibitions.

Nausicaá considers that mobilisation of the public is always challenging, as there are too many similar initiatives. Some people criticise aquariums, thinking that animals are tortured there. Hence, it is important to stimulate a positive image of the organisation to get support of the public.

In terms of lessons learned, Nausicaá considers that it is important to have different partners across the value chain, from research and education institutions involved in the citizen engagement activities. The aquarium has been participating in many European projects with Belgium, UK, French and other partners to improve knowledge of the sea. However, the major barrier for international collaboration is the language barrier.

People should be educated on impact their activities have on the environment. Hence, education and media support are very important. Nausicaá thinks that lobbying of politicians is needed to achieve a larger change. At the moment, the aquarium is involved in lobbying at a national and EU level to stimulate the development of blue economy and to use their resources for this purpose.

The general public enjoys educational, interactive and seafood tasting activities, or activities that involve interaction with animals. To keep communication with citizens active, the aquarium is sending request for feedback and shares results to collect data and to keep in touch with participants of citizen engagement activities.

Marine Conservation Society

Marine Conservation Society (MCS) is a UK-wide community of ocean lovers. Working with communities, businesses and governments, it defends habitats and species. MCS is a leading marine charity in the UK. They have a huge database of volunteers and coordinators in each region across the UK to mobilise volunteers.

MCS conducts many citizen engagement activities, such as education activities at schools, public events and campaigns, beach clean-ups, and citizen science projects. In addition, MCS distributes education materials through events and campaigns, such as Don't Let Go campaign, Marine unProtected Areas – petition. Among most famous and long-lasting citizen engagement activities is the Beach Watch programme. It has been running for over 30 years. The programme focuses on collection of litter from the beaches.

For several years, the NGO has been building relations with policymakers to support a positive change in the society. In addition, MCS is sharing monitored and collected data with other organisations, such as OSPAR.

Citizen science projects are in the focus of the organisation. MCS has internal science teams that are composed of researchers. In general, many universities are keen to run citizen science projects. They design these activities that are to the benefit of the society and researchers. Hence, a win-win situation.

Participants in citizen engagement activities are always asked to provide feedback for every project, using surveys and in a conversation with organisers. It is difficult to collect feedback during public campaigns, as the list of participants is not defined. Hence, it is difficult to analyse effectiveness of campaigns. Feedback helps to improve quality of these activities.

It is quite difficult to mobilise people to participate in citizen engagement activities. People should have some level of interest in the marine environment to contribute to a change in the community. It is easier to engage with young people, as they have more free time and enjoy something interactive. Young people enjoy working with digital technologies and applications, but it is quite expensive to develop an application for one citizen engagement activity.

To attract interest of the public, the cause/topic should resonate with most people. It should be fun, easy, personable, interactive. If there are training videos for citizen science projects, they should be short and very good in giving instructions. Clear communication is key. Social media is a good tool to attract interest and maintain communication with the public.

Social innovation in the blue economy is still in the infancy. Scientists and businesses do not know how to develop a profitable, sustainable business idea, how to work together, and how to engage with the public. There is a need for additional public support to stimulate social innovation in the blue sector.

Flanders Marine Institute

The Flanders Marine Institute (VLIZ) promotes accumulation of marine knowledge and excellence in marine research in Flanders. The marine research areas are the ocean and seas, the coast and the tidal systems. The target groups for knowledge accumulation are the marine research community as well as educational institutions, the general public, policymakers and the industry (within the scope of the blue economy).

VLIZ has been one of the pioneers in Europe in terms of ocean literacy. They organised a first conference on ocean literacy in Europe in 2012, together with partners – European Marine Board, Marine Biological Association. At the moment VLIZ focuses more on citizen science. They publish articles, organise events to disseminate knowledge and involve citizens in scientific projects. VLIZ has a group of 20 volunteers that are supporting the organisation on a continuous basis for all citizen science projects. These volunteers are like a family/community for VLIZ.

Currently, VLIZ is running 5 projects on marine citizen science. Citizens are not involved in the design of these projects, as it is a complex, research process. However, citizens are offered training prior to participation in the citizen science projects. VLIZ always collects feedback from participants. Communication with citizens is key, as people need to develop trust and relationships with scientists to help them in the project.

For successful implementation of citizen science projects, it is important to have a good management plan to ensure that data is not lost and that there are good quality control procedures. Also, it is important to make the public aware about the results and contribution of the public to the citizen science projects.

One of the projects, Coast Snap, tries to capture by camera changing coastlines. Citizens are asked to take a photo of a coastline and send it to VLIZ. This project is greatly appreciated by the citizens, as they feel their contribution to science.

Another interesting citizen science project which VLIZ is organising focuses on recreational fisheries. There is little information about recreational fisheries for the development of policies, therefore two institutes – VLIZ and Fisheries Institute, joined forces and collected data on catching of fish by these fishermen. Apart from this, VLIZ has several North Sea monitoring projects that collect variables in a standardized way on temperature of sea water, biodiversity, catchment with provided nets, archaeological findings.

One of most famous VLIZ citizen science projects focus on collection of seashells on the beaches during a one-day event. It gets significant attention of the media, as citizens express willingness to participate in this project. Apart from Belgium, the Netherlands has joined the project this year. Next year, the organisers anticipate that France and Germany will join.

All citizen engagement activities should be enthusiastic, touch the hearts of people, making them connect/relate to the initiative. To make it happen, it is necessary to include citizen science projects in education curriculum, organise events to have fun, open days in aquaria, nice publications for a wider public, and it’s important to capture attention of the media. These activities should change the mindset, behaviour of people the way they treat nature.

CPMR North Sea Commission

CPMR North Sea Commission is a cooperation platform for regions around the North Sea. Their mission is to strengthen partnerships between regional authorities which face the challenges and opportunities presented by the North Sea. Through dialogue and formal partnerships, they seek to promote common interests, especially in relation to European Union institutions, national governments and other organisations dealing with issues that are relevant to the North Sea. The main objectives of the North Sea Commission are:

- To promote and create awareness of the North Sea region as a major economic entity within Europe,

- To be a platform for developing and obtaining funding for joint development initiatives,

- To lobby for a better North Sea region.

CPMR North Sea Commission closely collaborates with the Baltic Sea Commission, and with INTERREG, especially in organizing conferences. CPMR North Sea Commission is organising public events, such North Sea conference, One ocean Summit, and workshops during the European week of regions.

Youth Initiative is a key initiative of the CPMR North Sea Commission. It represents a youth parliament that supports the Commission by giving a voice to the youth in the decision-making. The initiative has started a few years ago. The members of the Initiative provide information about policies in the North Sea to the public, especially youth, organise public events, engage with the stakeholders, and then bring new ideas/feedback from citizens to the Commission. This supports legitimacy of the CPMR North Sea Commission and its decisions.

The Initiative represents an institutionalised body, therefore it ensures continuity of work, which is critical for achieving a long-term change. Youth Initiative is effective in involving young people in politics, raising important topics (sustainability, circular economy, energy transition, climate neutrality) and thereby stimulating a change in behaviour in the society. In general, it is difficult to mobilise people, but young people have more time available and believe in a possibility of a change. Thus, it is easier to work with them, especially with youth who live near the coast/sea. Success in citizen's mobilisation strongly depends on enthusiasm of citizens related to the topic in focus and on effective methods for engagement. The latter should ensure interactivity, evidence of impact and good communication with the citizens. The Initiative involves citizens on a regular basis to sustain their enthusiasm and commitment.

At the moment, the Initiative has around 35 members and one adviser that submits reports to the executive committee of the Commission. These members meet every 2-3 months to make joint decisions. To ensure that the Initiative is effective, it is critical to invest resources in it and to take the advice/suggestions of its members seriously. COVID has a negative impact on the activity of the Initiative, as most meetings and activities were postponed or cancelled.

Baltic Environmental Forum

Baltic Environmental Forum (BEF) Germany was founded as a non-profit association in 2003 in Hamburg. It is funded through projects launched by public organisations. It holds the chairmanship of the international BEF network, the so-called BEF-Group, with offices in Ria (Latvia), Tallinn (Estonia) and Vilnius (Lithuania) existing since 1995. The German branch is involved in common projects with other BEF network members.

The citizen engagement activities of BEF are focused on creating awareness, promoting and improving environmental management, as well as initiate communication and information exchange. There are many internal teams that focus on specific issues and use different methods of citizen engagement. For example, the team on hazardous substances trains consumers how to lower risks of hazards in a daily life. They hold a workshop every week (40 people) on how to detoxify their houses. In addition, BEF uses many participatory citizen engagement methods, organise public campaigns, trainings etc. Among most recent campaigns are listed – the campaigns on reduction plastic and hazardous chemicals. Citizens are invited not to use plastic for 3 weeks.

In addition, BEF frequently attends different festivals, local events to share information, attract citizens to BEF projects, workshops and events. Over the years, BEF has build a group of volunteers that is regularly supporting its activities. BEF always monitors success of its citizen engagement activities and conducts an assessment at the end of the activity by collecting feedback from participants.

For the participatory and co-creation processes with citizens, BEF suggests involving citizens in maritime spatial planning projects. Based on their previous experience, it is essential to identify areas where citizen engagement is needed/would be useful. Then, it is critical to build relations with citizens/participants, take their feedback onboard in organising new activities. For effective organisation of citizen engagement activities that use participatory processes, it is important to understand who are the relevant stakeholders that should be involved, how much information they have at the moment and how much information they should receive to ensure successful participation it the activity. Then, organisation of the activity and convenient timing is essential. Based on experience of BEF, many organisers do not know how to use citizens effectively in participatory processes. Lastly, all organisers should invest in communication with participants to build relations.

Submariner Network

The Submariner Network promotes innovative approaches to the sustainable use of marine resources and offers a cooperation platform to related actors and initiatives in the Baltic Sea Region. It includes several groups that focus on ocean literacy and social innovation in the blue economy sector. These working groups work with start-ups and researchers, bringing together mentors and coaches for developing a technological solution or for facilitating the process of putting a product on the market.

The Submariner Network is also involved in EU4Ocean project. However, it assumes that the set-up of the project is not very successful, as the project is mostly limited to mapping of activities rather providing concrete support. Among other key projects of Submariner were names Ocean Blue projects, Sea-gardens, Futuria, Plastic pirates.

Social innovation in the blue economy sector requires significant support, especially at a local level. It is critical to establish communities of practice to develop a vision of how a municipality can contribute to blue economy, pull resources, identify niches for development and develop a concrete plan of action.

At the moment, involvement of citizens in social innovation has been limited to tasting/testing of “blue” food. But still “blue” food is considered “scary” food, as people did not use to consume it, and hence it requires promotion and awareness raising. Local community gardens would be helpful for this. Aquaria is a good place for promotion of social innovation, as it allows people to experience a new thing/product and collect their feedback/impressions from it to market it better on the market. In addition, supermarkets, TV promotion, cookbooks and chefs could be helpful in making blue products more popular and normal.

There are many innovative startup companies in the blue sector, but it is important to ensure support of large companies for driving new social innovation projects/products, as large companies have good reputation and resources to drive new ideas on the market.

COVID has a significant impact on citizen engagement activities, as most of them were cancelled. Effective citizen engagement activities are characterised by the following – clear message to the citizens on what and how they will contribute, identification of influencers who can attract citizens to specific activities, involvement of suitable partners/stakeholders in implementation of the initiative, careful design in terms of complexity/simplicity, purpose, feasibility, and affordability. In addition, organisers of citizen engagement activities should take into account local culture, amount of financial resources that are needed for effective citizen engagement.

The European Commission should focus on local actors with extensive networks that can effectively mobilise the public and achieve success of the Mission on Oceans.

Institute of Oceanology of the Polish Academy of Sciences (IO PAN)

The mission of the Institute of Oceanology PAN is to seek, understand, and communicate the scientific understanding of the marine environment and the issues related to its protection and sustainable use. IO PAN scientists and engineers achieve this by carrying out innovative, high-level scientific and technological research that further enhances our understanding of the environment and provides expertise and new technologies which are then shared with the broader public and interested parties from the public and private sector. The Institute of Oceanology conducts scientific research in the Baltic Sea and in the seas of the European Arctic.

The Institute involves PhD students, children and general public in its scientific projects. There are 3 people who work full time in popularising science and ocean literacy. They organise lectures, workshops and projects in which citizens can participate. In general, there are two types of lectures – one for schools (it is part of the curriculum) and for the citizens (mostly attended by senior citizens who have more time available for this).

Some citizen engagement activities are organised together with Sea Fisheries Institute in Gdynia. Together, they create short videos/films for Facebook and as non-typical handbook materials to attract attention and to make it user-friendly. These films are only 3 minute long and are very helpful in understanding a topic.

Overall, IO PAN tries to promote science and make it accessible, thereby generating a change in the society on how we think about sustainability, impact on climate etc. They also involve artists to co-create scientific/artistic projects on science. This has been very effective in the past. IO PAN also has several collaboration projects with aquaria and other stakeholders to attract volunteers.

In citizen science projects, it is essential to think how to instruct citizens well to inspire participation, to collect useful input and when this engagement makes sense. For example, it is useless to collect microplastic, as it is easy to contaminate it. Thus, citizens should be involved in something that is easy to collect, not dangerous to collect.

In view of IO PAN, scientists should get more creative on how to involve citizens in scientific projects. For example, during vacation families with children can be involved in making photos or collecting something for a scientific project. This has been very useful and effective in the past.

Lastly, it is important to choose the correct language/phrasing in how the sea/ocean is portrayed. When the messaging is that “the sea is dying” nobody wants to be involved, as it sounds hopeless and does not generate energy. Thus, it is important to make everything positive, to highlight impact that citizens are making, and to create innovative, interesting activities for citizens.

Fjord CleanUP

The Fjord CleanUP is a non-profit environmental organisation supporting the restoration and protection of the Inner Oslo Fjord’s natural marine environment. They organise weekly voluntary cleaning events where they provide volunteers with stand-up paddleboards, kayaks, diving equipment and all the gear necessary to clean marine pollution out of the fjord. In addition, they provide a soup for volunteers and a sauna. Every week they have around 30 people participating in the activity. There is a very high demand in supporting the organisation that they do not even have enough paddleboards/kayaks for all who is willing to participate. The activity is so popular by citizens, because it is exciting, pleasant and contributing to a good cause. In addition, they have a good presence on social media and have a core group of people who promote this activity. The social media presence has been helpful in scaling up activities, attracting new audience and making it a success.

The Fjord CleanUP has been organised by a private company (Medgoats) that provides kayaks and other equipment for the cleaning activities. Currently, the NGO is run by contributions from volunteers, but they are also applying for public grants to increase the scale of activities. At the moment, each member/volunteer is contributing around 50 eur per year to participate in activities. In total, the number of involved people is between 1500-2000 a year.

Currently, the Fjord CleanUP is discussing collaboration with the electric scooter company to expand activities on the ground. The rubbish collecting service in Norway also supports Fjord CleanUP by collecting and sorting rubbish found in waters. Later, the data is shared with universities to improve monitoring of the quality of water. The Fjord CleanUP is planning to expand to new communities/municipalities, and to explore social innovation projects (seaweed farming). The seaweed farming will be a non-profit project that will be stimulating jobs, local production and environmental sustainability in the region. At the moment, they are consulting with business organisations on how to run a social innovation project efficiently.

Tartu Nature House

Tartu Nature House is a foundation (NGO), funded by the Ministry of Education in Estonia. It comprises the following activities:

- Hobby school for children,
- Environmental Information Centre promotes and disseminates environmental information in multiple ways for publicity,
- Adult Training Centre offers training courses for families, educators and others,

- Nature educational programs for school curriculum are very popular among school teachers. These programs perfectly complement our formal educational system with outdoor activities.

The hobby school and programs for children (6-15) are central for the organization (it is teaching, there are some academic programmes in these classes). Cross-sectional classes at hobby school are offered: nature and technology, how to observe birds, environmental and sustainable design, a programme on exotic plants (they learn about impact on exotic plants). Tartu Nature House also offers training for teachers and adults – trainings in the nature. They are inviting scientists that do research and teach how to do classes outside. In total, there are around 600 students that participate in hobby school; over a 1000 have accessed services in the tourist centre and participated in training sessions.

Among the foundation’s largest projects is the UNESCO Baltic Sea Project. It has many partners across countries, including 58 schools in Estonia, 3800 participants. Through this project, many campaigns, events, trainings and water/ocean literacy activities are organised at schools and outside. For example, adult training is taking place in living environments, exhibitions are organised in cities and in education institutions. There are also family days in which specific topics are in focus.

Every year, an international camp is organised. Each participant is asked to create their own small workshop to share knowledge. Students are participating in decision-making by voting on pilot projects. Teachers provide feedback on usefulness of specific trainings to improve their quality every year. Overall, the project is well-monitored to ensure its effective implementation.

Among the major challenge for citizen engagement activities is that young people (age 11-15) start losing interesting in these activities. Thus, they need to be adjusted to teach them a new skill, to allow them to combine an activity with their hobby, to make sure that it is contributing to their personal development. For example, a mentorship type of activities, interactive and physically active activities could be effective in attracting interest of young people. In addition, young people enjoy interacting with digital tools and solving quizzes.

Another important barrier is a large number of citizen engagement activities. This creates an unnecessary competition for attention of citizens.

KIMO

KIMO is a network of local governments, working together for healthy seas, clean beaches, and thriving coastal communities. Their mission is to prevent pollution and to protect, preserve and enhance the seas and coastal waters of the North-East Atlantic and Baltic regions. Thus, there is a balance of lobbying and raising awareness.

KIMO is actively involved in citizen engagement activities. Among important ones discussed were the Coastal lottery scheme, the Beach cleaning scheme, Fishing flitch activity. In all of these activities it was critical to engage with local stakeholders and to connect with recycling centres. KIMO does not have a group of volunteers that are typically involved in its activities; therefore it takes time to recruit new ones. The organisation is collaboration with HELCOM, OSPAR, supporting collaboration in the North and Baltic Sea.

Success citizen engagement activities need several components – financial resources, skills to organise these activities, good design in terms of identification of suitable activities and methods how to involve citizens. In addition, all activities should be properly framed – it is critical not to shame people if they choose not to participate in the citizen engagement activities. Schools and other education institutions can stimulate willingness to contribute to a change. Communities should realise that they will benefit by participating in the activity.

All activities related to beach cleaning have been relatively easy to mobilise citizens, as they have a low barrier for participation and the impact is noticeable immediately. In addition, there are many stakeholders that are also interested in clean beaches; therefore it is easy to promote and achieve support in such activities.

Annex E: Methodology definition of disadvantaged areas

For the socio-economic and R&I dimensions, a data analysis was conducted to identify the NUTS3 regions that are leaders, are performing well, have potential, or are lagging behind at the dimension level. Several indicators were selected for each dimension, according to the data availability and their relevance.

Table 86 Selected indicator for the identification of disadvantaged areas

R&I dimension	Socio-economic dimension
Gross R&D expenditure per inhabitant and as % of GDP (GERD)	GDP per capita (annual)
Human resources in science and technology	Unemployment rate
Regional Innovation Scoreboard index	At-risk-of-poverty rate (after social transfers)
H2020 Projects	
Number of patents	
Number of publications	
Participation in EU R&I networks and structures	

Step 1

For each of these indicators, quartiles have been defined based on performance:

- First quartile: the lowest 25% of observations
- Second quartile: observations between 25% and 50% (up to the median)
- Third quartile: observations between 50% to 75%
- Fourth quartile: the highest 25% of observations

An alternative method for this step is to sort observations based on standard deviation from the mean instead of quartiles. However, the Jarque-Bera test indicated that the datasets do not have a normal distribution, preventing us from using a standard deviation based method.

Step 2

A score was assigned to each observation according to its quartile, such that the best performers get the highest score:

- First quartile: 0 point
- Second quartile: 1 point
- Third quartile: 2 points
- Fourth quartile: 3 points

(In the case of “reverse” indicators where the best performance corresponds to the lowest number (e.g. at-risk-of-poverty rate), the best score are assigned to the first quartile.)

Step 3

For each region, the scores obtained in each indicator of the dimension were aggregated through a simple average to obtain the aggregate performance in R&I / socio-economic dimension.

Step 4

The regions are classified in 4 performance groups, for both the R&I dimension and the socio-economic dimension:

Table 87 Breakdown in 4 performance groups

Performance group	Definition	R&I dimension	Socio-economic dimension
Top performers	Regions with an aggregate score in the top 25%	R&I hubs, leading the innovation activity in Europe	Best socio-economic conditions in Europe
Above average performers	Regions with an aggregate score in the top 25% to 50%	Regions with well-developed R&I activities	Socio-economic conditions above EU average but not optimal
Disadvan-taged performers	Regions with an aggregate score in the bottom 50% to 25%	Disadvantaged regions that show blooming R&I activity and where support is most relevant to reach their full potential	Regions with a socio-economic background that is insufficient
Bottom perfomers	Regions with an aggregate score in the bottom 25%	Regions with very limited R&I activities and resources	Least favorable socio-economic conditions

Annex F: List of abbreviations

Abbreviation	Full name
AFID	Alternative Fuel Infrastructure Directive
AIS	Automatic Identification System
AIT	Austrian Institute of Technology
ASC	Aquaculture Stewardship Council
BANOS CSA	Baltic and North Sea Coordination and Support Action
BSAP	Baltic Sea Action Plan
BSAP	Transmission System Operator
CBSS	Council of the Baltic Sea States
CCS	Carbon Capture and Storage
CEF	Connecting Europe Facility
CFD	Contract For Difference
CFP	EU Common Fisheries Policy
CPMR	Conference of Peripheral Maritime Regions
DG CLIMA	Directorate-General for Climate Action
DG CNECT	Directorate-General for Communications Networks, Content and Technology
DG ENER	Directorate-General for Energy
DG ENV	Directorate-General for Environment
DG MARE	Directorate General for Maritime Affairs and Fisheries
DG MOVE	Directorate-General for Mobility and Transport
DG RTD	Directorate-General for Research and Innovation
DIH	Digital Innovation Hub
EAFO	European Alternative Fuel Observatory
EAP	EU Environmental Action Programme
EC	European Commission
ECA/SECA	Emission Control Areas / Sulphur Emission Control Area
EEA	European Environment Agency
EEDI	Energy Efficiency Design Index
EEZ	Economic Exclusive Zone
EIT KIC	European Institute of Technology Knowledge and Innovation Community
EMSA	European Maritime Safety Agency
ERDF	European Regional Development Fund
ESI	Environmental Ship Index
ESPO	European Sea Ports Organisation
EU	European Union
EU MRV	EU regulation on Monitoring Reporting and Verification of carbon dioxide emissions from maritime transport and amending directives
EU SCORES	EU Scalable Offshore Renewable Energy Sources
EUSBSR	EU Strategy for the Baltic Sea Region
FAO	Food and Agriculture Organisation
FiT	Feed-in-Tariff
FP7	Framework Programme 7
GDP	Gross Domestic Product
GES	Good Environmental Status
GHG	Greenhouse Gas
GVA	Gross Value Added
H2020	Horizon 2020
HELCOM	Baltic Marine Environment Protection Commission (the Helsinki Commission)
HRST	Human Resources in Science and Technology
IAEA	International Atomic Energy Agency
ICES	International Council for the Exploration of the Sea

ICSU	International Council of Scientific Unions
IMO	International Maritime Organisation
IMP	Integrated Maritime Policy
IMTA	Integrated Multi-Trophic Aquaculture
INTERREG	European Territorial Cooperation
ISA	International Seabed Authority
ISO	International Organisation for Standardisation
IUCN	International Union for Conservation of Nature
IWAMA	Interactive water management
KPI	Key Performance Indicators
LCOE	Levelised Cost of Energy
LH2	Liquid Hydrogen
LIFE	EU Funding Instrument for Environment & Climate Action
LNG	Liquified Natural Gas
MAGPIE	Smart Green Ports as Integrated Efficient multi-model hubs
MARPOL	International Convention for the Prevention of Pollution from Ships
MERMAID	the Innovative Multi-purpose off-shore platforms: planning, Design and operation
MHK	Marine Hydro-Kinetics
MPP	Multipurpose Platforms
MS	Member States
MSFD	EU Marine Strategy Framework Directive
MSFD	Marine Strategy Framework Directive
MSP	Marine Spatial Planning
MSP	Maritime Spatial Planning
MUSES	Multi-Use in European Seas
NASCO	North Atlantic Salmon Conservation Organization
NEAFC	North-East Atlantic Fisheries Commission
NGO	Non-governmental Organisation
NOx	Nitrogen Oxide
NUTS	Nomenclature of Territorial Units for Statistics
O&G	Oil and gas
OECD	Organisation for Economic Co-operation and Development
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OPS	Onshore Power Supply
PIONEERS	Portable Innovation Open Network for Efficiency and Emissions Reduction Solutions
PORTHOS	Port Of Rotterdam C02 Transport Hub and Offshore Storage
PPA	Power Purchase Agreement
PTS	Port-to-Shore
PtX	Power-to-X
QA/QC	Quality Assurance/Quality Check
R&D	Research & Development
R&I	Research & Innovation
RACs	The Regional Advisory Councils
RAS	Recirculating Aquaculture System
RE	Renewable Energy
RIS3	Regional Strategy for Research and Innovation for Smart Specialisation
RRF	Recovery & Resilience Facility
RSP	Regional Seas Programme
RTDI	Research, Technology, Development and Innovation
S3	Smart Specialisation Strategy
SDG	Sustainable Development Goals
SECA	Sulphur Emission Control Area
SMART	Specific, Measurable, Actionable, Relevant, Time-bound
SME	Small and Medium-sized Enterprises
STI	Science, Technology and Innovation

STM	Sea Traffic Management
STS	Shore-To-Ship
Sox	Sulphur Oxide
TEN-T	Trans-European Transport Network
ToR	Terms of Reference
TSO	Transmission System Operator
TTS	Truck-to-Shore
UK	United Kingdom
UN ECE	UN Economic Commission for Europe
UN	United Nations
UNCLOS	United Nations Law of the Sea Convention
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
VASAB	Visions and Strategies Around the Baltic Sea
WASP	Wind Assisted Ship Propulsion
WFD	EU Water Framework Directive
WMO	World Meteorological Organisation
WWF	World Wildlife Fund

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct centres. You can find the address of the centre nearest you online (european-union.europa.eu/contact-eu/meet-us_en).

On the phone or in writing

Europe Direct is a service that answers your questions about the European Union.
You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696,
- via the following form: european-union.europa.eu/contact-eu/write-us_en.

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website (european-union.europa.eu).

EU publications

You can view or order EU publications at op.europa.eu/en/publications. Multiple copies of free publications can be obtained by contacting Europe Direct or your local documentation centre (european-union.europa.eu/contact-eu/meet-us_en).

EU law and related documents

For access to legal information from the EU, including all EU law since 1951 in all the official language versions, go to EUR-Lex (eur-lex.europa.eu).

EU open data

The portal data.europa.eu provides access to open datasets from the EU institutions, bodies and agencies. These can be downloaded and reused for free, for both commercial and non-commercial purposes. The portal also provides access to a wealth of datasets from European countries.

This baseline study for the **Mission Restore our Ocean and Waters** aims to provide a comprehensive basis for the development and piloting of the **Baltic and North Sea basin Lighthouse**, and its deployment and upscaling in the future, in line with Mission **objective 3: 'Make the sustainable blue economy carbon neutral and circular'**. It analyses **maritime transport, maritime ports and facilities, offshore (and onshore) renewable energy facilities, offshore renewable energy storage facilities, multipurpose platforms, and aquaculture** in the Lighthouse. The study proposes **indicators for measuring Mission progress** in these areas during its implementation and offers **recommendations** for further implementation of the Mission in the lighthouse.

Studies and reports

Publications Office
of the European Union